PACIFIC MACKEREL MANAGEMENT FOR 2010-2011

The Pacific Fishery Management Council (Council) is scheduled to review the current Pacific mackerel stock assessment and adopt a harvest guideline for the 2010/2011 Pacific mackerel fishing season, which runs from July 1, 2010 through June 30, 2011. The Council is also scheduled to review the 2010 Status Assessment and Fishery Evaluation document, which includes a Coastal Pelagic Species Management Team (CPSMT) recommendation on the Coastal Pelagic Species (CPS) Essential Fish Habitat (EFH) five-year review.

When setting harvest specifications and management measures for Pacific mackerel for the 2009-10 fishing season in June of 2009, the Council also recommended foregoing the scheduled 2010 assessment update. Rather, a full Pacific mackerel assessment is scheduled for 2011 and will serve as the basis for management recommendations in the 2011-12 fishing year. In July 2009, the Council sent a letter to the Southwest Fisheries Science Center (SWFSC) (Agenda Item F.1.a, Attachment 2) requesting work be done on the research and data needs identified during the review of the 2009 full assessment. In response, the SWFSC, sent a letter to the Council outlining research plans in support of a full assessment in 2011 (Agenda Item F.1.a, Attachment 3).

In the absence of an updated assessment in 2010, harvest and management recommendations for the 2010-11 fishing season will be based, in part, on the 2009 full assessment. The CPSMT will consider the 2009 assessment results, the ongoing 2009-10 fishing season, and any new research results when developing its recommendations for 2010-11. The harvest specifications and management measures in place for 2009-10 could be considered for the 2010-11 fishing year as well. These included an Acceptable Biological Catch (ABC) of 55,408 metric tons (mt), and a Harvest Guideline (HG) of 10,000 mt with a 2,000 mt set-aside for incidental harvest. This reserve was to be used for incidental landings following a potential closure of the directed fishery.

The CPSMT completed the tenth annual Status of the Pacific Coast CPS Fishery and Recommended Harvest Guidelines – Stock Assessment and Fishery Evaluation (SAFE) – 2010 document. This is included in the briefing book as Agenda Item F.1.a, Attachment 1 with stock assessment and management recommendations available in Chapter 3 and Chapter 11.

Finally, the SAFE document also includes a section on the five-year review of CPS EFH. The Magnuson Act requires periodic reviews of EFH descriptions and potential impacts from fishing and non-fishing activities. The last CPS review was completed in 2005, with no recommended changes to CPS EFH. For the 2010 review, the CPSMT compiled and reviewed recent relevant information, which is discussed in Chapter 14 of the SAFE document.

<u>Council Action</u>: Approve Stock Assessment and Essential Fish Habitat review; Harvest Guideline; and Management Measures.

Reference Materials:

1. Agenda Item F.1.a, Attachment 1: *Draft Status of the Pacific Coast Coastal Pelagic Species Fishery and Recommended Acceptable Biological Catches - Stock Assessment and Fishery Evaluation 2010.*
2. Agenda Item F.1.a, Attachment 2: July 29, 2009 letter from Dr. McIsaac to Dr. Bartoo regarding Pacific mackerel assessment schedule and research needs.
3. Agenda Item F.1.a, Attachment 3: August 4, 2009 letter from Dr. Bartoo to Dr. McIsaac regarding research plans in support of Pacific mackerel assessment.

Agenda Order:

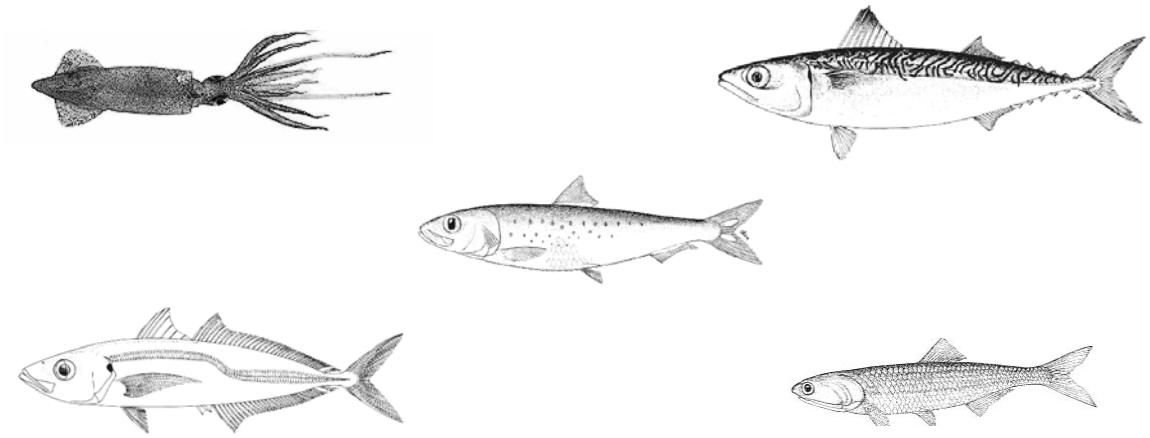
a. Agenda Item Overview — Kerry Griffin
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action:** Approve Stock Assessment and Essential Fish Habitat review; Harvest Guideline; and Management Measures

PFMC
05/27/10

DRAFT

STATUS OF THE PACIFIC COAST COASTAL PELAGIC SPECIES FISHERY AND RECOMMENDED ACCEPTABLE BIOLOGICAL CATCHES

STOCK ASSESSMENT AND FISHERY EVALUATION 2010



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ACKNOWLEDGMENTS

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LIST OF ACRONYMS AND ABBREVIATIONS

ABC	acceptable biological catch
ACL	Annual Catch Limit
ACT	Annual Catch Target
ADEPT	A population analysis model
ASAP	Age-structured Assessment Program
BO	Biological opinion
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CANSAR-TAM	Catch-at-age Analysis for Sardine - Two Area Model
CC	California Current
CCLME	California Current Large Marine Ecosystem
CDFG	California Department of Fish and Game
CESA	California Endangered Species Act
CFGC	California Fish and Game Commission
CONAPESCA	National Commission of Aquaculture and Fisheries (Mexico)
Council	Pacific Fishery Management Council
CPFV	commercial passenger fishing vessel
CPS	coastal pelagic species
CPSAS	Coastal Pelagic Species Advisory Subpanel
CPSMT	Coastal Pelagic Species Management Team
CPSPDT	Coastal Pelagic Species Plan Development Team
CPUE	catch per unit effort
EBFM	ecosystem based fishery conservation and management
EEZ	exclusive economic zone
EFH	essential fish habitat
EFMP	Ecosystem Fishery Management Plan
EIS	Environmental Impact Statement
ENSO	El Niño southern oscillation
ESA	Endangered Species Act
FMP	fishery management plan
GT	gross tonnage
HCR	Harvest Control Rule
HG	harvest guideline
INP	Instituto Nacional de la Pesca (Mexico)
LE	limited entry
LME	large marine ecosystem
Magnuson Act	Magnuson-Stevens Fishery Conservation and Management Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MAXCAT	maximum harvest level parameter
MEI	Multivariate El Niño Index
MSFMP	Market Squid Fishery Management Plan
MSY	maximum sustainable yield
mt	metric ton
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent

NWFSC	Northwest Fisheries Science Center (NMFS)
ODFW	Oregon Department of Fish and Wildlife
OFL	Overfishing Level
OFWC	Oregon Fish and Wildlife Commission
OMB	Office of Management and Budget
OY	optimum yield
PacFIN	Pacific Coast Fisheries Information Network
PDO	Pacific Decadal Oscillation
PFAU	Pelagic Fisheries Assessment Unit
PRD	Protected Resource Division
RecFIN	Recreational Fishery Information Network
RIR	regulatory impact review
ROV	remotely operated vehicle
SAFE	stock assessment and fishery evaluation
Secretary	U.S. Secretary of Commerce
SFD	Sustainable Fisheries Division
SS2	Stock Synthesis 2
SSC	Scientific and Statistical Committee
SST	sea surface temperature
st	short ton
STAR	Stock Assessment Review (Panel)
STAT	Stock Assessment Team
SWFSC	Southwest Fisheries Science Center (NMFS)
SWR	Southwest Region (NMFS)
TF	Transformation Frontier
USFWS	U.S. Fish and Wildlife Service
VPA	virtual population analysis
WDFW	Washington Department of Fish and Wildlife

1.0 INTRODUCTION

The Guidelines for Fishery Management Plans (FMPs) published by the National Marine Fisheries Service (NMFS) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each FMP. SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries being managed under federal regulation. Regional Fishery Management Councils use this information to determine annual harvest levels for each stock, document significant trends or changes in the resources, marine ecosystems, and fishery over time, and assess the relative success of existing state and federal fishery management programs.

This is the tenth *Status of the Pacific Coast Coastal Pelagic Species Fishery* SAFE document prepared for the Pacific Fishery Management Council (Council). Following NMFS guidelines, the purpose of this report is to briefly summarize aspects of the coastal pelagic species (CPS) FMP and to describe the history of the fishery and its management. Species managed under this FMP include: Pacific sardine (*Sardinops sagax*), Pacific mackerel (*Scomber japonicus*), northern anchovy (*Engraulis mordax*), jack mackerel (*Trachurus symmetricus*), market squid (*Loligo opalescens*), and krill (*euphausiid spp.)*. The SAFE report for Pacific Coast CPS fisheries was developed by the Council's Coastal Pelagic Species Management Team (CPSMT) from information contributed by scientists at NMFS, Southwest Fisheries Science Center (SWFSC), California Department of Fish and Game (CDFG), Oregon Department of Fish and Wildlife (ODFW), and Washington Department of Fish and Wildlife (WDFW). Included in this report are descriptions of landings, fishing patterns, estimates of the status of stocks (including stock assessments for Pacific sardine and Pacific mackerel, Appendix 1 and Appendix 2), and acceptable biological catches (ABCs).

The ABC recommendations, together with social and economic factors, are considered by the Council in determining annual harvest guidelines and other measures for actively managed fisheries (i.e., Pacific mackerel and Pacific sardine).

2.0 THE CPS FISHERY

2.1 Management History

The CPS FMP is an outgrowth of the *Northern Anchovy Fishery Management Plan*, which was implemented in September 1978. The Council began to consider expanding the scope of the northern anchovy FMP in 1990, with development of the seventh amendment to the FMP. The intent was to develop a greatly modified FMP, which included a wider range of coastal pelagic finfish and market squid. A complete draft was finished in November of 1993, but the Council suspended further work because NMFS withdrew support due to budget constraints. In July 1994, the Council decided to proceed with public review of the draft FMP. NMFS agreed with the decision on the condition that the Council also consider the options of dropping or amending the northern anchovy FMP. Four principal options were considered for managing CPS fisheries:

1. Drop the anchovy FMP (results in no Federal or Council involvement in CPS).
2. Continue with the existing FMP for anchovy (status quo).
3. Amend the FMP for northern anchovy.
4. Implement an FMP for the entire CPS fishery.

In March 1995, after considering the four options, the Council decided to proceed with option four, developing an FMP for the entire CPS fishery. Final action was postponed until June 1995 when the Council adopted a draft plan that had been revised to address comments provided by NMFS and the Council's Scientific and Statistical Committee (SSC). Amendment 7 was submitted to the U.S. Secretary of Commerce (Secretary), but rejected by NMFS Southwest Region (SWR) as being inconsistent with National Standard 7. NMFS announced its intention to drop the FMP for northern anchovy in a proposed rule published in the *Federal Register* on March 26, 1996 (61*FR*13148). The proposed rule was withdrawn on November 26, 1996 (61*FR*60254). Upon implementation of Amendment 8 (see below), the northern anchovy FMP was renamed the Coastal Pelagic Species Fishery Management Plan.

2.2 Recent Management

For a complete listing of formal Council actions and NMFS regulatory actions since implementation of the CPS FMP see Tables 2-1 and 2-2, respectively.

2.2.1 Amendment 8

Development of Amendment 8 to the northern anchovy FMP began during June 1997 when the Council directed the Coastal Pelagic Species Plan Development Team to amend the FMP for northern anchovy to conform to the recently revised Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and to expand the scope of the FMP to include other species harvested by the CPS fishery.

In June 1999, NMFS partially approved the CPS FMP. Approved FMP elements included: (1) the management unit species, (2) CPS fishery management areas, consisting of a limited entry (LE) zone and two subareas, (3) a procedure for setting annual specifications including harvest guidelines (HG), quotas, and allocations, (4) provisions for closing directed fisheries when the

directed portion of a HG or quota is taken, (5) fishing seasons for Pacific sardine and Pacific mackerel, (6) catch restrictions in the LE zone and, when the directed fishery for a CPS is closed, limited harvest of that species to an incidental limit, (7) a LE program, (8) authorization for NMFS to issue exempted fishing permits for the harvest of CPS that otherwise would be prohibited, and (9) a framework process to make management decisions without amending the FMP.

At that time, NMFS disapproved the optimum yield (OY) designation for market squid, because there was no estimate of maximum sustainable yield (MSY). Bycatch provisions were disapproved for lack of standardized reporting methodology to assess the amount and type of bycatch and because there was no explanation of whether additional management measures to minimize bycatch and the mortality of unavoidable bycatch were practicable.

On December 15, 1999, final regulations implementing the CPS FMP were published in the *Federal Register* (64*FR*69888). Provisions pertaining to issuance of LE permits were effective immediately. Other provisions, such as harvest guidelines, were effective January 1, 2000.

2.2.2 Amendment 9

During 1999 and 2000, the CPSMT developed Amendment 9 to the CPS FMP. Originally, Amendment 9 addressed the disapproved provisions of the FMP – bycatch and market squid MSY. The amendment also included provisions to ensure that treaty Indian fishing rights are implemented according to treaties between the U.S. and specific Pacific Northwest tribes.

The Council distributed Amendment 9 for public review on July 27, 2000. At its September 2000 meeting, the Council reviewed written public comments, received comments from its advisory bodies, and heard public comments. Based on advice about market squid MSY determination, the Council decided to include in Amendment 9 only the provisions for bycatch and treaty Indian fishing rights. The Council decided to conduct further analysis of the squid resource and prepare a separate amendment to address OY and MSY for squid. The Secretary approved Amendment 9 on March 22, 2001, and the final rule implementing Amendment 9 was published August 27, 2001 (66*FR*44986).

2.2.3 Amendment 10

In April 2001, the Council adopted a capacity goal for the CPS LE finfish fishery and asked the CPSMT to begin work on a 10th amendment to the FMP. Amendment 10 included the capacity goal, provisions for permit transferability, a process for monitoring fleet capacity relative to the goal, and a framework for modifying transferability provisions as warranted by increases or decreases in fleet capacity. The amendment also addressed determination of OY and MSY for market squid.

In June 2002, the Council adopted Amendment 10 to the CPS FMP. Relative to the LE fishery, the amendment established a capacity goal, provided for LE permit transferability to achieve and maintain the capacity goal, and established a process for considering new LE permits. The purpose of this action was to ensure fishing capacity in the CPS LE fishery is in balance with resource availability. Relative to market squid, Amendment 10 established an MSY (or proxy) for market squid to bring the FMP into compliance with the Magnuson-Stevens Act. The purpose of this action was to minimize the likelihood of overfishing the market squid resource.

On December 30, 2002, the Secretary approved Amendment 10. On January 27, 2003, NMFS issued the final rule and regulations implementing Amendment 10 (68*FR*3819).

2.2.4 Sardine Allocation Regulatory Amendment

In September 2002, the Coastal Pelagic Species Advisory Subpanel (CPSAS) recommended the Council initiate a regulatory or FMP amendment and direct the CPSMT to prepare management alternatives for revising the sardine allocation framework. The Council directed the CPSMT to review CPSAS recommendations for revising the allocation framework. At the March 2003 Council meeting, the SSC and CPSAS reviewed analyses of the proposed management alternatives for sardine allocation. Based on the advisory body recommendations and public comment, the Council adopted five allocation management alternatives for public review. In April 2003, the Council took final action on the regulatory amendment. This change was implemented by NMFS on September 4, 2003 (68*FR*52523); the new allocation system: (1) changed the definition of Subarea A and Subarea B by moving the geographic boundary between the two areas from 35°40' N latitude (Point Piedras Blancas, California) to 39° N latitude (Point Arena, California), (2) moved the date when Pacific sardine that remains unharvested is reallocated to Subarea A and Subarea B from October 1 to September 1, (3) changed the percentage of the unharvested sardine that is reallocated to Subarea A and Subarea B from 50% to both subareas, to 20% to Subarea A and 80% to Subarea B, and (4) provided for coastwide reallocation of all unharvested sardine that remains on December 1. This revised allocation framework was in place for the 2003 and 2004 fishing seasons. It was also used in 2005 because the 2005 HG is at least 90% of the 2003 harvest guideline.

2.2.5 Amendment 11

The Council began developing options for a new allocation framework for the coastwide Pacific sardine fishery in 2003 while the fishery operated under the regulatory amendment described in the previous section. This revision to the sardine allocation framework occured through Amendment 11 to the CPS FMP in 2006. The FMP amendment was intended to achieve optimal utilization of the resource and equitable allocation of harvest opportunity.

The Council tasked the CPSAS with initial development of a range of allocation alternatives. At the November 2004 meeting, the CPSAS presented several program objectives and a suite of alternative allocation formulae. The Council adopted for preliminary analysis a range of alternatives, including the CPSAS recommendations, as well as the following program objectives:

- Strive for simplicity and flexibility in developing an allocation scheme.
- Transfer quota as needed.
- Utilize OY.
- Implement a plan that balances maximizing value and historic dependence on sardine.
- Implement a plan that shares the pain equally at reduced HG levels.
- Implement a plan that produces a high probability of predictability and stability in the fishery.

For the analysis of the alternatives, the Council gave specific direction to the CPSMT, including:

- Analyze each alternative in a consistent manner.

- Review differential impacts on northern and southern sectors for each alternative.
- Review effects of high and low catch years by sector for each alternative.
- Review resulting effects at various HG levels ranging from 25,000 mt to 200,000 mt (at appropriate intervals) for each alternative.
- At the discretion of the CPSMT, combine aspects of the various alternatives to create new alternatives that meet program objectives.

At the April 2004 Council meeting, the CPSMT presented preliminary economic analyses of these alternatives to the Council and its advisory bodies. The economic analysis of alternative allocation schemes included five-year projections of the incremental change in producer surplus and landings projections for each fishing sector and subarea. Monthly landings projections were based on 2004 landings and were inflated by 10% annually to account for expected growth in the regional fishery sectors over the next five years. These projections identified months in which there would be a shortfall in landings, and months which would start out with no available allocation. These landings projections were conducted under three HG scenarios: (1) low HG = 72,000 mt, (2) Base case HG = 136,000 mt, and (3) high HG = 200,000 mt.

The Council reviewed the preliminary results and public testimony before following the advice of both the CPSAS and CPSMT when adopting the remaining range of alternatives for further analysis and public review. The Council directed the CPSMT to take into account the advice of the SSC as they proceed with the analysis. Specifically, the Council requested a sensitivity analysis of the effects of future fishery growth where varying growth assumptions by subarea are applied, rather than the previously assumed 10% growth of the fishery coastwide. The Council also recommended that two different provisions for the review of a sardine allocation framework be included in the documentation for public review. The first based on time, where sardine allocation would be reviewed after three, five, or seven years of implementation; the second based on the size of the HG, where sardine allocation would be revisited if the HG falls below 75,000 mt or 100,000 mt.

In June 2005, the Council adopted a long-term allocation framework to apportion the annual Pacific sardine harvest guideline among the various non-tribal sectors of the sardine fishery. The Council followed the unanimous opinion of the CPSAS when adopting a seasonal allocation scheme, which provides the following allocation formula for the non-tribal share of the HG:

(1) January 1, 35% of the harvest guideline to be allocated coastwide;

(2) July 1, 40% of the HG, plus any portion not harvested from the initial allocation, to be reallocated coastwide; and

(3) September 15, the remaining 25% of the harvest guideline, plus any portion not harvested from earlier allocations, to be reallocated coastwide.

The Council also heeded the advice of the CPSAS, CPSMT, and SSC regarding the dynamic nature of the Pacific sardine resource and uncertainties inherent in long-term projections, and scheduled a formal review of the allocation formula in 2008. This review has been postponed and will be considered for rescheduling at the November 2009 Council meeting. The review is intended to provide a comparison of the performance of the fishery to the projections used to evaluate the adopted allocation scheme and will include any new information from Pacific sardine research.

2.2.6 Amendment 12

At the November 2004 meeting the Council initiated development of a formal prohibition on directed fisheries for krill, and directed staff to begin development of management measures to regulate directed fisheries for krill within Council-managed waters. The proposal for a krill ban was first proposed for West Coast National Marine Sanctuary waters by the National Marine Sanctuary Program.

This Amendment was in recognition of the importance of krill as a fundamental food source for much of the marine life along the West Coast. Moreover, 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. There are currently no directed krill fisheries in Council-managed waters.

At the November 2005 Council meeting, the Council recommended that all species of krill be included in the CPS FMP as prohibited harvest species, and approved a range of krill fishing alternatives for public review and additional analysis over the winter. The Council narrowed the range of alternatives to: 1) status quo, 2) a prohibition on krill fishing in all Council-managed waters, and 3) an initial prohibition combined with the establishment of a process for considering future krill fishing opportunities. Of these alternatives, the Council adopted the second, a complete ban on krill fishing as a preliminary preferred alternative.

In March 2006, the Council adopted a complete ban on commercial fishing for all species of krill in West Coast Federal waters and made no provisions for future fisheries. They also specified essential fish habitat (EFH) for krill, making it easier to work with other Federal agencies to protect krill. This broad prohibition will apply to all vessels in Council-managed waters.

Amendment 12 has been approved by the Secretary and, in 2009, NMFS published the implementing regulations in a final rule.

2.2.7 Amendment 13

The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSRA) established several new fishery management provisions pertaining to National Standard 1 (NS1) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSRA sought to end overfishing and required rebuilding plans for those stocks considered to be overfished, It also introduced new fishery management concepts including overfishing levels (OFLs), annual catch limits (ACLs), annual catch targets (ACTs), and accountability measures (AMs) that are designed to better account for scientific and management uncertainty.

At its March, 2010 meeting, the Council adopted for review a draft preliminary alternatives document that will form the backbone of Amendment 13 to the Coastal Pelagic Species Fishery Management Plan. Amendment 13 is scheduled to be implemented for the 2011 CPS fishery.

2.3 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 addition to fishing for CPS finfish, many of these vessels fish for market squid, Pacific bonito, bluefin tuna, and Pacific herring.

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.

2.3.1 Limited Entry Fishery

The CPS LE fleet currently consists of 65 permits and 58 vessels (Table 2-3). The LE vessels range in age from 4 to 68 years, with an average age of 33 years (Table 2-4). 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. Calculated GT incorporates a vessel's length, breadth, and depth, which are consistent measures across vessel registration and U.S. Coast Guard documentation lists. As described at 46 CFR § 69.209, GT is defined as:

$$GT=0.67(length*breadth*depth)/100.$$

Vessel dimension data were obtained from the U.S. Coast Guard database, and each vessel's calculated GT was attached to the permit under Amendment 10. Original GT endorsements (specified in Table 2-3) remain with the permit, regardless of whether the permit is transferred to a smaller or larger vessel.

GT values for the current fleet range from 23.8 GT to 340.2 GT, with an average of 88.7 GT (Tables 2-3 and 2-4). Total fleet GT decreased from 5,462.9 GT to 5,408.4 GT during 2004. This decrease was due to the loss of the "Connie Marie" (permit 64; sank in 2002), which has yet to be replaced by the owner. 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%). The current LE fleet is 5,408.4 GT, well within the bounds of the capacity goal.

2.3.2 Northern Fisheries

2.3.2.1 Oregon State Limited Entry Fishery

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. Twenty-five permits were issued in 2009, but only 20 permits were actively utilized in the fishery. Table 2-5 contains information for vessels that participated in the 2009 fishery. Note that seven vessels landing sardine in Oregon also held either federal or Washington state permits.

ODFW held a series of three public meetings in late 2008 and early 2009 to discuss possible changes to regulations for the 2009 season. The OFWC enacted a number of rule changes for the Pacific sardine fishery in April 2009. First, the OFWC modified the requirement for minimum landings of sardines into Oregon to qualify for permit renewal that was enacted in 2006. The minimum landing requirements for permit renewal are now effective only when the federal coastwide maximum HG for the fishing year exceeds 100,000 mt. The minimum landing requirements themselves, either a minimum of ten landings of at least five mt each or landings totaling at least $40,000 exvessel price, were not changed. Second, the OFWC waived the 2008 annual landing requirements for permit renewal industry wide. Next, the OFWC eliminated a rule that became effective in 2008, which specified that permit holders must either own or operate a vessel that is permitted. The OFWC also established a lottery system for sardine permits. If the number of permits issued falls below 24 a lottery may be held the following year, but the total number issued shall not exceed 26 LE permits. Finally, a new rule put in place for the sardine fishery defined catching vessels and limited catch sharing to permitted catching vessels.

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^{o} N latitude, the fishery for northern anchovy is now an open access fishery off Oregon limited legal gear under the CPS FMP and state regulations.

2.3.2.2 Washington State Limited Entry Sardine Fishery

Pacific sardines are the primary coastal pelagic species harvested in Washington waters. Participation in the sardine fishery was managed under Emerging Commercial Fishery Act (ECFA) provisions, which provides for the harvest of a newly classified species or harvest of a classified species in a new area or by new means from 2000 through 2009. The ECFA gives two choices for fishery-permit designations: trial, which does not limit the number of participants or experimental, which limits participation and prohibits the transfer or sale of the permit. From 2000 through 2002, WDFW managed the purse seine fishery for sardine under the trial designation. Absent limited participation, the Washington fishery was managed to a state HG of 15,000 mt.

The Pacific Northwest sardine fishery saw a rapid expansion of catch between the years 1999 to 2002 when landings increased from 771mt 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 as provided for under the ECFA. 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.

In 2009, experimental fishery permits were issued to 16 fishers meeting the renewal criteria including that they previously held such a permit and also held a minimum of 50 percent ownership in the vessel designated on the sardine permit. Table 2-6 lists the vessels designated in 2009 on Washington sardine fishery permits. Of the 16 permits issued, only 6 were active in the 2009 fishery; two new vessels entered the fishery after the new legislation was passed making the purchase of a sardine license possible.

A mandatory state logbook program has been in place since the fishery began in 2000. The logbook data are maintained in electronic format at the WDFW regional office at Montesano, WA. From 2000 through 2004, WDFW conducted a 5-year observer program to document bycatch levels in the Pacific sardine fishery. Overall observer coverage in this program was in excess of 25 percent and was financially supported by fishery participants as part of their ECFA permit conditions. The results of the observer program showed by-catch of non-targeted species in the Washington sardine fishery to be relatively low. In addition to limiting participation in the fishery, WDFW also restricts the cumulative seasonal total of sardines that can go toward reduction to 15 percent for the individual vessels.

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.

2.3.2.3 Washington State Anchovy Fisheries

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% 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.

2.3.3 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 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.

2.3.4 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.

3.0 Stock Assessment Models

3.1 Pacific Sardine

The Pacific sardine resource is assessed each fall in support of the Council process that sets an annual harvest guideline (HG) for the U.S. commercial fishery. The primary purpose of the assessment is to provide an estimate of current biomass which is used to calculate HGs for the Jan 1 to Dec 31 management cycle. A general overview of the harvest control rule is provided in Sections 4.3.2 and 11.1.1.1 of this SAFE report. For background analyses regarding the harvest control rule, see Amendment 8 of the CPS FMP (PFMC 1998).

The Pacific sardine stock assessment used for 2010 management (Hill *et al*. 2009) was conducted using 'Stock Synthesis' (SS) version 3.03a (Methot 2009). SS is a likelihood-based, length- and age-structured model. The general estimation approach used in SS is a flexible, 'forward-simulation' that allows for the efficient and reliable estimation of a large number of parameters. The general population dynamics and estimator theory that serves as the basis of forward estimation models such as SS is described in Fournier and Archibald (1982), Deriso et al. (1985), Megrey (1989), and Methot (1990, 1998, 2005).

The final SS model for 2010 management included catch and biological samples for the fisheries off Ensenada, Southern California, Central California, and the Pacific Northwest, 1981-2009. Two time series of relative abundance were included in the base model: Daily Egg Production Method and Total Egg Production estimates of spawning stock biomass (1986-2009), both based on annual surveys conducted off California (see Lo et al. 1996, 2005, 2006, 2007a, 2008, 2009). Finally, the tuned base model was run with the addition of the 2009 aerial survey estimate of absolute biomass (q=1) to derive population quantities for 2010 management. An environmental index (i.e., a time series of sea-surface temperatures recorded at Scripps Pier, La Jolla, California) is used to determine a fishing mortality-based proxy for MSY, which is an additional parameter used in the harvest control rule for determination of annual HGs (see Section 11.1.1.1). For details regarding the current assessment model, readers should consult Hill et al. (2009; see Appendix 1 of this SAFE document). For descriptions of methods used in previous Pacific sardine assessment models (CANSAR, CANSAR-TAM, and ASAP), see Deriso et al. (1996), Legault and Restrepo (1999), and Hill et al. (1999, 2006, 2007, 2008).

3.2 Pacific Mackerel

A Pacific mackerel stock assessment is conducted annually in support of the Pacific Fishery Management Council (PFMC) process, which ultimately establishes a harvest guideline ('HG' or quota) for the Pacific mackerel fishery that operates off the USA Pacific Coast. The HG for mackerel applies to a fishing/management season that spans from July 1st and ends on June 30th of the subsequent year (henceforth, presented as a 'fishing year'). In this context, in this document, both a two-year (e.g., 2009-10) and single-year (e.g., 2009) reference refer to the same fishing year that spanned from July 1, 2009 to June 30, 2010. The primary purpose of the assessment is to provide an estimate of current abundance (in biomass), which is used in a harvest control rule for calculation of annual-based HGs. For details regarding this species' harvest control rule, see Amendment 8 of the Coastal Pelagic Species (CPS) Fishery Management Plan (FMP), section 4.0 (PFMC 1998).

Parrish and MacCall (1978) were the first to provide stock status determinations for Pacific mackerel using an age-structured population model (i.e., traditional virtual population analysis, VPA). The ADEPT model (the 'ADAPT' VPA modified for Pacific mackerel; Jacobson 1993 and Jacobson *et al*. 1994) was used to evaluate stock status and establish management quotas for approximately 10 years. The assessment conducted in 2004 (for 2004-05 management) represented the final ADEPT-based analysis for this stock (see Hill and Crone 2004). A forward-simulation model, Age-structured Assessment Program (ASAP; Legault and Restrepo 1998), was reviewed and adopted for Pacific mackerel at the 2004 STAR (Hill and Crone 2005). The ASAP model was used for assessments and management advice from 2005-08 (e.g., see Dorval *et al.* 2008). The STAR conducted in 2009 determined that the Stock Synthesis (SS; Methot 2005, 2009) model provided the best (most flexible) platform for assessing the status of Pacific mackerel currently (i.e., the 2009-10 fishing year) and in the future, see STAR (2009).

The SS model is founded on the AD Model Builder software environment, which essentially is a C++ library of automatic differentiation code for nonlinear statistical optimization (Otter Research 2001). The model framework allows full integration of both population size and age structure, with explicit parameterization both spatially and temporally. The model incorporates all relevant sources of variability and estimates goodness of fit in terms of the original data, allowing for final estimates of precision that accurately reflect uncertainty associated with the sources of data used as input in the overall modeling effort. The overall SS model is comprised of three sub-models: (1) a population dynamics sub-model, where abundance, mortality, and growth patterns are incorporated to create a synthetic representation of the true population; (2) an observation sub-model that defines various processes and filters to derive expected values for different types of data; and (3) a statistical sub-model that quantifies the difference between observed data and their expected values and implements algorithms to search for the set of parameters that maximizes goodness of fit. This modeling platform is also very flexible in terms of estimation of management quantities typically involved in forecast analysis. Finally, from an international context, the SS model is rapidly gaining popularity, with SS-based stock assessments being conducted on numerous marine species throughout the world.

The Pacific mackerel stock assessment conducted in 2009 was based on the SS model (Model "AA" as referenced in the assessment document and STAR Panel Report) and included catch, biological distributions (age, length, and mean length-at-age), and a commercial-passenger fishing vessel (CPFV) index of relative abundance (i.e., catch-per-unit-effort time series), see Crone *et al.* (2009) for the complete stock assessment documentation. Following the STAR in May 2009, the completed assessment was presented, reviewed, and approved by the following management bodies in June 2009: Science and Statistical Committee (SSC); CPS Management Team (CPSMT); and the Pacific Fishery Management Council (PFMC).

Finally, the PFMC, generally supported by the SSC, CPSMT, AND CPSAS, recommended that no formal stock assessment be conducted for the 2010-11 fishing year (i.e., for management purposes, July 1, 2010 to June 30, 2011, see section 11.1.2 and PFMC 2009a or 2009b?), given: (1) limited fishing pressure on the stock is not likely to change dramatically in the short-term and thus, the population is not considered vulnerable to overfishing related to the currently operating fisheries; (2) critical areas of research that support the ongoing stock assessment would benefit from further evaluation (e.g., index of relative abundance associated with southern California-based recreational fisheries, maturity schedule, time-varying selectivity and/or catchability parameterization within the developing SS model, and collaborative efforts concerning data

exchange with both Mexico and Canada; and lastly, (3) a 'full' assessment should be conducted for the 2011-12 fishing year (i.e., for management purposes, July 1, 2011 to June 30, 2012).

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4.0 OPTIMUM YIELD, MAXIMUM SUSTAINABLE YIELD, AND MAXIMUM SUSTAINABLE YIELD CONTROL RULES

Information in this section is excerpted from: Amendment 8 (to the Northern Anchovy Fishery Management Plan) incorporating a name change to the Coastal Pelagic Species Fishery Management Plan. Pacific Fishery Management Council. Portland, Oregon. 1998.

It is important to note that in 2010 and 2011, federally-mandated revisions to current regulations will be implemented in efforts to stem chronic overfishing, which will result in changes to some of the management-related statistics defined below. The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSRA) requires revisions to guidelines presented in *National Standard 1* (see Restrepo et al. 1998) to be in place in 2010-11.

4.1 Optimum Yield

The Magnuson-Stevens Act defines the term "optimum," with respect to the yield from a fishery, as the amount of fish which:

- Will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems.
- Is prescribed on the basis of the MSY from the fishery, as reduced by any relevant social, economic, or ecological factor.
- In the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY in such fishery [50 C*FR* §600.310(f)(1)(i)].

Optimum yield for a CPS stock is defined to be the level of harvest, which is less than or equal to ABC estimated using a MSY control rule, consistent with the goals and objectives of this FMP, and used by the Council to manage the stock. The ABC is a prudent harvest level calculated based on an MSY control rule. In practice, OY will be determined with reference to ABC. In particular, OY will be set less than ABC to the degree required to prevent overfishing.

4.2 Maximum Sustainable Yield, MSY Control Rules, and Acceptable Biological Catch

For CPS, an MSY control rule is defined to be a harvest strategy that provides biomass levels at least as high as the F_{MSY} (fishing mortality rate that maximizes catch biomass in the long term) approach while also providing relatively high and consistent levels of catch. According to Federal regulations (50 CFR §600.310(b)(1)(ii)), an MSY control rule is "a harvest strategy which, if implemented, would be expected to result in a long-term average catch approximating MSY." Similarly, MSY stock size "means the long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units that would be achieved under an MSY control rule in which the fishing mortality rate is constant." The definition of an MSY control rule for CPS is more general, because it includes the definition in National Standard 1. It is also more conservative, because the focus for CPS is oriented primarily towards stock biomass levels at least as high as the MSY stock size. The primary focus is on biomass, rather than catch, because most CPS (Pacific sardine, northern anchovy, and market squid) are very important to the ecosystem as forage.

The MSY control rules in the CPS fishery may vary depending on the nature of the fishery, management goals, assessment and monitoring capabilities, and available information. Under the framework management approach used for CPS, it is not necessary to amend the CPS FMP in order to develop or modify MSY control rules or definitions of overfishing.

The use of an MSY control rule for actively managed stocks provides managers with a tool for setting and adjusting harvest levels on a periodic basis, while preventing overfishing and overfished stock conditions. All actively managed stocks must have stock-specific MSY control rules, a definition of overfishing, and a definition of an overfished stock. Definitions of overfishing and overfished are detailed below in Section 5.

The main use of an MSY control rule for a monitored stock is to help gauge the need for active management. MSY control rules and harvest policies for monitored CPS stocks may be more generic and simpler than those used for actively managed stocks. Under the FMP, any stock supporting catches approaching the ABC or MSY levels should be actively managed unless there is too little information or other practical problems.

4.3 MSY Control Rules for CPS

The Council may use the default MSY control rule for monitored species, unless a better species-specific rule is available. The default MSY control rule can be modified under framework management procedures. The default MSY control rule sets the ABC for the entire stock (U.S., Mexico, Canada, and international fisheries) equal to 25 percent of the best estimate of the MSY catch level. Overfishing occurs whenever total catch (U.S., Mexico, Canada, and international fisheries) exceeds the ABC or whenever fishing occurs at a rate that is high enough to jeopardize the capacity of the stock to produce MSY. Overfishing of a monitored CPS stock is "approached" whenever projections or estimates indicate the overfishing will occur within two years.

In making decisions about active management, the Council may choose to consider the ABC and catches in U.S. waters only. The ABC in U.S. waters is the quota for the entire stock prorated by an estimate of the fraction of the population in U.S. waters. It is important to note that active management may not be effective if U.S. catches are small, and overfishing is occurring in Mexico, Canada, or in international waters outside the jurisdiction of Federal authorities.

4.3.1 General MSY Control Rule for Actively Managed Species

The general form of the MSY control rule used for actively managed CPS fisheries was designed to continuously reduce the exploitation rate as biomass declines. The general formula used is:

$$HG = (BIOMASS\text{-}CUTOFF) \times FRACTION$$

where H is the harvest target level, CUTOFF is the lowest level of estimated biomass at which directed harvest is allowed, and FRACTION is the fraction of the biomass above CUTOFF that can be taken by the fishery. The BIOMASS is generally the estimated biomass of fish age 1+ at the beginning of the fishing season. The purpose of CUTOFF is to protect the stock when biomass is low. The purpose of FRACTION is to specify how much of the stock is available to the fishery when BIOMASS exceeds CUTOFF. It may be useful to define any of the parameters in this general MSY control rule, so they depend on environmental conditions or stock biomass. Thus, the MSY control rule could depend explicitly on the condition of the stock or environment.

The formula generally uses the estimated biomass for the whole stock in one year (BIOMASS) to set harvest for the entire stock in the following year (H), although projections or estimates of BIOMASS, index of abundance values, or other data may be relied upon as well. The BIOMASS represents an estimate and thus, is subject to some amount of uncertainty, e.g., recent CPS stock assessments resulted in coefficients of variation associated with terminal biomass estimates of roughly 30%.

The general MSY control rule for CPS (depending on parameter values) is compatible with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and useful for related species that are important as forage for predators. 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 of spawning stock that is protected from fishing and available for use in rebuilding if a stock becomes overfished. The combination of a spawning biomass buffer equal to CUTOFF and reduced harvest rates at low biomass levels means that a rebuilding program for overfished stocks may be defined implicitly. Moreover, the harvest rate never increases above the FRACTION. If the FRACTION is approximately equal to F_{MSY}, then the MSY control rule harvest rate will not exceed F_{MSY}. In addition to the CUTOFF and FRACTION parameters, it may be advisable to define a maximum harvest level parameter (MAXCAT) so that total harvest specified by the general formula never exceeds the MAXCAT. The MAXCAT is used to protect against extremely high catch levels due to errors in estimating biomass, to reduce year-to-year variation in catch levels, and to avoid overcapitalization during short periods of high biomass and high harvest. Also, the MAXCAT prevents the catch from exceeding MSY at high stock levels and distributes the catch from strong year classes across a wider range of fishing seasons.

Other general types of control rules may be useful for CPS and this FMP does not preclude their use as long as they are compatible with National Standards and the MSFCMA.

4.3.2 MSY Control Rule for Pacific Sardine

The MSY Control Rule for Pacific sardine sets ABC for the entire sardine stock based on an estimate of biomass for the whole sardine stock, a CUTOFF equal to 150,000 mt, a FRACTION between 5% and 15% (depending on oceanographic conditions as described below), and MAXCAT of 200,000 mt. The U.S. ABC is calculated from the target harvest for the whole stock by prorating the total ABC based on 87% proportion of total biomass in U.S. waters.

FRACTION in the MSY control rule for Pacific sardine is a proxy for F_{MSY} (i.e., the fishing mortality rate for deterministic equilibrium MSY). FRACTION depends on recent ocean temperatures, because F_{MSY} and sardine stock productivity are higher under ocean conditions associated with warm water temperatures. An estimate of the relationship between F_{MSY} for sardine and ocean temperatures is:

$$F_{MSY} = 0.248649805\ T^2 - 8.190043975\ T + 67.4558326,$$

where T is the average three-season sea surface temperature (SST) (C°) at Scripps Pier (La Jolla, California) during the three preceding seasons. Thus, the MSY control rule for Pacific sardine sets the control rule parameter FRACTION equal to F_{MSY}, except that FRACTION is never allowed to be higher than 15% or lower than 5%, which depends on recent average sea surface temperature.

Although F_{MSY} may be greater or lesser, FRACTION can never be greater than 15% or less than 5% unless the MSY control rule for sardine is revised, because 5% and 15% are policy decisions based on social, economic, and biological criteria. In contrast, relationships between FRACTION, F_{MSY} and environmental conditions are technical questions and estimates or approaches may be revised by technical teams (e.g., the CPSMT) to accommodate new ideas and data.

4.3.3 MSY Control Rule for Pacific Mackerel

The MSY control rule for Pacific mackerel sets the CUTOFF and the definition of an overfished stock at 18,200 mt and the FRACTION at 30%. Overfishing is defined as any fishing in excess of the ABC calculated using the MSY control rule. No MAXCAT is defined, given the U.S. fishery appears to be limited by markets and resource availability to about 40,000 mt per year; however, in the event landings increase substantially, then the need for such a cap should be revisited. The target harvest level is defined for the entire stock in Mexico, Canada, and U.S. waters (i.e., not just the U.S. portion), and the U.S. target harvest level is prorated based on 70% relative abundance in U.S. waters.

4.3.4 MSY Control Rule for Market Squid

A potential MSY Control Rule for market squid, generally referred to as the Egg Escapement Method, was investigated over the course of several years during the early 2000s in efforts to provide a meaningful management tool for this species (e.g., see Dorval et al. 2008). This research addressed harvest and abundance relationships via per-recruit analysis, generally concluding that although such a monitoring/modeling effort provided informative (descriptive) statistics regarding population dynamics surrounding this species, further work in the laboratory (e.g., 'potential' fecundity estimation) and modeling (e.g., broader simulation analysis) were necessary before implementing the method for long-term management purposes. That is, the research highlighted substantial spatial and temporal variability in productivity of the population(s) off the central-southern California Coast, which in effect, hindered the applicability of the method in practical terms and ultimately, emphasized the need for timely data collection, laboratory processing, and modeling, if the method is employed formally in the future.

At this time in the development of the Egg Escapement Method, the approach should be considered strictly an "informal" management tool for this species (e.g., see Appendix 3 in PFMC (2002) for further discussion concerning specific details involved in this assessment approach, as well as review-related discussion). Ultimately, "formal" management is implemented via a state-based management plan that includes an annual landings cap and various spatial/temporal fishery-related constraints (CDFG 2005). The research in combination with the practical management approach appears the most reasonable at this time and supports this species' current status as a "monitored' stock. It is important to note that the main objective of a MSY Control Rule for a "monitored" stock (e.g., market squid) is to help assess the need for "active" management. That is, the MSY Control Rules and harvest policies for monitored CPS stocks may be based on broader concepts and constraints than those used for stocks with significant fisheries that fall under active management. Any fishery whereby catches approach an ABC or MSY level warrant consideration within active management processes, given catch statistics are scientifically based and management operations can be practically implemented.

Overfishing of a monitored CPS stock is considered whenever current estimates or projections indicate that a minimum stock threshold will be realized within two years. In this context, it would be beneficial to conduct the Egg Escapement Method on a systematic basis to assess the reproductive dynamics of the stock and subsequently, the need for an "active" management policy for this species.

4.4 Section References:

California Department of Fish and Game (CDFG). 2005. Final market squid fishery management plan. Document can be obtained from State of California Resources Agency, Department of Fish and Game, Marine Region, 4665 Lampson Avenue (Suite C), Los Alamitos, CA 90720. 124 p.

Dorval, E., J. McDaniel, and P. Crone. 2008. Squid population modeling and assessment (January 2008). Final report submitted to the California Department of Fish and Game (Marine Region) and the Southwest Fisheries Science Center. 30 p.

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). 1990. Public Law 94-265.

Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA). 2006. Public Law 109-479.

Restrepo, V. R., and ten co-authors. 1998. Technical guidance on the use of precautionary approaches to implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-31.

Pacific Fishery Management Council (PFMC). 1998. Amendment 8 (To the northern anchovy fishery management plan) incorporating a name change to: the coastal pelagic species fishery management plan. Document can be obtained from Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220.

Pacific Fishery Management Council (PFMC). 2002. Status of the Pacific Coast coastal pelagic species fishery and recommended acceptable biological catches: stock assessment and fishery evaluation (2002). Appendix 3: market squid MSY. Document can be obtained from Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220.

5.0 Overfishing Considerations

Information in this section is excerpted from: Amendment 8 (To the Northern anchovy fishery management plan) incorporating a name change to: the Coastal Pelagic Species Fishery Management Plan. Pacific Fishery Management Council. Portland, Oregon. 1998.

5.1 Definition of Overfishing

By definition, overfishing occurs in a fishery whenever fishing occurs over a period of one year or more at a rate that is high enough to jeopardize the capacity of the stock to produce MSY on a continuing basis if applied in the long-term. Overfishing in the CPS fishery is "approached" whenever projections indicate overfishing will occur within two years. The definition of overfishing is in terms of a fishing mortality or exploitation rate. Depending on the exploitation rate, overfishing can occur when CPS stocks are at either high or low abundance levels. The Council must take action to eliminate overfishing when it occurs and to avoid overfishing when exploitation rates approach the overfishing level.

In operational terms, overfishing occurs in the CPS fishery whenever catch exceeds ABC, and overfishing is approached whenever projections indicate that fishing mortality or exploitation rates will exceed the ABC level within two years. The definition of an overfished stock is an explicit part of the MSY control rule for CPS stocks.

5.2 Definition of an Overfished Stock

By definition, an overfished stock in the CPS fishery is a stock at a biomass level low enough to jeopardize the capacity of the stock to produce MSY on a continuing basis. An overfished condition is approached when projections indicate that stock biomass will fall below the overfished level within two years. The Council must take action to rebuild overfished stocks and to avoid overfished conditions in stocks with biomass levels approaching an overfished condition.

5.3 Rebuilding Programs

Management of overfished CPS stocks must include a rebuilding program that can, on average, be expected to result in recovery of the stock to MSY levels in ten years. It is impossible to develop a rebuilding program that would be guaranteed to restore a stock to the MSY level in ten years, because CPS stocks may remain at low biomass levels for more than ten years even with no fishing. The focus for CPS is, therefore, on the average or expected time to recovery based on realistic projections. If the expected time to stock recovery is associated with unfavorable ecosystem conditions and is greater than ten years, then the Council and the Secretary may consider extending the time period as described at 50 CFR § 600.310(e).

Rebuilding programs for CPS may be an integral part of the MSY control rule or may be developed or refined further in the event that biomass of a CPS stock reaches the overfished level.

6.0 Bycatch and Discard Mortality

Fishery management plans prepared by a fishery management council or by the Secretary must, among other things, establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent are practicable and in the following priority:

1. Minimize Bycatch.
2. Minimize the mortality of bycatch that cannot be avoided.

The Magnuson-Stevens Act defines bycatch as "fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Such term does not include fish released alive under a recreational catch and release fishery management program" (16USC1802).

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. When the school is surrounded, the bottom of the net may be closed, then the net drawn next to the boat. The area including the free-swimming fish is diminished by bringing one end of the net aboard the vessel. When the fish are crowded near the fishing vessel, pumps are lowered into the water to pump fish and water into the ship's hold. Another technique is to lift the fish out of the net with netted scoops (e.g., brails). 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. Incidental harvest of non-prohibited larger fish are often taken home for personal use or processed.

Historically, market squid have been fished at night with the use of powerful lights, which cause squid to aggregate, which enables fishermen to pump squid directly from the sea or to encircle them with a net. California actively manages the market squid fishery in waters off California and has developed an FMP for the state-managed fishery. California's market squid FMP established a management program for California's market squid resource with goals that are aimed at ensuring sustainability of the resource and reducing the potential for overfishing. The tools to accomplish these goals include:

- Establishing fishery control rules, including a seasonal catch limitation to prevent the fishery from over-expanding; continuing weekend closures, which provide for periods of uninterrupted spawning; continuing gear regulations regarding light shields and wattage used to attract squid; and maintaining monitoring programs designed to evaluate the impact of the fishery on the resource.

- Instituting a restricted access program, including provisions for initial entry into the fleet, types of permits, permit fees, and permit transferability.
- Establishing a general habitat closure area in northern California rarely used by the squid fishery to eliminate the potential of future negative interactions with seabirds, marine mammals, and important commercial and sport fishes, and adding limitations on using lights to attract squid around several of the Channel Islands, an effort intended to protect nesting seabirds.

In addition to the reasons discussed above, several circumstances in the fishery tend to reduce bycatch:

1. Most of what would be called bycatch under the Magnuson-Stevens Act is caught when roundhaul nets fish in shallow water over rocky bottom. Fishers try to avoid this to protect gear. Also, they may be specifically prohibited to fish these areas because of closures.
2. South of Pt. Buchon, California, many areas are closed to roundhaul nets under California law and the FMP, which reduces the chance for bycatch.
3. In California, a portion of the sardine caught incidentally by squid or anchovy fishers can be sold for reduction, which reduces discard.
4. The five tons or less allowable landing by vessels without LE permits under the FMP should reduce any regulatory discard, because those fish can be landed.
5. From 1996 to 2003, bycatch from the live bait logs was reported with an incidence of 10%. The primary species taken as incidental catch was barracuda. Virtually all fish caught incidentally in this fishery are either used for bait, for personal use, or released alive. See Table 16-11.
6. CDFG has implemented a logbook program for the squid fishery. The data to be collected includes bycatch.

Generally, fisheries for CPS can be divided into two areas: north and south of Pigeon Point, California (approximately 37°10' N latitude). In recent history, virtually the entire commercial fishery for CPS finfish and market squid has taken place south of Pigeon Point. The potential for taking salmon exists in this area, but diminishes south of Monterey, California (37° N latitude). Starting in 1999, CPS fisheries (notably, targeting Pacific sardine) increased in waters off Oregon and Washington. Oregon and Washington actively manage these northern fisheries, in part, because of the heightened potential for salmon bycatch. Section 6.1 through 6.2 describes the California fishery; Section 6.3 provides information on Oregon and Washington fisheries.

See Amendment 9 to the CPS FMP (Environmental Assessment (EA) /Regulatory Impact Review, March 2001) for a complete description of bycatch-related issues and monitoring and reporting requirements. Amendment 9 is available from the Council office.

6.1 Federal Protection Measures

The National Marine Fisheries Service regularly conducts Endangered Species Act (ESA) section 7 consultations to ensure that federally threatened or endangered species are not adversely affected by federally managed fisheries. Since 1999, the NMFS Southwest Region (SWR) has conducted eight consultations with Federal agencies, including the NMFS Protected

Resource Division (PRD) and U.S. Fish and Wildlife Service (USFWS) regarding the CPS fishery.

Most recently, the NMFS SWR Sustainable Fisheries Division initiated a formal section 7 consultation with NMFS SWR Protected Resources Division (PRD) for the implementation of Amendment 11 to the CPS FMP. PRD completed a formal section 7 consultation on this action and in a Biological Opinion dated March 10, 2006, 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, and Lower Columbia River coho were deemed not likely to be jeopardized by the Pacific sardine fishery.

NMFS also initiated an ESA section 7 consultation with 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.

These reporting requirements and conservation measures require all CPS fishermen and vessel operators to employ avoidance measures when sea otters are present in the fishing area and to report any interactions that may occur between their vessel and/or fishing gear and otters. Specifically, these new measures and regulations are:

1. CPS fishing boat operators and crew are prohibited from deploying their nets if a southern sea otter is observed within the area that would be encircled by the purse seine.
2. If a southern sea otter is entangled in a net, regardless of whether the animal is injured or killed, such an occurrence must be reported within 24 hours to the Regional Administrator, NMFS Southwest Region.
3. While fishing for CPS, vessel operators must record all observations of otter interactions (defined as otters within encircled nets or coming into contact with nets or vessels, including but not limited to entanglement) with their purse seine net(s) or vessel(s). With the exception of an entanglement, which will be initially reported as described in #2 above, all other observations must be reported within 20 days to the Regional Administrator.

6.1.1 California Coastal Pelagic Species Pilot Observer Program

NMFS SWR initiated a pilot observer program for California-based commercial purse seine fishing vessels targeting CPS in July 2004 with hopes of augmenting and confirming bycatch

rates derived from CDFG dockside sampling. SWR personnel trained the first group of CPS observers in mid-July in Long Beach, California. Frank Orth and Associates, a private contractor, hired and provided observers for training and subsequent deployment. Six observers who had previous experience in other SWR-observed fisheries attended and completed the course. The training course emphasized a review of ongoing observer programs (drift gillnet, pelagic longline) and introduction to the soon-to-be observed fisheries (purse seine, albacore hook-and-line). The training curriculum included vessel safety, fishing operations, species identification, and data collection.

In late July 2004, observers began going to sea aboard CPS vessels. Observers used ODFW's Sardine Bycatch Observations' form to record data on fishing gear characteristics, fishing operations, and target/non-target species catch and disposition. Observers also recorded data on trip specifics and protected species sightings/interactions. Observers had access to data field definitions in their SWR observer program Field Manuals. Most data detailing length, volume, or weight are obtained verbally from the vessel operator. Position and time data are recorded by the observer directly from hand-held or on-board electronics.

Data from this ongoing program has been compiled though January 2006 (Tables 6-1 through 6-4). A total of 107 trips by vessels targeting CPS (228 sets) were observed from July 2004 to January 2006. Tables 6-1 through 6-4 show how incidental catch and bycatch data collected during this time and are categorized by target species of the trip (i.e., Pacific sardine, Pacific mackerel, market squid or anchovy). Additionally, from January 2006 to January 2008 a total of 199 trips (426 sets) were observed. Although incidental catch and bycatch data collected during this time is continuing to be analyzed and categorized, no marine mammals, sea turtles, or seabirds were observed as bycatch.

Future needs of the CPS observer program include: standardization of data fields, development of a fishery-specific Observer Field Manual, construction of a relational database for the observer data, and creation of a statistically reliable sampling plan. A review of the protocol and catch data by NMFS Southwest Science Center staff, the CPS Management team and other CPS interested parties is planned in the future to help address some of these needs.

6.2 Fishery South of Pigeon Point

Information from at-sea observations of the CDFG and conversations with CPS fishers suggest that bycatch is not significant in these fisheries. However, some individuals have expressed concern that game fish and salmon might constitute significant bycatch in this fishery. This is a reasonable concern, because anchovy and sardine are forage for virtually all predators, but there are no data to confirm significant bycatch of these species. CDFG port samples indicate minimal incidental catch in the California fishery (Tables 6-5). The behavior of predators, which tend to dart through a school of prey rather than linger in it, and can more easily avoid encirclement with a purse seine, may help to minimize bycatch.

CDFG port samplers collect information from CPS landings in Monterey and ports to the south. Biological samples are taken to monitor the fish stocks, and port samplers report incidentally caught fish. Reports of incidental catch by CDFG port samplers confirm small and insignificant landings of bycatch at California off-loading sites (Tables 6-5). These data are likely representatives of actual bycatch, because (as noted) fish are pumped from the sea directly into fish holds aboard the vessel. Fishers do not sort catch at sea or what passes through the pump;

however, large fishes and other animals that cannot pass through the pump are not observed by the port sampler. Unloading of fish also occurs with pumps. The fish is either pumped into ice bins and trucked to processing facilities in another location or to a conveyor belt in a processing facility, where fish are sorted, boxed, and frozen.

From 1985 through 1999, there were 5,306 CDFG port samples taken from the sardine and mackerel landings. From 1992 to 1999, incidental catch was reported on only 179 occasions, representing a 3.4 percent occurrence. Up to 1999 reports of incidental catch were sparse, and prior to 1992 none were reported. Earlier incidents of bycatch may not have been noted, because the harvest of anchovy and sardine was small, and only in recent years has the harvest of sardine increased. The incidental catch reported are primarily those species that are marketable and do not meet the definition of bycatch in the Magnuson-Stevens Act. During this period, unless an incidental species represented a significant portion of the load (at least a whole percentage point) the amount of the incidental catch was not recorded. Of the incidental catch reported from 1992 to 1999, the two most prevalent species were market squid at 79 percent, and northern anchovy at 12 percent incidence within samples (not by load composition). CDFG port samples provide useful information for determining the significance of bycatch in the CPS fishery off California (south of Pigeon Point).

In 2001, California wetfish port samplers began tallying undocumented incidental catch observed during landings in greater detail, and listed the occurrence of species in each sampled landing. The port sampling program records bycatch observed (i.e., presence or absence evaluations), but actual amounts of incidental catch have not been quantified to date. These observations are summarized for all areas in Table 6-5 for the last 5 years (2005 – 2009). The dynamic of the 2008 sardine fishery changed due to a decrease in the annual harvest guideline. Since then, fishing activity no longer takes place year around, but has been truncated within each allocation period. This may have affected the types and frequencies of organisms observed during the offloading process of sardine. The most commonly occurring flora and fauna in wetfish landings during 2009 were kelp, northern anchovy, jellyfish, Pacific sanddabs, market squid, and white croaker. Sixty incidental species were observed in total.

Larger fish and animals are typically sorted for market, personal consumption, or nutrient recycling in the harbor. To document bycatch more fully at sea, including marine mammal and bird interactions, NOAA Fisheries has placed observers on a number of California purse seine vessels beginning in the summer of 2004 (see Sec. 11.6).

6.2.1 Incidental Catch Associated with the Market Squid Fishery

Because market squid frequently school with CPS finfish, mixed landings of market squid and incidentally caught CPS finfish occur intermittently. In 2009, about 1 percent of round haul market squid landings (by volume) included reported incidental catch of CPS (Table 6-6).

Although non-target catch in market squid landings is considered minimal, the presence of incidental catch (i.e., species that are landed along with market squid that are not recorded through landing receipt processes [i.e., not sold] as is typically done for incidentally-caught species) has been documented through CDFG's port sampling program. The port sampling program records incidental catch observed (i.e., presence or absence), but actual amounts of incidental catch have not been quantified to date. During 2009, incidental catch consisted of 29

species (Table 6-7). Similar to previous years, most of this catch was other pelagic species, including Pacific sardine and mackerel. However, kelp was also observed frequently.

The extent that market squid egg beds and bottom substrate are damaged by purse seine operations, which subsequently may contribute to mortality of early life stages is not definitively known at this time. One way to determine if nets are disturbing egg beds is to look for egg cases in market squid landings. When market squid egg cases are observed at offloading sites, there are two potential reasons that egg cases may be in the net: 1) market squid released eggs in the net after being captured, or 2) egg cases were taken from the ocean floor during fishing activity. In 2009, market squid egg cases were identified in 5.2 percent of observed landings. Since market squid exude egg cases while in a purse seine net, the observed egg cases need to be collected and aged. If egg cases are more than one day old, then egg cases were likely to have been taken from the bottom. According to CDFG market squid logbooks, fishing nets in the northern fishery have the potential to contact the bottom more frequently than in the southern fishery. In this context, further investigations regarding potential damage to market squid spawning beds from fishery-related operations would likely benefit status-based analyses concerning the overall market squid population off California, given eggs-per-recruit theory underlies the recently adopted market squid assessment method. In 2007, CDFG developed a protocol to retain egg capsules in order to determine first, if capsule age can be quickly determined in the laboratory, and second whether a measure of egg bed disturbance can be produced. Based on market squid embryo development and the condition of the outside of the egg capsule, determining if the egg case was laid in the net or collected from the bottom is possible.

6.3 Fishery North of Point Arena

Since 1999, limited fisheries for Pacific sardines have occurred off the Pacific Northwest. Oregon and Washington closely monitor these fisheries and collect information about landings. Information on bycatch from Oregon and Washington is summarized in Tables 6-8 through 6-10.

6.3.1 Oregon

Vessels landed 20,298 mt of Pacific sardine in 371 Oregon landings in 2009. The harvest was down 23 percent from the 22,948.7 mt of sardines landed in Oregon in 2008. All of the directed fishery harvest took place in allocation periods 2 and 3 during July and September. The decrease in harvest reflected the 25 percent reduction in the coastwide HG in 2009 from 2008 (Table 11-3). The early closures of all three allocation periods limited fishing during the traditional peak months of August and September and prevented fishing off Oregon during June and October a time when the fishery was open and sardines were landed in past years. As in the past, spotter planes hired by the industry were used to locate fish schools. Sardines were landed by state permitted LE vessels primarily in Astoria and Warrenton at seven different processors. Sardine value varied from $0.00 to $0.12 per pound, with 96.6 percent of fish landed valued at greater than $0.05/lb. The exvessel value of sardine landed in Oregon in 2009 was roughly $4.98 million with the average price slightly more than $0.11/lb or $246.6 per mt.

Oregon's LE sardine permit rules stipulate that an at sea observer be accommodated aboard vessels when requested by ODFW. ODFW currently does not have personnel dedicated to observe on sardine vessels and document bycatch of non-target species and no federal observers

were placed on the vessels. Available state staff made attempts to observe trips, however only one of the 371 trips (0.2 percent) was successfully observed. No sets were made during that trip due to poor weather conditions. The state requires the use of a grate over the intake of the hold to sort out larger species of fish, such as salmon or mackerel. The grate size spacing can be no larger than 2-3/8 inches between bars. Non-target species caught in the 2009 season included Pacific and jack mackerel, American shad, Northern anchovy, Pacific hake, salmon, sharks, skates, and jellyfish. Oregon LE sardine permit rules require logbooks that record incidental catch including salmonids and other species (Table 6-9). The estimated total catch of salmon for the fishery, based on log data, was 248 salmon. Based on this estimate, the incidental catch rate was 0.012 salmon per mt of sardines landed. An estimated 53 percent of all salmon were released alive. Based on Oregon fish tickets, bycatch in the fishery continues to be relatively low, with approximately 52.6 mt of non-target species landed (Table 6-10) with 20,298 mt of sardine. Almost 98% of the non-target species landed in the sardine fishery was other coastal pelagic species. Pacific mackerel accounted for 49.5 mt and had an ex-vessel value of approximately $4,767. Jack mackerel accounted for 2.0 mt of incidental catch.

6.3.2 Washington

The Washington fishery opened by rule on April 1, 2009; however, the first landing into Washington did not occur until July 1 because fishers reached the first period allocation by February 20, 2009. WDFW issued a total of 16 permits and 6 of the permit holders participated in the fishery in July. Another two vessels joined the sardine fishery in September. These two vessels were new entrants, having just obtained sardine licenses when the fishery moved from emerging to standard rules in July. A total of 8,026 mt of sardines were landed into Washington in 2009; three vessels accounted for 62 percent of the catch. Of the 173 landings in 2009, 59 percent were made in July and 41 percent were made in September. The average landing into Washington was about 46 mt. All landings were made into Westport or Ilwaco with the majority of the catch (95%) occurring in waters adjacent to Washington. A total of 238 sets were made with 203 (85%) of them successful. The average catch per successful set was about 44 mt.

From 2000 through 2004, WDFW required fishers to carry at-sea observers, as well as provide financial support for this observer effort. Bycatch information was collected in terms of species, amount, and condition; observers noted whether the fish were released or landed, and whether alive, dead, or in poor condition. During the five-year period of the program, overall observer coverage averaged over 25 percent of both total landed catch and number of landings made. Based on observer data, the bycatch of non-targeted species in the Washington sardine fishery was relatively low. Due to low bycatch levels, as well as a WDFW commitment to industry that the observer fee would only be assessed until bycatch in the sardine fishery could be characterized, the mandatory observer program was suspended at the conclusion of the 2004 season. A comparison of logbook and observer data from 2000 to 2004 indicated that logbook data, in general, tended to under report bycatch by 20 to 80 percent (Culver and Henry, 2006). For this reason, salmon bycatch in the Washington sardine fishery for years subsequent to the observer program is calculated by multiplying total sardine catch and the observed 5-year average bycatch rates. Bycatch and mortality estimates of incidentally captured salmon by year and species are shown in Table 6-8.

Incidental species caught and reported on Washington fish tickets are shown in Table 6. 14. Mackerel, both Pacific and jack, comprise the majority of non-target catch in the sardine fishery. In 2009, 4.31 tons of mackerel were landed in the 2009 season; other species recorded on fish tickets included sharks (less than 0.1 ton) and jellyfish (coded as miscellaneous).

6.4 Section References

Culver, M., and C. Henry, 2006. Summary Report of the 2005 Experimental Purse Seine Fishery for Pacific Sardine (Sardinops sagax). Washington Department of Fish and Wildlife, Montesano, Washington. 11 pp.

7.0 Live Bait Fishery

7.1 California Live Bait Fishery

Through much of the 20th century, CDFG monitored the harvest of CPS finfish in the California live bait fisheries by requiring live bait logs. Northern anchovy and Pacific sardine are the main species in this fishery, with a variety of other nearshore or CPS taken incidentally. An estimated 20% of this harvest is sold to private fishing vessels, with the remainder to the CPFV fleet, where payment to the bait haulers is on a percentage basis of the CPFV revenues (Thomson *et al.* 1994). An example of the first Live Bait Log from 1939, termed a "Daily Bait Record" as printed for the State of California, Department of Natural Resources, and Division of Fish and Game can be found in Alpin (1942). The nature of the data collected were self-reported daily estimates of the number of "scoops" taken and sold by the fishermen, by species. Although this variety of data does not lend itself readily to rigorous scientific analysis, there are at least 63 years of data available, collected in a reasonably uniform manner that can serve as an index to this low volume, high value fishery.

Studies conducted by CDFG, NMFS, and others have examined this fishery, generally with a focus on the dominant species taken over a given period. As in the directed commercial CPS fisheries, the local availability of each CPS to the bait fleet changes periodically. Problems with the live bait data such as conversion factors for scoops of live fish to weight, the economics of the fishery, the character of the fleet, and compliance rates in submitting logs have been addressed in various agency reports (Maxwell 1974; and Thomson *et al.* 1991, 1992, 1994).

7.1.1 Legislative History

Alpin (1942) describes the earliest implementation of the live bait log program in 1939, which followed a pilot program of verbal interaction with the fishermen that established four categories describing the variation in abundance or availability of CPS to the recreational industry.

Live bait logs have been at different times mandated by state law or submitted to the CDFG on a voluntary basis. In the early 1990s sardine became more prevalent in the bait fishery, and quotas were imposed on their annual take pursuant to management efforts to recover the sardine population off California. In 1995, CDFG lifted quotas restricting the quantity of sardines that

the live bait industry could harvest. The sardine population along the California Coast was increasing toward a "recovered" level, as anchovy showed a decline, and sardines became the preferred live bait over anchovy. With the sardine quota lifted, the level of scrutiny on the harvest of the live bait industry lessened.

7.1.2 Species Composition

The ratio of anchovy to sardine in the southern California live bait harvests shifts significantly as the populations of these two fish expand and contract over periods of years or decades. Much of the early reported harvest consisted of anchovy, following the collapse of the sardine fishery in the 1940s. Through the years 1994 to 2006 the proportion of anchovy in the total reported harvest ranged from a high of 58 percent in 1994 to a new low in 2004 of five percent. The proportion of sardine ranged from a low of 42 percent in 1994, to a new high of 95 percent in 2004 (Table 6-13).

A new market squid live bait fishery has expanded in southern California in recent years. However, the amount of market squid harvested and the value of the fishery is largely unknown, as there are no permitting and reporting requirements. The live bait fishery is likely a low-volume, high-value endeavor, as recreational anglers targeting mainly white seabass are willing to pay up to $85 for a "scoop" of live squid.

7.1.3 Logbook Information

The CDFG Live Bait Log (Title 14, Section 158, California Code of Regulations: DFG 158, October 1989) requires only the estimated scoops taken daily of either anchovy or sardine be reported, and a check mark be made if other particular species were taken, with space for comments related to fishing. Other species noted, but not consistently enumerated in the live bait harvest, include white croaker (*Genyonemus lineatus*), queenfish (*Seriphus politus*), Pacific and jack mackerels, and various small fishes collectively known as "brown bait" that can include juvenile barracuda (*Sphyraena argentea*), Osmerids, Atherinids, and market squid (Table 6-11). Estimates of ancillary catch data has been documented in earlier reports, and in CPS FMP Amendment 9.

The CDFG Pelagic Fisheries Assessment Unit at the SWFSC in La Jolla presently archives the CDFG live bait logs. Preliminary estimates of the reported total live bait harvest in California through 2008 have been appended to previously reported estimates from Thomson *et al.* (1991, 1992, 1994) (Table 6-12). The CDFG is in the process of an evaluation of the current logbook structure, reporting requirements, and the information obtained in order to correct the data problems identified above, increase reporting compliance rates, and to better estimate the economics of the fishery.

7.2 Oregon Live Bait Fishery

In 2009 the Oregon Fish and Wildlife Commission implemented rules to allow capture of northern anchovy in a limited number of Oregon estuaries, all other species must be released unharmed. This harvest of anchovy is limited to commercial vessels that utilize the anchovy as live bait in commercial fishing operations on the catching vessel. The gear utilized to capture anchovy is restricted to purse seines with a maximum length of 50 fathoms (300 ft), lampara

nets, and hook and line. This fishery is open from July 1 to October 31. Fishers intending to fish for anchovy in this manner must notify Oregon State Police with the vessel name, fishing location and estimated time of the activity 12 hours prior to fishing activity. Information on live bait catch must be recorded in logbooks provided by ODFW. In 2009, there was no record of live bait capture of anchovy in Oregon under these new rules. There has also been interest expressed in commercial operations to capture and hold anchovy to be sold as live bait in some of these estuaries. There is no provision in rule to date for commercial operations to capture, hold and sell anchovy as live bait in any of these estuaries except in the Umpqua estuary where Pacific herring, Pacific sardine, northern anchovy, smelt and American shad may be taken by beach seine and sold as bait, some of which is sold as live bait.

7.3 Washington Live Bait Fishery

A portion of Washington's anchovy landings include live bait destined for use in recreational and commercial fisheries. Although all Washington anchovy landings are listed on fish tickets regardless of their ultimate use, Washington does not distinguish between anchovy destined for packaged product versus anchovy destined for use as live bait.

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.

7.4 References:

Alpin, J. A. 1942. Bait records in The commercial fish catch of California for the year 1940. Calif. Dept. Fish and Game Fish Bull. 58: 20-23.

Maxwell, W. D. 1974. A History of the California Live-Bait Fishing Industry. Calif. Dept. Fish and Game Marine Resources Technical Report 27. 24 p.

Thomson, C. J., T. Dickerson, G. Walls, and J. Morgan. 1991. Status of the California coastal pelagic fisheries in 1990. NMFS, SWFSC Admin. Rep. LJ-91-22: 27 p.

Thomson, C. J., T. Dickerson, G. Walls, and J. Morgan. 1992. Status of the California coastal pelagic fisheries in 1991. NMFS, SWFSC Admin. Rep. LJ-92-95:46 p.

Thomson, C. J., T. Bishop, and J. Morgan. 1994. Status of the California coastal pelagic fisheries in 1993. NMFS, SWFSC Admin. Rep. LJ-94-14.

Title 14, California Code of Regulations.

California Fish and Game Code. 2000. Lexis Law Publishing, Charlottesville, VA. 553 p.

California Fish and Game Code. 2001. Gould publications, Altamonte Springs, FL. 568 p.

8.0 Safety at Sea Considerations

In implementing any form of management, it is imperative to evaluate whether the strategy will impact the safety of fishing activities. Roundhaul fisheries operating off the Pacific Coast are often limited by environmental conditions, most notably inclement weather. Given that the average age of permitted CPS vessels in the LE fishery is 32 years and many older vessels are constructed of wood, concern has been raised regarding their safety and seaworthiness. Implementing time/area closures or restricting transferability could impact safety by restricting the ability of an older vessel to be replaced with a newer, safer vessel or by promoting fishing activity during potentially hazardous weather conditions.

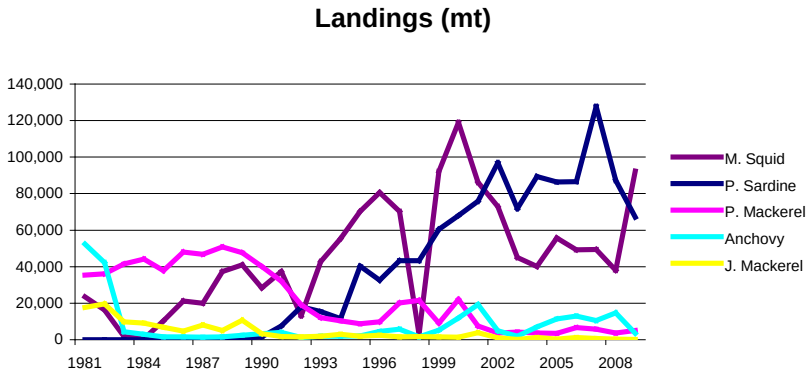
In January 2003, NMFS published final regulations to implement Amendment 10 to the CPS FMP, which allows LE permits to be transferred to another vessel and/or individual.

As discussed in Section 2.2, the Council has implemented a long-term allocation strategy for sardines under Amendment 11 to the CPS FMP. This action is not expected to have a substantial adverse impact on public health or safety. However, for Pacific Northwest fisheries, the action is anticipated to enhance safety at sea by advancing the reallocation date from October 1 to September 15. Waiting until October 1 to reallocate has the potential of inducing fishermen to fish in unsafe weather conditions. Ocean conditions off Oregon and Washington become increasingly rough in October. Also, crossing the Columbia River bar, always a hazardous exercise, becomes very dangerous during this time of year.

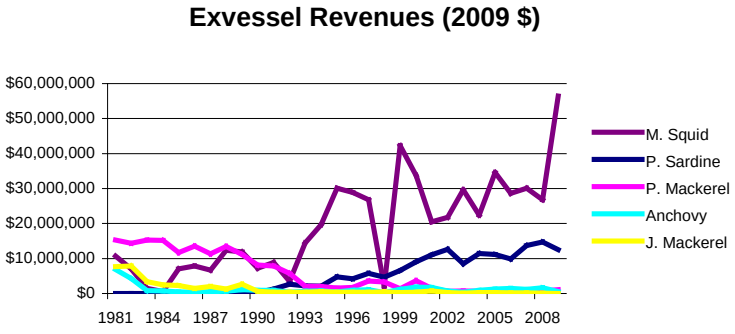
In 2008 and 2009 the directed Pacific sardine fishery experienced seasonal closures because harvest guidelines in these years have dropped while Pacific sardine continue to be available to the fishery and market demand is steady or increasing. This has lead to a “derby style” fishery where vessels compete for a share of the seasonal harvest guideline over a short period of time. This circumstance can create situations where safety considerations may be compromised as season duration is compressed and competition increases.

9.0 ECONOMIC STATUS OF WASHINGTON, OREGON, AND CALIFORNIA CPS FISHERIES IN 2009

This section summarizes economic data presented in Tables 25-29 (presented in the Tables section following Chapter 13) and Figures 9-1 through 9-8 (at the end of this chapter). 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.

Figure 9-1. Annual West coast landings and real exvessel revenues for all CPS species, 1981-2009.

Figure 9-2. Percentage contribution of Pacific coast CPS finfish and market squid landings to the total exvessel value of all Pacific coast landings, 1981-2009.

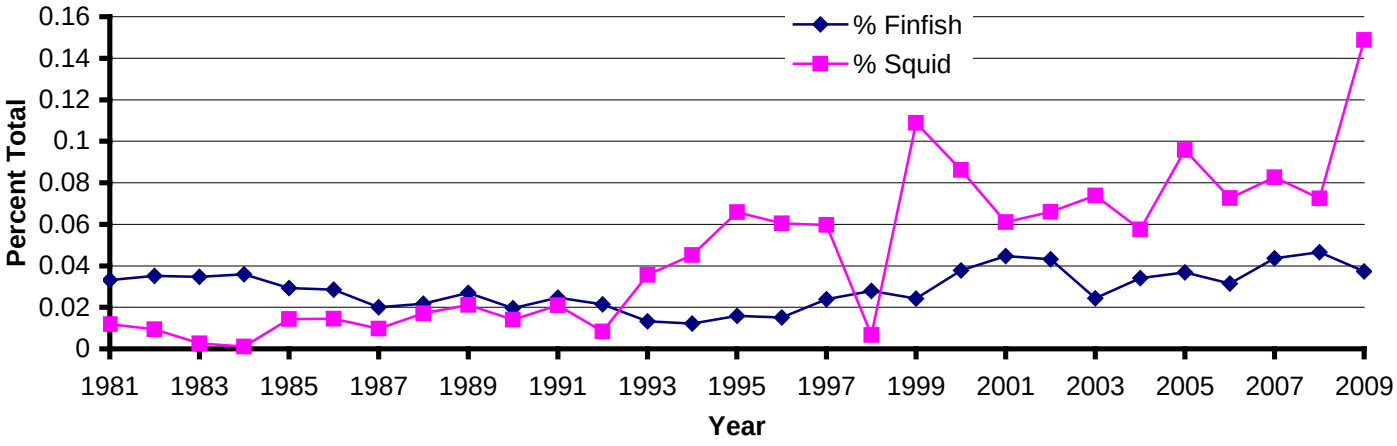


Figure9-3. West coast CPS finfish landings and real exvessel price ($/lb, 2009 $), 1981-2009.

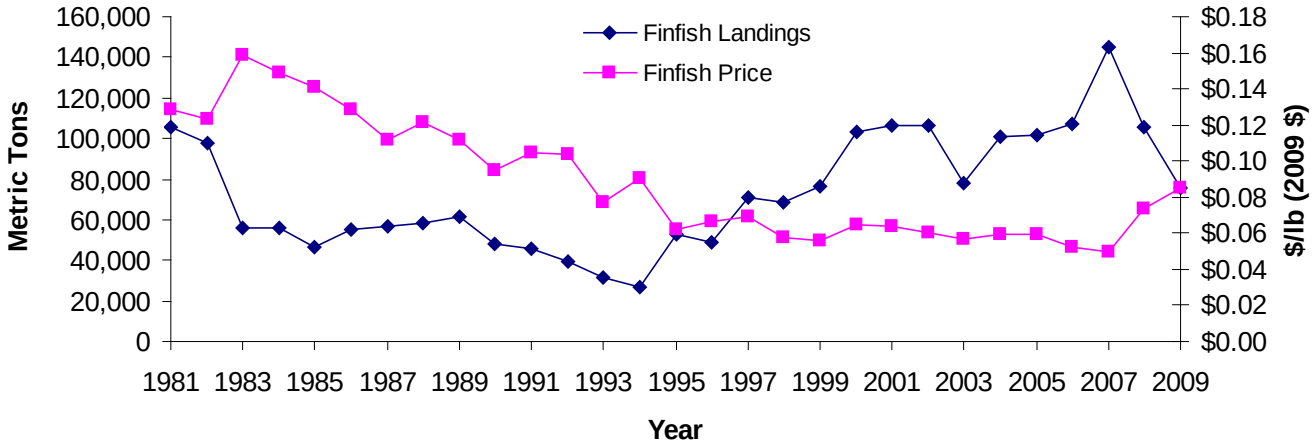


Figure 9-4. West coast market squid landings and real exvessel price ($/lb, 2009$), 1981-2009.

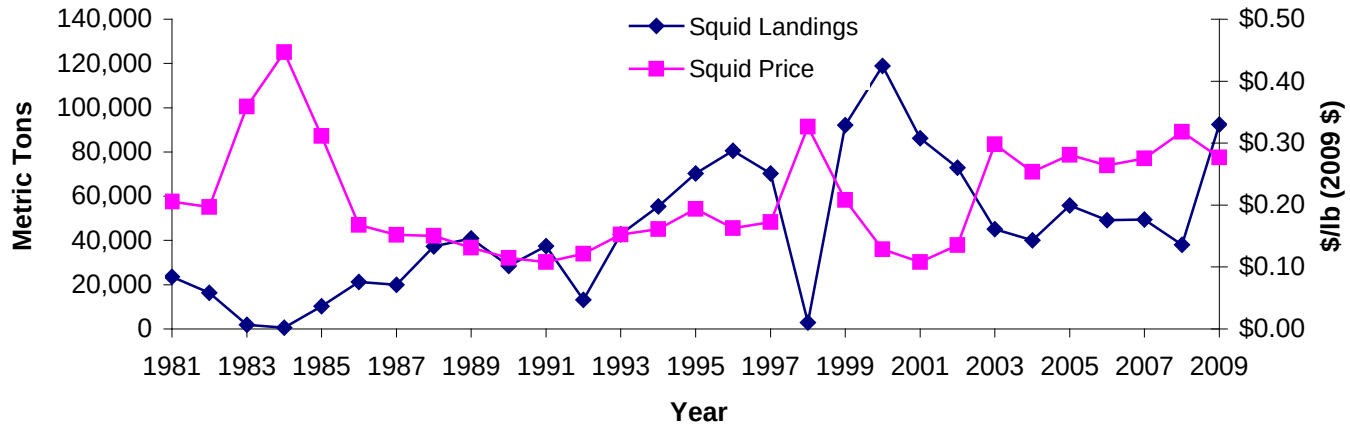
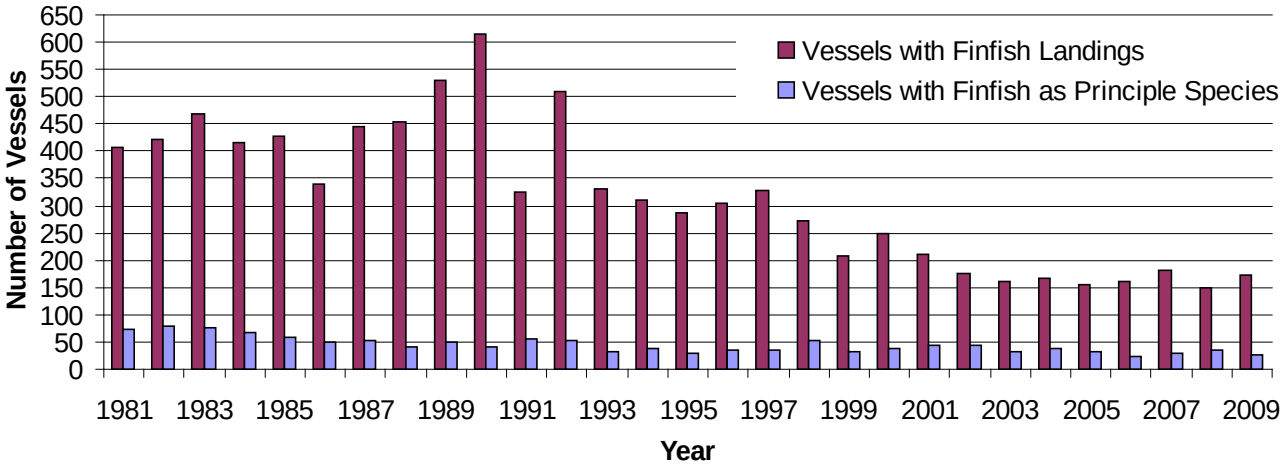
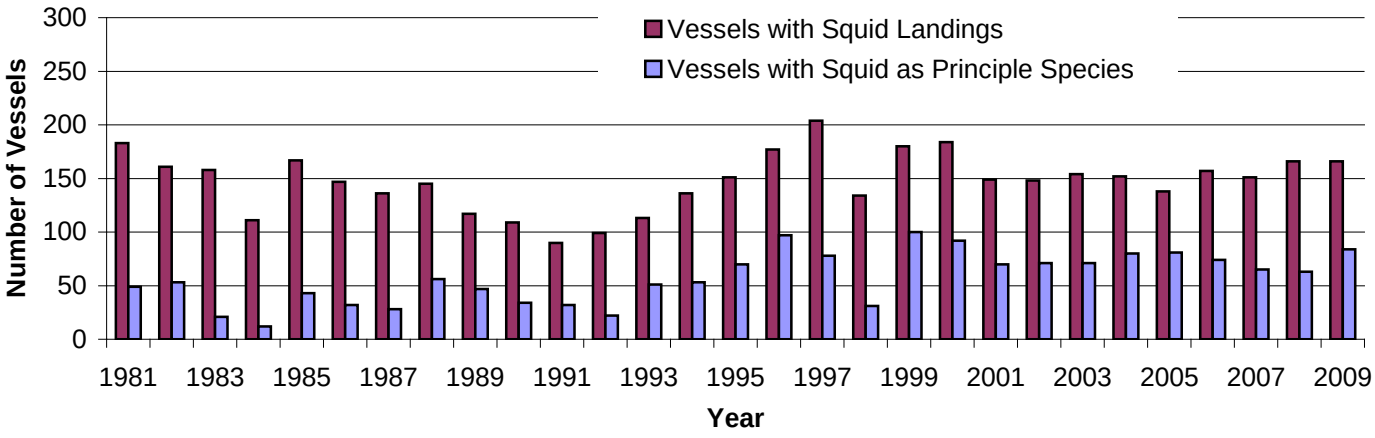


Figure 9-5. Number of vessels with Pacific coast landings of CPS finfish, and number for which CPS finfish was the principle species, 1981-2009.



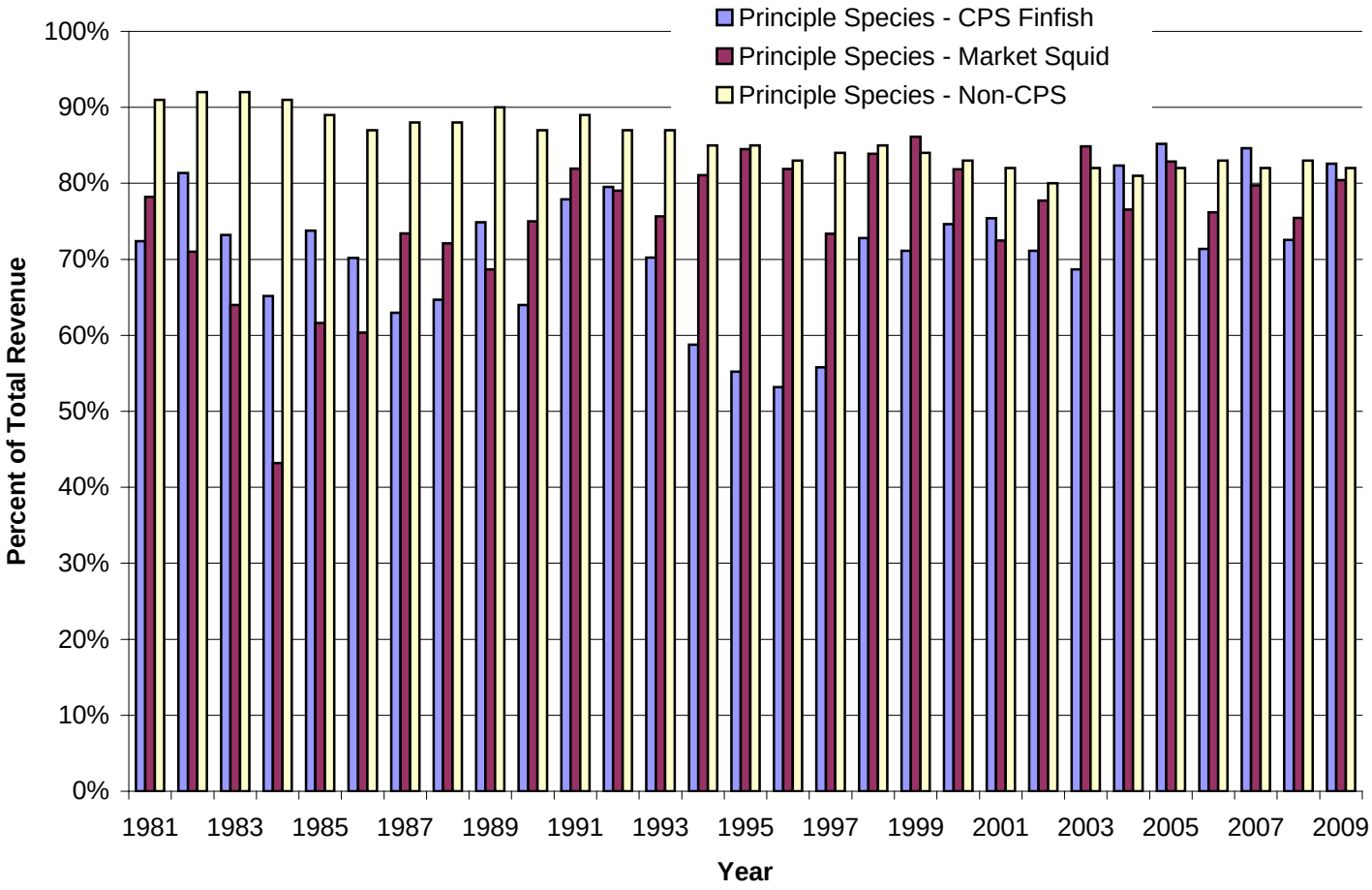
Note: The principle species accounts for the largest share of the vessels annual exvessel revenue.

Figure 9-6. Number of vessels with Pacific coast landings of market squid, and number for which market squid was the principle species, 1981-2009.



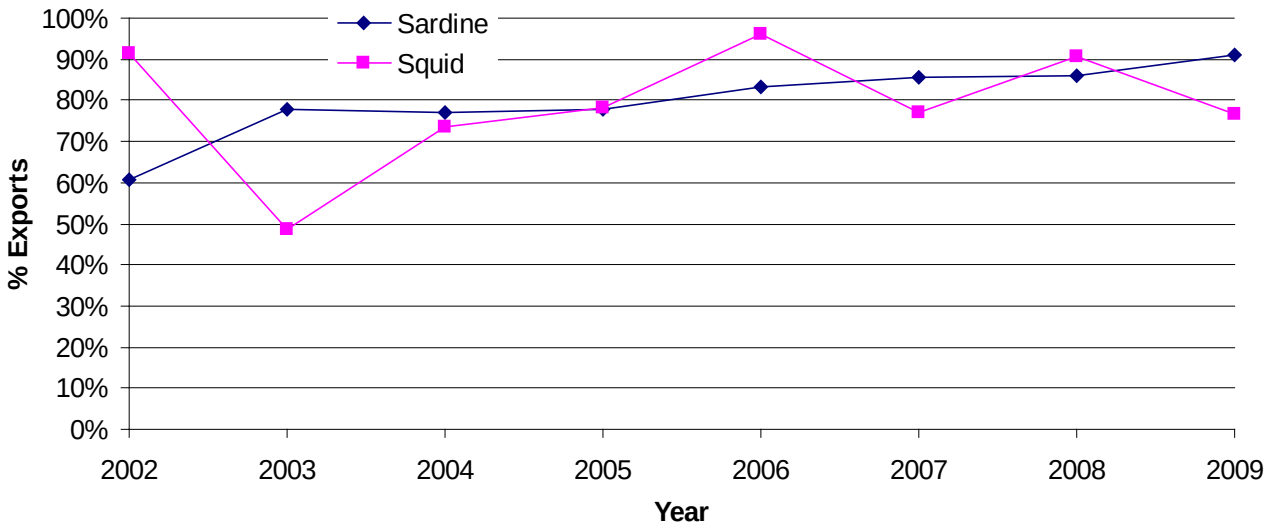
Note: The principle species accounts for the largest share of the vessels annual exvessel revenue.

Figure 9-7. Average share principle species revenues of total revenues for vessels whose principle species was CPS finfish, market squid or non-CPS, 1981-2009.



Note: The principle species accounts for the largest share of the vessels annual exvessel revenue.

Figure 9-8. West coast sardine and squid exports as a percentage of total landings, 2002-2009.



10.0 ECOSYSTEM CONSIDERATIONS

10.1 INTRODUCTION

There is a growing national interest in augmenting existing single-species management approaches with ecosystem-based fishery management principles that could place fishery management decisions and actions in a the context of a broader scope. NMFS Science Centers around the country have been working on improving the science behind ecosystem-based fishery management including status monitoring and reporting on ecosystem health. This section provides a summary of trends and indicators being tracked by NMFS. Additionally, Appendix A of Amendment 8 to the CPS FMP provides a review of the life-cycles, distributions, and population dynamics of CPS and discusses their roles as forage and can be found on the Council's web site. Appendix D provided a description of CPS essential fish habitat that is closely related to ecosystem health and fluctuation. Recent research efforts into ecosystem functions and trophic interactions will improve our knowledge base and improved CPS management decisions.

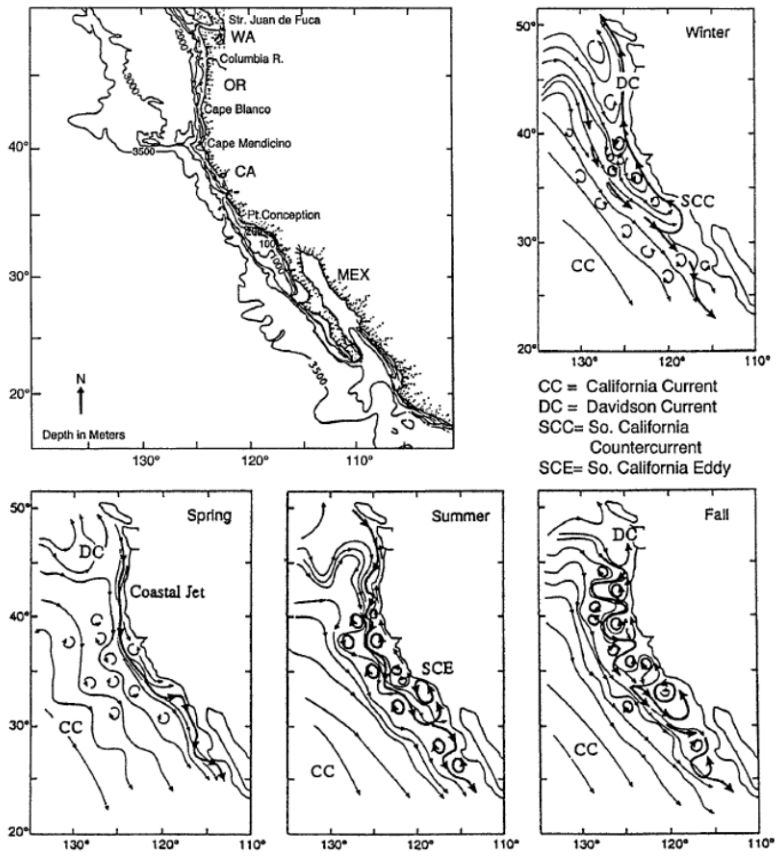


Figure 1. Seasonal variation of large-scale currents along the West Coast with bathymetry illustrating the dynamic conditions in the CCLME. The CC flows southward year round offshore from the shelf break to several hundred kilometers. Along the shelf break, several other currents are found, including the Davidson Current (DC), Southern California Countercurrent, and the Southern California Eddy (SCE). From Hickey and Royer 2001.

10.2 Description of the California Current Large Marine Ecosystem

The California Current (CC) (Figure 1) is formed by the bifurcation of the North Pacific Current. At approximately Vancouver Island, Canada, it begins to flow southward along the West Coast to mid Baja, Mexico. The California Current flows southward year round off shore from the shelf break to ~200 miles. Other coastal currents generally dominate along the continental shelf including the northward Davidson Current and California

Undercurrent, the Southern California Countercurrent, as well as many eddies and smaller shelf currents.

The California Current also defines the outer boundary of the California Current Large Marine Ecosystem (CCLME) that is delineated by bathymetry, productivity and trophic interactions. The LME is an organizational unit to facilitate management of an entire ecosystem and recognizes the complex dynamics between the biological and physical components. NOAA's ecosystem based management approach uses the LME concept to define ecosystem boundaries**.**

The CCLME is characterized as often having very high biological productivity (>250 mg C/m^2/day) that is stimulated by the addition of nutrients that is either upwelled along the shelf break or advected in surface currents from the Gulf of Alaska into the northern region or beginning of the California Current. The biological productivity is reflected in the extensive nearshore kelp beds, large schools of CPS (e.g., sardine, anchovy, squid etc) and groundfish (Pacific hake) that, in turn, support large populations of marine mammals, sea birds and highly migratory species (e.g., tuna, sharks, billfish).

The CCLME is heavily influenced by climate at the annual, interannual and decadal time scales. Annually, between winter and spring, the large scale wind fields in the NE Pacific reverse (from southerly to northerly) and the prevailing shelf currents also reverse. The transition in currents and concurrent increase in solar radiation in the spring leads to the dramatic increase in productivity, and is called the 'Spring Transition'. The timing and duration of the Spring Transition is determined by NMFS' Newport, OR laboratory, which conducts monthly surveys of the CCLME since 1997 (Figure 2). Additional data from new survey lines off Trinidad Head (Humboldt Co.), CA (NMFS) and Bodega, CA (Sonoma Water Agency-UCD) confirms the Newport prediction.

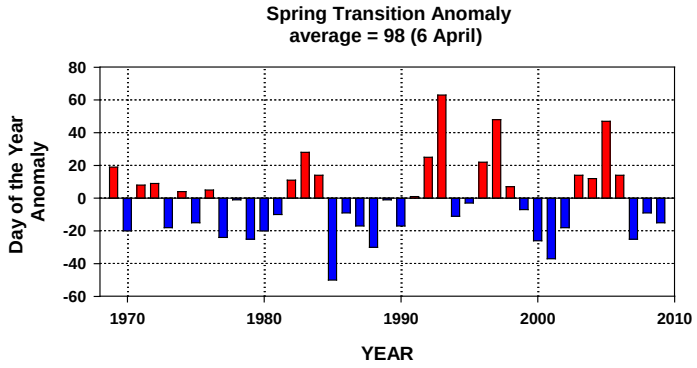


Figure 2. Anomaly of the date of the spring transition. William Peterson, NOAA, NMFS, NWFSC.

Along the OR coast, the timing and duration of the Spring Transition has been linked to coho salmon abundance in the Columbia River (Peterson et al. 2006). The connection between the Spring Transition and CPS is presently not known but it is suspected to effect recruitment of herring, smelt, anchovy and other coastal pelagic species.

On an interannual time scale of 3-7 years, the CCLME is affected by ENSO (El Niño Southern Oscillation) (Figure 3), whereby either warmer, salty surface water from the equator (El Niño) or cool, upwelled water (La

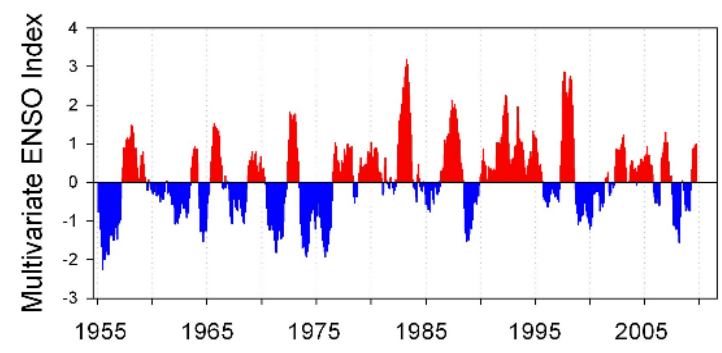


Figure 3. El Nino/Sothern Oscillation Index anomalies. Red indicates warm or El Nino conditions and blue cool La Nina conditions.

Niña) affects the ecosystem. During El Niño, CPS landings along the CA coast are mixed with a large decrease of market squid, anchovy and Pacific herring while the landings for sardine and mackerel remain relatively constant (Figure 4, CDFG 2009).

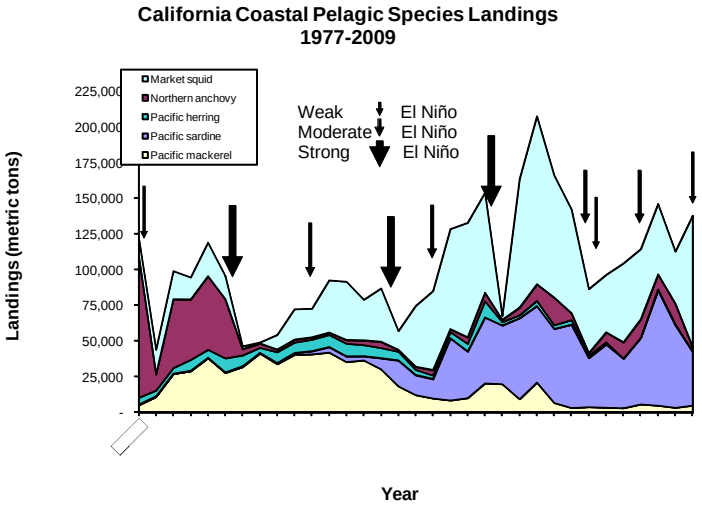


Figure 4. El Nino events and California CPS landings.

At periods between 20 to 50 years, low frequency climatic forcing from the Pacific Decadal Oscillation (PDO) affect the CCLME (Figure 5). The mechanism(s) behind the PDO are still being researched (Beamish et al. 2004). The PDO was mostly negative (warm in the central North Pacific Ocean and cool near the west coast of the Americas) from 1942-1976 and from 1998-2001 and positive from 1977 to 1998. Since 2001, the PDO has fluctuated between positive and negative signaling an unusual climatic period for the CCLME.

The effects of the PDO on fisheries are mixed. In general, the warm phase of the PDO is associated with warm ocean temperatures off the West Coast and reduced landings of coho and Chinook salmon while the cool phase is associated with higher landings (Mantua et. 1997). For sardine, positive PDO indices seem to correlate with high landings along the CCLME while anchovy landings are reduced under positive PDO (Figure 6) (Takasura et al. 2008).

Like all marine ecosystems, the CCLME is very complex, and despite 60 years of surveys from the California Cooperative Fisheries Investigation (CalCOFI) survey, understanding and predicting

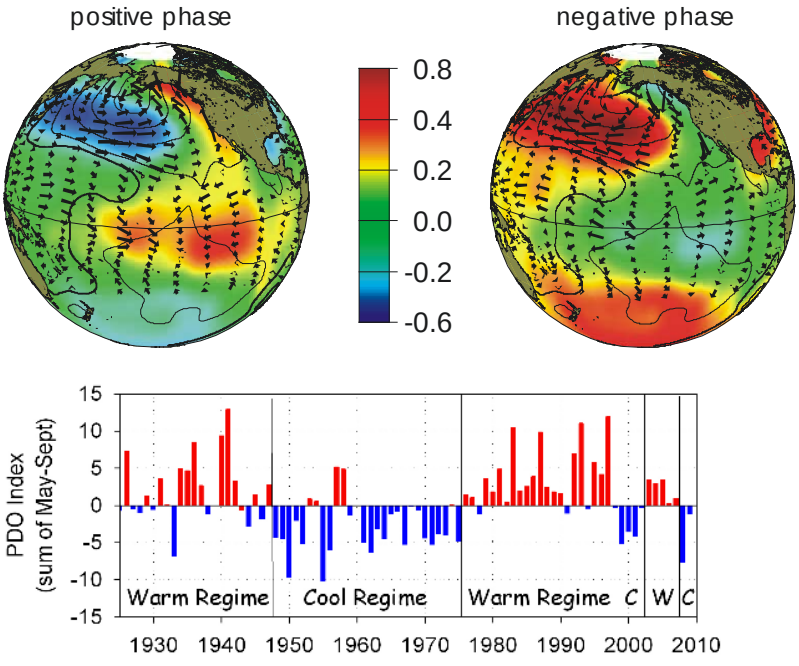


Figure 5. Time series of shifts in sign of the Pacific Decadal Oscillation (PDO), 1925 to 2009. Values are averaged over the months of May through September. Red bars indicate positive (warm) years; blue bars negative (cool) years. Note that 2008 was the most negative since 1956. http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/ca-pdo.cfm

recruitment success for any fishery including CPS remains elusive. In light of the complexity, ecological indicators are used as surrogates of ecosystem health and status of fisheries. Preliminary physical indicators and sentinel species are under development by NMFS and will take on increased importance as the agency embarks on an Integrated Ecosystem Assessment in the CCLME. Since 2008, the Pacific Coast Ocean Observing System (PaCOOS) has produced a quarterly summary of climate and ecosystem science and management in the CCLME has tracked the indicators and sentinel species (visit www.pacoos.org).

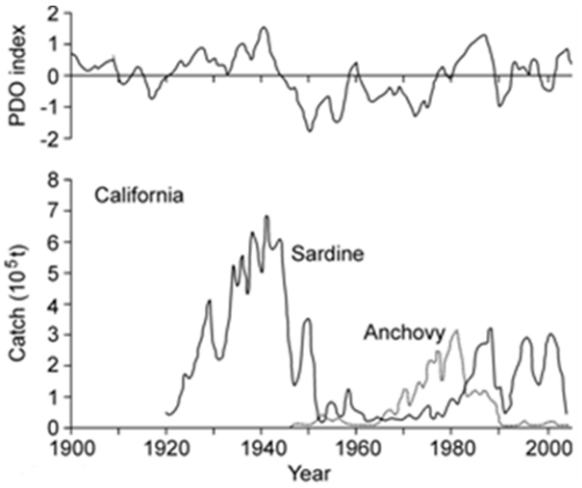


Figure 6. The relationships between sardine and anchovy landings in California and the PDO. From Takasura et al. 2008.

10.3 Current Climate and Oceanographic Conditions.

10.3.1 Spring Transition

In 2009, the Spring Transition (Figure 2) was relatively early (26 March 2009), but was not as strong as 2008. Northwest winds remained steady in spring but frequently stopped or relaxed from June-October. This probably accounted for the anomalous high sea surface temperatures and low chlorophyll *a* levels observed.

10.3.2 El Niño/Southern Oscillation

The Multivariate ENSO Index for the Northeast Pacific reflects El Niño conditions for late 2009 and early 2010, with warm water dominating the CCLME and bringing with it lower primary productivity along the coast (Figure 3). Based on model forecasts, the El Niño is expected to be weakening or ending in the spring.

10.3.3 Pacific Decadal Oscillation

The PDO became positive in mid-2009 (Figure 7). A positive PDO value is considered favorable for sardine but not anchovy. Effects on other CPS such as market squid is also probably negative.

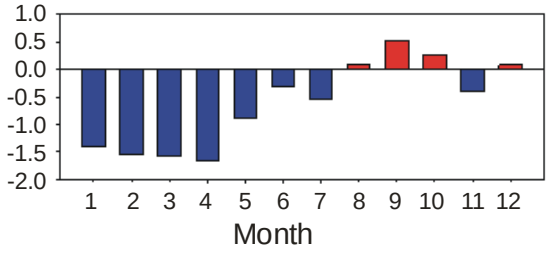


Figure 7. Monthly Pacific Decadal Oscillation index values in 2009. http://jisao.washington.edu/pdo/

10.4 Trends in Ecosystem Indicators

10.4.1 Sea Surface Temperatures

Sea surface temperatures are known to affect sardine, anchovy and other CPS

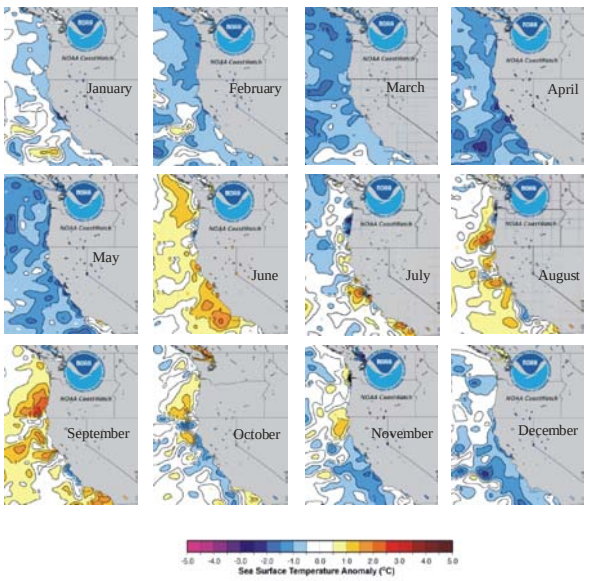
species abundance. In 2010 ocean temperatures were anomalously cold at the beginning of the year, but were anomalously warm during summer and early fall (Figure 8), probably reflecting the El Nino.

10.4.2 Ocean Productivity

Chlorophyll *a* is a phytoplankton pigment that can be measured at the surface by satellites. In 2010 coastal chlorophyll *a* was low in February, March, April, July, August, and September (Figure 9). The low summer values reflect the warmer ocean temperatures and change in the PDO sign.

10.4.3 Copepods

The copepod species richness, is surveyed by the NMFS, NWFSC off Newport, OR and is highly correlated to the PDO. In 2009 (Figure 10) the copepod community was composed of primarily sub-arctic species in the spring but became more diverse (more subtropical species) as the summer and fall progressed. The presence of sub-arctic species is favorable for coho salmon returns to the Columbia River but has not been correlated to CPS in the area, although preliminary information indicate that Pacific herring and anchovy recruit better when these cold-water copepods are abundant.



Figue 8. Monthly sea surface temperature anomalies. http://coastwatch.pfel.noaa.gov/

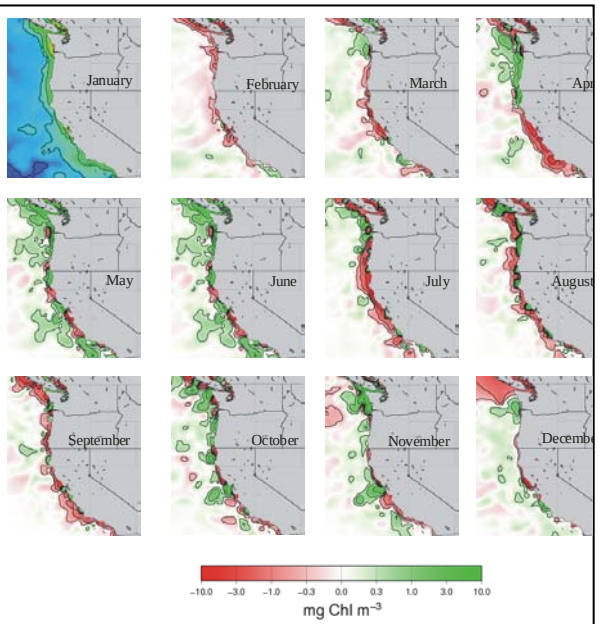


Figure 9. Chlorophyll *a* concentration anomalies in 2010. http://coastwatch.pfel.noaa.gov/

10.4.4 Juvenile Fish

Surveys for juvenile fish and krill are conducted by the NMFS, SWFSC off the Central California coast in the May-June time period

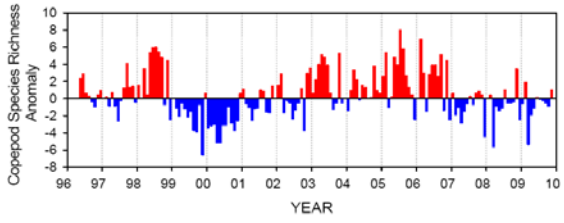


Figure 10. Monthly anomaly of copepod diversity found off Newport, OR. From William Peterson, NOAA, NMFS, Newport, OR.

since 1983 (Figure 11). In 2009, sardine numbers dropped below their long-term average, and juvenile anchovy abundance remained very low. Market squid encounters were below average but came closer to their long-term mean.

Pelagic fish surveys off the Columbia River by, NMFS, NWFSC indicate relatively higher abundance of forage fish in 2009 (Figure 12), evidently related to good recruitment in 2008. These surveys capture primarily older age-classes forage fish. Overall forage fish densities continued to be much lower than the high densities observed from 2000-2005.

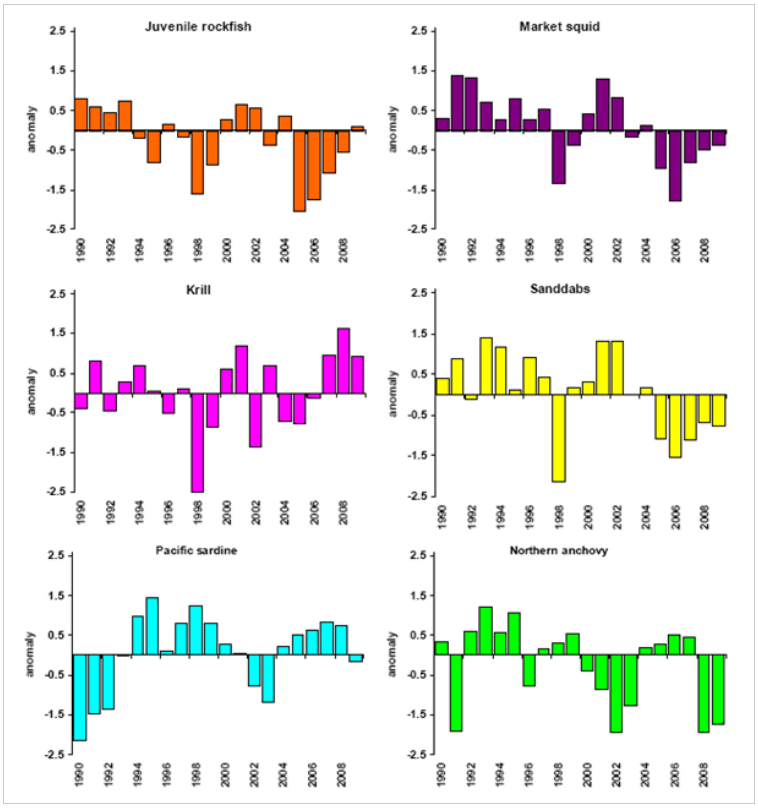


Figure 11. Long-term standardized anomalies of six pelagic forage species off central California. Steve Ralston, NOAA, NMFS, SWFSC.

10.4.5 Humboldt squid

During the summer, fall and winter 2009, record numbers of Humboldt squid were captured by sport and incidentally by commercial fisheries from California to British Columbia, Canada. Extremely high Humboldt squid densities were observed off the Columbia River in 2009 (Figure 13). We suspect that large numbers of sardines, anchovy, and other CPS were eaten by Humboldt squid in 2009. This predation may have affected overall CPS abundance but we were unable to quantify this predation mortality.

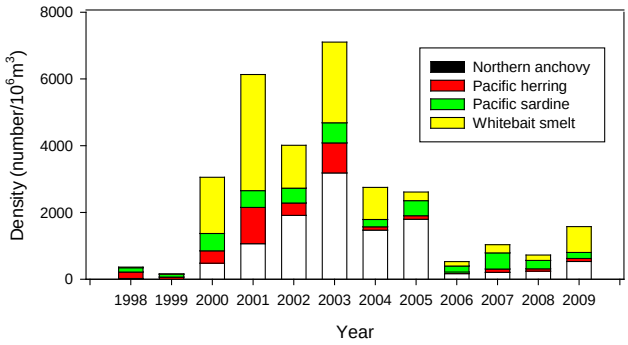


Figure 12. Annual densities of forage fishes off the Columbia River. Robert Emmett, NOAA, NMFS, NWFSC.

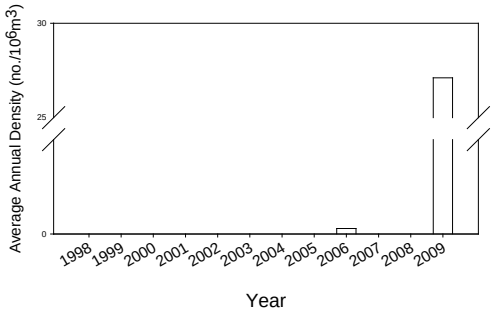


Figure 13. Annual abundance of Humboldt squid off the Columbia River. Robert Emmett, NOAA, NMFS, NWFSC.

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Source: http://www.cdc.noaa.gov/people/klaus.wolter/MEI/mei.html

Pacific Decadal Oscillation (PDO):
Source: The PDO
Source: http://jisao.washington.edu/pdo/, http://jisao.washington.edu/pdo/PDO.latest

California Current Ecosystem Indicators:
Copepods:
Source: Bill Peterson, NOAA, NWFSC

Coastal Pelagics:
Ecosystem indicators for the Central California Coast, May-June 2009
Source: Steve Ralston, John Field and Keith Sakuma, Fisheries Ecology Division, SWFSC

Forage fish densities off Oregon/Washington Coast 1998-2009
Source: Robert Emmett, Paul Bentley, Fisheries Ecology Division, NOAA, NWFSC

Humboldt Squid:
Annual abundance of Humboldt Squid identified during pelagic surveys.
Source: Robert Emmett, Richard Brodeur, Fisheries Ecology Division, NOAA, NWFSC

11.0 Summary of Stock Status and Management Recommendations

The CPS FMP distinguishes between "actively managed" and "monitored" species. Actively managed species (Pacific sardine and Pacific mackerel) are assessed annually. Seasonal closures and allocations, HGs, incidental landing allowances, and other management controls are used. Other CPS species (northern anchovy, jack mackerel, and market squid) are monitored to ensure their stocks are stable, but annual stock assessments and Federal fishery controls are not used.

While this document focuses on U.S. fisheries, many CPS stocks are distributed coastwide, hence, catch information from Mexican fisheries is of interest. See Table 11-1 for information on commercial harvest of CPS finfish landed into Ensenada, Mexico (1978-2008) (Table 15, García and Sanchéz 2003).

11.1 Actively Managed Species

11.1.1 Pacific Sardine

Hill *et al.* (2009; see Appendix 1) summarized the status of the Pacific sardine resource off the U.S. Pacific Coast and northern Baja California, Mexico. Pacific sardine landings for Canada, the U.S., and Mexico (Ensenada) totaled 134,269 mt in calendar year 2009 (Table 11-4). In 2009, landings in California (37,699 mt) decreased considerably from the previous year (57,736 mt in 2008); combined Oregon-Washington landings for 2009 (29,507 mt) were slightly higher than 2008 (29,384 mt) (Table 11-3). The U.S. sardine fishery is regulated using a quota-based HG management scheme (see Section 11.1.1.1). From the mid-1990s through 2007, landings from the U.S.-based fisheries were typically lower than the recommended HGs (Table 11-3). HGs for 2008 and 2009 were 42% and 25% lower than each previous year, respectively, so the U.S. fishery was subject to in-season closures throughout these two management years. Harvest of Pacific sardine by the Ensenada (Mexico) fishery is not regulated by a quota system, but there is a minimum legal size requirement of 150 mm standard length, and measures are in place to control fleet capacity. The Ensenada fishery landed 52,064 mt in 2009, down from 66,866 mt in 2008 (Table 11-4). Canadian sardine landings increased substantially to10,435 mt in 2008 and ~15,000 mt in 2009 (Table 11-4).

Estimated stock biomass (ages 1+) from the assessment conducted in 2009 (Hill et al. 2009) indicates a declining trend since the recent peak year (1.68 mmt in 2000), with an estimate of roughly 702,024 mt in July 2009 (Table 11-2). Current recruitments are considerably lower than the recent peak of 18.62 billion fish in 2003 (Table 11-2). Biomass and recruitment estimates (1981-2009 from the most recent assessment are provided in Table 11-2 and Appendix 1). Based on the most recent assessment's estimate of total (age 0+) mid-year biomass (Table 11-2) and total catch from Ensenada to Vancouver Island (Table 11-4), the coast-wide harvest rate was approximately 17.6% during 2009.

Finally, estimates of Pacific sardine biomass from the 1930s (Murphy 1966 and MacCall 1979) indicate that the sardine population may have been more than five times its current size before the stock decline and eventual collapse observed in the 1960s. Considering this historical perspective, it would appear that the sardine population, under favorable oceanographic conditions, may still have growth potential beyond its current size. However, per capita recruitment estimates indicate a downward trend in productivity (recruits per spawner) in recent

years, which may be indicative of a stock that has reached a threshold under current environmental conditions.

11.1.1.1 Harvest Guideline for 2010

Based on results from the base model in Hill et al. (2009), the HG for the U.S. fishery in calendar year 2010 was determined to be 72,039 mt. To calculate the HG for 2010, the Council used the maximum sustainable yield (MSY) control rule defined in Amendment 8 of the Coastal Pelagic Species-Fishery Management Plan, Option J, Table 4.2.5-1, PFMC (1998). This formula is intended to prevent Pacific sardine from being overfished and maintain relatively high and consistent catch levels over the long-term. The Amendment 8 harvest formula for sardines is:

$HG_{2010} = (BIOMASS_{2009} - CUTOFF) \bullet FRACTION \bullet DISTRIBUTION;$

where HG_{2010} is the total USA (California, Oregon, and Washington) harvest guideline in 2010, $BIOMASS_{2009}$ is the estimated July 1, 2009 stock biomass (ages 1+) from the assessment (702,024 mt), CUTOFF is the lowest level of estimated biomass at which harvest is allowed (150,000 mt), FRACTION is an environmentally-based percentage of biomass above the CUTOFF that can be harvested by the fisheries, and DISTRIBUTION (87%) is the average portion of BIOMASS assumed in U.S. waters.

The value for FRACTION in the MSY control rule for Pacific sardines is a proxy for F_{msy} (i.e., the fishing mortality rate that achieves equilibrium MSY). Given that F_{msy} and the productivity of the sardine stock have been shown to increase when relatively warm-ocean conditions persist, the following formula has been used to determine an appropriate (sustainable) FRACTION value:

$\text{FRACTION or } F_{msy} = 0.248649805(T^2) - 8.190043975(T) + 67.4558326,$

where T is the running average sea-surface temperature at Scripps Pier, La Jolla, California during the three preceding seasons (July-June). Ultimately, under Option J (PFMC 1998), F_{msy} is constrained and ranges between 5% and 15%. Based on the T values observed throughout the period covered by this stock assessment (Figure 55), the appropriate F_{msy} exploitation fraction has consistently been 15%; and this remains the case under current conditions (T_{2009} = 17.92 °C).

11.1.2 Pacific Mackerel

Total biomass (age-1+ biomass) of Pacific mackerel remained low from the early 1960s to the mid 1970s, at which time the population began to rapidly increase in size, reaching a peak in the early 1980s. From the mid 1980s to early 2000s, the stock declined steadily, with some signs of "rebuilding," i.e., on an increasing limb of a cyclical, historical distribution. However, as noted previously, recent estimates of stock size are necessarily related to assumptions regarding the dynamics of the fish (biology) and fishery (operations) over the last several years, which generally confounds long-term (abundance) forecasts for this species (see Crone *et al.* 2009). It is important to note that exploitation of this stock has changed considerably over the last two decades, i.e., during the 1990s, the directed fisheries off California had average annual landings of roughly 18,000 mt, whereas since 2002, average yearly landings have decreased over 70 percent to approximately 5,000 mt/yr. This pattern of declining yields in recent years generally characterized all of the fisheries, including U.S. commercial and recreational fleets, as well as the commercial fishery of Mexico.

In summary, the Council adopted the most recent assessment for Pacific mackerel, i.e., determination of the status of the Pacific mackerel population for the 2009-10 fishing year was based on the SS model *AA*, which generated a biomass estimate of 282,049 mt (see section 3.2 and Crone *et al.* 2009). However, based on model uncertainty (see Crone *et al.* 2009) and precautionary management strategies (PFMC 1998), the Council set a final quota (HG) below that typically derived from the formal harvest control rule (see section 11.1.2.1); this general adjustment was done in the two previous Pacific mackerel stock assessments conducted in 2007 and 2008.

For the 2009-10 fishing year, the Council recommended an acceptable biological catch (ABC) of 55,408 mt (see section 11.1.2.1) and an overall HG of 10,000 mt that included a 2,000 mt set-aside for incidental landings should the directed fishery close. Additionally, the Council reviewed historic Pacific mackerel landings, which have rarely exceeded 15,000 mt in recent years, with an average annual harvest of approximately 5,000 mt. Alternatively, the Council considered the resiliency of the Pacific mackerel stock and industry reports of increasing Pacific mackerel availability at a time when opportunities for Pacific sardine and market squid are declining. Should the directed fishery attain the harvest guideline of 8,000 mt, the Council recommended that NMFS close the directed fishery and establish a 45% incidental catch allowance when Pacific mackerel are landed with other coastal pelagic species (CPS), with the exception that up to 1 mt of Pacific mackerel could be landed without landing any other CPS. Any incidental harvest of Pacific mackerel shall be applied against the 2,000 mt set-aside for incidental landings. Further, full assessments for actively managed CPS stocks (e.g., Pacific mackerel and Pacific sardine) typically occur every third year, with updates in interim years. However, in efforts to make progress with research and data needs critical to the ongoing assessment of this stock (see section 13.2), the Council recommended no update assessment in 2010, with a full assessment scheduled in 2011. Finally, the above management stipulations for the 2009-10 fishing year, inclusive, are applicable to the 2010-11 fishing year as well, with a full assessment as the basis for management recommendations in the 2011-12 fishing year.

11.1.2.1 Harvest Guideline for 2010-11

All Council stipulations related to Pacific mackerel harvest in the 2009-10 fishing year are also applicable to the 2010-11 fishing year (see section 11.1.2 above).

11.2 Monitored Species

The monitored species category of the CPS FMP includes northern anchovy, jack mackerel, market squid, and krill.

11.2.1 Northern Anchovy

The most recent complete assessment for northern anchovy was described in Jacobson *et al.* (1995). California landings of northern anchovy began to increase in 1964, peaking in 1975 at 143,799 mt. After 1975, landings declined. From 1983 to 1999, landings did not exceed 6,000 mt per year. There were no reported landings of northern anchovy in Oregon from 1981 through 1999. Washington reported about 42 mt in 1988, but didn't land more until 2003. From 2000 to

2009, northern anchovy landings averaged 322 mt for Washington, 65 mt for Oregon, and 9,446 mt for California. In California, northern anchovy were landed each year. The greatest northern anchovy landings in California occurred in 2001 (19,277 mt). In Washington, northern anchovy were landed in 2003 and 2007 to 2009, and the greatest landings occurred in 2009 (810 mt). In Oregon, northern anchovy were landed from 2002 to 2006 and in 2008.

Anchovy (mt)	WA	OR	CA
2000	-	-	11,753
2001	-	-	19,277
2002	-	3	4,650
2003	214	39	1,676
2004	-	13	6,793
2005	-	68	11,182
2006	-	9	12,790
2007	153	-	10,390
2008	109	260	14,285
2009	810	39-	1,668

Through the 1970s and early 1980s, Mexican landings increased, peaking at 258,745 mt in 1981 (Table 11-1). Mexican landings decreased to less than 2,324 mt per year during the early 1990s, with a spike of 17,772 mt in 1995, primarily during the months of September through November. Catches in Ensenada decreased to 4,168 mt in 1996; and remained at less than 5,000 mt through 2007.

11.2.2 Jack Mackerel

Until 1999, jack mackerel were managed under the Council's groundfish FMP. Jack mackerel are now a monitored species under the CPS FMP. There is no evidence of significant exploitation of this species on the Pacific Coast of North America, and accordingly, there have not been regular stock assessments or efforts to collect biological information. Management efforts to collect fishery-dependent age composition data, such as the CDFG Port Sampling Program, are in place for the two actively managed CPS (Pacific sardine and Pacific mackerel), but not for jack mackerel, aside from samples taken prior to 1995. Previous discussions of jack mackerel, such as in the groundfish FMP, were brief:

> Available data indicate that the current, nearly un-used spawning biomass is about one million mt, the natural mortality rate is in the range of 0.1 to 0.2, a fishery located north of 39° N latitude would harvest fish that are mostly older than age 16, and the long-term potential yield for this age range is 19,000 mt. The [Council's Groundfish Management Team] recommends continuation of the 52,600 mt ABC on the basis of a constant exploitation rate (equal to natural mortality) applied to estimates of current biomass of ages 16 and over. Biomass and short-term yield are expected to slowly decline under this level of exploitation. If this level of exploitation reduces long-term biomass to approximately 30% to 50% of the current biomass, the long-term average yields for this age range would be near 19,000 mt. The GMT recommended close tracking of this fishery and the age composition of the harvested fish,

particularly if catches are begun outside the exclusive economic zone. (PFMC, 1998.)

Landings of jack mackerel in the California Pelagic Wetfish fishery through the decade of the 1990s reached a maximum of 5,878 mt in 1992, and averaged under 1,900 mt over 1990-2000. During the previous decade, California landings ranged from a high of 25,984 mt in 1982 to a low of 9,210 mt in 1985. Currently, most landings of jack mackerel are incidental to Pacific sardine and Pacific mackerel in California; however, pure landings do occur sporadically. From 2000 to 2009, jack mackerel landings averaged 7 mt for Washington, 70 mt for Oregon, and 949 mt for California. In California and Oregon, jack mackerel landings occurred each year; however, in Washington, jack mackerel were landed in 2002 and 2003. In California and Oregon, the greatest landings occurred in 2001 (3,624 mt; 196 mt). In California, CDFG landing receipts for jack mackerel totaled 3,624 mt in 2001; however, these may be somewhat over-reported – the jump in jack mackerel landings in 2001 coincided with an early closure of the Pacific mackerel HG.

Jack Mackerel (mt)	WA	WA Unspecified	OR	CA
2000	-		161	1,269
2001	-	371	196	3,624
2002	12	248	9	1,006
2003	2	54	74	156
2004	-	22	126	1,027
2005	-	24	70	213
2006	-		5	1,167
2007	-		14	631
2008	-		46	274
2009	-		2	119

Mason (2001) concluded that spawning biomass estimates of the past were inadequate. Anecdotal evidence suggests that the spawning biomass may be large in California waters, but test fishing found the adult fish too scattered for economical harvest, since portions of the contemporary catch are sometimes found in small aggregations of young fish along rocky shores.

11.2.3 Market Squid

The CDFG is currently monitoring the market squid fishery through a state-based management plan including an annual landings cap and various spatial/temporal constraints, such as weekend closures and the establishment of marine protected areas (CDFG 2005). In addition, the Egg Escapement Method has been used in the past as an informal assessment tool, i.e., within a research context only, to evaluate population dynamics and biological reference points (MSY-related) regarding this species (section 4.3.4 and Dorval et al. 2008). Although it is presumed that market squid would be exempt from new annual catch limits and accountability measures provisions due to its short life cycle, the fishery control rules currently in place under the MSFMP, including a restricted access program, which limits fishery participation, as well as the expansion of marine protected areas in California to protect spawning areas, are thought to preclude the need for active management. However, if fishery operations change substantially (e.g., spatially expand, harvest high amounts of immature squid) in the future, additional management measures may be required.

11.2.3.1 California's Market Squid Fishery

In 2001, legislation transferred the authority for management of the market squid fishery to the California FGC. Legislation required that the FGC adopt a MSFMP and regulations to protect and manage the squid resource. In August and December of 2004, the FGC adopted the Market Squid Fishery Management Plan (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, which started April 1.

In 2009, the market squid fishery was California's largest fishery, with landings estimated at 92,371 mt. This is a 142 percent increase over 2008 (38,100 mt) and 22 percent less than the record high set in 2000 (118,827 mt). The total ex-vessel value more than doubled from to $26.5 million in 2008 to $56.4 million in 2009. The ex-vessel price per ton of market squid decreased from 2008 with three prices accounting for 93% of the 2009 landings: $496/t (15%), $551/t (49%), and $771/t (29%). The fishing permit season for market squid extends from 1 April through 31 March of the following year. During the 2008-2009 season (as opposed to the 2008 calendar year) 34,050 mt were landed, a 26 percent decrease from the 2007-2008 season (45,935 mt). There was an increase in catch in the northern fishery near Monterey with 877 mt landed. However, squid landings in northern California have remained low since the 2006-2007 season probably the result of unusual environmental conditions observed during the past several years and the lingering La Niña Southern Oscillation event. In contrast, most of the market squid was taken from the southern California region during the season, accounting for 98.9 percent of the total catch (82,603 mt), similar to the previous two seasons, 2006-2007 (98.5 percent) and 2007-08 (99.9 percent). This regional domination of catch last occurred during the 1998-1999 and 1999–2000 seasons (99.7 percent and 99.8 percent respectively), and was also influenced by a La Niña event.

11.3 References

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12.0 Emerging Issues

This section describes current and future issues that may need to be addressed relative to FMP species and management in general.

12.1 Pacific Sardine

12.1.1 Allocation

Beginning with the 2006 season, the Pacific sardine fishery has operated under a seasonal allocation framework adopted as Amendment 11 to the CPS FMP (see Section 2). When the Council approved Amendment 11, they scheduled a formal review of the allocation formula to provide a comparison of the performance of the fishery to the projections used to evaluate the adopted allocation scheme. Originally scheduled for June 2008, this review has been postponed indefinitely.

12.1.2 Exempted Fishing Permits and Aerial Survey

The 2010 Harvest Guidelines include a 5,000mt set-aside for survey research activities. This represents an increase over the 2009 set-aside, which was 2,400mt. At the April, 2010 meeting, the Council voted unanimously in support of issuing an Exempted Fishing Permit (EFP) for aerial sardine research. The EFP proposal lays out a detailed survey methodology to utilize the 5,000mt set-aside that was included in the 2010 Harvest Guidelines.

4,200mt are to be used for a nearly coastwide survey between Cape Flattery in the north, to (and including) the Channel Islands in the south. The applicants established 66 transects, each extending 38 miles offshore. The proposed survey involves a two-stage sampling design. First, aircraft fly over the transects, following explicit methodology described in the application. Photos are taken of sardine schools, to estimate surface area and biomass. Then spotter planes will work in tandem with purse seine vessels to capture up to 112 sardine schools of various sizes. This will establish the relationship between surface area and biomass.

The proposal also includes a pilot survey in the Southern California Bight, to investigate alternative survey methods, utilizing the remaining 800mt of the set-aside. For this portion of the research, the applicants will fly a total of 36 replicates over six transects, half during daylight and half at night. They will be testing 1) day versus night detection, photogrammetry versus lidar detection, and 3) acoustic versus lidar detection. There are likely fish behavior differences between day and night, such as swimming closer to the surface or schooling density. This research is designed to help establish those potential differences, as well as to explore whether the alternative survey methods might be adapted to spatially broader surveys, inclement weather, and nighttime surveying.

The National Marine Fisheries Service is to consider the EFP application, and, if approved, issuance of the EFP by early summer, 2010.

12.2 Pacific Mackerel

Pacific mackerel continue to be actively managed although recent landings have been well below the ABC. Pacific mackerel are not undergoing the full assessment process in 2010, having undergone a full assessment in 2009. See Appendix 2**.**

12.3 Management Issues

Emerging management issues include implementation of new provisions in the reauthorized MSA, ecosystem-based fishery management, and international CPS fisheries.

12.3.1 Implementation of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006

Although not unique to CPS management, implementation of new provisions in the MSA as reauthorized in 2007 will involve a reevaluation and amendment of the CPS FMP to incorporate mechanisms to prevent overfishing such as annual catch limits and accountability measures. In accordance, NMFS has revised guidance on preventing overfishing under MSA National Standard 1.

Precautionary harvest control rules exist for Pacific sardine and Pacific mackerel which provide a solid foundation for the implementation of new fishery management provisions such as overfishing limits and annual catch limits. The CPS FMP's monitored stocks are either exempt from the new requirements because of their short life-cycle (market squid) or are currently harvested at relatively low levels (anchovy, jack mackerel). Annual catch limits for monitored stocks may be appropriately implemented with greater flexibility but greater precaution than the actively managed species because they are assessed with less frequency. Scoping comments on amending the Council's CPS FMP for National Standard 1 guidelines 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 to improve inseason harvest reporting. Council staff prepared a scoping summary and the Council is scheduled to adopt preferred CPS FMP amendment alternatives in June 2010.

12.3.2 Ecosystem Based Fishery Management

In November 2006, the Pacific Council initiated development of an Ecosystem Fishery Management Plan (EFMP). The EFMP is intended to serve as an "umbrella" plan over the four existing FMPs, helping with coastwide research planning and policy guidance and creating a framework for status reports on the health of the CCLME. The plan envisioned by the Council would not replace the existing FMPs, but would advance fishery management under these FMPs by introducing new science and new authorities to the current Council process.

The Council formally established an Ecosystem Plan Development Team, which is developing preliminary scoping documents. The Council also established an Ecosystem Advisory Subpanel. The two bodies held a joint kick off meeting in February, 2010.

12.4 International CPS Fisheries

There has been interest in coastwide management for the Pacific sardine fishery, which would entail a more consistent forum for discussion between the U.S., Mexico, and Canada. Continued U.S.-Mexico bilateral meetings indicate willingness from Mexico to continue scientific data exchange and cooperation on research, and engage in discussions of coordinated management. The Trinational Sardine Forum has been a good venue for international exchange. Victoria, British Columbia is tentatively scheduled to host the 2010 Trinational Sardine Forum.

12.5 Catch Shares

The National Ocean and Atmospheric Administration (NOAA) issued a Catch Shares Policy in late 2009, encouraging fishery management councils to explore the potential for catch shares as a tool to address problems in management of fisheries. NOAA offers technical and financial support to councils exploring CS, but there is no requirement to explore or implement CS systems.

The National Marine Fisheries Service (NMFS) sponsored a Catch Shares Workshop in February, 2010, to explore the applicability of using a form of CS system for the CPS fishery. That workshop included representatives of the commercial and recreational fishing industries; Federal and state governments; and NGOs. The Council also received an informational report on CS from Margaret Spring, NOAA Chief of Staff, at the March, 2010 meeting. Ms. Spring noted that CS may be one tool that councils should consider as a way to achieve maximum economic yield of their fisheries, and that the 2010 Federal budget includes a $36 million increase to support CS.

12.6 Wave Energy

12.6.1 Summary

The development of wave energy is moving rapidly forward off the West Coast, particularly Oregon (http://www.oregon.gov/ENERGY/RENEW/Hydro/Ocean_Wave.shtml). Proposals are calling for possibly thousands of acres of nearshore habitat that will have wave energy parks. A variety of wave energy structures have been proposed for deployment. The specific areas proposed are sandy habitat within 2.5 miles from shore. These areas: 1) allow appropriate anchoring and b) provide the most wave energy to be gathered. The deployment of these structures will change local currents, alter bottom sediments, and possibly many other aspects of the habitats they are placed.

12.6.2 Adverse Impacts

The biological effects of these wave energy parks on CPS and other species are highly uncertain but studies are just beginning (Boehlert et al. 2008). Some of the concerns are that these structures would act like large fish aggregating devices (FADs). They will also be off limits to sport and commercial fishing, essentially creating a “reserve” for marine resources. Other concerns are related to biological effects of anti-fouling paints, fuel spills, changes in water flows, increased predator abundance, and electro-magnetic forces on biological organisms.

Boehlert, G.W., G.R. McMurray, and C. E. Tortorici (editors). 2008. Ecological Effects of Wave Energy Development in the Pacific Northwest: A Scientific Workshop, October 11–12, 2007" NOAA Technical Memorandum NMFS-F/SPO-92, 173 p..

12.7 Climate Change

12.7.1 Summary

Recent reports by the International Panel on Climate Change (IPCC) has made it clear that the earth's climate is changing, and with it the environmental conditions in the ocean are also changing (http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html). The Pacific and other oceans are expected to warm in the future. The California Current is known to historically have large natural fluctuations in its oceanography and CPS abundance. Baumgartner et al. (1992) and Field et al. 2009) looked at deposits of coastal pelagic fish scales and were able to identify historic periods or regimes of anchovy and sardine abundance, probably linked to large scale climate phenomena. For example, during the 1930's-1950's when the California Current was undergoing a "warm" period as reflected in the Pacific Decadal Oscillation (Mantua et al. 1997) sardines were highly abundant, only to crash as the California Current and the North Pacific entered a cool period. The biological mechanisms actual causing these abrupt shifts in abundance are still unclear (Checkley et al. 2009), but probably related to decadal changes in wind-stress curl (Rykaczewski and Checkley 2007) and ocean temperatures (Takasuka et al. 2008) and linked to productivity and temperature tolerances. Scientist originally thought that anchovy and sardine populations fluctuated out of phase because of "competitive" interactions, but this does not appear to be true (Barange et al. 2009).

12.7.2 Adverse Impacts

Changes in the North Pacific Ocean climate was recently identified a major factors in the decline and ESA listing of the anadromous smelt eulachon (*Thaleichthys pacificus*) (Eulachon Biological Review Team. 2010) and affecting Pacific salmonid population (Schindler et al. 2009). How climate change will alter the productivity of the California Current fish stocks, or if it will enhance decadal fluctuations in fish abundance is uncertain, but the future effects on fisheries could be modeled (Hollowed et al. 2009).

12.7 References

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Takasuka, A., Y. Oozeki, H. Kubota, S. E. Lluch-Cota. 2008 Contrasting spawning temperature optima: Why are anchovy and sardine regime shifts synchronous across the North Pacific? Prog. Oceanog. 77 (2008) 225–232.

13.0 Research and Data Needs

Several recent developments highlight the need to enhance current assessment procedures in order to meet the requirements of the FMP. These include (1) the recent development of a high-volume fishery for Pacific sardine in Oregon and Washington; (2) increasing recognition of the importance of CPS as principal forage for many salmon and groundfish stocks that are currently at low abundance levels; (3) the importance of CPS biomass estimates to the Council's annual determination of allowable coastal pelagic harvests; and (4) the need to monitor status of the market squid stock using data-intensive techniques. A pressing need exists for stock assessments that accurately reflect the reproductive characteristics of CPS stocks throughout their geographic range and for additional stock assessment personnel in NMFS and the three Pacific Coast states to carry out these assessments.

In addition to research and data needs presented in this section, refer to the Council's comprehensive research and data needs document last revised in December 2008. The document includes a chapter dedicated to CPS matters and can be obtained by contacting the Council office or by visiting the Council web page. Also, the latest Pacific sardine and Pacific mackerel assessments and STAR Panel reports include detailed, species-specific, research and data needs.

The highest priority research and data needs for CPS are:

- Gain more information about the status of CPS resources in the north using egg pumps, trawl and sonar surveys, and spotter planes.
- Develop a coastwide (Mexico to British Columbia) synoptic survey of sardine and Pacific mackerel biomass; i.e., coordinate a coastwide sampling effort (during a specified time period) to reduce "double-counting" caused by migration.
- Develop a formal review process for the harvest control rules for Pacific sardine and Pacific mackerel. Currently this review is not part of the stock assessment process.
- Increase fishery sampling for age structure (Pacific sardine and Pacific mackerel) in the northern and southern end of the range. Establish a program of port sample data exchange with Mexican scientists.
- Evaluate the role of CPS resources in the ecosystem, the influence of climatic/oceanographic conditions on CPS, and define predatory-prey relationships.
- Routinely, collect detailed cost-earnings data to facilitate analyses for long-term changes to the sardine allocation structure.

13.1 Pacific Sardine

High priority research and data needs for Pacific sardine include:

1) gaining better information about Pacific sardine status through annual coastwide surveys that include ichthyoplankton, hydroacoustic, and trawl sampling;
2) standardizing fishery-dependent data collection among agencies, and improving exchange of raw data or monthly summaries for stock assessments;
3) obtaining more fishery-dependent and fishery-independent data from northern Baja California, México;

4) further refinement of ageing methods and improved ageing error estimates through a workshop of all production readers from the respective agencies. A workshop is scheduled for June, 2010, to address these and other issues;

5) further developing methods (e.g., otolith microchemistry, genetic, morphometric, temperature-at-catch analyses) to improve our knowledge of sardine stock structure. If sardine captured in Ensenada and San Pedro represent a mixture of the southern and northern stocks, then objective criteria should be applied to the catch and biological data from these areas;

6) exploring environmental covariates (e.g., SST, wind stress) to inform the assessment model.

13.2 Pacific Mackerel

Given the transboundary status of this fish population, it is imperative that efforts continue in terms of encouraging collaborative research and data exchange between NMFS SWFSC and researchers from both Canada's and in particular, Mexico's academic and federal fishery bodies, i.e., such cooperation is critical to providing a synoptic assessment that considers available sample data across the entire range of this species in any given year.

Fishery-independent survey data for measuring changes in mackerel spawning (or total) biomass are currently lacking. Further, at this time, a single index of relative abundance is used in the assessment, which is developed from a marine recreational fishery (CPFV fleet) that typically does not (directly) target the species. In this context, it is imperative that future research funds be focused on improvement of the current CPFV survey, with emphasis on a long-term horizon, which will necessarily rely on cooperative efforts between the industry, research, and management bodies. Finally, further sensitivity analysis related to this index of relative abundance, including issues surrounding catchability (and/or selectivity) and influences regarding time-varying vs. constant parameterization of these fishery time series.

Given the importance of age (and length) distribution time series to developing a sound understanding of this species' population dynamics, it is critical that data collection programs at the federal and particularly, the state-level continue to be supported adequately. In particular, CDFG/NOAA funding should be bolstered to ensure ongoing ageing-related laboratory work is not interrupted, as well as providing necessary funds for related biological research that is long overdue. For example, maturity-related time series currently relied upon in the assessment model are based on data collected over twenty years ago during a period of high spawning biomass that does not reflect current levels. Also, further work is needed to obtain more timely error estimates from production ageing efforts in the laboratory, i.e., accurate interpretation of age-distribution data used in the ongoing assessment necessarily requires a reliable ageing error time series. Finally, examinations of sex-specific age distributions will allow hypotheses regarding natural mortality/selectivity (i.e., absence of older animals in sex-combined age distributions) to be more fully evaluated.

13.3 Market Squid

Currently, there exists limited understanding of market squid population dynamics, which has hampered assessing the status (health) of this valuable marine resource found off California. General information concerning important stock- and fishery-related parameters suggests

maximum age is less than one year, and the average age of squid harvested is roughly six to seven months. Under the proposed National Standard 1 Guidelines, market squid will not be considered for updated annual catch limits and accountability measures provisions due to the short lifespan. However, in this context, the CPSMT advises that current monitoring programs continue for this species, including tracking fishery landings, collecting reproductive-related data from the fishery, and obtaining fishermen-related logbook information.

Although some information exists on coastwide squid distribution and abundance from fishery-independent midwater and bottom trawl surveys largely aimed at assessing other finfish species, there is no reliable measure of annual recruitment success beyond information obtained from the fishery. Given fishing activity generally occurs only on shallow-water spawning aggregations, it is unclear how fluctuations in landings are related to actual population abundance and/or availability to the fishery itself. That is, the general consensus from the scientific and fishery management communities is that squid do inhabit, to some degree, greater depths than fished by the fleet; however, species' range suppositions remain largely qualitative at this point in time. Better information on the extent and distribution of spawning grounds along the U.S. Pacific Coast is needed, particularly, in deep water and areas north of central California. Additionally, fecundity, egg survival, and paralarvae density estimates are needed from different spawning habitats in nearshore areas and oceanographic conditions associated with the population. Furthermore, information describing mechanisms and patterns of dispersal of adults, as well as paralarvae, along the coast is required to clarify how local impacts might be mitigated by recruitment from other areas inhabited by this short-lived species.

Although some fishery effort information is now being collected with a logbook program in the State of California, the continuation of this program is essential to provide estimates of relative abundance (e.g., CPUE time series) in the future. Continuation and/or establishment of annual surveys using midwater trawls, bottom trawls, remotely operated vehicles (ROVs), and satellite and aerial surveys would also provide useful information for developing alternative indices of abundance other than those derived from logbook data.

Potential impacts to EFH-related issues would most likely arise in concert with fishing activity by the purse-seine fleet on spawning aggregations in shallow water when gear potentially makes contact with the sea floor. In this regard, there are two areas of potential concern that have not been quantified to date: (1) damage to substrate where eggs may be deposited; and (2) damage or mortality to egg masses from contact with the gear itself. The CDFG is currently working on research methods to evaluate egg stage of squid egg capsules collected in fishery landings to determine how long the egg capsule had been laid before being taken by the fishery.

Currently, market squid fecundity estimates, based on the Egg Escapement Method (Dorval et al. 2008), are used informally to assess the status of the stock through evaluations of alternative biological reference points related to productivity and MSY (see sections 4.3.4 and 11.2.3). The Egg Escapement Method is based on several assumptions, (1) immature squid are not harvested; (2) potential fecundity and standing stock of eggs are accurately measured; (3) life history parameters are accurately estimated (e.g., natural mortality, egg laying rate); and (4) instantaneous fishing mortality (F) translates into meaningful management units. Given the inherent uncertainty associated with these assumptions, it is imperative that each receive further scrutiny in the future, through continuation of rigorous sampling programs in the field that generate representative data for analysis purposes, as well as further histological evaluations in the laboratory and more detailed assessment-related work. For example, data collected through

the CDFG port sampling program currently in place will provide information on the age and maturity stages of harvested squid. Further, laboratory work concerning general mantle condition, especially the rate of mantle "thinning,", will likely benefit the current understanding of squid life history and subsequently, help improve the overall assessment of this species. Finally, other biological-related parameters that are currently poorly understood generally relate to spawning and senescence (e.g., life history strategies concerning spawning frequency, the duration of time spent on spawning grounds, and the period of time from maturation to death).

13.4 Live Bait Fishery

Although tonnage of CPS and market squid taken in the live bait fishery is minimal compared with volume taken in the commercial fishery, better estimates of live bait landings and sales of sardine, anchovy and market squid are essential as it pertains to estimates of the overall economic value of these fisheries. Outdated estimates have previously shown that the value of the live bait fishery for sardine has equaled that of the commercial catch. In the case of market squid, there is no documentation of the dramatic expansion of live bait sales in southern California made by commercial light vessels in recent years.

The live bait fishery supplies product for several recreational fisheries along the Pacific Coast, primarily in southern California, but as far north as Eureka. Live bait catch is generally comprised of both Pacific sardine and northern anchovy; the predominant species depends on biomass levels and local availability. Recent landings estimates range between 5,000 mt and 8,000 mt annually statewide, with effort increasing in summer months. However, these estimates are based only on logbooks provided by a limited number of bait haulers, and estimates provided by the CPFV industry. Since the sale of live bait in California is not permitted in a manner similar to that used for the commercial sale of CPS, estimates of tonnage and value are imprecise. Therefore, no estimates of volume or value for the sale of market squid for live bait are available at this time. However, the CDFG will reexamine reporting requirements and data needs to better estimate landings and value.

13.5 Socioeconomic Data

Economic analyses of management actions affecting coastal pelagic fisheries requires detailed, representative cost and earnings data for the sardine harvesters and processors making up each fishery sector. These data are used to evaluate the impact on net economic benefits in the commercial fisheries associated with a proposed management action. Experience with the long-term allocation of the Pacific HG emphasizes this need, and moreover underscores the necessity to collect these data on a routine basis. Collecting such data as needed to address an issue at hand often makes them suspect in a number of regards, particularly in terms of strategic bias.

Under Ecosystem-based fishery conservation and management we will have to expand the economic analyses to evaluate changes in yields from a number of different species. Such an undertaking inherently involves finding a socially optimum balance among the variety of ecosystem services CPS are capable of generating. The tradeoffs of interest are between benefits CPS provide as: (1) directed harvests; (2) food for higher trophic level commercial predators; (3) food for recreationally important predators; and, (4) food for non-commercial but ecologically important predators. The economic data required to evaluate tradeoffs involving species in

categories (3) and (4) will entail the development of non-market data acquisition and valuation techniques.

13.5.1 Commercial Fisheries

Economic analyses of management actions effecting coastal pelagic fisheries require basic cost and earnings data for the sardine harvesters and processors making up each fishery sector. Experience with the long-term allocation of the Pacific HG emphasizes this need, and moreover underscores the necessity to collect these data on a routine basis. Collecting such data when needed to address an issue at hand makes them suspect in a number of regards particularly in terms of strategic bias.

A step in this direction would be a comprehensive CPS vessel logbook program for Washington, Oregon, and California vessels. Such a program will serve not only as a means of collecting biological and stock assessment related data, but also vessel-trip-level fishery economic data (e.g., fuel cost and consumption, number of crew, cost of provisions) across all CPS fishery operations. Moreover, the logbook program would want to include all fishery operations in which these vessels engage to be able to fully evaluate their economic opportunities. To get the full picture in terms of fleet economics the at sea data would have to be supplemented with annual expenditure data, and other data that are not trip-specific (e.g., interest payments). These data will have to be collected separately to obtain comprehensive economic data for harvesting vessels.

A parallel effort will need to be taken with regard to processors. To be able to fully evaluate the economic impacts of proposed management actions detailed, representative cost and earnings data for West Coast sardine processors will also be needed on a routine basis. This will entail periodic surveys of CPS processors to collect representative economic data on their processing operations.

13.5.2 Non-market Values

Economic analyses of conservation and management actions affecting the availability of sardines as forage for non-commercial predators will entail developing a framework and compiling the data to estimate the non-market values of recreationally and ecologically important sardine predators. These nonmarket values can then be used to impute the economic value (shadow prices) of Pacific sardine as forage for these predators.

13.6 Observer Program

Bycatch in the California contingent of the CPS fishery has been qualitatively monitored by the CDFG's dockside monitoring program since the mid-1980s (Sweetnam and Laughlin, Pers. Comm., 2005). CDFG only gives qualitative descriptions of bycatch meaning they do not document the amount or quantity of bycatch but rather only document the species or type of bycatch encountered at the fish processing plant. In order to confirm bycatch rates derived from CDFG's dock-side sampling, NMFS started a pilot observer program in July 2004 on the California purse seine fishing vessels landing CPS in the LE fishery. The pilot observer program's main focus is to gather data on total catch and bycatch, and on interactions between

their fishing gear and protected species such as marine mammals, sea turtles, and sea birds. See Section 6.1.1 for additional information and preliminary results from this program.

13.7 References

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14.0 ESSENTIAL FISH HABITAT FIVE-YEAR REVIEW

Recognizing the importance of fish habitat to the productivity and sustainability of U.S. marine fisheries, in 1996 Congress added new habitat conservation provisions to the Magnuson-Stevens Act (MSA), the federal law that governs U.S. marine fisheries management. The re-named Magnuson-Stevens Act mandated the identification of EFH for managed species as well as measures to conserve and enhance the habitat necessary to fish to carry out their life cycles. The MSA requires cooperation among NMFS, the Councils, fishing participants, Federal and state agencies, and others in achieving EFH protection, conservation, and enhancement. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The EFH guidelines under 50 *CFR* 600.10 further interpret the EFH definition as follows:

> *"Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle."*

The Councils and NMFS are expected to periodically review the EFH components of FMPs. Each FMP EFH identification recommendation and amendment should include a provision to review and update EFH information and prepare a revised FMP amendment if newly-available information warrants revision of EFH. The schedule for this review should be based on an assessment of the quality of both the existing data and expectations when new data will be available. Such a review of information should be conducted at least once every five years (62 *FR* 66531, December 19, 1997).

14.1 Process for five-year Review of CPS EFH

The CPSMT initiated review of recent relevant literature, and is working with NMFS to determine whether new information warrants amending the existing description of EFH for CPS

species. Council Staff will coordinate continued review of CPS EFH, soliciting input from interested parties, and will make a recommendation during summer, 2010. Below is more information regarding the status or CPS EFH five-year review.

The following questions are being considered in determining whether newly-available information warrants revisions to CPS EFH:

1. Is the original data used to identify and describe CPS EFH still accurate and relevant?
2. Is there new data is available that may help describe CPS EFH?
3. Is the original fishing gear impacts analysis consistent with any new data, including any analyses of similar gear used in other fisheries?
4. Are there new non-fishing impacts that warrant a change in CPS EFH?
5. Does the CPS to provide adequate forage for dependent species?

The review process was initiated at a meeting of the CPSMT in January, 2010, in La Jolla, California, with a discussion of the existing EFH, habitat needs, and new information. The team compiled three publications and one unpublished manuscript (see Section 13.4, References) relevant to CPS habitat needs and associations. The CPSMT again discussed CPS EFH at their April 27-30, 2010 CPSMT meeting in Portland, Oregon.

14.2 Description of EFH

Unless the Council and NMFS conclude that there are reasons to substantiate a change to the definition of CPS EFH at this time, the description of EFH will remain the same as that identified in Amendment 8 to the FMP (PFMC, 1998). 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.

Using presence/absence data, EFH is based on a thermal range bordered within the geographic area where a managed species occurs at any life stage, where the species has occurred historically during periods of similar environmental conditions, or where environmental conditions do not preclude colonization by the species. 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. For example, an increase in sea surface temperature since the 1970s has led to a northerly expansion of the Pacific sardine resource. With an environment favorable to Pacific sardine, this species can now be found in significant quantities from Mexico to Canada. Adult CPS finfish are generally not found at temperatures colder than 10° C or warmer than 26° C. Preferred temperatures (including minimum spawning temperatures) are generally above 13° C. Spawning is most common at 14° C to 16° C.

Essential Fish Habitat for West Coast CPS species was established in December, 1998, with the issuance of Appendix D to Amendment 8 of the Northern Anchovy Fishery Management Plan. Appendix D contains the identification and description of CPS EFH; information on life history and habitat needs; fishing and non-fishing effects on CPS EFH; and potential conservation and

enhancement measures. 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 10^0C to 26^0C. 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 26^0C, 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 10^0C isotherm which varies both seasonally and annually.*

14.3 References

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July 29, 2009

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RE: Pacific Fishery Management Council Recommendations for Future Pacific Mackerel Assessments.

Norm

Dear Dr. Bartoo:

This letter is formal notice of recent Pacific Fishery Management Council (Council) action regarding the future assessments of Pacific mackerel. The Council appreciates the dedicated efforts of the Southwest Fisheries Science Center (SWFSC) in the research and assessment of coastal pelagic species (CPS). Dr. Paul Crone and the stock assessment team conducted a thorough and timely assessment, participated fully in a well-conducted Stock Assessment Review (STAR) Panel meeting in May, and were an integral part of the Council's June 2009 meeting where the assessment was adopted for use in management.

Concerns were raised throughout the 2009 assessment process for Pacific mackerel regarding the data that inform the assessment model and the uncertainty associated with model results. The stock assessment team, the STAR Panel, the Scientific and Statistical Committee (SSC) and the Council's two CPS advisory bodies all reported some level of discomfort with the current assessment. The Council, in response, recommends a new assessment schedule that allows time to address research and data issues aimed at improving the next full assessment of Pacific mackerel.

Because of variability and the difficulty in forecasting CPS populations, actively managed species in the CPS Fishery Management plan, such as Pacific mackerel, are assessed annually. This assessment cycle includes full assessments every three years and updated assessments in the interim years. Under this schedule, updated Pacific mackerel assessments would be conducted in 2010 and 2011, and in 2012 a full assessment would be conducted and a STAR Panel would be convened.

The Council recommends an alternate schedule where no assessment is conducted in 2010, but the next full assessment is conducted in 2011, one year in advance of the adopted plan. In the absence of an assessment update in 2010, the Council intends to use the 2009 assessment plus any new research and landings data to inform management decisions for the 2010-2011 fishery. Further, the Council recommends that the savings of time and workload from not conducting an assessment update in 2010 be used to address research and data needs identified in the 2009

assessment process. Although this proposed schedule involves a break in the assessment schedule, the Council recommends continued data collection in 2010 and concurs with requests at the June 2009 Council meeting for enhanced data gathering.

The SSC endorsed the 2009 Pacific mackerel as the best available science for use in management, but recommended caution in its application and agreed with the research and data needs identified by the stock assessment team and the STAR Panel. These recommendations included but are not limited to:

- Enhance monitoring of the commercial passenger fishing vessel (CPFV) fleet including increased sampling for biological data,
- Examine use of CPFV data as a fishery dependent index to determine if catchability and selectivity have not changed over time, or that the changes have been adequately included in the model configuration,
- Increase support of current port sampling and laboratory analysis programs and increase biological sampling of landings in the Pacific Northwest,
- Reanalyze biological parameters such as maturity-at-age, sex ratio, sex-specific parameters, and natural mortality rates,
- Revisit ageing error and consider conducting an age validation study, and
- Improve collaboration with Mexico and Canada in data collection including size- and age-composition from landings.

Complete listings of research and data needs for the Pacific mackerel assessment can be found in the 2009 assessment and the May 2009 STAR Panel report; both documents are readily available in the June 2009 Council Briefing Book as posted on our web site.

Thank you for your consideration of these recommendations. Should your staff have any questions on this matter or need additional documentation, please contact Mr. Mike Burner at the Council office.

Sincerely,

Donald McIsaac, Ph.D.
Executive Director

MDB:kam

c: Ms. Marija Vojkovich, Marine Regional Manager, California Department of Fish and Game
Mr. Rod McInnis, Regional Administrator, NMFS, Southwest Region
Dr. Gary Sakagawa, Assistant Center Director, NMFS, SWFSC
Dr. Russ Vetter, Fisheries Resources Division Director, NMFS, SWFSC
Mr. Mark Helvey, Assistant Regional Administrator, NMFS, Southwest Region
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Dr. Sam Herrick, CPS Management Team Chair
Mr. John Royal, CPS Advisory Subpanel Chair
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Science Center
8604 La Jolla Shores Drive
La Jolla, CA 92037-1508

August 4, 2009

RECEIVED
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PFMC

MEMORANDUM FOR: Dr. Don McIsaac, Executive Director
Pacific Fishery Management Council (PFMC)

THRU: Dr. Norm Bartoo, Acting Science Director
Southwest Fisheries Science Center (SWFSC)

FROM: Dr. Russ Vetter, Division Chief
Fisheries Resources Division, SWFSC

SUBJECT: Response to letter *Pacific Fishery Management Council Recommendations for Future Pacific Mackerel Assessments* (July 29, 2009); Pacific mackerel (coastal pelagic species, CPS) research in 2009-11

At the onset, thanks for your recent letter addressing Pacific Fishery Management Council (PFMC) recommendations regarding critical areas of research applicable to the Pacific mackerel population off the Pacific coast of the USA and Baja, Mexico (in support of federal/state Fishery Management Plan directives), i.e., we (Southwest Fisheries Science Center) have begun outlining specific projects for meeting PFMC recommendations that followed review/discussion at the forum convened recently in Spokane. Your letter provides a very good list, albeit an ideally inclusive one, which includes a broad range of topics from data collection in the field, evaluations in the laboratory, and statistical analysis of historical and alternative time series used in ongoing stock assessments of this species. In this context, the following discussion regards further details regarding the upcoming work, particularly in terms of scope, timing, and expectations associated with the respective projects underway (particularly, efforts that span from now, mid 2009, to the next stock assessment in mid 2011):

Pacific mackerel maturity study

- Re-examination of this species' maturity schedule is considered a high priority research effort that will likely take two years to realize fruition
  - it is important to note that Pacific mackerel have received little fishing pressure in recent years and thus, data collection is hampered accordingly, given it's not anticipated that independent 'survey' samples will be obtained for this species in the near future;
  - further, the formal status of this project was only recently finalized and thus, this year's sampling schemes are accordingly hampered;
  - in collaboration with the California Department of Fish and Game CDFG), samples will be collected in the field, processed in the laboratory, and evaluated statistically;
  - sampling will be conducted across (at least) two complete summer blocks

- the overriding goal this summer (2009) is to establish a sampling protocol(s) across multiple fisheries (both commercial and recreational), whereby the following summer(s), the overall process from field-to-laboratory is efficient; and,
- it's possible (but not probable say …) that a meaningful (statistically-sound) maturity schedule will be ready for the next formal assessment, but it's critical that the temporal/spatial attributes of the sampling design are not compromised, given such research is infrequently conducted and thus, conclusions generally remain in place for an extended time.

Commercial Passenger Fishing Vessel logbook project

- In collaboration with CDFG, review current monitoring programs for this fleet, as well as related recreational fisheries (e.g., private vessels) that harvest Pacific mackerel and CPS in general
  - re-evaluate current index of relative abundance (catch-per-unit-effort, CPUE) used in the formal stock assessment;
  - re-evaluate current length distribution time series for this fleet … see above for CPUE index);
  - examine via sensitivity analysis in the fully-integrated assessment model (Stock Synthesis, SS) both catchability and selectivity parameterization, particularly, time-varying vs. constant assumptions;
  - develop (potentially) alternative indices of abundance based on this sample information; and,
  - it's very likely that substantial progress will be made with this project during this 'interim' year and thus, the next assessment will be based on an improved understanding of the accuracy (say robustness) of this index of abundance and ultimately, its influence in the ongoing assessment model.

California Cooperative Oceanic Fisheries Investigations (CalCOFI) time series project

- Re-examination of this species' egg/larvae data collected from the ongoing CalCOFI survey
  - assess the merits/drawbacks of alternative (potentially) time series of Pacific mackerel relative abundance associated with this research survey based on different spatial/temporal post stratification schemes, statistical methods, and/or oceanographic dynamics than used in previous stock status determinations; and
  - it's likely that progress will be made with this project prior to the next assessment, with findings presented accordingly for review in late 2010.

Improved scientific relations with Canada and in particular, Mexico

- We continue to initiate discussion and encourage collaborative research with our international colleagues, including coordinating and attending pivotal conferences/meetings in efforts to establish a setting that fosters long-term, high quality, and politically supported information exchange.

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON PACIFIC MACKEREL MANAGEMENT FOR 2010-2011

The Coastal Pelagic Species Advisory Subpanel (CPSAS) met jointly with the Coastal Pelagic Species Management Team (CPSMT) to discuss Pacific mackerel management measures and the harvest guideline (HG) for the 2010-2011 season. Dr. Kevin Hill presented CPSMT analysis of scientific uncertainty and application of an uncertainty buffer relative to Pacific Mackerel. The CPSAS thanks and commends Dr. Hill, Dr. Crone and the Pacific Mackerel Assessment Team for their dedication and hard work in developing the analysis.

CPSAS members voiced concern with a suggestion to simply adopt the existing management measures for another year. Pacific mackerel are subject to rapid increase in biomass and landings, as was documented in the 2000-2001 season, which led to premature closure of the mackerel fishery. California fishermen have reported a recent increase in mackerel sightings. A spike in mackerel abundance could trigger closure of other fisheries such as market squid, under current management measures. Currently there are only 2,000 mt available for incidental take in other fisheries.

Based on the 2009-10 assessment, the acceptable biological catch (ABC) for the 2010-2011 season remains 55,408 metric tons (mt). The CPSAS acknowledges the continuing need to set a HG below the ABC in light of scientific uncertainty.

The Council should consider the following in adopting management measures for 2010-2011:

- The potential for a rapid increase in catches as occurred in 2000-01 (see Table 11-7 of the Draft CPS Stock Assessment Fishery Evaluation document);
- The potential for negative impacts to other fisheries if there is a sharp increase in mackerel landings;
- The likelihood that aerial surveys conducted in Southern California in summer 2010 for sardine will identify Pacific mackerel and potentially lead to an increase in catch;
- Both the CPSMT and CPSAS recommended HGs in the range of 30,000 mt in 2009, which still left a substantial buffer to account for uncertainty.

The CPSAS recommends that the Council retain the 8,000 mt directed fishery HG established for 2009-2010. However, for the above reasons, we recommend increasing the incidental set-aside to 8,000 mt, for a total HG of 16,000 mt. This will protect other fisheries, and leave a substantial buffer to account for uncertainty.

The CPSAS further recommends the following in the event the directed fishery closes:

- A 45 percent incidental catch is allowed when Pacific mackerel are landed with other coastal pelagic species; and
- Up to 1 mt of Pacific mackerel could be landed without landing any other CPS.

Presently, the commercial passenger fishing vessel index is the sole index remaining in the Stock Synthesis Model. More research is sorely needed to produce accurate Pacific mackerel stock assessments in the future. The CPSAS recommends exploring alternative indices that might inform the assessment. One potential source of data in the future could include using the Aerial Survey for both sardine and mackerel.

Essential Fish Habitat (EFH) Five-Year Review

The CPSAS heard a report on the CPS EFH five-year review, and recommends that the CPSMT continue this review, coordinating with the CPSAS and Habitat Committee. The CPSAS further recommends having the opportunity to review a draft document prior to final Council action at the November Council meeting.

PFMC
06/15/10

COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON PACIFIC MACKEREL MANAGEMENT FOR 2010-2011

The Coastal Pelagic Species Management Team (CPSMT) met June 13-14, 2010 to review management and research recommendations for Pacific mackerel for the 2010-11 fishing season and discuss these topics with the Coastal Pelagic Species Advisory Subpanel (CPSAS). In May 2009, a full stock assessment for Pacific mackerel was reviewed by a Stock Assessment Review (STAR) Panel in La Jolla, California and subsequently, by the Pacific Fishery Management Council (Council) in June 2009 in Spokane, Washington. The Council adopted the Pacific mackerel stock assessment and the following harvest specifications and management measures for the 2009 fishing year (July 1, 2009 - June 30, 2010):

1) establish an acceptable biological catch (ABC) of 55,408 metric ton (mt) and a harvest guideline (HG) for the directed fishery of 10,000 mt, which includes an incidental set-aside of 2,000 mt for incidental catch in non-directed fisheries;
2) should the directed fishery attain landings of 8,000 mt, the Council recommends that National Marine Fisheries Service (NMFS) close the directed fishery and revert to an incidental-catch-only fishery with a 45 percent incidental landing allowance when Pacific mackerel are landed with other coastal pelagic species (CPS), with the exception that up to 1 mt of Pacific mackerel could be landed without landing any other CPS; and,
3) to provide time to address research and data needs associated with the ongoing Pacific mackerel stock assessment, the Council recommends no assessment be conducted in 2010, with a full assessment conducted in 2011.

The CPSAS expressed concerns about the 10,000 mt HG, particularly the relatively small 2,000 mt set aside for incidental catch in other CPS fisheries. The CPSMT does not object to the CPSAS's request to increase the HG to 16,000 mt because there is no biological reason to not allow harvest at this level given an ABC of 55,408 mt. Regardless of the HG that the Council chooses, the CPSMT recommends an incidental catch allowance for other CPS fisheries of at least 3,000 mt. The CPSMT's recommendation to increase the incidental catch allowance is based on its previous analysis which suggested that 3,000 mt should be adequate for Pacific mackerel catch in other CPS fisheries (Agenda Item F.1.a, Attachment1, Draft CPS SAFE, Table 2-2, subsection October 3, 2002).

The CPSMT recognizes that efforts have been undertaken to address recommendations outlined in the 2009 reviews regarding critical areas of research needed to improve overall model robustness and strengthen the next full stock assessment scheduled for May 2011. These include:

1) Southwest Fisheries Science Center (SWFSC) staff continues to make progress with collaborative efforts with Mexico. For example, SWFSC staff have recently participated in meetings hosted by fishery researchers in Mexico (both Federal and academic institutions) that addressed issues from modeling to data exchange.
2) SWFSC staff and California Department of Fish and Game (CDFG) researchers have further explored sensitivity analyses involving the index of relative abundance included in the current assessment model, which is based on a Commercial Passenger Fishing Vessel survey. Specifically, issues surrounding catchability and/or selectivity,

particularly concerning time-varying vs. constant parameterization of this influential recreational fishery-based time series are being examined.

3) SWFSC and CDFG have jointly developed a research outline and begun field/laboratory efforts collecting, processing, and analyzing reproductive samples from Pacific mackerel harvested in both the recreational and commercial fisheries. It is important to note that an 'aggressive' sampling plan year over a 2 to 4 year time horizon will be required to accumulate enough samples to develop an updated maturity schedule for use in stock assessments due to limited landings of this species, coupled with few field-based surveys.

Stock Assessment and Fishery Evaluation (SAFE) and Essential Fish Habitat (EFH)

The draft CPS SAFE is available for public review. The draft contains information for Essential Fish Habitat. The CPSMT has conducted an initial review of relevant literature for EFH. Council and NMFS staff will continue to work with the CPSMT to provide a full review of EFH for the November Council meeting.

PFMC
06/15/10

HABITAT COMMITTEE REPORT ON PACIFIC MACKEREL MANAGEMENT FOR 2010-2011

Pacific Mackerel Management for 2010-2011

The Habitat Committee (HC) briefly reviewed the Status of the Coastal Pelagic Species Fishery and Recommended Acceptable Biological Catches – Stock Assessment and Fishery Evaluation (CPS SAFE, Agenda Item F.1.a Attachment 1) for Pacific Mackerel.

The HC supports the conservative fishery harvest guideline proposed for 2010-2011 Pacific mackerel management that addresses the current scientific uncertainty in the stock assessment and acknowledges the recent history of low level directed fisheries relative to the harvest control rule. The HC continues to support conservative fishery management strategies for important forage species such as Pacific mackerel and moving towards development of specific set-asides for these forage species as better data are developed that identify the predator-prey food web relationships between Council-managed and other ecosystem species.

Coastal Pelagic Species Essential Fish Habitat

The HC received an update on the status of the CPS SAFE document, in particular the section on the 5-year Essential Fish Habitat (EFH) review process. Based on the information provided, the HC finds that the process warrants additional consideration and opportunity for input from the Council advisory bodies at the September or November meetings. For example, krill sensitivity to ocean acidification and the importance of upwelling zones warrant more attention.

The HC notes that the description of EFH for CPS is quite different than that for salmon and groundfish, as CPS EFH varies in time and space related to sea surface temperatures. The Council has a role in setting harvest guidelines for coastal pelagics which are important forage species, as prey is a component of EFH. Therefore, there should be specific consideration in the EFH section of prey species as important components of the ecosystem.

PFMC
06/12/10

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PACIFIC MACKEREL MANAGEMENT FOR 2010-2011

The Scientific and Statistical Committee (SSC) received an overview of the status of Pacific mackerel from Dr. Kevin Hill.

The most recent stock assessment was conducted in 2009 to inform management for the 2009-2010 fishing year. No update was conducted for 2010; however, a new, full assessment is scheduled for 2011. The 2009 assessment indicated that the population had begun to level off following an increase from very low abundance. Dr. Hill noted that the 2009-2010 fishery landings were relatively low, despite El Niño conditions, which usually tend to increase the availability of Pacific mackerel.

A chief source of uncertainty in the Pacific mackerel model is the treatment of the commercial passenger fishing vessel (CPFV) logbook index of relative abundance. One model (AA), with a single CPFV index time block, yielded an acceptable biological catch (ABC) of 55,408 mt, while a two period model (AB) resulted in an ABC of 7,729 mt. In June 2009, the SSC endorsed the use of model AA for setting the ABC, but recommended taking the results of model AB into account when setting the harvest guideline (HG). The Council subsequently approved an ABC of 55,408 mt and a HG of 10,000 mt with a 2000 mt set-aside for incidental harvest.

Lacking an assessment update, and given that recent catches have remained at low levels (approximately 3,000 mt), the SSC concluded that the ABC and HG recommendations for 2009-2010 would be appropriate for the 2010-2011 fishing year as well.

PFMC
06/14/10

FISHERY MANAGEMENT PLAN AMENDMENT 13: ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

The Magnuson-Steven Fishery Conservation and Management Reauthorization Act of 2006 (MSRA) established several new fishery management provisions pertaining to National Standard 1 (NS1) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), which states "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." On January 16, 2009, the National Marine Fisheries Service (NMFS) published a final rule to implement the new MSRA requirements and amend the guidelines for NS1. The MSRA and amended NMFS guidelines introduce new fishery management concepts including overfishing levels (OFLs), annual catch limits (ACLs), annual catch targets (ACTs), and accountability measures (AMs) that are designed to better account for scientific and management uncertainty and to prevent overfishing. These important aspects of the MSRA are required to be implemented by 2011 for most species and by 2010 for those species subject to overfishing.

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 and provide a solid foundation for new fishery management provisions such as OFLs, ACLs, and ACTs. The CPS FMP's monitored stocks are either exempt from the new requirements because of their short life cycle (market squid) or are currently harvested at relatively low levels (anchovy, jack mackerel). ACLs for monitored stocks may be implemented with greater flexibility, but also greater precaution, than for actively managed species because they are assessed with less frequency.

At its March 2010 meeting, the Council identified the following preliminary preferred alternatives for Amendment 13:

- All actively managed and monitored species in the fishery management plan (FMP) remain "in the fishery" and krill are moved to a new Ecosystem Component (EC) category while continuing the existing harvest prohibitions for krill species.
- Add no new forage species to the EC category pending additional analysis of non-target stocks.
- Maintain existing Status Determination Criteria for CPS FMP stocks and develop a maximum sustainable yield (MSY) proxy for the Northern subpopulation of Northern anchovy.
- Adopt no preferred alternative at this time for OFLs, acceptable biological catches (ABCs), and ACLs, pending additional analyses and direct the CPS Management Team and the Scientific and Statistical Committee (SSC) to continue to analyze alternatives and report the results at the June Council meeting.
- Maintain the default harvest control rule for monitored stocks.
- Maintain all current species in the current CPS FMP and transfer no species to State management.
- Adopt no preferred alternative for sector-specific ACLs, AMs or ACTs. Rather, further analyze the use of AMs such as ACTs, set-asides, and management uncertainty buffers to address research, live bait, management uncertainty, and incidental fishery mortality.

Additionally, consider describing all of these tools in the CPS FMP framework to maintain annual flexibility in their application to CPS fishery management.

At this meeting, the Council is scheduled to take final action on Amendment 13. This schedule is anticipated to allow adequate time for the Secretarial approval process and full implementation by 2011.

Council Action:

1. **Adopt a Final Amendment 13 Alternative.**
2. **Provide Guidance on Amendatory Language Proposed Under Amendment 13.**

Reference Materials**:**

1. Agenda Item F.2.a, Attachment 1, *Draft Environmental Assessment for Amendment 13 to the Coastal Pelagic Species Fishery Management Plan.*
2. Agenda Item F.2.a, Attachment 2, Draft CPS FMP Amendatory Language Proposed Under Amendment 13.
3. Agenda Item F.2.b, Supplemental SSC Report.
4. Agenda Item F.2.b, Supplemental CPSMT Report.
5. Agenda Item F.2.b, Supplemental CPSAS Report.
6. Agenda Item F.2.c, Public Comment

Agenda Order:

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

PFMC
05/27/10

MEASURES FOR INTEGRATING NEW PROVISIONS OF THE MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT AND NATIONAL STANDARD 1 GUIDELINES INTO COASTAL PELAGIC SPECIES MANAGEMENT

AMENDMENT 13 TO THE COASTAL PELAGIC SPECIES FISHERY MANAGEMENT PLAN

PARTIAL DRAFT ENVIRONMENTAL ASSESSMENT

MAY 2010

PREPARED BY:

PACIFIC FISHERY MANAGEMENT COUNCIL
COASTAL PELAGIC SPECIES MANAGEMENT TEAM AND COUNCIL STAFF
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CONTENTS

1.0 INTRODUCTION

The Pacific Fishery Management Council's (Council's) Coastal Pelagic Species (CPS) 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* document which is posted on the Council's web page. The final Environmental Assessment (EA) will be developed after the June 2010 Council meeting when the final preferred alternative for Amendment 13 is decided.

1.1 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 Magnuson-Stevens Fishery Conservation and Management Act (MSA), Section 301. National Standard 1 (NS1) states "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 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. 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 for fisheries undergoing overfishing, to have ACLs and AMs to end overfishing by 2010, and all fisheries to have ACLs and AMs in place to prevent or end overfishing by 2011, and beyond. A stock or stock complex may not require an ACL and AMs if it qualifies for a statutory exception under the Magnuson-Stevens Act. The NS1 Guidelines also discuss how stocks should be classified in the FMP. As part of this action the CPSMT evaluated all the species and stocks identified in the FMP in light of available information on catch to consider possible reclassification.

The Guidelines are intended to meet the objectives of NS1 by providing guidance on:

1. Specifying maximum sustainable yield (MSY) and OY;
2. Specifying status determination criteria (SDC) so that overfishing and overfished determinations can be made for stocks and stock complexes that are part of a fishery;
3. Preventing overfishing and achieving OY, incorporation of scientific and management uncertainty in control rules, and adaptive management using annual catch limits (ACL) and measures to ensure accountability (AM); and

4. Rebuilding stocks and stock complexes.

The Council is revising the CPS FMP to be consistent with revised NS1 Guidelines in order to more effectively prevent overfishing and rebuild overfished stocks, or stocks that may become overfished.

1.2 Amendment 13 Process and Schedule

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 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 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.

This draft Environmental Assessment (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.

2.0 DESCRIPTION OF ALTERNATIVES

Legal requirements of the MSRA and the MSA combined with the policy guidance from NMFS on implementing NS1 require new provisions such as overfishing limits (OFLs) and ACLs be included in FMPs and management practices to end and prevent overfishing within a specific timeframe.

2.1 STOCK CLASSIFICATIONS

2.1.1 STOCKS "IN THE FISHERY"

According to NS1 guidelines (' 600.310(d)(1)), all stocks in an FMP are considered to be "in the fishery" by default, unless they are identified as ecosystem component (EC) species. Species "in the fishery" are generally targeted and sold commercially or retained for personal use. All species in the fishery require specification of SDCs, including: OFL; MSY; allowable biological catch (ABC); optimum yield (OY); and most require ACLs and AMs to prevent overfishing. Stocks that exhibit annual life cycles or stocks managed under international agreements to which the United States is a party are exempt from the new measures, such as the ACL, AM, etc. requirements. No CPS are currently managed under international agreements, but market squid would be considered exempt, given this species' longevity is less than one year.

The NS1 guidelines identify reference points for stocks "in the fishery" which will likely include FMP species in the actively managed and monitored categories and may include krill in the prohibited harvest category. Market squid are exempt from ACL and AM requirements because of their annual life cycle.

Species in the actively managed category as well as market squid and northern anchovy in the monitored species category are target species and thus, would be considered "in the fishery". The other species in the monitored category, jack mackerel, is currently targeted to a much lesser degree than the two actively managed species, but when encountered is generally retained for sale.

Harvest for krill is currently prohibited under the FMP and Federal regulation. Ecosystem considerations were a key element of the rationale for the prohibition; krill may be a candidate for an EC species.

2.1.2 ECOSYSTEM COMPONENT SPECIES

The specification of EC species is optional and there are several criteria that should be met for a species to be included in the EC category (' 660.310(d)(5)(i)). These are:

- Be a non-target stock/species;
- Not be subject to overfishing, approaching overfished, or overfished and not likely to become subject to overfishing or overfished in the absence of conservation and management measures; and,
- Not generally retained for sale or personal use, although "occasional" retention is not by itself a reason for excluding a species from the EC category.

Comments received during the scoping sessions have requested that the Council consider the addition of forage species not currently in the FMP as EC species (i.e., Pacific saury,

myctophids, Pacific sand lance, white bait smelt, and other smelts). The intent of the request is to monitor a set of forage species and to report on their trends, status, and ecological roles, and not to develop a fishery.

2.1.3 Summary of Stock Classification Alternatives

***Alternative 1,* No Action Alternative**– All species currently in the CPS FMP, including krill are included "in the fishery" in their existing category and no EC species are established.

Alternative 2, **Preliminary Preferred Alternative** - 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.

Alternative 3 – Add additional forage and/or bycatch species to the CPS FMP as EC species. (This alternative can be eliminated or coupled with Alternative 1 or 2 above.

2.2 Status Determination Criteria

Status Determination Criteria exist in the current CPS FMP with the exception of the new OFL provision (see Section 3.2). Although the Council and the CPSMT have identified the review of some of the existing SDCs as priority research needs, the process of reviewing and potentially revising the existing SDCs is outside the scope and the allotted time of Amendment 13.

The use of an MSY control rule for actively managed stocks is designed to provide managers with a tool for setting and adjusting harvest levels on a periodic basis, while preventing overfishing and overfished stock conditions. All actively managed stocks must have stock-specific MSY control rules, a definition of overfishing, and a definition of an overfished stock.

The main use of an MSY control rule for a monitored stock is to help gauge the need for active management and to trigger such consideration before a stock is experiencing overfishing. While landings are low and the stock remains in the monitored category, its status is assessed infrequently making estimates of MSY or minimum stock size thresholds (MSST) difficult and impractical. MSY control rules and harvest policies for monitored CPS stocks may be more generic, precautionary, and simpler than those used for actively managed stocks. Under the FMP, any stock supporting catches approaching the ABC or MSY levels should be actively managed unless there is too little information or other practical problems.

The CPS FMP currently does not include an estimate of or proxy for MSY or OY for the Northern subpopulation of Northern Anchovy. As for other species in the monitored category, an estimate of biomass and a proxy MSY harvest level is an important part of establishing reference points for determining if and when the stock status warrants active management (see section 2.3).

2.2.1 Summary of Stock Determination Criteria Alternatives

***Alternative 1,* No Action Alternative** – Maintain existing SDCs for CPS FMP stocks.

***Alternative 2,* Preliminary Preferred Alternative** - Maintain existing SDCs for CPS FMP stocks and develop an MSY proxy for the Northern subpopulation of Northern anchovy.

2.3 OVERFISHING LEVELS, ACCEPTABLE BIOLOGICAL CATCH, AND ANNUAL CATCH LIMITS

The NS1 guidelines envision OFL to correspond to the best available estimate of MSY stock size. The guidelines also call for an assessment of scientific uncertainty in the estimate of MSY and the development of an ABC control rule that addresses scientific uncertainty and management risk when setting an ABC level below the OFL. Given the differences in harvest levels and available information on stock status between actively managed and monitored stocks, it is recommended that the existing "tiered" system be modified to meet new provisions to prevent overfishing while recognizing the amount of available data for each tier or category and the appropriate management response based on fishing pressure.

2.3.1 ACTIVELY MANAGED SPECIES

Because of their importance to current fisheries, Pacific sardine and Pacific mackerel are actively managed. Assessments and management measures are revised, reviewed, and adopted on an annual basis. This relatively intensive management strategy responds to year-to-year changes in stock dynamics for these productive stocks and places these species in the top management tier due to a greater understanding of stock status and management performance.

Determining the degree to which the provisions in the existing harvest control rules adequately buffer CPS stocks from overfishing will be a critical step in ensuring the amended CPS FMP meets the new NS1 requirements. The SSC Groundfish and CPS Subcommittees have worked on the development of a framework for factoring scientific uncertainty into harvest control rules by quantifying assessment variability for stocks with a history of multiple assessments as a basis for evaluating the size of a scientific uncertainty buffer (i.e., the difference in yield between the OFL and the ABC) and the risk of overfishing the stock. Scientific uncertainty would be expressed in terms of a BUFFER that is a combination of quantified assessment uncertainty and a policy choice by the Council regarding the estimated risk of overfishing (see Agenda Item G.5.b, Supplemental SSC Groundfish and CPS Subcommittees Report, *An Approach to Quantifying Scientific Uncertainty in West Coast Stock Assessments*, from the November 2009 Council Briefing Book available on the Council web page). Revised SSC recommendations were brought forward at the March 2010 meeting and are also available on the Council web site.

Alternative 1, No Action Alternative – Maintain the existing harvest control rules to specify the new management reference points.

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

Alternative 2 – 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

Alternative 3 – Scientific Uncertainty Buffer – 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

2.3.2 Monitored Finfish and Squid Species

Monitored stocks are either currently landed at relatively low levels or are managed primarily at the State level. The default MSY control rule for monitored stocks sets the ABC at 25 percent of estimated MSY levels making it more conservative than the MSY control rules for actively managed species for which more data and more current assessments exist. This approach is similar to "tiered" approaches used in North Pacific Fishery Management Council FMPs and the Council's Groundfish FMP where harvest specifications and reference points differ for categories or tiers of species based on the amount and quality of data that is available for management. Because monitored stocks are not annually assessed or managed, the Council may recommend that ACLs for monitored species be specified for multiple years until such time as the species becomes actively managed or new scientific information becomes available.

Alternative 1 – 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.

Alternative 2 – Scientific Uncertainty Buffer – 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 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.

Market squid are also a monitored species under the CPS FMP, but the current MSY proxy for market squid is completely different from the finfish species and uses an escapement method detailed in Section 4.3.2.1.

2.3.3 SECTOR-SPECIFIC ACLS

The NS1 guidelines allow for sector specific ACLs and recommend their use if a stock is targeted by multiple fishery sectors, each with their own level of monitoring and inseason management. Alternatively, the landings associated with the following activities could be incorporated into management as AMs or ACTs (see section 2.4).

The Council has expressed an interest in continuing the practice of setting aside a portion of the Pacific sardine harvest for the purpose of conducting research under an exempted fishing permit (EFP). In November 2009, the Council recommended including this EFP research in the management framework as fishery sector with a specific ACL. Mortality associated with other research programs with NMFS or other agencies is not intended to be included in this EFP research sector and are proposed to be considered as AMs.

California live bait fishery may be a candidate for a sector specific portion of the overall ACL. In November 2009, the Council did not recommend this management approach. However, the CPSMT and Council staff discussed the merits of establishing a sector-specific ACL for the live bait fishery and is asking the Council to reconsider or reaffirm their November 2009 recommendation. This fishery is small but important and supplies bait fish primarily for recreational vessels. The fishery is not actively monitored or managed inseason, but landings are estimated at the end of the year. The Council could choose to adopt one or both of Alternatives 2 and 3.

Alternative 1, No Action Alternative – No sector-specific ACLs.

Alternative 2 - Assign a sector-specific ACL to EFP research activities.

Alternative 3 – Assign a sector-specific ACL for the live bait fishery.

Alternative 4 – Add sector-specific ACLs to the FMP framework as a management tool and assess their applicability on an annual basis.

2.4 ANNUAL CATCH TARGETS AND ACCOUNTABILITY MEASURES

Annual catch targets (ACTs) are optional reference points designed to account for management uncertainty when setting target levels below ACLs. Accountability Measures (AMs) are management controls to prevent ACLs from being exceeded and to correct or mitigate overages of the ACL if they occur. Good inseason management of CPS fisheries exists through catch monitoring, and the fishery can be closed quickly by NMFS through an automatic regulatory action. However, several aspects of CPS fisheries warrant the consideration of ACTs.

2.4.1 MANAGEMENT UNCERTAINTY

Harvest levels for the directed Pacific sardine fishery have been declining in recent years and have created a derby-style fishery. This has increased the rate at which the seasonal allocations are taken and added additional management uncertainty. The Council has recently begun setting aside portions of the Pacific sardine and Pacific mackerel harvest to account for "management uncertainty" or the potential errors in monitoring and reporting landings and closing the fishery before overfishing occurs. This proactive approach could be included as part of the establishment of an ACT. In recent years, the CPSMT and the CPSAS have assessed the nature of the fishery, the effectiveness of inseason reporting mechanisms, and the regulatory processes necessary to close the fishery when recommending buffers to account for management uncertainty.

2.4.2 TOTAL CATCH ACCOUNTING

Under the NS1 guidelines "catch" is defined to include all sources of mortality associated with a fishery (discards, research impacts, incidental landings, etc.). To meet the NS1 requirements and account for total mortality in the catch, a consideration of additional sources of mortality when setting an ACT could be prudent.

Discard Mortality

Discards do occur in CPS fisheries when a vessel captures more fish than can be brought onboard or when a school of an undesirable species composition is captured and then released. There is limited observer and logbook data available to enumerate the mortality associated with these discards. To meet the NS1 requirements and account for total mortality in the catch, the estimation of discard mortality when setting an ACT could be analyzed as an alternative. The CPSMT has discussed ways of assessing discard mortality and could, on an annual basis, make recommendations on discard mortality.

Incidental Fishery Impacts

Under the current management regime, the Council has been in the practice of setting aside a portion of the Pacific mackerel and the Pacific sardine HGs for the purpose of protecting other CPS fisheries that may land these species incidentally after their respective directed fisheries close. The Council may recommend an approach within the scope of the existing management strategies that would set aside a portion of an ACT to cover incidental landings.

Research Impacts (not including set asides for EFPs)

The California Cooperative Oceanic Fisheries Investigations and NMFS conduct annual research cruises for the purposed of monitoring many ecological and biological parameters in the support of fishery management. A substantial portion of these research initiatives is focused on CPS. Although small (generally assessed at around 1 mt for Pacific sardine in recent years), these sources of mortality are well documented and can easily incorporated into the annual management cycle.

Live Bait Fisheries

In November 2009 the Council recommended that mortality associated with live bait harvest not be included as a separate fishery sector with its own ACL, but rather be treated as an AM in the directed commercial fishery. Under this scenario, a preseason estimate of mortality, however small, from live bait fisheries would be taken into account when establishing an ACT for the directed fisheries.

2.4.3 Annual Catch Targets for Monitored Stocks

The current management framework for monitored stocks is intended to provide a mechanism for alerting the CPSMT and the Council to potential conservation concerns that may warrant elevating a species from the monitored category to the actively managed category. Current OYs or proposed ACLs currently function as the level of landings that are generally used to assess the need for active management. The CPSMT and the SSC CPS Subcommittee have discussed using either a recent average catch or a recent highest catch level as an ACT that would alert the Council of increasing landings to allow time to plan for the management response to moving to an actively managed status (i.e., scheduling a stock assessment and revising harvest control rules and SDCs).

2.4.4 Summary of ACT and AM Alternatives

The Council does not have to include ACTs in the CPS FMP and could choose Alternative 1. Additionally, the Council could choose to adopt one or both of Alternatives 2 and 3.

Alternative 1, No Action Alternative – No ACTs.

Alternative 2 – Develop ACTs only for actively managed stocks.

Alternative 3 – Develop ACTs for actively managed and monitored stocks.

2.6 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 as time and workload allows. At this time, the Council has determined that these alternatives will not be considered under Amendment 13.

2.6.1 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.

2.6.2 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:

- Alternative 1, – All species, including market squid and jack mackerel remain in the CPS FMP and no species is transferred to state management.
- Alternative 2 – Remove market squid from the CPS FMP and Federal management and transfer that authority to the State of California.
- Alternative 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 these alternatives or the removal of species from the CPS FMP under Amendment 13.

3.0 AFFECTED ENVIRONMENT

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* document which is posted on the Council's web page. The following sections contain background information that may be particularly pertinent for the review of Amendment 13.

3.1 STOCK CLASSIFICATIONS

Stocks in the CPS FMP are classified under the following management categories: actively managed; monitored; and prohibited harvest species (Table 2.1-1). 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 STATUS DETERMINATION CRITERIA

Table 3.2-1 describes SDCs as specified under the CPS FMP. Some SDCs for monitored stocks are not specified. Landings of these species are currently small and assessment data are often either dated or non-existent. The CPSMT is working on methods for determining a biomass estimate for the Northern subpopulation of Northern anchovy and some preliminary values are presented in Section 3.3.

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	Not specified	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%	Not specified	F_{MSY} resulting in egg escape-ment ≥ 30% mt	107,049mt
Jack mackerel	Age/Area based potential yield	Catch exceeding ABC	Not specified	48,000mt 31,000mt in U.S.	Currently at or below ABC
Krill or Euphausiids	Not specified	Not specified	Not specified	Not specified	0

3.3 HARVEST CONTROL RULE 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.

3.4 HARVEST CONTROL RULES FOR MONITORED AND PROHIBITED HARVEST SPECIES

Table 3.4-1 presents potential reference points for monitored species under the proposed Amendment 13 framework. Values for the northern subpopulation of northern anchovy are based on preliminary work of the CPSMT and will likely be revised as more data are analyzed. The Council will likely revisit some or all of these reference points after a final preferred alternative is adopted and approved by the Secretary.

Table 3.4-1 Potential Reference Points in the CPS FMP		
Jack Mackerel	Source: MacCall and Stauffer (1983)	
OFL	$B*F_{MSY}$ * Distribution 195,000mt*0.65	124,800 mt
ABC	OFL * 0.25	31,000 mt
ACL	Equal to ABC	31,000 mt
Northern Anchovy, Northern Subpop.	Source**:** Preliminary **a**coustic biomass estimate, Zwolinski et al., in prep; Advanced Survey Technologies-SWFSC, 2010	
OFL	$B*F_{MSY}$ 159,800 mt (CV>0.88) * F_{MSY}?	Not specified
ABC	OFL * 0.25	Not specified
ACL	Equal to ABC	Not specified
Northern Anchovy, Central Subpop.	Source: Conrad (1991) 123,000 F_{MSY} at biomass of 733,000mt	
OFL	$B*F_{MSY}$ * Distribution 123,000mt*0.82	100,860 mt
ABC	OFL * 0.25	25,215 mt
ACL	Equal to ABC	25,215 mt
Market Squid	Source: CPS FMP Amendment 10 and California State FMP for market squid.	
OFL/MSST	F_{MSY} Resulting in Egg Esc > 30%	NA
ABC	F_{MSY} Resulting in Egg Esc > 30%	NA
ACL	California Landing Limit	107,047 mt
Krill	Source: Amendment 12 to the CPS FMP	
OFL	No Operational Purpose	
ABC	No Operational Purpose	
ACL	Prohibited Harvest, de minimus amounts tolerated	0

Section References

CDFG. 2005. Market Squid Fishery Management Plan. March 25, 2005.

PFMC 2002. Coastal Pelagic Species Fishery Management Plan. Limited Entry

Conrad J. M. 1991. A bioeconomic analysis of the northern anchovy. NMFS, Southwest Fisheries Science Center Admin. Rep. LJ-91-26: 34 p.

MacCall, A.D., and G. D. Stoufer. 1983. Biology and fishery potential of jack mackerel (*Trachurus symemetricus*) CalCOFI Rep. 24: 46-56.

PFMC (1998) CPS FMP Amendment 8 Appendix B.

PFMC (2002) CPS FMP Amendment 10

4.0 ANALYSES OF THE ALTERNATIVES

4.1 STOCK CLASSIFICATION CONSIDERATIONS

Alternative 1 – All species currently in the CPS FMP, including krill are included "in the fishery" in their existing category and no EC species are established.

Species in the actively managed category as well as market squid and northern anchovy in the monitored species category are target species and thus, would be considered "in the fishery". The other species in the monitored category, jack mackerel, is currently targeted to a much lesser degree than the two actively managed species, but when encountered is generally retained for sale.

Regarding the krill species in the prohibited harvest category, harvest for krill is currently prohibited in any fishery within the West Coast Exclusive Economic Zone (EEZ) under the FMP and Federal regulation. Until the EC designation is more fully developed, maintaining krill "in the fishery" may be the more appropriate course to ensure the intent of Amendment 11 and the current harvest ban. Although ecosystem considerations were a key element of the rationale for the prohibition krill are not an explicit component of CPS fisheries and because of this and the existing broad prohibition, which also prevents the conceivable development of a targeted fishery in the future, may be rationale to continue to include krill and its broad regulatory harvest prohibition as a species "in the fishery". Additionally, the requisite SDCs for krill were established or omitted with good rationale under Amendment 12 to the CPS FMP. Currently OY for krill is defined as zero and harvest has been prohibited. Because of these reasons it was determined during the implementation of Amendment 12 that specifications of MSY and of SDC do not have any operational purpose. As with the management reference points adopted for krill under Amendment 12, establishment of new SDCs such as OFLs and ABCs may also not be needed and NMFS staff are reviewing cases around the nation for similar applications to draw from in this unique situation.

Alternative 2, **Preliminary Preferred Alternative** - 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.

As noted above, ecosystem considerations were a critical component of the rationale behind prohibiting their harvest. Recognition of the vital role krill play in the food web and the importance of this species to the productivity and recovery of groundfish stocks declared overfished and salmon stocks listed under the Endangered Species Act. However, the EC category is in part intended as a vehicle to monitor fishery impacts to non-target species to determine if such impacts could be contributing to the overfishing of an EC species. This is may not be a good fit for krill which is not targeted in any fishery and is not a substantial bycatch species in CPS fisheries.

The Council has initiated the development of an Ecosystem Fishery Management Plan (E-FMP) and has appointed a plan development team and advisory subpanel. The identification and monitoring of indicator species and the role species play in the food web are likely to be important issues for

the E-FMP, which is intended as an over-arching framework for all four of the Council's existing FMPs. It may become more practical to monitor species for their ecological role and associated ecosystem functions under the E-FMP rather than in the EC categories of the Council's four FMPs.

Alternative 3 – Add additional forage and/or bycatch species to the CPS FMP as EC species. (This alternative can be eliminated or coupled with Alternative 1 or 2 above).

A review of available landings and bycatch information from the CPS fisheries indicates that the incidence of what might be considered EC species in the landings and in the bycatch of West Coast CPS fisheries appears to be very low (Harrington et al. 2005; PFMC 2008, 2009).

There are many small pelagic nekton species (primarily fish and squid) that are not presently a target of commercial fisheries and not likely to be subjected to overfishing. However, these species are critical for the ecosystem services (forage) they provide to living marine resources in the California Current. These forage species are not generally retained for sale or personal use, but may be caught as bycatch in many fisheries. These forage species, together with presently managed coastal pelagic species, comprise the forage base for the California Current ecosystem. Large and small upper-trophic level species feed on this suite of forage. At this time, the abundance, status, and trends of many forage species are poorly understood. However, the abundance and distribution of these forage species probably affects the total number of the CPS that are consumed by upper-trophic species. As the Council moves to developing an E-FMP, it is important that key populations of forage species are monitored, their role in the food web identified, as well as identifying how fluctuations in forage species abundances affect CPS abundance.

4.1.1 Evaluation of Additional Ecosystem Component Species

A review of incidental and bycatch data reported in the CPS SAFE (Section 6) was completed; landings and bycatch data in CPS fisheries were compiled from logbooks, observer records, and landing receipts. Across all CPS fisheries, incidental catch by weight is comprised largely of other CPS species. A number of finfish, invertebrates and elasmobranchs constitute incidental catch and bycatch in nominal amounts.

This analysis confirmed that incidental catch and bycatch in CPS fisheries is dominated by other CPS and that bycatch/incidental catch of non-CPS is extremely low. In California the most encountered species occur at annual levels of approximately5 mt or less and include Pacific bonito, white croaker and jacksmelt. In Oregon and Washington levels are much lower, 1 mt or less and include Pacific hake and spiny dogfish.

Additionally, these data was cross-referenced with a list of forage fish species, some of which are already FMP species (Table 4.1.1). The scope of this review is limited to the identification of forage species which might fit in the CPS FMP as EC species and since measures by which to evaluate species for inclusion in the FMP have not been previously been identified, the factors specified in the NS1 guidelines for EC designation were considered.

TABLE 4.1-1. Important forage species. YOY indicates young-of-the-year.

Common Name	Scientific Name
Euphausiid (krill)	Euphausiidae
California market squid	*Loligo opalescens*
Neon flying squid	*Ommastrephes bartramii*
Boreal Clubhook Squid	*Onychoteuthis borealijaponica*
American shad	*Alosa sapidissima*
Pacific herring	*Clupea pallasi*
Smelts	Osmeridae
Surf smelt	*Hypomesus pretiosus*
Night smelt	*Spirinchus starksi*
Longfin smelt	*Spirinchus thaleichthys*
Eulachon	*Thaleichthys pacificus*
Whitebait smelt	*Allosmerus elongatus*
Topsmelt	*Atherinops affinis*
Jacksmelt	*Atherinopsis californiensis*
Californian grunion	*Leuresthes tenuis*
Lantern fish	Myctophidae
Codfishes YOY	Gadidae
Pacific tomcod	*Microgadus proximus*
Pacific saury	*Cololabis saira*
Rockfishes YOY	*Sebastes* spp.
Greenlings YOY	*Hexagrammos* spp.
Pacific sandlance	*Ammodytes hexapterus*
Sanddab spp.	*Citharichthys* spp.

Forage species that have been suggested by public comment for consideration for inclusion in the FMP as EC species include Pacific saury, Pacific sandlance, whitebait smelt and myctophids. These species are not targeted by any CPS fishery, nor is there any documented incidental catch or bycatch in logbooks, fish tickets or observer data. Therefore, inclusion of these species in the FMP as EC species might be considered for other "ecosystem issues".

Although those species proposed through public comment are not caught while fishing for CPS, other forage species are caught in CPS fisheries including sanddabs (currently in the Council's groundfish FMP), smelts, California grunion and American shad. Therefore these species potentially could be added to the CPS FMP and designated as EC species of the CPS fishery. The following species are not specifically targeted by CPS fisheries, are landed at levels that overfishing or overfished concerns are unlikely, and except for one species of smelt (jacksmelt) are generally not retained for sale or personal use.

- Sanddabs: Reported in California bycatch observations of CPS finfish and market squid fisheries. Observations are made for presence or absence of bycatch in sampled landings; amounts are not quantified but the percent frequency is calculated. For 2004-2008 the

percent frequency for sanddabs in CPS finfish fishery landings ranged from 2.1 to 5.1 and ranged from 1.3 to 4.9 in CPS market squid fishery landings. In Washington, sardine fishery onboard observer data from 2000-2004 noted fewer than two dozen individual sanddabs total; and in Oregon sanddabs have not been recorded by observers or in logbooks and appear on fish tickets in two of ten years, totaling less than 0.002 mt in those years.

- Smelts: Except for jacksmelt, smelt species are infrequently observed in California CPS finfish and market squid fisheries based on bycatch observations (maximum percent frequency of any observed smelt spp. was 0.6 from 2004-2008). Jacksmelt are landed and sold; landings were noted in each year from 2000 through 2009, and averaged 5.79 mt. Smelt were not documented as bycatch in the Washington sardine observer program suggesting they rarely occur in the fishery, and smelt have not been reported on fish tickets. The sardine fishery in Washington is limited to fishing outside 3 miles and, therefore, is not likely to encounter forage species that typically inhabit estuaries or nearshore areas. Smelt species are not recorded on fish tickets from landings in the Oregon sardine fishery, nor are they reported in logbooks.
- California Grunion: From 2004-2008, California grunion was only observed in 3 years and at a percent frequency of 0.3 or less. Oregon and Washington are beyond the typical range for California grunion.
- American shad: Landings of shad are documented on fish tickets in both Oregon and Washington. Since 2002, landings were recorded in four years in Oregon and two years in Washington. Landings in Oregon ranged from 0.3 to 1.2 mt, and were 0.18 mt and less than 0.01 mt for Washington.

Herring and jacksmelt are also both listed as important forage species but are either landed and sold routinely under State management (jacksmelt only in California) or are landed relatively infrequently but in more substantial quantities than the forage species addressed above.

- Herring: In California, herring are infrequently incidental catch in the CPS fisheries. The 10-year averages for landing and value is less than 9 mt and $900, respectively for Pacific and round herring combined. Herring are a prohibited species in the Washington sardine fishery; therefore there is no incentive to target them; since 2000 two landings neither exceeding 5 mt have been reported on fish receipts at zero value. Pacific herring landings in the Oregon sardine fishery since 2001 have varied considerably, from several years with zero reported catch up to 55.8 mt in 2008. The 9-year average for landings and value in Oregon are 8.9 mt and $431 respectively with no landings in 4 of the 9 years.
- Jacksmelt: As indicated above, incidental catches of jacksmelt are routinely landed and sold in the California CPS fisheries. The 10-year averages for landing and value are approximately 6 mt and $2,800.

Beyond the evaluation of which species may be considered for inclusion in a plan as an EC species, are the questions of why such action should be taken and what purpose is served, or what value is achieved by doing so. Identifying and including EC species in the CPS FMP is not mandatory but may be done for a variety of purposes:

- Data collection;
- For ecosystem considerations related to specification of OY for the associated fishery;
- As considerations in the development of conservation and management measures for the associated fishery;
- and/or to address other ecosystem issues.

Inclusion of the species identified above, or any other species that might be considered, in the absence of new or expanded data collection programs will not change what data are available to inform management. The expectation for EC species is that they "should be monitored to be the extent any new pertinent scientific information becomes available (e.g., catch trends, vulnerability) to determine changes in their status or vulnerability to the fishery. Monitoring incidental catch and bycatch is not dependent on an EC designation and already occurs in CPS fisheries through sampling and logbook programs. Incidental catch and bycatch in CPS fisheries will continue to be reported in the SAFE.

Under the CPS FMP conservation and management measures for targeted stocks are achieved directly through harvest control rules and regulations. The current harvest control rules for sardine were developed with significant ecosystem considerations relative to OY specifications (Section 4.2).

Finally, including some or all of these species as EC species might be considered for "ecosystem issues" which in this case would reasonably be their importance as part of the forage base of the California Current ecosystem. However, without any criteria or decisional framework guiding actions relative to EC species, there exists a risk of a piecemeal approach applied to a single FMP to address all forage and ecosystem issues which runs counter to a holistic "ecosystem" approach. This combined with the relatively low bycatch of these species in CPS fisheries, suggests that the Council's developing EFMP may be a more appropriate framework for monitoring and evaluating forage and predator species and their respective roles in the management of all Council managed fisheries.

4.2 Status Determination Criteria Considerations

Revising SDCs in the CPS FMP is not required by the MSRA. Reviewing and potentially revising some SDCs (such as the harvest control rule for Pacific sardine) has been identified as a priority research need, but completing that analysis would require more time than the current Amendment 13 timeframe allows.

***Alternative 1,* No Action Alternative** – Maintain existing SDCs for CPS FMP stocks.

***Alternative 2,* Preliminary Preferred Alternative** - Maintain existing SDCs for CPS FMP stocks and develop an MSY proxy for the Northern subpopulation of Northern anchovy.

The Northern subpopulation of Northern anchovy currently lacks an estimate of biomass or MSY harvest levels making the development of OFLs and ACLs problematic for this species. In March, the Council directed the CPSMT to work with NMFS on the establishment of these reference points in advance of the June 2010 Council meeting. Preliminary biomass estimates have been derived for the Northern subpopulation by the SWFSC using hydro acoustic data collected in 2008 (see Table 3.4-1). This method has not been fully developed and reviewed and the Council is not expected to adopt these values in June. The CPSMT is continuing to refine the biomass and MSY values for this subpopulation and anticipates final adoption of these reference points under the annual management cycle in November 2010.

Additionally, funding constraints in Oregon, have led the Oregon Fish and Wildlife Commission and the Oregon Department of Fish and Wildlife to suspend the Oregon Developmental Fishery Program that, in turn, has removed State permitting requirements and regulations from limiting potential fishing pressure on Northern anchovy.

4.3 OFL, ABC, ACL AND ACT CONSIDERATIONS

The NS1 guidelines envision OFL to correspond to the best available estimate of MSY stock size. The guidelines also call for an assessment of scientific uncertainty in the estimate of MSY and the development of an ABC control rule that addresses scientific uncertainty and management risk when setting an ABC level below the OFL.

The CPSMT has proposed that the MSY control rules for actively managed species could serve as an adequate buffer to account for scientific uncertainty as it explicitly and significantly reduces harvest as biomass approaches an overfished condition, or in the case of Pacific sardine as biomass approaches a level three times the current designation of MSST. The SSC has not supported this approach stating that the MSY control rules "were selected to maximize long-term yield given variation in recruitment (an MSY control rule)."

4.3.1 ACTIVELY MANAGED SPECIES

This section is comprised of two preliminary analyses completed by the CPSMT, 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 a preliminary analysis of the potential need for additional buffering of these harvest policies due to scientific uncertainty in estimated biomass. Please note, these analyses are based, in part, on preliminary recommendations of the CPS and groundfish SSC Subcommittees. The Council may consider revised analyses and recommendations of the SSC and the CPSMT at the June 2010 meeting before adopting a preferred alternative.

Alternative 1 – Maintain the existing harvest control rules to specify the new management reference points.

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

Alternative 2 – 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

Alternative 3 – Scientific Uncertainty Buffer – 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

4.3.1.1 PACIFIC SARDINE

Background

The harvest control rule (HCR) in the Coastal Pelagic Species Fishery Management Plan (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%;
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 4.3.1-1), 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% to biomass in each run, with biomass errors being randomly drawn from a normal distribution with a mean of zero. A CV of 50% is higher than that estimated in the SSC's recent analysis for sardine (CV_{within} = 41%; SD_{within} = 0.39).

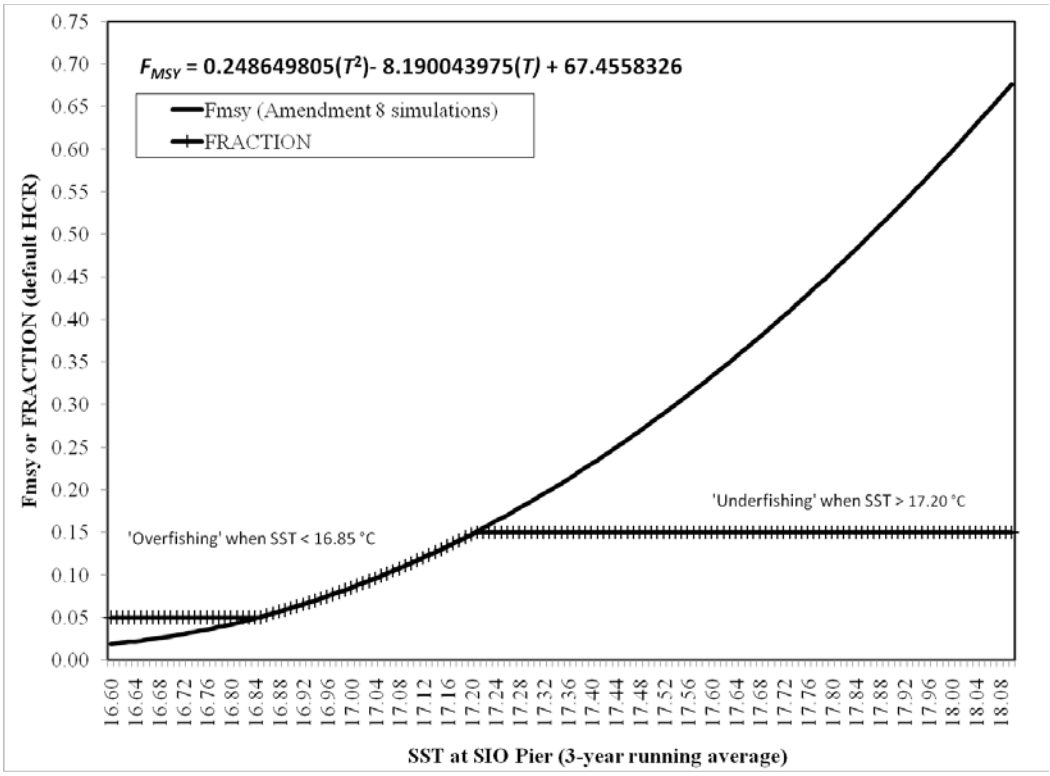

Figure 4.3.1-1. Relationship between SST (°C) at SIO pier and F_{MSY} for Pacific sardine (solid line). Harvest 'FRACTION' in the PFMC's HCR policy, bracketed between 0.05 and 0.15, is represented by the segmented line. Simulations included SSTs from 1916-19 through 1994-97.

The upper range of FRACTION chosen by the Council was capped at 15%, 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%) 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 4.3.1-1).

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

The revised NS1 guidelines require FMPs to define an overfishing limit (OFL), acceptable biological catch (ABC), and annual catch limit (ACL) for each managed stock. In this plan amendment, each of the new NS1 parameters is compared to HARVEST GUIDELINE (HG), the default management approach which includes OY considerations. For Pacific sardine, the values are defined:

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 4.3.1-1, Figure 4.3.1-2).

Table 4.3.1-1. Uncertainty buffers for various *P** values when σ = 0.39. See also Figure 4.3.1-2.

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

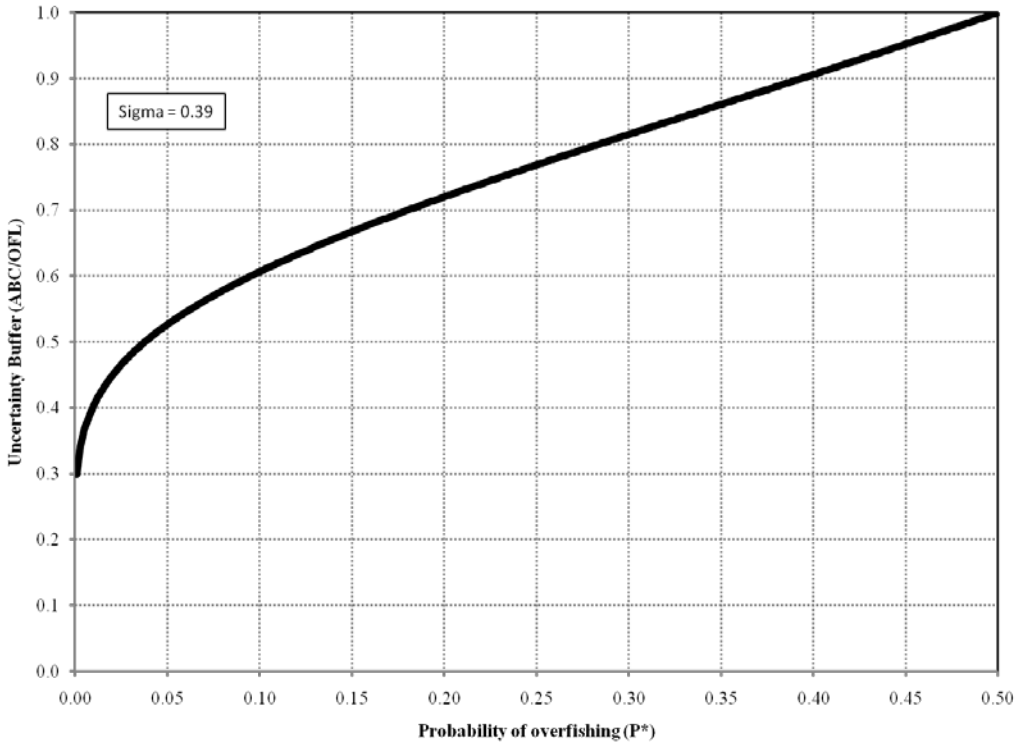

Figure 4.3.1-2. Relationship between the probability of overfishing (*P**) and uncertainty buffers (ABC/OFL) for Sigma=0.39.

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 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 4.3.1-3a-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 4.3.1-3c. 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 4.3.1-4a-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 4.3.1-4a). 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 4.3.1-4b). 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 4.3.1-4b). 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 4.3.1-4c), 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 4.3.1-5a-d and summarized in Tables 4.3.1-2a-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% for lower temperatures. The oddly-shaped three-dimensional surfaces shown in Figures 4.3.1-5a-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 4.3.1-2a-d.

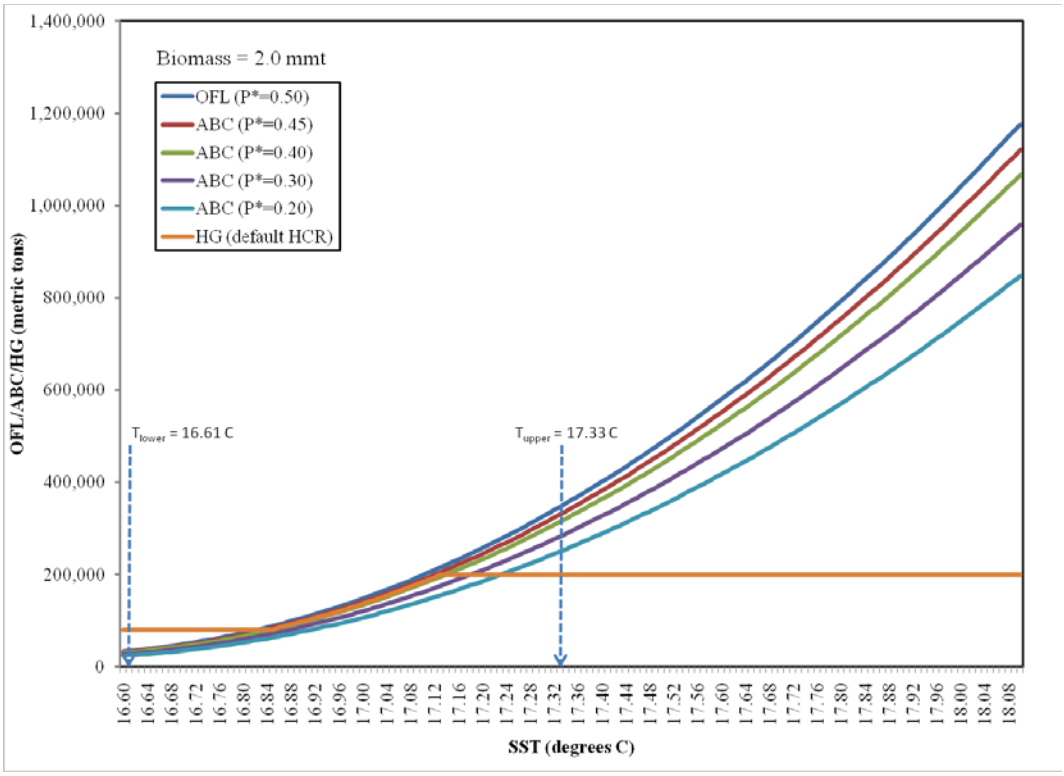

Figure 4.3.1-3a. Relationship between SST and catch (OFL, ABC, HG) when biomass = 2.0 mmt. ACL would be equal to ABC or HG, whichever value is less. The CPSMT recommends bounding OFL and ABC calculations by the upper and lower quartiles of SST observed from 1919 to 1997.

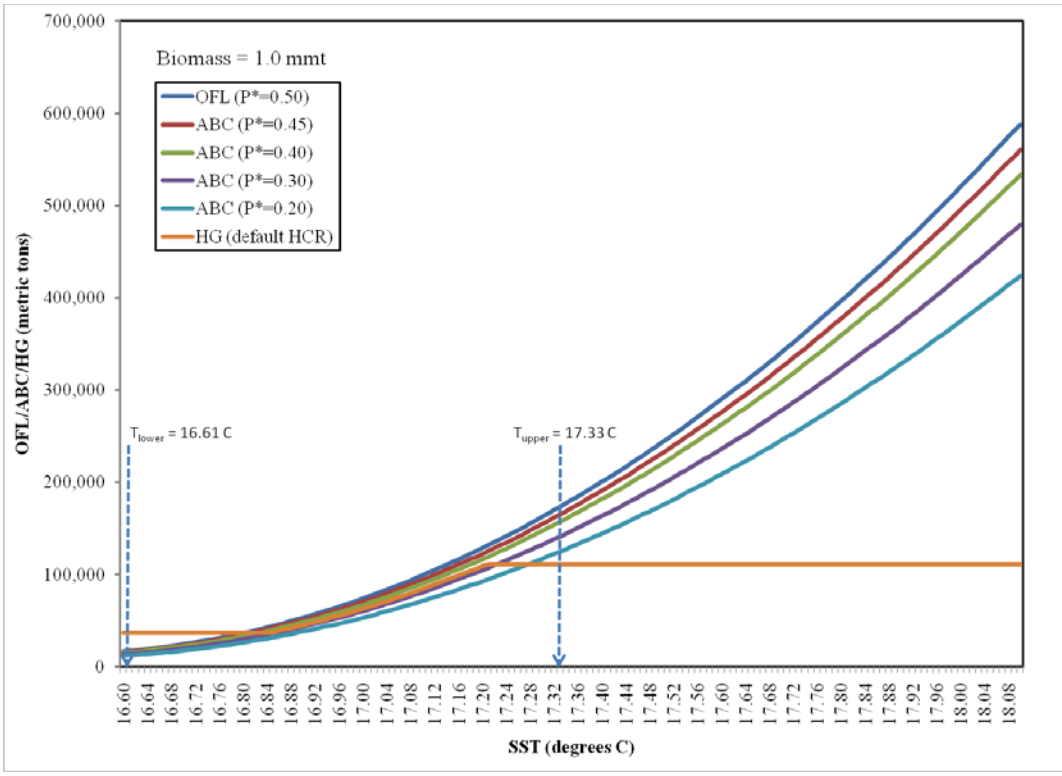

Figure 4.3.1-3b. Relationship between SST and catch (OFL, ABC, HG) when biomass = 1.0 mmt. ACL would be equal to ABC or HG, whichever value is less. The CPSMT recommends bounding OFL and ABC calculations by the upper and lower quartiles of SST observed from 1919 to 1997.

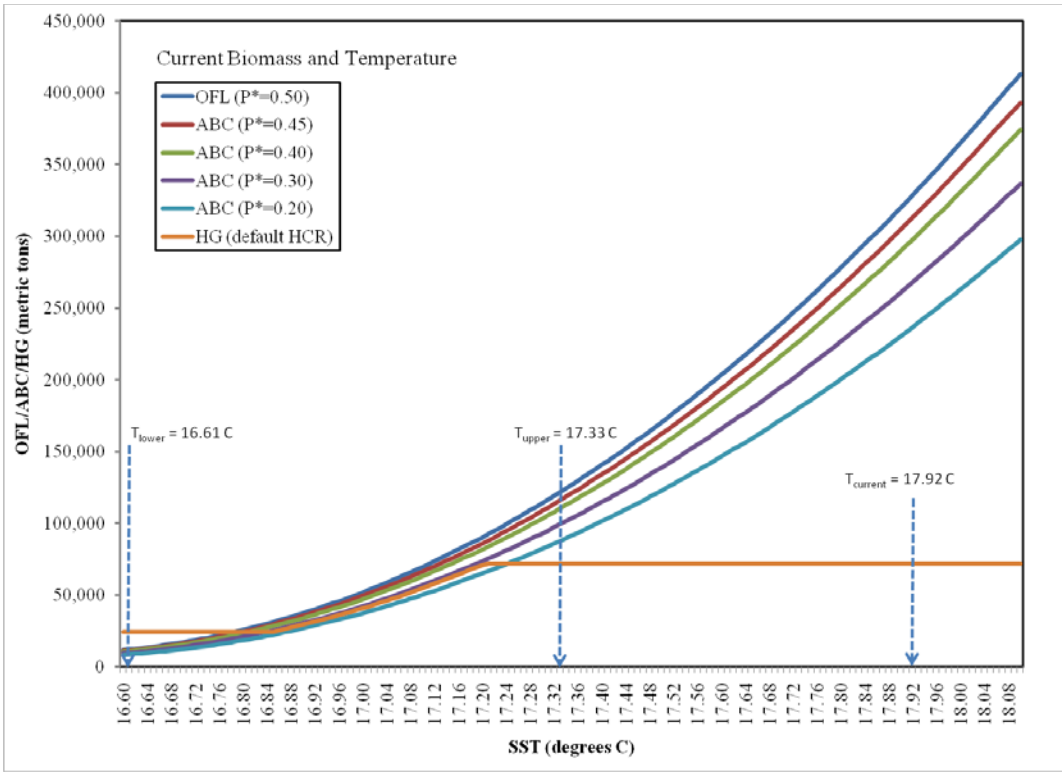

Figure 4.3.1-3c. Relationship between SST and catch (OFL, ABC, HG) when biomass = 0.702 mmt (2010 management). ACL would be equal to ABC or HG, whichever value is less. The CPSMT recommends bounding OFL and ABC calculations by the upper and lower quartiles of SST observed from 1919 to 1997.

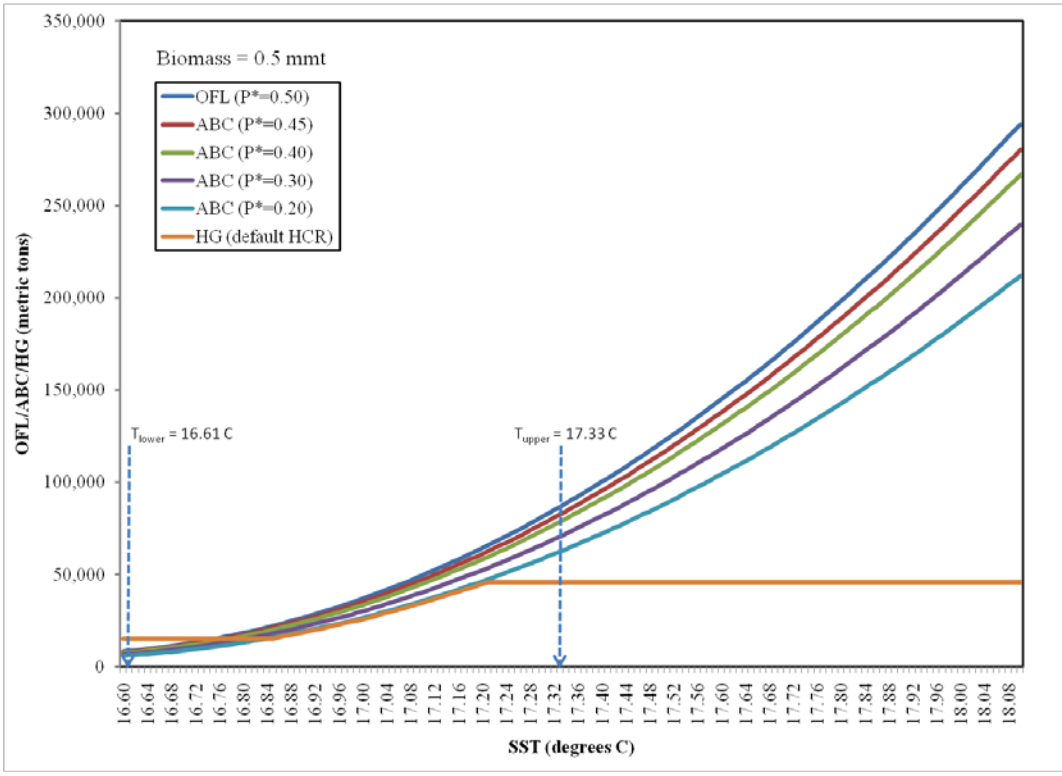

Figure 4.3.1-3d. Relationship between SST and catch (OFL, ABC, HG) when biomass = 0.5 mmt. ACL would be equal to ABC or HG, whichever value is less. The CPSMT recommends bounding OFL and ABC calculations by the upper and lower quartiles of SST observed from 1919 to 1997.

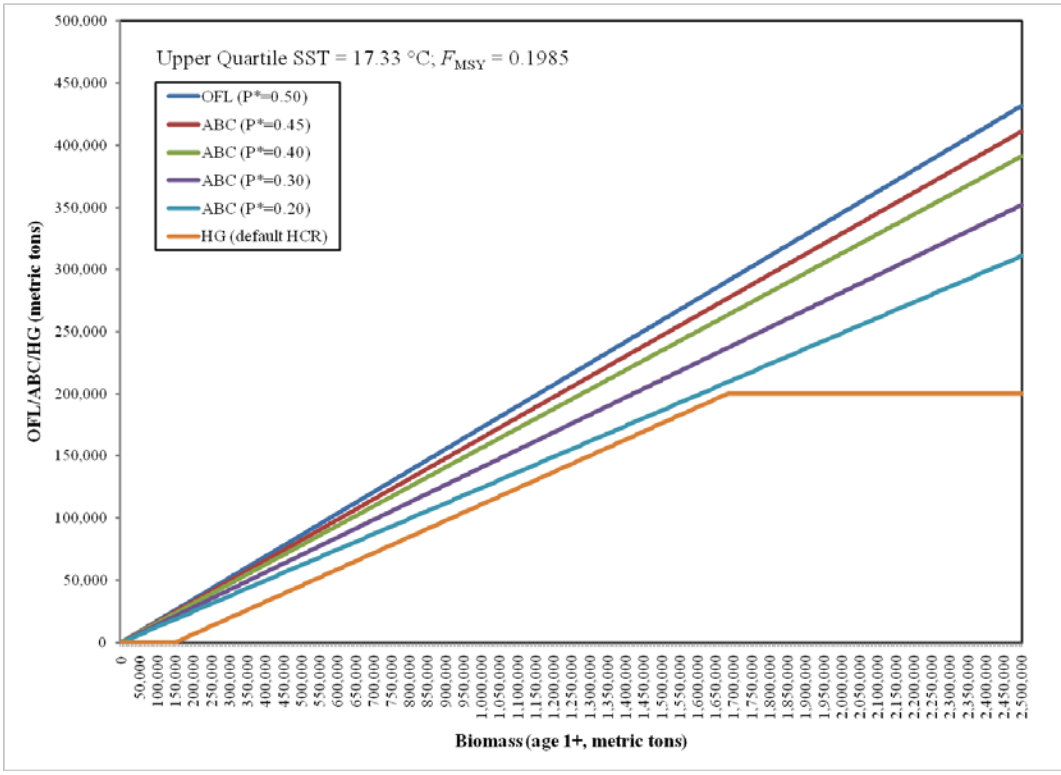

Figure 4.3.1-4a. Relationship between biomass and catch (OFL, ABC, HG) for the upper quartile of SSTs observed from 1916 to 1997. ACL would be equal to ABC or HG, whichever value is less.

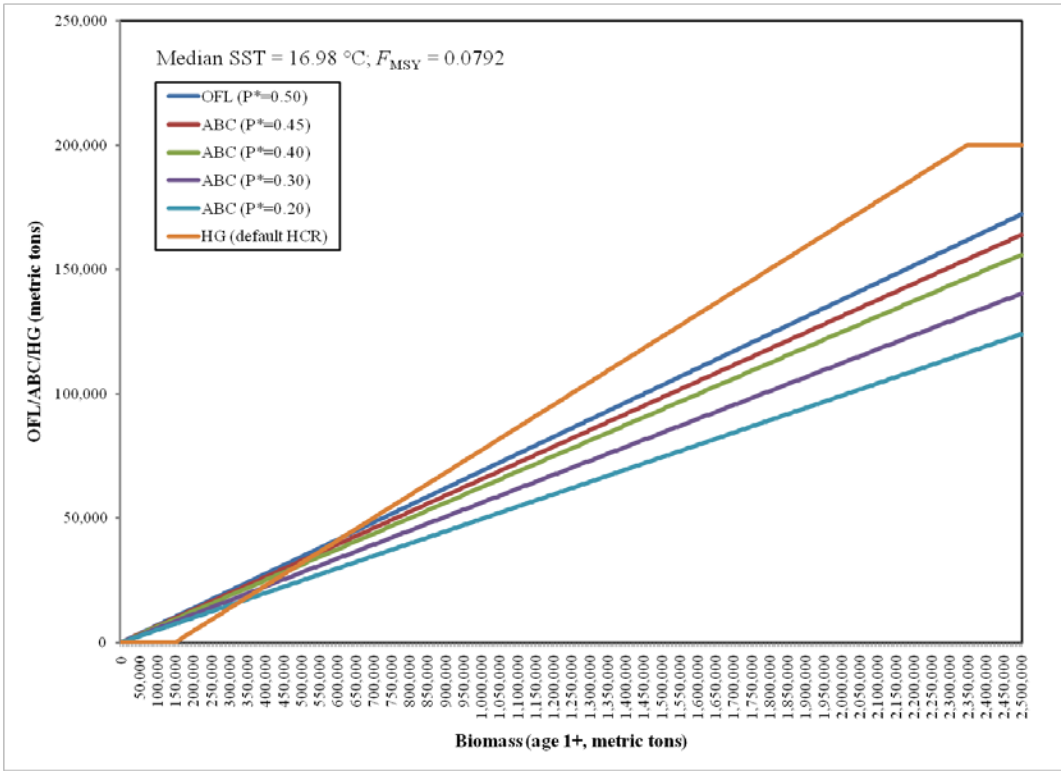

Figure 4.3.1-4b. Relationship between biomass and catch (OFL, ABC, HG) for the median of SSTs observed from 1916 to 1997. ACL would be equal to ABC or HG, whichever value is less.

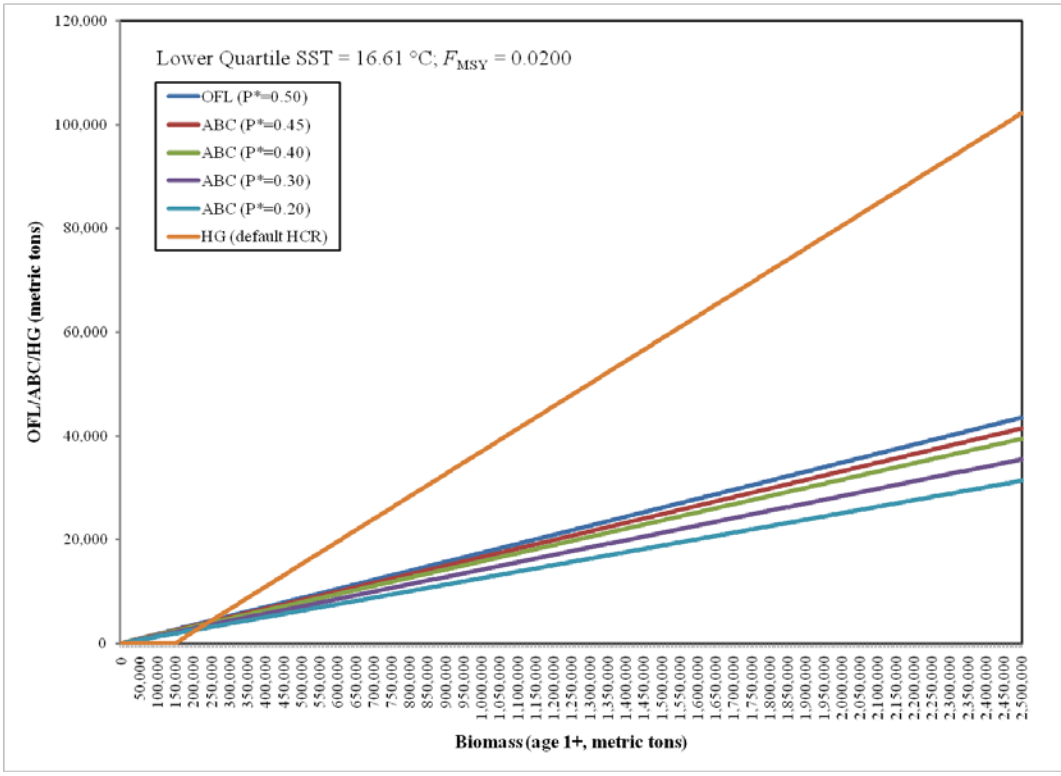

Figure 4.3.1-4c. Relationship between biomass and catch (OFL, ABC, HG) for the lower quartile of SSTs observed from 1916 to 1997. ACL would be equal to ABC or HG, whichever value is less.

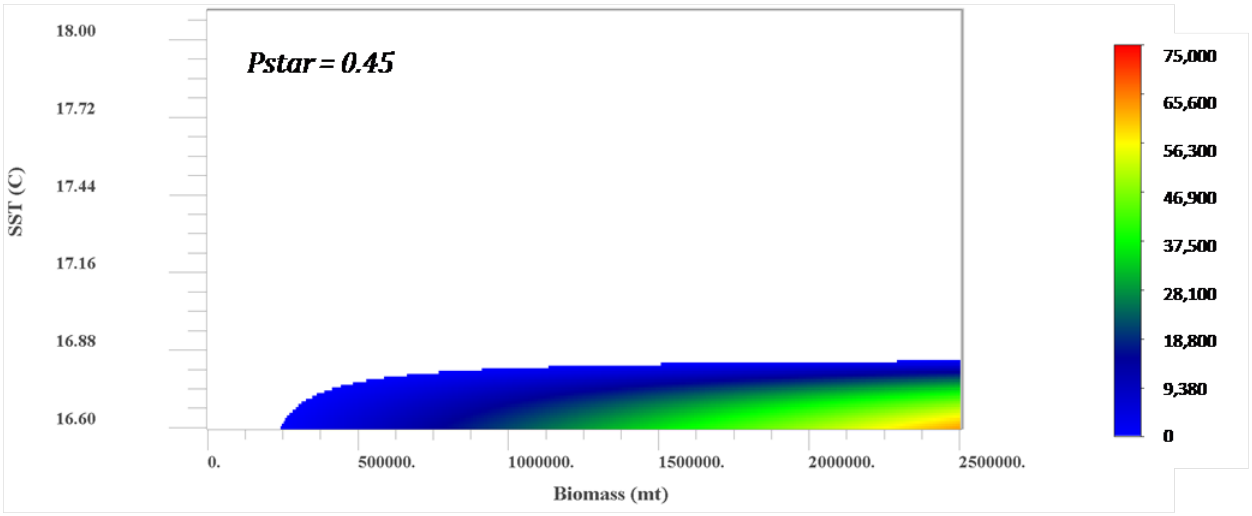

Figure 4.3.1-5a. Impact of scientific uncertainty buffer (for *P**=0.45) on sardine catch (mt) for a range of biomass and SST values. Catch reductions occur when HG is greater than buffered ABC (colored areas). White areas represent cases where HG is less than buffered ABC (i.e. no impact on catch from status quo).

Table 4.3.1-2a. Impact of scientific uncertainty buffer (for *P**=0.45) on sardine catch (mt) for a range of biomass and SST values (per Figure 4.3.1-5a 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

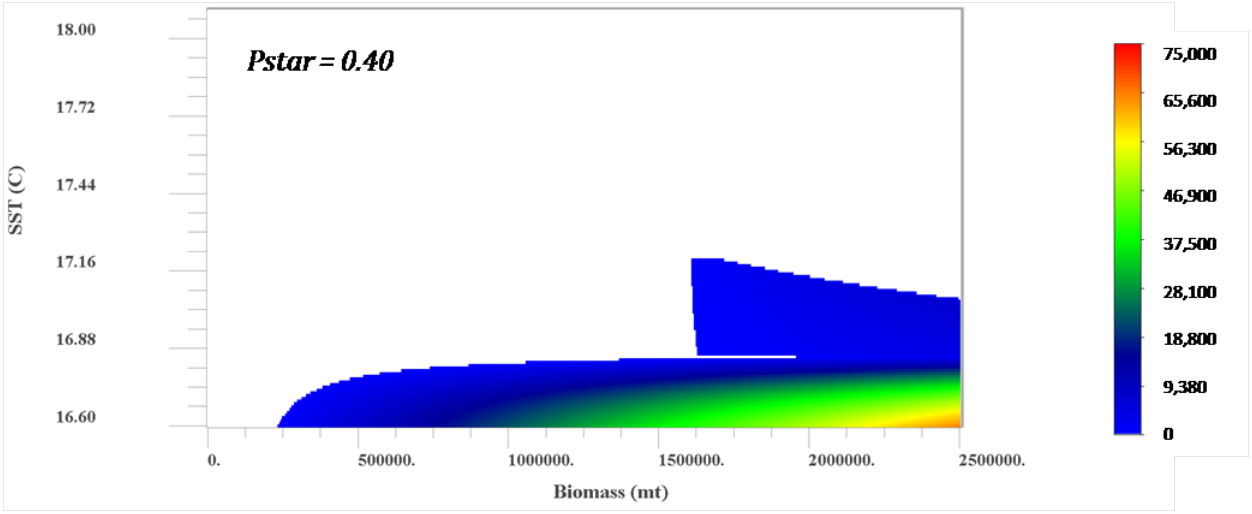

Figure 4.3.1-5b. Impact of scientific uncertainty buffer (for *P**=0.40) on sardine catch (mt) for a range of biomass and SST values. Catch reductions occur when HG is greater than buffered ABC (colored areas). White areas represent cases where HG is less than buffered ABC (i.e. no impact on catch from status quo).

Table 4.3.1-2b. Impact of scientific uncertainty buffer (for *P**=0.40) on sardine catch (mt) for a range of biomass and SST values (per Figure 4.3.1-5b 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

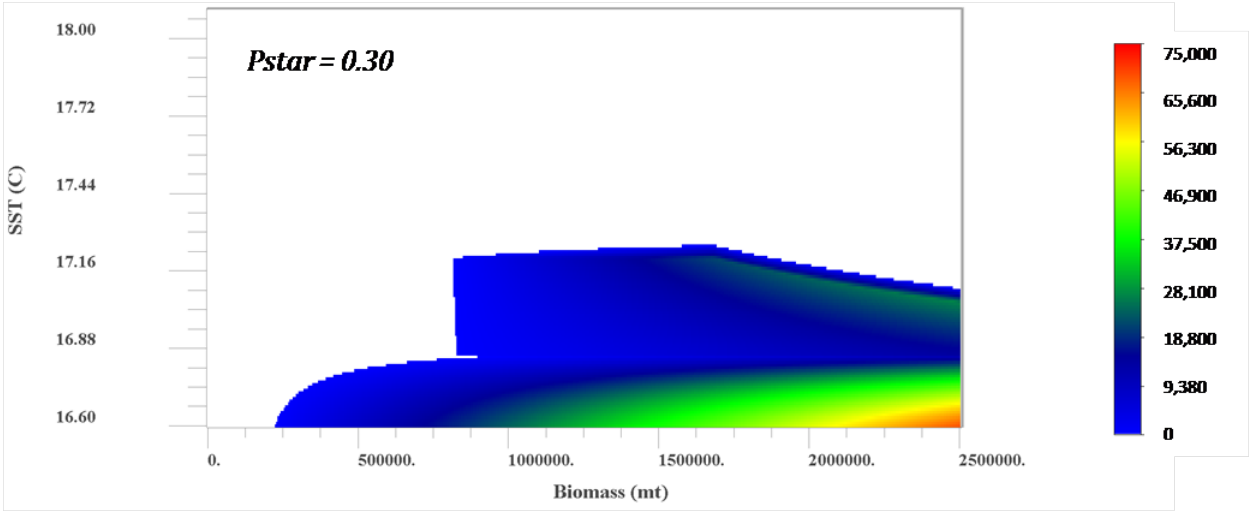

Figure 4.3.1-5c. Impact of scientific uncertainty buffer (for *P**=0.30) on sardine catches (mt) for a range of biomass and SST values. Catch reductions occur when HG is greater than buffered ABC (colored areas). White areas represent cases where HG is less than buffered ABC (i.e. no impact on catch from status quo).

Table 4.3.1-2c. Impact of scientific uncertainty buffer (for *P**=0.30) on sardine catch (mt) for a range of biomass and SST values (per Figure 4.3.1-5c 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

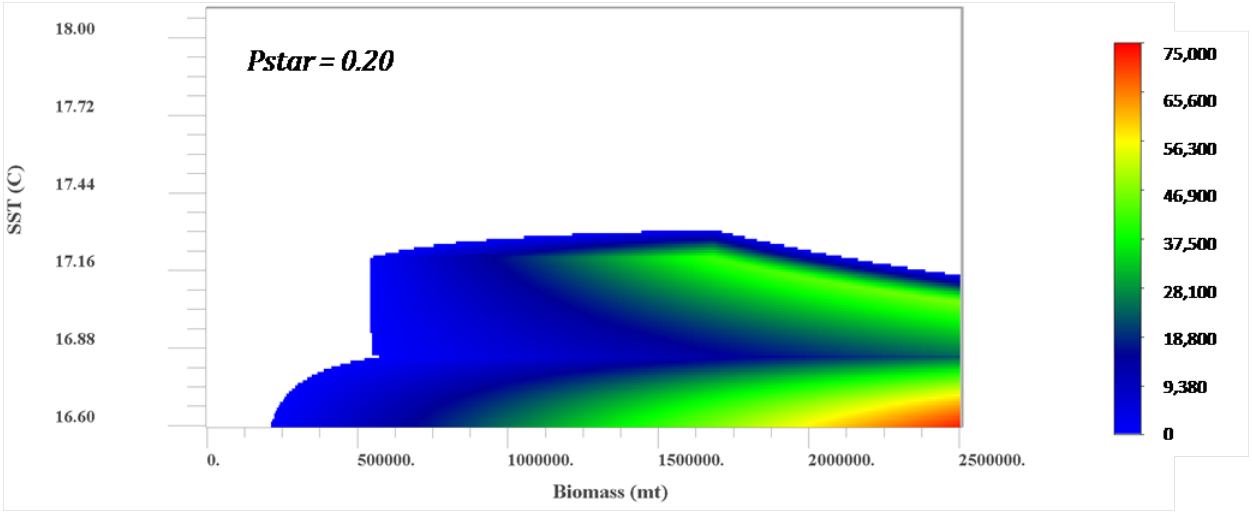

Figure 4.3.1-5d. Impact of scientific uncertainty buffer (for *P**=0.20) on sardine catches (mt) for a range of biomass and SST values. Catch reductions occur when HG is greater than buffered ABC (colored areas). White areas represent cases where HG is less than buffered ABC (i.e. no impact on catch from status quo).

Table 4.3.1-2d. Impact of scientific uncertainty buffer (for *P**=0.20) on sardine catch (mt) for a range of biomass and SST values (per Figure 4.3.1-5d 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 4.3.1-3 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%) 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 4.3.1-3).

TABLE 4.3.1-3 Adapted from Amendment 8 App. B, Table 4.2.5-1. *MSY control rule options for Pacific Sardine.* Option J adopted. 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/ 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 4.3.1-4 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 recommends 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 4.3.1-4). The current HCR has not exceeded the ABC even at P* buffer levels = 0.20 (20% 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 4.3.1-4. 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.

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4.3.1.1 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%); and
DISTRIBUTION is the distribution of the stock, on average, in USA waters (70%).

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 Acceptable Biological Catch (ABC)), but is more akin to an Annual Catch Limit (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% 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 yr 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 standing stock biomass (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-yr 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/yr 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%. 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 4.3.1-5 and 4.3.1-6 and Figures 4.3.1-6 and 4.3.1-7 are based on the most recent guidance from the Scientific and Statistical Committee (SSC) for addressing scientific uncertainty and stipulations in the MSRA, see SSC 2010. Finally, Table 4.3.1-5 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 4.3.1-5. 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

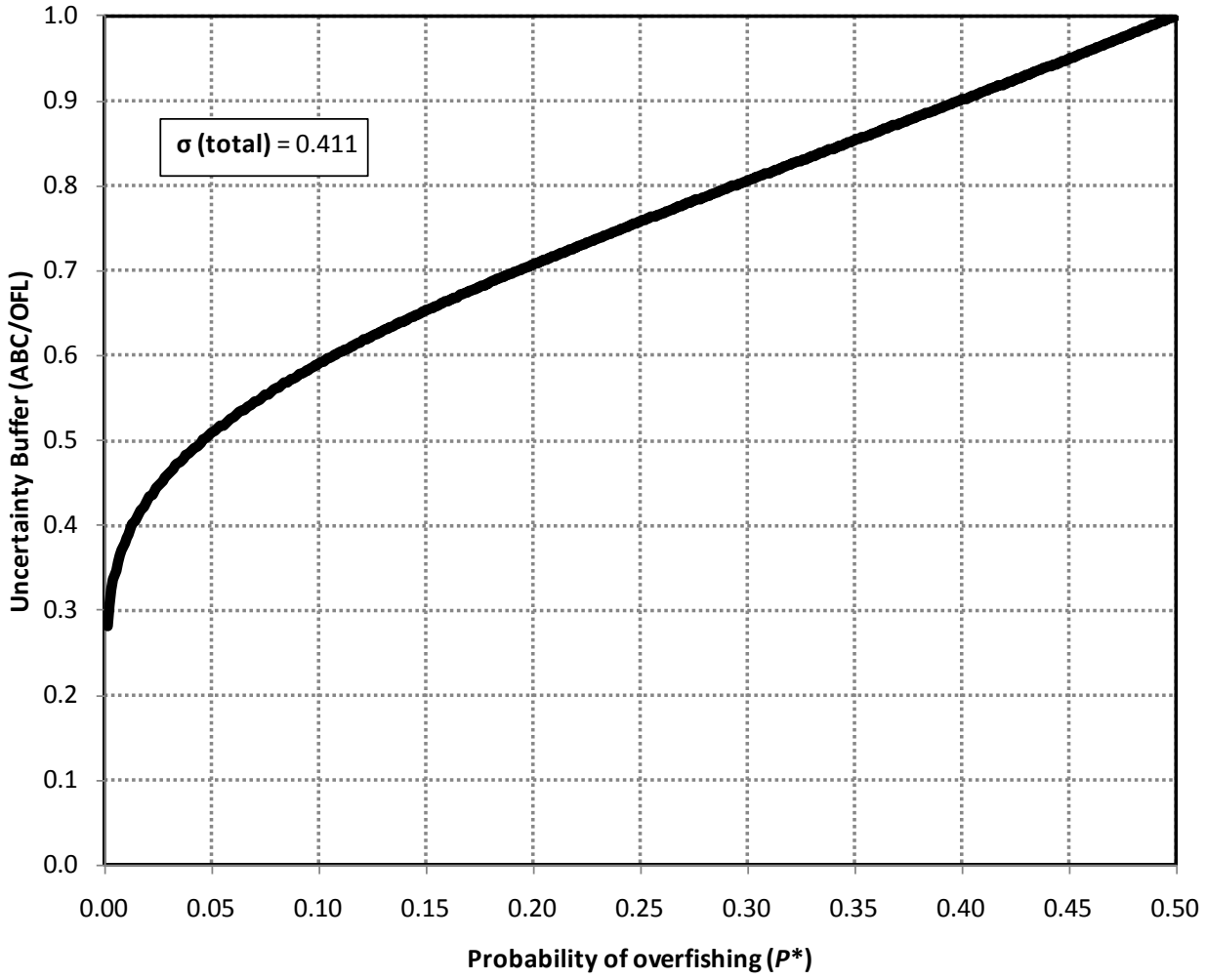

Figure 4.3.1-6. Relationship between Probability of overfishing (*P**) and associated 'buffers' (ABC/OFL) for Pacific mackerel, based on σ-total = 0.411 (SSC 2010).

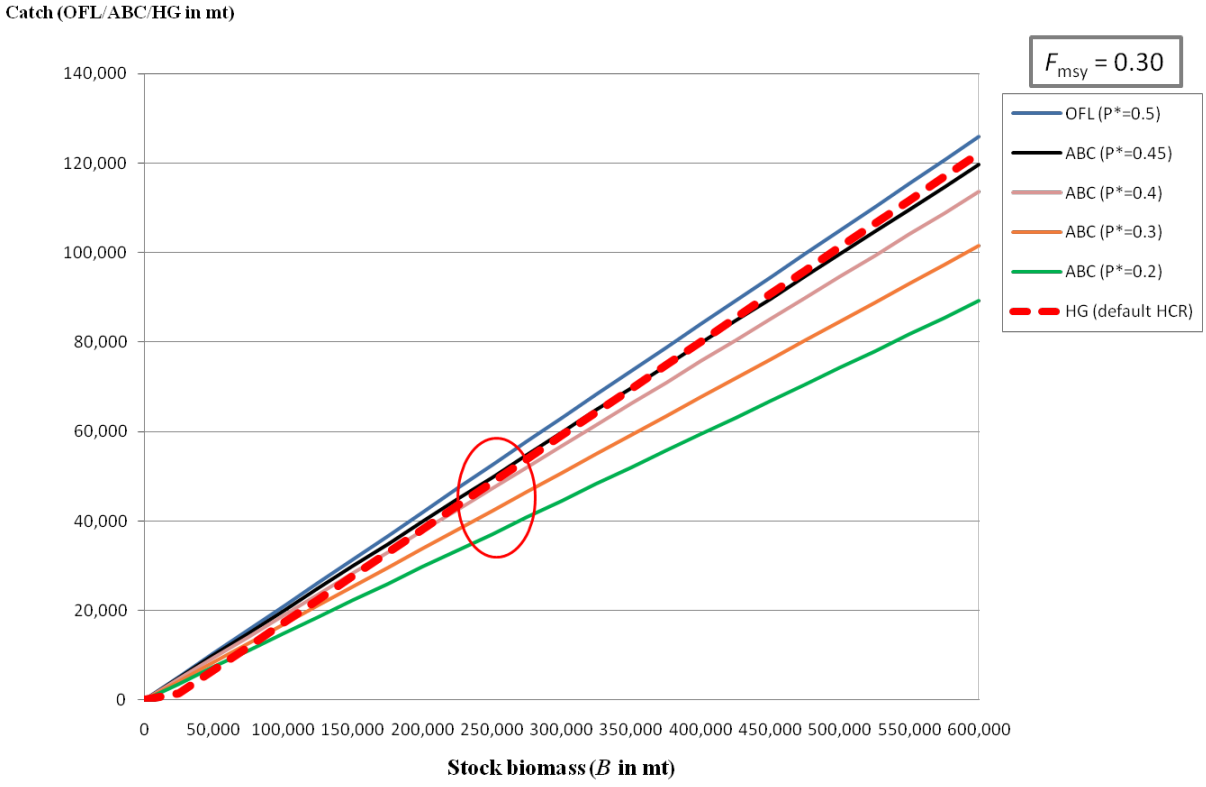

Figure 4.3.1-7. Relationship between stock biomass (*B* in mt) and catch (OFL, ABC, HG in mt) across a range of probability of overfishing (*P**) levels, based on a FRACTION (F_{MSY} proxy) equal to 0.3. The ACL would be equal to ABC or HG, whichever value is less. Recent estimated biomass (*B*) is denoted by red oval.

Table 4.3.1-6. Impact of probability of overfishing values (*P**) on Pacific mackerel catch (mt) for different biomass (*B*) values (also, see Figure 2 above), based on a FRACTION (F_{MSY} proxy) equal to 0.3. 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

Section References

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4.3.2 MONITORED SPECIES

Alternative 1 – 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	BIOMASS*F_{MSY} * DISTRIBUTION
ABC	OFL * 0.25
ACL	Equal to ABC or reduced by OY considerations.

The default control rule specified for monitored species reduces the MSY harvest level by 75 percent, in part, to account for the relatively data-poor status of these species. Under this system ACLs are intended more as a decision point for moving the species into an actively managed category than to signal a conservation concern or potential overfishing. Under both of these alternatives, it is presumed that as landings approach the ACL, the CPSMT and the SSC may recommend an elevation of a species to the higher actively managed tier

Alternative 2 – Scientific Uncertainty Buffer – 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 built into the default control rule. In practice either a BUFFER recommended by the 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	BIOMASS*F_{MSY} * DISTRIBUTION
ABC	OFL * 0.25 * BUFFER
ACL	Equal to ABC or reduced by OY considerations.

The SSC's CPS Subcommittee has preliminarily reviewed the management approach listed under Alternative 1 above. There are concerns regarding the dated nature of the assessment used to estimate both biomass and F_{MSY}. The full SSC will review theses two alternative approaches and may recommend additional analyses to further inform a decision on management reference points for monitored stocks to prevent overfishing. The degree to which these species are targeted and the magnitude of recent landings should be considered when investing limited financial and human resources to developing and analyzing alternate control rules for monitored stocks.

4.3.2.1 Additional Considerations for Market Squid

Market squid is a short-lived species, and the relationship between F_{MSY} and stock abundance is poorly understood. Current management establishes a threshold egg escapement of at least 30 percent as a proxy for MSY.

OFL = F_{MSY} * Biomass (egg esc. Proxy)	(PFMC 2002)
ABC = 245,348 mt	(PFMC 2002)
ACL/ACT= 107,049 mt	(CDFG 2005)

Although an ACL is not required for market squid, the California Department of Fish and Game implements an annual landings cap 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.

Section References

CDFG. 2005. Market Squid Fishery Management Plan. March 25, 2005.

PFMC 2002. Coastal Pelagic Species Fishery Management Plan. Limited Entry

4.3.3 SECTOR-SPECIFIC ANNUAL CATCH LIMITS

Alternative 1, No Action Alternative – No sector-specific ACLs.

The Council has practiced the setting aside a portion of the overall Pacific sardine HG ? for "sector-like" segments of the directed fisheries (i.e. incidental fisheries and EFP research). EFP set-asides have traditionally been "taken off the top" or deducted from the overall harvest guideline before distributing harvest across the seasonal allocation schedule of Amendment 11. Incidental fishery set-asides are often established for each allocation period under Amendment 11 in response to the seasonal availability of other CPS. These set-asides are deducted from harvest otherwise allocated to the directed fishery. The Council often adopts preseason accountability measures that rollover set-aside overages and deficits where appropriate to maximize the utilization of harvestable surplus while preventing overfishing. Because of the interrelation of these set-asides to the directed fishery in some years and because these portions of the fisheries do not operate as distinct sectors, the Council may choose to forego sector-specific ACLs.

Alternative 2 - Assign a sector-specific ACL to EFP research activities.

The use of EFPs in Council managed CPS fisheries has increased in recent years and the CPS industry in increasingly involved in CPS research and is seeking further cooperative research activities in the future. Although existing EFPs have been accounted for through the setting aide of a portion of the directed fishery HG, future EFP proposals may not fit this model well and the Council may choose to consider a sector-specific ACL for EFP activity.

Alternative 3 – Assign a sector-specific ACL for the live bait fishery.

The overall take from this fishery is a small proportion of the total commercial landings of Pacific sardine. Therefore, the use of AMs as a means of including this fishery in the total catch is reasonable and is explored in the next section. However, this low volume high value fishery is important to the California commercial passenger fishing vessel and recreational fishery sectors and under the current FMP this fishery remains open after the directed commercial fishery is closed. The Council may consider further analysis of using sector-specific ACLs for this fishery as a means of preserving the regulatory framework that allows this fishery to operate outside the directed fishery. Additionally, this fishery is not monitored inseason to the degree that the directed fishery is managed and impacts are estimated postseason via logbook data. This alternative would allow the Council to further prevent overfishing or a fishery closure by considering an ACT for this sector that is commensurate with its lower tier of monitoring.

Alternative 4 – Add sector-specific ACLs to the FMP framework as a management tool and assess their applicability on an annual basis.

This alternative would provide the Council with maximum flexibility to respond to the varying annual needs of CPS fisheries and the cyclic nature of CPS population levels. CPS fisheries experience changes in target species, incidental species, and live bait species between seasons and years in response to population fluctuations, markets, oceanographic conditions, etc. This alternative would allow the Council to consider sector-specific ACLs on an annual basis which is in keeping with current management practices and the NS1 guidelines. The intent of this alternative would be to prevent overfishing regardless of the mechanism chosen (sector-specific ACL, AMs, or ACTs, or a combination thereof).

4.4 Annual Catch Target and Accountability Measure Considerations

Alternative 1, No Action Alternative – No ACTs.

Recent CPS management strategies have proactively attempted to prevent overfishing while preserving harvest opportunities for exploitable stocks. The Council has a history of accounting for management uncertainty and has set aside a portion of the directed harvest to cover incidental landings of a limiting CPS stock in pursuit of a harvestable CPS stock and to forego lost opportunity associated with the closing of all fisheries to the retention of a particular species.

Alternative 2 – Develop ACTs only for actively managed stocks.

Alternative 2 best matches the current management regime and is more likely to minimize the chance of exceeding the ACL than Alternative 1. Framework language in the FMP would generally describe methods for assessing management uncertainty and total catch accounting and specific amounts for these AMs could be developed, reviewed, and approved on an annual basis when the Council adopts annual fishery specifications for actively managed stocks.

Alternative 3 – Develop ACTs for actively managed and monitored stocks.

Developing ACTs is optional for all stocks and, unlike the actively managed species, this approach has not been applied to monitored species. The CPSMT discussed the potential benefits to establishing early trigger points or ACTs for monitored species that could act as an early indicator of increasing harvest. There is no requirement to take management actions if an ACT is exceeded, this approach would simply provide an opportunity for advanced planning if a monitored stock is a candidate for active management. However, the Council and the CPSMT monitor CPS fisheries closely and can elevate a species to active management in response under the current FMP. Should harvest of a monitored stock exceed its ACL in more that one of four years, the Council would be required to address the situation with additional AMs and may consider moving the stock to the actively managed category.

5.0 AMENDMENT SCHEDULE

The implementation of Amendment 13 and the promulgation of associated fishery regulations are targeted for the 2011 fishing year. The Council is scheduled to review a range of amendment alternatives and adopt a preliminary preferred alternative at its March 2010 meeting. Final Council action is scheduled for the June 2010 Council meeting to allow for full implementation by 2011.

Table 5.0-1Proposed Timeline for CPS FMP Amendment 13

Stage	Date
Council Announces Scoping –Initiates FMP Amendments	March 2009
Potential alternatives for draft FMP Amendment	November 2009
Adopt Preliminary Preferred Alternative for Public Review	March 2010
Final Council Action	June 2010
Proposed and Final Rulemaking	Late 2010
Secretarial Approval	Late 2010
Council adoption of harvest specifications and management measures under Amendment 13 for Pacific sardine and monitored species. Pacific mackerel management is offset six months and would be adopted by the Council in June 2011.	November 2010 Council meeting
Changes in Existing Fishing Regulations	2011

Agenda Item F.2.a
Attachment 2
June 2010

COASTAL PELAGIC SPECIES FISHERY MANAGEMENT PLAN

AS AMENDED THROUGH AMENDMENT ~~12~~13

REVIEW DRAFT

This draft is intended to assist reviewers understand potential revisions to the CPS FMP under Amendment 13 with a focus on preliminary preferred and action alternatives. Final amendatory language will be developed after Council final action. The listed potential changes are also not intended to be comprehensive or prescriptive.

Proposed new text is in bold and underlined font. Text proposed for deletion is in ~~strikeout~~ font.
Shaded texts represents notes to aid the reviewer and are not intended for the FMP.

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1.0 INTRODUCTION

1.1 History of the Fishery Management Plan

The Council initiated the development of the FMP for northern anchovy in January of 1977. A final draft of the plan was approved and submitted to the U.S. Secretary of Commerce (Secretary) in June of 1978. Regulations implementing the FMP for northern anchovy were published in the *Federal Register* on September 13, 1978.

The first amendment changed the method of specifying the domestic annual harvest for northern anchovy and added a requirement for an estimate of domestic processing capacity and expected annual level of domestic processing. Approval for this amendment was published in the *Federal Register* on July 18, 1979.

The second amendment, which became effective on February 5, 1982, was published in the *Federal Register* on January 6, 1982. The purpose of this amendment was to increase the domestic fishing fleet's opportunity to harvest the entire optimum yield (OY) of northern anchovy from the U.S. exclusive economic zone (EEZ).

During the spring of 1982, the Council considered a third amendment that divided the quota for northern anchovy into two halves and made release of the second half conditional on the results of a mid-season review of the status of the stock. The methods proposed for the mid-season assessment were considered too complex to implement, and the amendment was not approved.

The fourth amendment, which had two parts, was published in the *Federal Register* on August 2, 1983 and became effective on August 13, 1983. The first part abolished the five-inch size limit in the commercial fishery and established a minimum mesh size of 5/8 inch for northern anchovy. The mesh size requirement did not become effective until April 1986 in order to give the fleet additional time to comply without undue economic hardship. The second part established a mid-season quota evaluation that was simpler in design than the method proposed in Amendment 3.

The fifth amendment, in 1983, incorporated advances in scientific information concerning the size and potential yield of the central subpopulation of northern anchovy. In addition, the fifth amendment included changes to a variety of other management measures. Two or more alternative actions were considered in each of seven general categories (1) OY and harvest quotas; (2) season closures; (3) area closures; (4) quota allocation between areas; (5) the reduction quota reserve; (6) minimum fish size or mesh size; and (7) foreign fishing and joint venture regulations. The alternatives for the fifth amendment were reviewed by the Council during 1983. The final rule on the fifth amendment measures was published in the *Federal Register* on March 14, 1984.

The sixth amendment in 1990 implemented a definition of overfishing for northern anchovy consistent with National Standard 7 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The Council began developing the seventh amendment as a new FMP for CPS in 1990. A complete draft was available in November of 1993, but the Council suspended further work, because NMFS withdrew support due to budget constraints. In July of 1994, the Council decided to proceed with the plan through the public comment period. NMFS agreed with the decision on the condition that the Council also consider the options of dropping or amending the anchovy FMP. Thus, four principal options were considered for managing CPS (1) drop the anchovy FMP (no federal or Council involvement in CPS); (2) continue with the existing FMP for anchovy (status quo); (3) amend the FMP for northern anchovy; and (4) implement an FMP for the entire CPS fishery. In March of 1995, after considering all four principal options, the Council decided to proceed with the FMP for CPS. Final action was postponed until June 1995 when the Council adopted a draft plan that had been revised to

address comments provided by NMFS and the Scientific and Statistical Committee (SSC). Amendment 7 was submitted to the Secretary, but rejected by NMFS Southwest Region as being inconsistent with National Standard 7 of the Magnuson-Stevens Act. NMFS announced its intention to drop the FMP for northern anchovy (in addition to FMPs for other species) in the *Federal Register* on March 26, 1996, but the action was never completed.

Development of Amendment 8 began during a June 23-25, 1997 Council meeting where the Council directed the Coastal Pelagic Species Plan Development Team (CPSPDT) to amend the FMP for northern anchovy to conform to the recently revised Magnuson-Stevens Act and to expand the scope of the FMP to include the entire CPS fishery. Amendment 8 updates the fishery management plan (FMP) for northern anchovy to manage the entire coastal pelagic species (CPS) fishery along the West Coast of the United States, including Pacific sardine, northern anchovy, Pacific (chub) mackerel, jack mackerel, and market squid. The amendment also changes the name of the plan from the *Northern Anchovy Fishery Management Plan* to the *Coastal Pelagic Species Fishery Management Plan*. Stocks and fisheries are described in Appendix A. All options considered by the Council and analysis of those options is in Appendix B. Costs involved in this FMP are estimated in Appendix C. Essential fish habitat is described in Appendix D. References are included in Appendix E. Amendment 8 was partially approved by the Secretary on June 10, 1999, and final regulations were published on December 15, 1999 (64FR69888). The FMP was implemented on January 1, 2000.

Amendment 9 was originally intended to address the development of MSY for market squid as well as bycatch and treaty Indian fishing rights. The Council distributed Amendment 9 for public review on July 27, 2000. At its September 2000 meeting, the Council reviewed written comments, received comments from its advisory bodies, and heard public comments, and decided to submit only two provisions for Secretarial review. Based on testimony concerning MSY for squid, the Council decided to include in Amendment 9 only the bycatch provision and a provision providing a framework to ensure that Indian fishing rights are implemented according to treaties between the U.S. and the specific tribes. Since implementation of the FMP, the CPS fishery has expanded to Oregon and Washington. As a result, the FMP must discuss Indian fishing rights in these areas. These rights were not included in the FMP; and the Council decided to address this issue in Amendment 9. The Council decided to conduct further analysis of the squid resource under a separate amendment that addresses OY and MSY for squid. The U.S. Secretary of Commerce approved Amendment 9 on March 22, 2001.

In April 2001, the Council adopted the capacity goal and transferability provisions recommended by the CPSMT for inclusion in Amendment 10. The Council directed the CPSMT to develop an amendment to the CPS FMP that includes the capacity goal, provisions for permit transferability, a process for monitoring fleet capacity relative to the goal, and a framework for modifying transferability provisions as warranted by increases or decreases in fleet capacity. The amendment also addressed determination of OY and MSY for market squid. In November 2001, the Council reviewed the findings of the market squid stock assessment review (STAR) workshop and endorsed the egg escapement approach as a proxy for squid MSY, as recommended by the market squid STAR Panel and CPSMT. In March 2002, the Council adopted draft Amendment 10 to the CPS FMP for public review. In June 2002, the Council adopted Amendment 10 to the CPS FMP. On December 30, 2002, the Secretary approved Amendment 10 and on January 27, 2003 NMFS issued the final rule and regulations for implementing Amendment 10.

Amendment 11 to the FMP addressed long-term allocation of Pacific sardine. While Amendment 11 was in development, the Council recommended a regulatory amendment that implemented an interim revision to the allocation framework for the 2003 and 2004 seasons. The interim allocation regime was extended to 2005. The interim regime (1) changed the definition of subarea A and subarea B by moving the geographic boundary between the two areas from 35° 40' N latitude to 39° N latitude, (2) moved the reallocation date for unharvested Pacific sardine to Subarea A and Subarea B from October 1 to September 1, (3) changed the percentage of the unharvested sardine reallocated to Subarea A and Subarea

B from 50 percent to both subareas to 20 percent to Subarea A and 80 percent to Subarea B, and (4) reallocated all unharvested sardine that remains on December 1 coastwide. At the June 2005 Council meeting the interim allocation framework was replaced by Council final action on Amendment 11 which provided the following allocation formula for the non-tribal share of the Pacific sardine HG:

1. A seasonal allocation structure with 35 percent of the HG to be allocated coastwide on January 1.
2. 40 percent of the HG, plus any portion not harvested from the initial allocation, to be reallocated coastwide on July 1.
3. On September 15 the remaining 25 percent of the HG, plus any portion not harvested from earlier allocations, to be reallocated coastwide.

On June 29, 2006, NMFS issued the final rule to implement Amendment 11 to the CPS FMP (71 *FR* 36999).

In March 2005, the Council took final action on Amendment 12 to the FMP. Amendment 12 added all species of krill (euphausiids) that occur within the West Coast EEZ and placed them in a new management category, "Prohibited Harvest". Amendment 12 is intended to ensure that, to the extent practicable, fisheries will not develop that could put at risk krill stocks and the other living marine resources that depend on krill. This means that optimum yield (OY) for krill is zero, and the target, harvest and transhipment of krill is prohibited. Also, exempted fishing permits (EFPs) will not be issued under the EFP procedures of this FMP to allow individuals to harvest krill as an exception to the prohibition of harvest. These actions are not intended to account for the responses of krill and other resources to changes in environmental conditions. The final rule adopting Amendment 12 was published by NMFS in the Federal Register on July 9, 2009.

Amendment 13 was initiated in 2009 to incorporate new National Standard 1 guidelines to prevent overfishing. These new National Standard 1 guidelines were developed in response to the Magnuson-Stevens Reauthorization Act of 2006 to end and prevent overfishing.

1.2 Fishery Management Unit

Sections 1.2 and 1.3 will be amended after Council final action should the Council choose to include Ecosystem Component species in the FMP.

Stocks managed under this FMP include:

Common Name	Scientific Name
Pacific sardine	*Sardinops sagax*
Pacific (chub) mackerel	*Scomber japonicus*
Northern anchovy	*Engraulis mordax*
Central and northern subpopulations	
Market squid	*Loligo opalescens*
Jack mackerel	*Trachurus symmetricus*
Krill or Euphausiids	*All Species in West Coast EEZ*
Included these eight dominant species.	*Euphausia pacifica*
First two species are common and are	*Thysanoessa spinifera*
most likely to be targeted by fishing	*Nyctiphanes simplex*
	Nematocelis difficilis
	T. gregaria
	E. recurva
	E. gibboides

E. eximia

Stocks may be added or removed from the management unit through the framework process described in Section 2.0.

1.3 Categories of Management

The CPS FMP includes three management categories or tiers for CPS fish stocks: AActive@ management, "Monitored" management, and "Prohibited Harvest" management. "Active" is for stocks and fisheries with biologically significant levels of catch, or biological or socioeconomic considerations requiring relatively intense harvest management procedures. The second category, AMonitored@, is for stocks and fisheries not requiring intensive harvest management and where monitoring of landings and available abundance indices are considered sufficient to manage the stock. The third category "Prohibited Harvest" is for stocks that are prohibited to fish for, harvest or land in any fishery within the West Coast EEZ. Currently this management category consists of all species of euphausiids (krill) that occur in the West Coast EEZ.

The purpose of Active and Monitored management is to use available agency resources in the most efficient and effective manner while satisfying goals and objectives of the FMP. The distinction enables managers and scientists to concentrate efforts on stocks and segments of the CPS fishery that need the greatest attention or where the most significant benefits might be expected.

Active management may be characterized by periodic stock assessments, and/or periodic adjustments of target harvest levels based on maximum sustainable yield (MSY) control rules. Monitored management, in contrast, involves tracking trends in landings and qualitative comparison to available abundance data, but without periodic stock assessments, or periodic adjustments to target harvest levels. Species in both categories may be subject to management measures such as catch allocation, gear regulations, closed areas, closed seasons, or other forms of Active management.

Prohibited Harvest management includes all species of krill occurring in the West Coast EEZ and is intended to ensure that, to the extent practicable, fisheries will not develop that could put at risk krill stocks and the other living marine resources that depend on krill. This means that optimum yield (OY) for krill is zero, and the targeting, harvesting and transhipping of krill is prohibited. Also, exempted fishing permits (EFPs) will not be issued under the EFP procedures of this FMP to allow individuals to harvest krill as an exception to the prohibition of harvest. These actions would fully achieve the objectives of the amendment to the extent practicable, but would not account for environmental conditions and the responses of krill and other resources to changes in environmental conditions. This management category recognizes that *de minimis* or trace amounts of krill may be retained by fishermen while targeting other species; such inadvertent action is not intended to be the subject of this prohibition.

Explicit MSY control rules, definitions of overfishing and overfished stocks must be developed for all Actively managed species. Monitored management, in contrast, may use generic or general definitions of overfishing and overfished stocks that do not have specific fishing mortality or biomass cutoffs. Essential fish habitat (EFH) must be described for all stocks in the management unit, including Actively managed and Monitored species.

The CPSMT will review all CPS stocks annually and make recommendations to the Council and agencies regarding appropriate management categories for each stock ("Active" or "Monitored"). Changes to the appropriate management category for each species can be made annually by the Council based on all available data, including acceptable biological catch (ABC) levels and MSY control rules, and the goals and objectives of this FMP. Changes in a management category may be accomplished according to any of the four procedures for establishing and adjusting management measures described below in Section 2.0. In addition, CPS in the Monitored management category can be reassigned to Active management on short notice under the point-of-concern framework.

1.4 Operational Definitions of Terms

Acceptable Biological Catch (ABC) is a harvest specification of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL and any other scientific uncertainty and should be based on the ABC control rule. ABC control rule means a specified approach to setting ABC for a stock or stock complex as a function of the scientific uncertainty in the estimate of OFL and any other scientific uncertainty.

Accountability Measures (AMs) Management controls to prevent ACLs from being exceeded and to correct or mitigate overages of the ACL if they occur. There are two categories: inseason AMs and AMs for when the ACL is exceeded.

Annual Catch Limit (ACL) The level of annual catch of a stock or stock complex that serves as the basis for invoking AMs. ACL cannot exceed ABC but may be divided into sector-specific ACLs.

Annual Catch Target (ACT) An optional AM. An amount of annual catch that is the management target of the fishery, and accounts for management uncertainty in controlling catch at or below the ACL.

Actively managed species (AMS) means CPS the Secretary has determined to require federal management by harvest guideline or quota according to the provisions of the FMP.

Biomass means the estimated amount, by weight, of a CPS population. The term biomass means total biomass (age one and above) unless stated otherwise.

Capacity goal means 5,650.9 metric tons (mt), which is the goal for the total gross tonnage of all vessels participating in the limited entry fishery established by Amendment 10 to the FMP.

Coastal pelagic species (CPS) means northern anchovy (*Engraulis mordax*), Pacific mackerel (*Scomber japonicus*), Pacific sardine (*Sardinops sagax*), jack mackerel (*Trachurus symmetricus*), market squid (*Loligo opalescens*), and all species of the family *Euphausiidae* found in the water of the EEZ off the west coast.

Coastal Pelagic Species Advisory Subpanel (CPSAS) the CPSAS is comprised of members of the fishing industry and public appointed by the Council to review proposed actions for managing the coastal pelagic species fisheries.

Coastal Pelagic Species Management Team (CPSMT) means the individuals appointed by the Council to review, analyze, and develop management measures for the CPS fishery.

Comparable capacity means gross tonnage as determined by the formula in 46 CFR 69.209(a) for a vessel not designed for sailing plus 10 percent of the vessel=s calculated gross tonnage.

Council means the Pacific Fishery Management Council, including its CPSMT, CPSAS, SSC, and any other committee established by the Council.

Egg Escapement Approach means a market squid fishery management approach used to evaluate the effects of fishing mortality (F) on the spawning potential of the stock and in particular, to examine the relationship between the population=s reproductive output and candidate proxies for the fishing mortality that results in MSY (F_{MSY}).

Finfish means northern anchovy, Pacific (chub) mackerel, Pacific sardine, and jack mackerel.

Fishery Management Area means the EEZ off the coasts of Washington, Oregon, and California between three and 200 nautical miles offshore, bounded in the north by the Provisional International Boundary between the United States and Canada, and bounded in the south by the International Boundary between the United States and Mexico.

Gross tonnage means gross tonnage as determined by the formula in 46 CFR 69.209(a) for a vessel not designed for sailing (.67 x length x breadth x depth/100). A vessel's length, breadth, and depth are those specified on the vessel=s certificate of documentation issued by the U.S. Coast Guard or state.

Harvest guideline (HG) means a specified numerical harvest objective that is not a quota. Attainment of a harvest guideline does not require complete closure of a fishery.

Harvesting vessel means a vessel involved in the attempt or actual catching, taking or harvesting of fish, or any activity that can reasonably be expected to result in the catching, taking or harvesting of fish.

Krill means all species of euphausiids that occur in the EEZ off the West Coast.

Limited entry fishery means the fishery comprised of vessels fishing for CPS in the CPS management zone under limited entry permits issued under this FMP.

Live bait fishery means fishing for CPS for use as live bait in other fisheries.

Monitored species (MS) means those CPS the Secretary has determined not to need management by harvest guidelines or quotas according to the provisions of the FMP.

Nonreduction fishery means fishing for CPS for use as dead bait or for processing for direct human consumption.

Overfishing Level (OFL) Annual amount of catch that corresponds to the estimate of fishing mortality on an annual basis, above which overfishing is occurring applied to a stock or stock complex's abundance expressed in terms of numbers or weight of fish.

Owner, as used in this subpart, means a person who is identified as the current owner in the Certificate of Documentation (CG-1270) issued by the U.S. Coast Guard for a documented vessel, or in a registration certificate issued by a state or the U.S. Coast Guard for an undocumented vessel.

Person, as used in this subpart, means any individual, corporation, partnership, association or other entity (whether or not organized or existing under the laws of any state), and any federal, state, or local government, or any entity of any such government that is eligible to own a documented vessel under the terms of 46 U.S.C. 12102(a).

Processing or to process means the preparation or packaging of CPS to render the fish suitable for human consumption, pet food, industrial uses or long-term storage, including; but not limited to, cooking, canning, smoking, salting, drying, filleting, freezing, or rendering into meal or oil, but does not mean heading and gutting unless there is additional preparation.

Prohibited Species means species that are subject to fishery controls under state or other federal regulations and may not be taken, retained, or possessed incidentally by CPS fishery participants.

Prohibited Harvest Species is a management category for species for which it is prohibited to fish for, harvest or land in any fishery within the West Coast EEZ. Currently this management category consists of all species of euphausiids (krill) that occur in the West Coast EEZ. This management category recognizes that *de minimis* or trace amounts of krill may be retained by fishermen while targeting other species; such inadvertent action is not intended to be the subject of this prohibition.

Quota means a specified numerical harvest objective for a single species of CPS, the attainment (or expected attainment) of which causes the complete closure of the fishery for that species.

Reduction fishery means fishing for CPS for the purposes of conversion into: fish flour; fish meal; fish scrap; fertilizer; fish oil; other fishery products; or byproducts for purposes other than direct human consumption.

Regional Administrator means the Administrator, Southwest Region, NMFS, or a designee.

Reserve means a portion of the harvest guideline or quota set aside at the beginning of the year for

specific purposes, such as for individual harvesting groups to ensure equitable distribution of the resource.

Sustainable Fisheries Division (SFD) means the Assistant Regional Administrator for Sustainable Fisheries, Southwest Region, NMFS, or a designee.

Threshold level of egg escapement means a level of reproductive (egg) escapement that is believed to be at or near a minimum level necessary to allow the population to maintain its level of abundance into the future (i.e., allow for Asustainable@ reproduction year after year).

Totally lost means that the vessel being replaced no longer exists in specie, or is absolutely and irretrievably sunk or otherwise beyond the possible control of the owner, or the costs of repair (including recovery) would exceed the repaired value of the vessel.

1.5 Goals and Objectives

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

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

2.0 FRAMEWORK MANAGEMENT

The framework approach to management of coastal pelagic species (CPS) allows changes and modifications to management procedures to be made in a timely and efficient manner without need to amend the fishery management plan (FMP). The FMP establishes two framework procedures through which the Council is able to recommend establishment and adjustment of management measures. The "point-of-concern" framework allows the Council to develop management measures in response to resource conservation and ecological issues. The Asocioeconomic@ framework allows the Council to develop management measures in response to social and economic issues.

Management measures may be imposed, adjusted, or removed at any time during the year. Management measures may be imposed for resource conservation, social, or economic reasons consistent with FMP procedures, goals, and objectives.

Analyses of biological, ecological, social, and economic impacts will be considered when a particular change is proposed. As a result, time required to take action will vary depending on the type of action (see below), its impacts on the fishing industry, resource, and environment, as well as review of these impacts by interested parties. Satisfaction of legal requirements for other applicable laws (e.g., the Administrative Procedure Act, Regulatory Flexibility Act, Executive Order 12866, etc.) for actions taken under this framework requires analysis and public comment before measures may be implemented by the U.S. Secretary of Commerce (Secretary).

Management measures addressing resource conservation or ecological issues must be based on the point-of-concern framework consistent with procedures and criteria listed in Section 2.1.2.

Management measures addressing social or economic issues must be based on the socioeconomic framework consistent with procedures and criteria described in Section 2.1.3.

2.1 Types of Actions and Procedures

Under the point-of-concern or the socioeconomic frameworks, there are four different types of management actions, requiring slightly different processes. Management measures may be established, adjusted, or removed using any of these four actions:

1. **Automatic Actions** may be initiated by the National Marine Fisheries Service (NMFS) Regional Administrator without prior public notice, opportunity to comment, or a Council meeting. These actions are non-discretionary and the impacts must previously have been taken into account. Examples include closure of the directed fishery when the directed portion of the ~~harvest guideline~~ fishery is attained, an inseason release of allocations (all species and fishery segments), release of surplus incidental catch ~~harvest guideline~~ allowance to the directed fishery (if necessary), or closure of the fishery when the total harvest guideline, ACT, or ACL is attained. The Secretary will publish a single notice in the *Federal Register* making the action effective.

2. **"Notice" Actions** require at least one Council meeting and one *Federal Register* notice. These include all management actions other than automatic actions that are either non-discretionary or have probable impacts that have been previously analyzed.

   Notice actions are intended to have temporary effect and the expectation is that they may need frequent adjustment. They may be recommended at a single Council meeting, although the Council will provide as much advance information to the public as possible concerning the issues it will be considering. The primary examples are management actions defined as routine in Section 2.1.1. Previous analysis must have been specific as to species and gear type before a management measure

can be defined as routine and acted upon at a single Council meeting. If recommendations are approved, the Secretary may waive, for good cause, the requirement for prior notice and comment in the *Federal Register* and will publish a single notice in the *Federal Register* making the action effective. This category of actions presumes the Secretary will find that the extensive notice and opportunity for comment along with other information provided by the Council will serve as good cause to waive the need for additional prior notice and comment in the *Federal Register*.

3. **Abbreviated Rulemaking Actions** normally require at least two Council meetings and one *Federal Register* rule. These include all management actions intended to have permanent effect and be discretionary in nature with impacts that have not been previously analyzed. The Council will develop and analyze the proposed management actions over the span of at least two Council meetings and provide public advance notice and opportunity to comment on proposals and analysis prior to and at the second Council meeting. If the NMFS Regional Administrator approves the Council's recommendation, the Secretary may waive, for good cause, the requirement for prior notice and comment in the *Federal Register* and publish a final rule in the *Federal Register* which will remain in effect until amended. If a management measure is designated as routine by final rule under this procedure, specific adjustments of that measure can subsequently be announced in the *Federal Register* by notice as described in this FMP. The Secretary may waive the opportunity for prior notice and comment in the *Federal Register*.

   The primary purposes of the previous two categories of notice and abbreviated rulemaking procedures are (1) to accommodate the Council's meeting schedule for developing annual management recommendations; (2) to satisfy the Secretary's responsibilities under the Administrative Procedures Act; and (3) to address the need to implement management measures by a specified date each fishing year.

   The two-Council meeting process refers to two decision meetings. The first meeting to develop proposed management measures and their alternatives, and the second meeting to make a final recommendation to the Secretary. Identification of issues and the development of proposals normally will begin at a Council meeting prior to the first decision meeting.

4. **Full Rulemaking Actions** normally require at least two Council meetings and two *Federal Register* rules (Regulatory Amendment). These include any highly controversial management measure. The Council will follow the two meeting procedures described for the abbreviated rulemaking category. The Secretary will publish a proposed rule in the *Federal Register* with an appropriate period for public comment followed by publication of a final rule in the *Federal Register*.

2.1.1 Routine Management Measures

Routine management measures are those the Council determines likely to be adjusted annually or more frequently. Measures are classified as routine by the Council through either full or abbreviated rulemaking process. In order for a measure to be classified as routine, the Council will determine that the measure addresses an issue at hand and may, in the near future, require further adjustment to achieve its purpose.

Once a management measure has been classified as routine through the abbreviated or full rulemaking procedures, it may be modified thereafter through the single meeting notice procedure if (1) modification is proposed for the same purpose as the original measure; and (2) impacts of the modification are within the scope of the impacts analyzed when the measure was originally classified as routine. Analysis need not be repeated when the measure is subsequently modified if the Council determines impacts do not differ substantially from original analysis. The Council may change a routine classification for an action without following any prespecified procedure.

Any measure designated as routine for one specific species, species group, or gear type may not be treated as routine for a different species, species group, or gear type without first having been classified as routine through the rulemaking process.

To facilitate this process, the Coastal Pelagic Species Management Team (CPSMT) will make recommendations to the Council and agencies regarding assessment or management needs.

The following measures are classified as routine measures at the outset of this FMP:

1. Reallocation of surplus incidental harvest guideline to the directed fishery (all species and fishery segments).
2. Inseason changes in the incidental catch allowance.
3. Specification of annual harvest guidelines, annual catch limits, annual catch targets, or quotas.

2.1.2 Point-of-Concern Framework

The point-of-concern process is the Council's primary tool (along with setting harvest guidelines annual catch limits, annual catch targets, or harvest quotas) for exercising resource stewardship responsibilities. The process is intended to foster continuous and vigilant review of Pacific Coast CPS stocks and fisheries. The process is also to prevent overfishing or any other resource damages. The CPSMT will monitor the fishery throughout the year, and account for any new information on status of each species or species group to determine if a resource conservation or ecological issue exists. Point-of-concern criteria are intended to assist the Council in determining when a focused review on a particular species is warranted and may require implementation of specific management measures. This framework provides the Council authority to act based solely on a point-of-concern. Thus, the Council may act quickly and directly to address resource conservation or ecological issues. In conducting this review, the CPSMT will utilize the most current catch, effort, abundance and other relevant data from the fishery.

In the course of the continuing review, a "point-of-concern" occurs when one or more of the following is found or expected:

1. Catch is projected to exceed the current harvest guidelines annual catch limits, annual catch targets, or the harvest quota.
2. Any adverse or significant change in the biological characteristics of a species (age composition, size composition, age at maturity, or recruitment) is discovered.
3. An overfishing condition appears to be imminent or likely within two years.
4. Any adverse or significant change in the availability of CPS forage for dependent species or in the status of a dependent species is discovered.
5. Developments in a foreign fishery occur that affect the likelihood of overfishing of CPS.
6. An error in data or a stock assessment is detected that significantly changes estimates of impacts due to current management.
7. Maximum sustainable yield (MSY) control rule (harvest policy) parameters or approach require modification.
8. Projected catches for a Monitored species are expected to exceed the acceptable biological catch (ABC) or the ACL using either a species-specific control rule or the default control rule. This could require moving a Monitored species to the Actively managed classification.

Once a point-of-concern is identified, the CPSMT will evaluate current data to determine if a resource conservation or ecological issue exists and will provide its findings in writing at the next scheduled Council meeting. If the CPSMT determines a resource conservation or ecological issue exists, it will provide its recommendation, rationale, and analysis for appropriate management measures that will address the issue.

Direct allocation of a resource between different segments of a fishery is, in most cases, not the appropriate response to a resource conservation or ecological issue. Council recommendations to directly allocate the resource will be developed according to criteria and processes in the socioeconomic framework described in Section 2.1.3 and Section 2.1.4.

After receiving the CPSMT report, the Council will take public testimony and, if appropriate, recommend management measures to the NMFS Regional Administrator accompanied by supporting rationale and analysis of impacts. The Council analysis will include a description of (1) resource conservation or ecological issues consistent with FMP objectives; (2) likely impacts on other management measures and other fisheries; (3) socioeconomic impacts; and (4) costs and benefits to commercial and recreational segments of the CPS fishery. The recommendation will explain the urgency in implementation of the measure(s), if any.

The NMFS Regional Administrator will review the Council's recommendation and supporting information and will follow appropriate implementation processes described in this FMP, following public notice and comment. If the Council contemplates frequent adjustments to the recommended measures, it may classify them as "routine" through the appropriate process described in Section 2.1.1.

If the NMFS Regional Administrator does not concur with the Council's recommendation, he/she will notify the Council in writing of the reasons for rejection. Nothing prevents the Secretary from exercising authority to take emergency action under Section 305 (c) and (d) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Nothing precludes or limits Council access to the point-of-concern framework.

2.1.3 The Socioeconomic Framework

Nonbiological issues may arise which require the Council to recommend management actions to address certain social or economic conditions in the fishery or to achieve FMP objectives. Resource allocation, fishing seasons, or landing limits based on market quality and timing, safety measures, and prevention of gear conflicts are examples of possible management issues with a social or economic basis. Actions that are permitted under this framework include all categories of actions authorized under the point-of-concern framework with the addition of direct resource allocation and access-limitation measures.

If the Council concludes that management action is necessary to address a social or economic issue, it will prepare a report containing the rationale supporting its conclusion. The report will include proposed management measures, a description of viable alternatives, and analyses addressing (1) achievement of FMP goals and objectives, (2) likely impacts on other fisheries and other management measures, (3)sociobiological impacts, (4) socioeconomic impacts, and (5) costs and benefits to the CPS fishery.

The Council, following review of the report, supporting data, public comment and other relevant information, may recommend management measures to the NMFS Regional Administrator accompanied by relevant background data, information, and public comment. The recommendation will explain the urgency in implementation of the measure(s), if any.

The NMFS Regional Administrator will review the Council's recommendation, supporting rationale, public comments and other relevant information and, if it is approved, will undertake the appropriate method of implementation. Rejection of the recommendation will be explained in writing.

Procedures specified in this FMP do not affect authority of the Secretary to take emergency regulatory action under Section 305(c) or (d) of the Magnuson-Stevens Act.

If conditions warrant, the Council may designate a management measure developed and recommended to

address social and economic issues as a routine management measure provided that the criteria and procedures in Section 2.1.1 are followed.

2.1.4 Allocation

In addition to other requirements in this FMP, the Council will consider the following factors when considering direct allocation of the resource:

1. Present participation in and dependence on the fishery, including alternative fisheries.
2. Historical fishing practices in, and historical dependence on, the fishery.
3. Economics of the fishery.
4. Agreements or negotiated settlements between the affected participants in the fishery.
5. Potential biological impacts on any species affected by the allocation.
6. Consistency with the Magnuson-Stevens Act national standards.
7. Consistency with the goals and objectives of this FMP.

Modification of a direct allocation cannot be designated as "routine" unless the specific criteria for the modification have been established in the regulations.

2.1.5 Procedures for Specifying Maximum Sustainable Yield and Optimum Yield

As data become available, improve, or are updated, OFL or MSY, ABC control rules, and OY specifications or procedures for setting OFL or MSY, ABC control rules or OY specifications may need to be modified. Changes and additions to these formulas are authorized by the FMP and may be accomplished through the point-of-concern mechanism or the socioeconomic mechanism.

2.1.6 Management Agreements with Other Nations

In the event that a management agreement between the U.S. and a foreign nation concerning CPS occurs, this FMP authorizes changes or modifications to any management measure through Council processes described herein.

2.1.7 Management Measures to Protect Noncoastal Pelagic Species

CPS fishing activities may directly impact certain non-CPS species including birds, marine mammals, and other fishes. This FMP authorizes implementation of measures to control CPS fishing to support conservation objectives identified under overfishing definitions adopted by the Council, the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), or other applicable law, while minimizing disruption of the CPS fishery. Any measures described in this FMP may be employed to control fishing impacts on non-CPS species. However, allocation may not be the primary intention of any such regulation.

The process for implementing and adjusting such measures may be initiated at any time under the point of concern or socioeconomic frameworks. In addition, measures to protect non-CPS may be designated as routine as described in Section 2.1.1, which will allow adjustment at a single meeting based on relevant information available at the time if (1) modification is proposed for the same purpose as the original measure, and (2) impacts of the modification are within the scope of the impacts analyzed when the measure was originally classified as routine.

Generally, the Council will initiate the process of establishing or adjusting management measures when a non-CPS resource problem is identified, and it has been determined that CPS fishing regulations will reduce the total impact on that species or stock. It is anticipated this will generally occur when a state or

federal resource management agency (such as the U.S. Department of the Interior, NMFS, or a state fishery agency) presents the Council with information substantiating its concern for a particular species. The Council will review the information and refer it to the Scientific and Statistical Committee, CPSMT or other appropriate technical advisory group for evaluation. If the Council determines that management measures may be necessary to address requirements of the ESA, MMPA, international agreements, or other relevant federal law or policy, it may implement appropriate management measures in accordance with the procedures identified in Section 2.1. The intention of the measures may be to share conservation burdens while minimizing disruption of the CPS fishery, but under no circumstances may the intention be simply to provide more fish to a different user group or to achieve other allocation objectives.

2.2 Other Management Measures

2.2.1 Generic

These management measures apply to all vessels participating in the CPS fishery.

2.2.1.1 Observers

All fishing vessels operating in this management unit, including catcher/processors, at-sea processors, and vessels that harvest in Washington, Oregon, or California and land catch in another area, may be required to accommodate NMFS certified observers on board to collect scientific data. An observer program will be considered only for circumstances where other data collection methods are deemed insufficient for management of the fishery. Implementation of any observer program will be in accordance with appropriate procedures outlined under this framework.

As determined by the NMFS Regional Administrator, there may be a need for observers on at-sea processing vessels to collect data normally collected at shore-based processing plants. Processing vessels must accommodate on board observers and may be required to provide the NMFS certified observers prior to issuance of any required federal permits. Observers are required on foreign vessels operating in U.S. waters.

2.2.1.2 Essential Fish Habitat

The Magnuson-Stevens Act requires Councils to include descriptions of essential fish habitat (EFH) in all federal FMPs. In addition, the Magnuson-Stevens Act requires federal agencies to consult with NMFS on activities that may adversely affect EFH. Appendix D of Amendment 8 to this FMP includes a description of EFH for the CPS included in the plan at that time, fishing effects on EFH, non-fishing effects on EFH, and options to avoid or minimize adverse effects on EFH or promote conservation and enhancement of EFH. This definition was reviewed and reaffirmed by the Council in 2005. Amendment 12 to the CPS FMP defined EFH for prohibited harvest species (Euphausiids).

Magnuson-Stevens Act Directives Relating to EFH

Magnuson-Stevens Act directives and NMFS guidance on implementation are addressed in greater detail in Appendix D. The Magnuson-Stevens Act defines EFH as Athose waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.@ To clarify this definition, the following interpretations are made: Awaters@ include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; Asubstrate@ includes sediment, hard bottom, structures underlying the waters, and associated biological communities; Anecessary@ means the habitat required to support a sustainable fishery and the managed species= contribution to a healthy ecosystem; and Aspawning, breeding, feeding, or growth to maturity@ covers the full life cycle of a species. The definition of EFH may include habitat for an

individual species or an assemblage of species, whichever is appropriate to the FMP.

The Magnuson-Stevens Act requires councils to describe in FMPs any fishing activities that may adversely affect EFH. The Magnuson-Stevens Act also requires FMPs to include management measures that minimize adverse effects on EFH from fishing, to the extent practicable.

In addition, the EFH regulations require identification of non-fishing adverse impacts on EFH. The Magnuson-Stevens Act specifies that councils may comment on and make recommendations to the Secretary and any federal or state agency concerning any activity authorized, funded, or undertaken, or proposed to be authorized, funded or undertaken, by any state or federal agency that, in the view of the Council, may affect the habitat, including EFH, of a fishery resource under its authority. If the Secretary receives information that an activity of a state or federal agency would adversely affect EFH, the Secretary shall recommend to such agency measures that can be taken by such agency to conserve such habitat. Nonfishing impacts on EFH and corresponding potential conservation measures are included in Appendix D.

Definition of Essential Fish Habitat for CPS

The CPS fishery includes four finfish (Pacific sardine, Pacific [chub] mackerel, northern anchovy, and jack mackerel) the invertebrate, market squid, and all euphausiid (krill) species that occur in the West Coast EEZ. CPS finfish are pelagic (in the water column near the surface and not associated with substrate), because they generally occur or are harvested above the thermocline in the upper mixed layer. For the purposes of EFH, the four CPS finfish are treated as a complex because of similarities in their life histories and similarities in their habitat requirements. Market squid are also treated in this same complex because they are similarly fished above spawning aggregations.

The definition of EFH for CPS finfish is based on a thermal range bordered by the geographic area where CPS occur at any life stage, where CPS have occurred historically during periods of similar environmental conditions, or where environmental conditions do not preclude colonization by CPS. The identification of EFH for CPS accommodates the fact that the geographic range of CPS varies widely over time in response to the temperature of the upper mixed layer of the ocean.

The east-west geographic boundary of EFH for CPS is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range between 10EC to 26EC. The southern boundary is the United States-Mexico maritime boundary. The northern boundary is more dynamic, and is defined as the position of the 10E C isotherm, which varies seasonally and annually. Appendix D provides a more detailed description of this variability.

The essential fish habitat designation for all species of krill extends the length of the West Coast from the shoreline to the 1,000 fm isobath and to a depth of 400 meters. The designation of essential habitat for krill is based on information about essential fish habitat for the two principal species, *Euphausia pacifica* and *Thysanoessa spinifera*. It was not possible at the time of Amendment 12 to discern consistent differences in distribution of the various life stages, other than coastwide, the larvae of both species tend to occur closer to shore, often over the shelf. Isobaths (depth contours) are used below as outer boundaries of EFH, but only because they roughly approximate the outer bounds of reported densest concentrations of the populations, and because static boundaries are preferred for the legal definition of EFH. These contours also roughly form the outer boundaries of some of the major upwelling areas (though perhaps not some of the larger offshore jets), within which consistently high concentrations of phytoplankton occur. The boundaries are not meant to imply the strict association of these highly dynamic macroplanktonic species with fixed bottom topography. No habitat areas of particular concern were identified.

Management Measures To Minimize Adverse Impacts on EFH from Fishing

The Council may use any of the following management measures to minimize adverse effects on EFH from fishing, if there is evidence that a fishing activity is having an identifiable adverse effect on EFH. Currently, there is not evidence that a fishing activity is having an identifiable adverse effect on CPS EFH. Such management measures shall be implemented under the point-of-concern framework as described in Section 2.1.2.

- Fishing Gear Restrictions
- Time/Area Closures
- Harvest Limits, or other applicable measures

In determining whether it is practicable to minimize an adverse effect from fishing, the Council should consider whether, and to what extent, the fishing activity is adversely impacting EFH, including the fishery; the nature and extent of the adverse effect on EFH; and whether management measures are practicable. This determination should take into consideration the long and short term costs and benefits to the fishery and EFH, along with other appropriate factors, consistent with National Standard 7 (conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication).

2.2.1.3 Vessel Safety Considerations

The Council will consider and may provide, after consultation with the U.S. Coast Guard and persons utilizing the fishery, temporary adjustments for access to the fishery by vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of the vessels.

2.2.1.4 Limited Entry

This FMP authorizes changes and modifications to any effort limitation programs established herein and development of additional effort limitation programs. Changes may include, but are not limited to, requirements for obtaining, maintaining, and renewing permits in any effort limitation system.

2.2.2 Domestic Commercial Management Measures

All measures, unless otherwise specified, apply to all domestic vessels.

2.2.2.1 Permits

Federal permits may be required for individuals or vessels that harvest CPS, and for individuals or facilities (including vessels) that process CPS or purchase live CPS. In determining whether to require a harvesting or processing permit, and in establishing the terms and conditions for issuing a permit, the Council may consider any relevant factors including whether a permit:

1. Will enhance the collection of biological, economic, or social data.
2. Will provide better enforcement of laws and regulations, including those designed to ensure conservation and management and those designed to protect consumer health and safety.
3. Will help achieve the goals and objectives of the FMP.
4. Will help prevent or reduce overcapacity in the fishery.
5. May be transferred, and under what conditions.

Separate permits or endorsements may be required for harvesting and processing, or for vessels or facilities based on size, type of fishing gear used, species harvested or processed, or such other factors that may be appropriate. The permits and endorsements are also subject to sanctions, including

revocation, as provided by Section 308 of the Magnuson-Stevens Act.

In establishing a permit requirement, the Council will follow the rulemaking procedures as described in Section 2.1.

2.2.2.2 Permit Revocation and Reinstatement

This FMP allows National Oceanic and Atmospheric Administration (NOAA), under procedures of 15 CFR Part 904, to revoke or suspend any Federal LE permit issued under authority of the CPS FMP.

2.2.2.3 Catch Restrictions

This FMP authorizes the commercial and recreational harvest of CPS and provides for limiting the harvest of CPS managed under this plan. Catch restrictions may be modified under the framework provisions.

2.2.2.4 Prohibited Species

This FMP does not authorize the taking, retaining, or possessing of any species by CPS gears, if such taking or possessing is prohibited by other state or federal regulations. Species identified as prohibited must be returned to the sea as soon as practical with a minimum of injury after allowing for sampling by an observer, if any. Exceptions may be made for recovery of tagged fish.

This FMP authorizes the designation of other prohibited species in the future, or the removal of a species from this classification, consistent with other applicable law for that species.

2.2.2.5 Gear Restrictions

This FMP authorizes the use of net gear, hook-and-line, pots (traps), longlines, and any other type of gear as legal gear for the commercial harvest of CPS, unless such gear is specifically prohibited by state law. A complete listing of current state regulations in Washington, Oregon, and California is in Appendix B.

Implementation and modification of specific management measures regarding gear, such as definitions of legal gear, mesh size restrictions, gear marking, or other gear restrictions are authorized by this FMP. Gear restrictions may be established, modified, or removed under the point-of-concern or socioeconomic frameworks. Any changes in gear regulations should be scheduled to minimize costs to the fishing industry, insofar as this is consistent with achieving the goals of the change.

2.2.2.6 Closed Fishing Areas

Currently, there are certain areas closed to commercial round-haul fishing or fishing for reduction processing. Those areas were originally closed by the State of California to avoid commercial fishing conflicts with sport fisheries and reduce potential impacts on sport fish and salmon. This FMP authorizes the issuance of exempted fishing permits in Section 2.2.8 for fishing in closed areas consistent with the goals and objectives of the FMP.

Closed areas shall be implemented or changed through the procedures described in Section 2.1.

2.2.2.7 Reporting Requirements

This FMP authorizes domestic annual harvest (DAH) survey, exempted fishing permit (EFP) application, and foreign vessel reporting and records keeping requirements. This FMP authorizes other domestic

vessel permit applications and reporting requirements in the future.

Other Reporting and Record Keeping Requirements

Catch, effort, biological, and other data necessary for implementation of this FMP will continue to be collected by the states of Washington, Oregon, and California under existing state data collection provisions. Federal reporting requirements, such as logbooks, will be implemented only when data collection and reporting systems operated by state agencies fail to provide the Secretary with statistical information for adequate management. Any special reporting requirement should be imposed only if it is expected to enhance the Council=s and NMFS= ability to manage the CPS fishery more effectively.

Conditions may develop in the CPS fishery that make current state reporting requirements insufficient. It is possible that delays in obtaining catch data or missing catch data could affect stock assessments or other management efforts. To address these potential future problems, the FMP authorizes implementation of federal reporting requirements in addition to those of the various states. The purpose of these measures would be to enhance Council's ability to manage CPS stocks effectively. Additional reporting requirements would be developed under framework management procedures and announced in the *Federal Register*.

2.2.2.8 Vessel Identification

The FMP authorizes vessel identification requirements which may be modified as necessary to facilitate enforcement and vessel recognition.

2.2.3 Domestic Recreational

Measures described in this section apply to domestic recreational fisheries only, although most measures could be used to manage foreign recreational fisheries as well.

2.2.3.1 Permits

Washington, Oregon, and California have state laws concerning recreational licenses and permits. In the event that a federal licenses or permits become necessary, they may be required under this FMP.

2.2.3.2 Catch Restrictions

This FMP authorizes establishment of catch restrictions on the recreational fishery consistent with FMP goals and objectives and national standards established by the Magnuson-Stevens Act.

2.2.3.3 Gear Restrictions

There are no federal restrictions on legal recreational gear for CPS. Existing state regulations apply in Washington, Oregon, and California. This FMP authorizes federal recreational regulations for CPS.

2.2.4 Domestic Vessels in a Joint Venture

U.S. vessels operating in joint ventures on the West Coast are domestic vessels and traditionally have been treated the same as U.S. vessels delivering to shore facilities. However, conditions in the fishery could warrant separate treatment in the future. Although all U.S. vessels have been subject to the same regulations, joint venture catcher operations may be affected indirectly by restrictions (such as closed areas) placed on the foreign processing vessels that receive U.S. catch at sea.

2.2.5 Foreign Vessels in a Joint Venture or Foreign Fishery

These measures apply to foreign vessels that process fish taken by U.S. catcher-boats under joint venture processing or to foreign vessels that operate in a fishery directed at a species for which there is a TALFF. The CPS FMP provides authority to establish, modify or remove future regulations including, but not limited to, harvest guidelines, harvest quotas, seasons, area closures, incidental harvest restrictions, trip and landing limits, and gear restrictions.

2.2.5.1 Permits

All foreign vessels operating in this management area shall have on board a permit issued by the Secretary pursuant to the Magnuson-Stevens Act.

2.2.5.2 Target Species

A foreign nation may conduct joint venture operations only for species for which there is a JVP and only using boats with appropriate permits. Directed fishing is allowed only for species for which the foreign nation has received an allocation of TALFF.

2.2.5.3 Incidental Catch

Incidental catch refers to CPS which are unavoidably caught while fishing for another species. It is recognized that incidental harvest of domestically fully utilized CPS is unavoidable in joint venture and foreign fisheries. Minimal incidental allowances consistent with the status of the stocks and the efficiency of the joint venture or foreign fisheries will usually be allowed. These incidental allowances are not to be considered as surpluses to domestic processing needs and are allowed only to provide for full utilization of the species targeted in the joint venture or foreign fishery.

Allowances for incidental harvest in joint ventures or foreign fisheries may be percentages or some other quantity at the Council's discretion. Incidental allowances may be changed at any time during the year, but are published at least annually, concurrent with the annual specifications of JVP.

The Council may modify incidental catch allowances inseason to reflect changes in the condition of the resource and performance of the U.S. industry. The Council will consider public testimony and consider the following factors before establishing or changing incidental allowances, (1) observed catch rates in any previous joint venture or foreign fishery; (2) current estimates of relative abundance and availability of species caught incidentally; (3) ability of the foreign vessels to take the JVP or TALFF; (4) past and projected foreign and U.S. fishing effort; (5) status of stocks; (6) impacts on the domestic industry; and (7) other relevant information. Inseason changes will be made as a routine management measure.

2.2.5.4 Prohibited Species

Prohibited species means salmonids or any species of fish that a joint venture or foreign vessel is not authorized to retain. Prohibited includes fish received in excess of any authorization, landing limit, or harvest guideline. These species must be immediately returned to the sea with a minimum of injury after allowing for sampling by an observer, if any. This FMP authorizes the designation of other prohibited species in the future, or the removal of a species from this classification if consistent with the applicable law for that species.

2.2.5.5 Season and Area Restrictions

There is no season restriction unless otherwise specified according to this FMP. There is no area

restriction, unless otherwise specified according to this FMP. Joint venture and foreign fisheries for CPS may not be conducted within the limited entry area south of 39E N latitude.

Season and area restrictions for foreign vessels operating in a joint venture or foreign fishery may be established, modified, or removed at any time during the year in accordance with the procedures in Sections 2.1.2 and 2.1.3 or by foreign vessel permit conditions.

2.2.5.6 Reporting and Record Keeping Requirements

Foreign nations receiving U.S. harvested fish in a joint venture or participating in a foreign fishery are required to submit detailed reports of fishing effort, location, amount, and disposition by species or species group, and transfer of fish or fish products, as needed for monitoring and management of the fishery. Reports may be required at specified time intervals. The NMFS Regional Administrator may require daily reports when a specified fraction of JVP, TALFF, or incidental allowance is reached. In addition, each country may be required to report arrival, departure, and positions of each of its vessels, as specified under the regulations and permit conditions, as needed for monitoring fleet deployment. Logbooks may be required to fulfill fishery conservation, management, and enforcement purposes of Magnuson-Stevens Act. These logs may include, but are not limited to, communications logs, transfer logs, or daily joint venture logs with haul by haul and daily receipt data, effort, and production information.

2.2.5.7 Dumping

Foreign and other vessels are prohibited from dumping pollutants and fishing gear which would degrade the environment or interfere with domestic fishing operations.

2.2.5.8 Fishery Closure

A joint venture or directed foreign fishery shall cease each year when, (1) the JVP or TALFF is reached; (2) the maximum incidental catch allowance for that nation of any species or species group is reached; (3) the overall harvest guideline or harvest quota for the allocated species is reached; (4) the applicable open season is ended; or (5) as necessary for resource conservation reasons under the point-of-concern mechanism.

2.2.5.9 Observers

Observers shall be placed on each foreign vessel while it is operating in a foreign or joint venture fishery, as provided by Title II of the Magnuson-Stevens Act. The law provides for the following exceptions to this requirement:

1. If observers are aboard motherships of a mothership/catcher vessel fleet.
2. If the vessel is in the exclusive economic zone (EEZ) for such a short time that at observer would be impractical.
3. If facilities for quartering an observer are inadequate or unsafe.
4. For reasons beyond the control of the Secretary an observer is not available.

2.2.5.10 Other Restrictions

The Secretary may impose additional requirements for the conservation and management of fishery resources covered by the vessel permit or for national defense or security reasons. These restrictions include, but are not limited to, season, area, and reporting requirements.

The highest priority of this FMP is to provide for conservation of the resource. Any restriction on the joint venture fishery may be modified under the point-of-concern mechanism for resource conservation reasons.

2.2.6 Foreign Recreational

Foreign recreational fishing refers to any fishing from a foreign vessel not operated for profit or scientific research, and not involved in the sale, barter, or trade of any part of the catch. This FMP authorizes establishment of catch restrictions on the foreign recreational fishery which are consistent with the goals and objectives of this FMP and the national standards established by the Magnuson-Stevens Act.

2.2.7 Limited Entry

Research and monitoring programs may need to be developed and implemented for the CPS fishery so that information required in a limited entry program is available. Such data should indicate the character and level of participation in the fishery, including but not limited to, (1) investment in vessel and gear; (2) the number and type of units of gear; (3) the distribution of catch; (4) the value of catch; (5) the economic returns to the participants; (6) mobility between fisheries; (7) purchase or sale prices of limited entry permits; various social and community considerations.

2.2.8 Exempted Fishing

"Exempted fishing" is defined to be fishing practices that are new to the fishery or not allowed under the FMP. Under this FMP, the NMFS Regional Administrator may authorize the targeted or incidental harvest of CPS for experimental or exploratory fishing that would otherwise be prohibited. The NMFS Regional Administrator may restrict the number of experimental permits by total catch, time, or area. The NMFS Regional Administrator may also require any level of industry-funded observer coverage for these experimental permits. Exempted fisheries for euphausiids (krill) will not be considered.

Exempted fisheries are expected to be of limited size and duration and must be authorized by an EFP issued for the participating vessel in accordance with the criteria and procedures specified in 50 CFR '600.745. The duration of EFPs will ordinarily be one year. Permits will not be renewed automatically. An application must be submitted to the Regional Administrator for each year. A fee sufficient to cover administrative expenses may be charged for EFPs. An applicant for an EFP need not be the owner or operator of the vessel(s) for which the EFP is requested as long as the proposed activity is compatible with limited entry and other management measures in the FMP.

This FMP authorizes mandatory data reporting and mandatory on-board observers with exempted fishing permits. Installation of vessel monitoring units aboard vessels with exempted fishing permits may be required.

Nothing in this FMP is intended to exclude or to limit use of CPS, markets, or processing methods as long as the process in question is compatible with measures and intentions of this FMP.

Priorities for issuing EFPs are as follows:

1. Domestic boats delivering to domestic processors and domestic factory trawlers (with equal priority).
2. Domestic catcher-boats delivering to a foreign offshore processor.

Boats already involved in developing a fishery for an underutilized species (i.e., boats with a catch history

or previous EFP) should receive highest priority in applying for and renewing permits.

2.2.9 Other Fees and Permits

Nothing in this FMP is intended to exclude use of additional fees or permits in the future as long as the fee or permit is consistent with applicable law, management measures, and intent of this FMP. It may, for example, become desirable to issue permits for processing CPS in onshore plants or processing vessels offshore. It may be desirable to charge fees sufficient to cover administrative costs of issuing additional types of permits. Changes in requirements for obtaining, maintaining, and renewing permits are authorized.

2.3 Scientific Research

Nothing in this FMP is intended to inhibit or prevent any scientific research involving CPS which is acknowledged by the Secretary through procedures set out in 50 CFR '600.745.

Proposed activity is not scientific research unless it is submitted in writing to the Secretary in the form of a research proposal which addresses all of the factors below. An activity may be acknowledged as scientific research if its primary objective, purpose, or product is the acquisition of data, information, or knowledge as determined by consideration of all of the following factors:

1. The proposed program will result in information useful for scientific or management purposes.
2. The application of existing knowledge alone is insufficient to solve the scientific or management subject or problem presented by the scientific research proposal.
3. Facts/data/samples will be collected or observed and analyzed in a scientifically acceptable manner and the results will be formally prepared and available to the public.
4. Recognized scientific experts, organizations, or institutions with expertise in the field or subject matter area are conducting, sponsoring or are otherwise affiliated with the activity.

Secretarial Acknowledgment of Scientific Research

If the Secretary agrees that an activity constitutes scientific research involving CPS, a letter of acknowledgment should be issued to the applicant and operator or master of the vessel conducting the scientific research. The letter will include information on the purpose, scope, location, and schedule of the acknowledged activities. Any activities not in accordance with the letter of acknowledgment should be subject to all provisions of the Magnuson-Stevens Act and its implementing regulations. The Secretary should transmit copies of letters of acknowledgment to the Council, state or federal administrative and enforcement agencies to ensure they are aware of the research activities.

CPS taken under the scientific research exclusion may be sold to offset all or part of the cost of carrying out the research plan including costs associated with operating the research vessel.

2.4 Restrictions on Other Fisheries

For each non-CPS fishery, a reasonable limit on the incidental CPS catch may be established that is based on the best available information. The objectives of restrictions on other fisheries under this framework are to:

1. Minimize discards in the non-CPS fishery by allowing retention and sale, thereby increasing fishing income.
2. Discourage targeting on CPS by the non-CPS fleet.

Incidental limits may be imposed or adjusted in accordance with appropriate procedures described in this FMP. The Secretary may accept or reject but not substantially modify the Council's recommendations.

2.5 Procedures for Reviewing State Regulations

This FMP acknowledges that state regulations are a fundamental part of CPS management. All existing state regulations at the time of implementation of this plan are consistent with this FMP. Those regulations are listed in Section 2.2.5.2 of Appendix B.

This FMP establishes a review process by which any state may obtain a determination that its regulations are consistent with the FMP and the national standards. As necessary, the Council may also recommend to NMFS that duplicate or different federal regulations be implemented in the EEZ. While the Council retains the authority to recommend federal regulations be implemented in the EEZ, the preference is to continue to rely on state regulations in that area as long as they are consistent with the FMP.

While states are not required to submit regulations which they wish to apply in the EEZ to the Council for a consistency determination, regulations which have not received a consistency determination run the risk of being declared inconsistent and invalid if challenged in a state law enforcement proceeding. The Council invites submission of all present and future state fishery regulations relating to the harvest of species managed under this FMP which are to apply in the EEZ.

Review Procedure

Any state may propose that the Council review a particular state regulation for the purpose of determining its consistency with the FMP and the need for complementary federal regulations. Although this procedure is directed at the review of new regulations, existing regulations affecting the harvest of CPS managed by the FMP may also be reviewed under this process. The state making the proposal will include a summary of the regulation in question and concise arguments in support of consistency.

Upon receipt of a state's proposal, the Council may make an initial determination whether or not to proceed with the review. If the Council determines that the proposal has insufficient merit or little likelihood of being found consistent, it may terminate the process immediately and inform the petitioning state in writing of the reasons for its rejection.

If the Council determines sufficient merit exists to proceed with a determination, it will review the state's documentation or prepare an analysis considering, if relevant, the following factors:

1. How the proposal furthers or is not otherwise consistent with the objectives of the FMP, the Magnuson-Stevens Act, and other applicable law.
2. Likely effect on or interaction with any other regulations in force for the fisheries in the area concerned.
3. Expected impacts on the species or species group taken in the fishery sector being affected by the regulation.
4. Economic impacts of the regulation, including changes in catch, effort, revenue, fishing costs, participation, and income to different sectors being regulated as well as to sectors which might be indirectly affected.
5. Any impacts in terms of achievement of harvest guidelines or harvest quotas, maintaining year-round fisheries, maintaining stability in fisheries, prices to consumers, improved product quality, discards, joint venture operations, gear conflicts, enforcement, data collection, or other factors.

The Council will inform the public of the proposal and supporting analysis and invite public comments before and at the next scheduled Council meeting. At its next scheduled meeting, the Council will consider public testimony, public comment, advisory reports, and any further state comments or reports, and determine whether or not the state regulation is consistent with the FMP and whether or not to recommend implementation of complementary federal regulations or to endorse state regulations as consistent with the FMP without additional federal regulations.

If the Council recommends the implementation of complementary federal regulations, it will forward its recommendation to the NMFS Regional Administrator for review and approval. The NMFS Regional Administrator will publish the proposed regulation in the *Federal Register* for public comment, after which, if approved, he/she will publish final regulations as soon as practicable. If the Regional Administrator disapproves the proposed regulations, he/she will inform the Council in writing of the reasons for disapproval.

3.0 LIMITED ENTRY

This fishery management plan (FMP) establishes a limited entry program for coastal pelagic species (CPS) finfish including northern anchovy, Pacific (chub) mackerel, jack mackerel, and Pacific sardine landed south of 39° N latitude.

3.1 Problem Addressed by Limited Entry

Prior to implementation of the FMP, vessels participating in the CPS finfish fishery were capable of harvesting more CPS finfish than is available under current or likely future biomass conditions. Fisheries characterized by excess harvesting capacity are described as overcapitalized in terms of the number of vessels, and the amount of gear and equipment devoted to harvesting. As fisheries become overcapitalized, harvesting costs increase while catches remain the same. This situation represents an economically inefficient use of society=s productive resources, and causes several problems for managers and the fishing industry when abundance declines and catches are reduced. As harvest capacity in the fisheries increases, problems arising from the need for more restrictive management measures and resolution of allocation issues become more acute. No relief from these problems will occur if harvest capacity continues to rise.

It was estimated that 640 vessels landed CPS finfish during the period January 1, 1993 through November 5, 1997. Forty-one of these vessels, six percent, accounted for more than 95% of finfish landings for the five-year period (Appendix B, Table 3.8.7-1). Available information indicated that present participants could harvest at least as much CPS finfish as would be available under conditions of greater availability. At the time, capacity was estimated to be as much as 20% greater than the combined maximum sustainable yield (MSY) for anchovy, Pacific (chub) mackerel, and sardine (about 400,000 mt per year).[1]1/ Experience in the fishery and some crude calculations indicate that about 75 vessels would have sufficient harvesting capacity to take almost all of the CPS finfish likely to ever be available.

In addition to current CPS finfish participants, newcomers are likely to be attracted to the fishery, because of the expanding sardine biomass and squid fishery, and as competition in other Pacific Coast fisheries becomes more intense. In the latter instance, nearly all groundfish stocks are now fully harvested by domestic fishers in the Pacific Coast groundfish fishery. Potential participants in the CPS finfish fishery consist of fishers leaving other West Coast and North Pacific fisheries that have grown increasingly more restrictive and overcrowded relative to available harvests.

In the Pacific Coast CPS finfish fishery, excess harvest capacity is likely to result in an increasing number and complexity of regulations. Accordingly, the Council will face increased pressure to balance the conflicting need to protect the resource with the need to provide sufficient allowable catch to sustain the fishery.

Increased number and complexity of regulations have many adverse impacts in such areas as fleet costs, resource utilization, safety, enforcement costs and effectiveness. Moreover, there is a point beyond which additional regulations, which interfere with day to day vessel operations (e.g., trip limits or mesh size regulations), will not improve the Council's ability to accomplish its management goals. Pressures on industry arise not only from management measures which restrict operations, but also from increased competition for the allowable catches among larger numbers of vessels.

1/ The estimate 400,000 mt per year is the sum of estimated MSY for each stock reduced by a crude estimate of the fraction of the stock in U.S. waters. It is unlikely that all stocks would be abundant at the same time and that 400,000 mt of catch would be available in any one year.

For these reasons, the FMP established a limited entry fishery south of 39E North latitude (as described at Section 3.5.2). Operational aspects of the limited entry fishery are described in subsequent sections.

3.2 Goals and Objectives for Finfish Limited Entry

The goals and objectives for this FMP are presented in Section 1.5. The most important of these in the context of limited entry are:

A. Promote efficiency and profitability in the fishery.
B. Achieve optimum yield (OY).
C. Accommodate existing fishery segments.
D. Use resources spent on management of CPS efficiently.

Not all these objectives are complementary. The challenge is to create a limited entry program which strikes a balance between increasing net returns from the fishery, achieving OY, accommodating participation by those with substantial investments in the fishery, and efficiently using management resources.

3.2.1 Capacity Goal

The purpose of the capacity goal is to ensure fishing capacity in the CPS limited entry fishery is in balance with resource availability. The limited entry fleet capacity goal is 5,650.9 mt as represented by cumulative gross tonnage (GT) of the limited entry fleet of vessels.

This level of capacity results in a larger, diverse CPS finfish fleet, which also relies on other fishing opportunities such as squid and tuna, with normal harvesting capacity equal to the long-term expected aggregate finfish target harvest level, approximately 110,000 mt, and with physical capacity available to harvest peak period amounts of finfish, 275,000 mt. The current (June 2002) fleet of 65 vessels satisfies this goal. Estimated normal harvesting capacity for the current (June 2002) fleet ranged from 60,000 mt to 111,000 mt per year; physical harvesting capacity ranged from 361,000 to 539,000 mt per year. Total calculated Gross Tonnage (GT) for the current (June 2002) fleet is 5,650.9 mt. Therefore, 5,650.9 mt of GT represents the current fleet capacity goal.

3.3 Achievement of Goals and Objectives and Need for Additional Measures to Reduce Capacity

The limited entry program for CPS finfish adopted under this amendment to the northern anchovy FMP will not in itself immediately accomplish the goals and objectives the Council has established for the fishery. It is a first step that may slow or prevent the worsening of conditions which impede the Council from achieving the overall goals and objectives for the fishery. The limited entry fleet size and transferability provisions represent a balance between the limited entry goals of accommodating existing fishery participants (goal C) and promoting efficiency and profitability in the fishery (goal A). Establishment of this limited entry system will provide a starting point for any future programs which may be necessary to further reduce harvest capacity.

3.3.1 Maintaining the Capacity Goal

Conditions and effects of transferability will be reevaluated periodically in conjunction with achievement of the capacity goal, and objectives of the FMP. The Council established a trigger for reevaluation based on an overall change in fleet GT of 5%. The CPSMT will evaluate capacity in the CPS finfish fishery relative to the capacity goal every two years starting in 2003. In the annual CPS SAFE, the CPSMT will

include a report to the Council on the status of fleet capacity and, if necessary, recommendations regarding the capacity goal and permit transferability.

3.4 Nature of the Interest Created

CPS limited entry permits confer a privilege to participate in the West Coast CPS finfish fishery in accordance with the limited entry system established under this FMP and implementing regulations, or any future amendment to the FMP and implementing regulations. Future amendments to the FMP may modify or even abolish the limited entry system. The permits are also subject to sanctions including revocation, as provided by the Magnuson-Stevens Act, 16 USC 1858(g) and 15 CFR part 904.

3.5 Scope of Limited Entry

3.5.1 Species within the Scope of Limited Entry

The provisions of this chapter apply only to CPS finfish, including northern anchovy, Pacific (chub) mackerel, jack mackerel, and Pacific sardine.

3.5.2 Geographic Scope of Limited Entry

The provisions of this chapter establish a CPS finfish limited entry program for the fishery south of 39E N latitude (approximately Point Arena, California). In the context of limited entry, fishing for and landing CPS finfish south of 39E N latitude is defined as landing CPS finfish. Fishing for and landing of CPS finfish north of 39E N latitude is not affected by limited entry requirements. CPS finfish fishing in the northern area would be managed as an open access fishery. This does not preclude effective management or future extension of limited entry in the north.

3.6 Limited Entry Permits

3.6.1 Initial Issuance of Limited Entry Permits

1. Each qualifying vessel will entitle the current owner to one limited entry permit.
2. A vessel qualifies for a limited entry permit by meeting the initial issuance criteria in Section 3.6.1.1.
3. A given vessel cannot receive more than one limited entry permit.
4. Fees may be charged to cover National Marine Fisheries Service (NMFS) administrative costs associated with issuance or transfer of permits.
5. Permits are assigned to one vessel at a time.
6. The vessel owner is responsible for maintaining the permit and any other documentation required on board each vessel with a permit to fish for CPS.
7. A limited entry permit may not be used with a vessel unless it is registered for use with that vessel.
8. Limited entry permits will be registered for use with a vessel and a registered vessel may be changed only according to procedures outlined in the FMP and regulations.
9. If the permit will be used with a vessel other than the one registered on the permit, a registration for use with the new vessel must be obtained from the Regional Director and placed aboard the vessel before the vessel is used to fish for CPS.

3.6.1.1 Initial Issuance Criteria

The owner of a CPS vessel will receive a limited entry permit if, during the window period of January 1, 1993 to November 5, 1997, the vessel landed or delivered a cumulative total of 100 mt of CPS finfish.

No more than one limited entry permit will be issued for each qualifying vessel. The permit will be issued only to the current owner of the vessel, unless (1) the previous owner of a vessel qualifying for a permit has, by the express terms of a written contract, reserved the right to the permit, in which case the permit will be issued to the previous owner based on the catch history of the qualifying vessel; or (2) a vessel that would have qualified for a limited entry permit was totally lost before a permit was issued. In this case, the owner of the vessel at the time it was lost retains the right to the permit, unless the owner conveyed the right to another person by the express terms of a written contract.

3.6.1.2 Ownership Restriction

Only entities (human beings, corporations, etc.) qualified to own a U.S. fishing vessel may be issued or may hold (by ownership or otherwise) a limited entry permit.

3.6.1.3 Limited Entry Permit Held by Owner of Record of the Vessel

1. The vessel owner is responsible for acquiring and holding a limited entry permit for each vessel that is required to have a limited entry permit to catch CPS finfish under this limited entry section.
2. The vessel owner is responsible for maintaining NMFS required documentation of the limited entry permit on board the vessel.
3. The limited entry permit will be used with one vessel only. That vessel must be declared and registered with the NMFS issuing authority. Registration is incomplete and limited entry permits may not be used until acknowledged in writing by NMFS.
4. A vessel owner may not use a vessel, or allow a vessel to be used, to catch any Council-managed CPS finfish under the limited entry regulations unless the vessel owner holds a limited entry permit which explicitly allows such catch and the limited entry permit has been registered with NMFS for use with that vessel.

3.6.1.4 Loss of a Vessel Prior to Permit Issuance

1. A limited entry permit will be issued for a vessel which qualified for a permit but is lost before permits are issued. The vessel must be replaced within two years of the loss unless otherwise determined by the NMFS Regional Director. The replacement vessel must be of equal or less gross tonnage.
2. For a vessel that would qualify an owner for a limited entry permit, in the case of a vessel=s sinking or total loss, all rights to a permit from the fishing history of the vessel prior to the sinking or total loss remain with the owner unless specifically transferred.

3.6.1.5 Appeals Process

If an application for a permit is denied, the applicant may appeal the denial to the NMFS Regional Administrator. The appeal must be in writing, state the action being appealed, and reasons. The appellant may request an informal hearing before a hearing officer and the NMFS Regional Administrator will decide if a hearing is required. If required, hearings will be carried out in a timely fashion (normally within 30 days of the receipt of sufficient information).

The NMFS Regional Administrator will decide the appeal in accordance with the criteria for limited entry permits specified in this FMP and implementing regulations. The NMFS Regional Administrator will consider the information submitted by the appellant, the summary record of the hearing and hearing officer=s recommendation (if any) and other relevant information.

3.6.2 Permit Renewal Procedures

1. Permits must be renewed every two calendar years in order to remain valid for the following calendar year. The renewal date for limited entry permits will be January 1 at two year intervals beginning in the year after implementation.
2. Notice of upcoming renewal periods will be sent at the appropriate time every two years to the most recent address as provided to the permit issuing authority by the permit holder. It shall be the permit holder=s responsibility to provide the permit issuing authority with address changes in a timely manner.
3. An annual fee will be charged which reflects the administrative costs of maintaining the permit system.
4. Failure to renew during this period will result in expiration of the permit at the end of the calendar year.
5. Once a permit has expired because of failure to renew during the renewal period, it may not subsequently be renewed or reissued, except through a process as specified in Section 3.6.1.5.

3.6.3 Conditions for Transfers of Existing Permits

CPS finfish limited entry permits may be transferred with restrictions on the harvesting capacity of the vessel to which it would be transferred. These restrictions are as follows: 1) full transferability of permits to vessels of comparable capacity (vessel GT +10% allowance), and 2) allow permits to be combined up to a greater level of capacity in cases where the vessel to be transferred to is of greater harvesting capacity than the one from which the permit will be transferred.

Each limited entry permit will have an endorsement based on the currently permitted vessel=s calculated gross tonnage (GT) as defined in 46 *CFR* 69.209 for ship-shaped hulls, where:

$$GT = 0.67(Length*Breadth*Depth)/100.$$

The original permits and their respective endorsements will remain in effect for the lifetime of each permit, regardless of the GT of a vessel to which it may be transferred. In cases where a permit is transferred to a vessel with smaller GT, the original GT endorsement will remain, and excess GT may not be split out from the original permit configuration and sold. In cases where two or more permits are transferred to a larger vessel, the larger vessel will hold the original permits and may fish for CPS finfish as long as the aggregate GT endorsements, including the 10% allowances, add up to the new vessel=s calculated GT. In the event that a vessel with multiple permits wishes to leave the CPS limited entry program, those permits may be sold together or separately, but the original permit endorsement may not be altered.

To ensure manageability of the permit program and stability of the fleet, only one transfer per permit will be allowed in each calendar year. Permits may only be used on the vessel to which they are registered, and permit leasing will not be allowed. Catch history will be tied to the vessel, and not to the permits.

3.6.3.1 Adjusting Permit Transferability to Maintain the Capacity Goal

When the upper threshold of fleet GT (fleet GT plus 5%, or 5,933.5 mt) is reached, fleet capacity will be restored to the capacity goal (5,650.9 mt) by restricting conditions for permit transfer. Under this mechanism, once the trigger point (5,933.5 mt) is met or exceeded, permits could only be transferred to vessels with equal or smaller GT and the 10% vessel allowance is removed. The 10% allowance could be reconsidered once total fleet GT is reduced to the 5,650.9 mt target.

3.6.4 Procedures for Issuing New Limited Entry Permits in the Future

If, in response to positive changes in CPS finfish resources or market conditions, it is determined that new limited entry permits should be issued the qualifying criteria originally established in the FMP (Section 3.6.1.1) would be used for issuance of these new permits. It is expected that this would entail continuing down the list of vessels having landings during the 1993-97 window period in order of decreasing window period landings. For example, the next permit awarded would go to the 71st of the 640 vessels identified in the original analysis (Amendment 8) with window period finfish landings if this vessel were to apply for a new permit. Each vessel on the list would need to have its harvest capacity evaluated so that in aggregate the new capacity target was not exceeded. New permits could be issued on either a temporary or permanent basis, depending on the circumstances surrounding the need for additional fleet capacity. Prior to issuance of new permits, the Council or the Regional Administrator would need to determine if the new permits would be either temporary or permanent.

3.6.5 Coastal Pelagic Species Fishing Exempted from Limited Entry

3.6.5.1 Exempted Landings

Vessels landing small quantities of CPS finfish on a per trip basis do not require a limited entry permit. The Council will set, by regulation, a level of landings per trip that is exempt from limited entry. This level must be between one mt and five mt per trip. The level specified by the Council will remain in place until changed by rulemaking.

3.6.5.2 Recreational Fishing

Recreational fishing for CPS finfish does not require a limited entry permit. However, the Council may choose to restrict recreational harvest quotas, implement area closures or impose any other type of management measure.

3.6.5.3 Live Bait Coastal Pelagic Species Fishing

Fishing CPS species for use as live bait does not require a limited entry permit. This includes live bait harvested for use in recreational and commercial fisheries.

3.6.6 Additional Management of the Limited Entry Fishery

3.6.6.1 Trip Limit

The Council may set a trip limit, by regulation, of up to 125 mt on landings of CPS finfish. In this context, a trip is defined as any activity (e.g., catching, landing, transporting or delivering) by a vessel that harvests CPS finfish with a limited entry permit; (i.e., a possession limit that applies to harvesting operations only). Also in this context, a trip limit should not be confused with trip limits used in other fisheries (e.g., groundfish) to lengthen the season without exceeding harvest guidelines or to manage bycatch.

4.0 OPTIMUM YIELD, MAXIMUM SUSTAINABLE YIELD CONTROL RULES, AND OVERFISHING DEFINITIONS FOR THE COASTAL PELAGIC SPECIES FISHERY

This fishery management plan defines optimum yield (OY), maximum sustainable yield (MSY) control rules, and defines overfishing and overfished stocks. All aspects of harvest policies for coastal pelagic species (CPS) including the MSY control rule, definition of overfishing, definition of overfished stocks and rebuilding criteria can be modified using framework procedures described in Section 2.0.

4.1 Definition of Optimum Yield

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) defines the term "optimum", with respect to the yield from a fishery, as the amount of fish which:

(A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
(B) is prescribed on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant social, economic, or ecological factor; and
(C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery [50 CFR '600.310(f)(1)(i)].

OY for a CPS stock is defined to be the level of harvest which is less than or equal to acceptable biological catch (ABC) estimated using an ABC ~~MSY~~ control rule, consistent with the goals and objectives of this fishery management plan (FMP), and used by the Council to manage the stock. The ABC is a harvest specification of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL (MSY or MSY proxy) and any other scientific uncertainty and should be based on the ABC control rule. The ABC control rule specifies an approach to setting ABC for a stock or stock complex as a function of the scientific uncertainty in the estimate of OFL and any other scientific uncertainty. ~~a prudent harvest level calculated based on an MSY control rule (see below)~~. In practice, OY will be determined with reference to ABC. Harvest control rules and other OY considerations will be used to set annual catch limits, annual catch targets, and/or harvest guidelines on an annual or multi-year basis. In particular, OY will be set less than ABC to the degree required to prevent overfishing.

4.2 Definition of Overfishing Limits or Maximum Sustainable Yield, ~~MSY~~ and ABC Control Rules ~~and Acceptable Biological Catch~~

An overfishing limit is an annual amount of catch that corresponds to the estimate of fishing mortality on an annual basis, above which overfishing is occurring applied to a stock or stock complex's abundance expressed in terms of numbers or weight of fish. Overfishing limits fir CPS are based on MSY or MSY proxy harvest rates applied to the best available estimate of biomass. In cases where biomass estimates include portions of the population in foreign waters, a DISTRIBUTION term will be used to estimate the percentage of the population in U.S. EEZ.

The ABC is a harvest specification set below the OFL and is a threshold that incorporates a scientific uncertainty buffer against overfishing (i.e., exceeding the OFL). The ABC is decided by the Council based on its preferred level of overfishing risk aversion. The ABC is based on a percentage reduction of the OFL. In cases where scientific uncertainty associated with estimating an OFL (σ) is quantified by the SSC, the percentage reduction that defines the scientific uncertainty buffer and the ABC can be determined by translating the estimated σ to a range of probability of overfishing (P*) values. The Council then determines the preferred level of risk aversion by selecting an appropriate P* value, accordingly. Each P* value is then mapped to its corresponding BUFFER fraction that is applied to the OFL according to the ABC control rule.

OFL	BIOMASS * F_{MSY} * DISTRIBUTION
ABC	BIOMASS * BUFFER * F_{MSY} * DISTRIBUTION

To some extent, the existing harvest control rules for Actively managed species merge scientific uncertainty and OY considerations thereby providing additional reductions from OFL levels, particularly during warm temperature regimes. Therefore, harvest control rules will be considered in conjunction with ABC control rules to prevent overfishing (see Section 4.6).

4.3 Definition of Overfishing

By definition, overfishing occurs in a fishery whenever fishing occurs over a period of one year or more at a rate that is high enough to jeopardize the capacity of the stock to produce MSY on a continuing basis if applied in the long term. Overfishing in the CPS fishery is "approached" whenever projections indicate overfishing will occur within two years. The definition of overfishing is in terms of a fishing mortality or exploitation rate. Depending on the exploitation rate, overfishing can occur when CPS stocks are at either high or low abundance levels. The Council must take action to eliminate overfishing when it occurs and to avoid overfishing when exploitation rates approach the overfishing level.

In operational terms, overfishing occurs in the CPS fishery whenever catch exceeds ~~ABC~~ OFL and overfishing is approached whenever projections indicate that fishing mortality or exploitation rates will exceed the ~~ABC~~ OFL level within two years. The definition of an overfished stock is an explicit part of the ~~MSY~~ harvest control rule for CPS stocks.

4.4 Definition of an Overfished Stock

By definition, an overfished stock in the CPS fishery is a stock at a biomass level low enough to jeopardize the capacity of the stock to produce MSY on a continuing basis. An overfished condition is approached when projections indicate that stock biomass will fall below the overfished level within two years. The Council must take action to rebuild overfished stocks and to avoid overfished conditions in stocks with biomass levels approaching an overfished condition.

4.5 Rebuilding Programs

Management of overfished CPS stocks must include a rebuilding program that can, on average, be expected to result in recovery of the stock to MSY levels in ten years. It is impossible to develop a rebuilding program that would be guaranteed to restore a stock to the MSY level in ten years, because CPS stocks may remain at low biomass levels for more than ten years even with no fishing. The focus for CPS is, therefore, on the average or expected time to recovery based on realistic projections. If the expected time to stock recovery is associated with unfavorable ecosystem conditions and is greater than ten years, then the Council and the U.S. Secretary of Commerce (Secretary) may consider extending the time period as described at 50 CFR '600.310(e).

Rebuilding programs for CPS may be an integral part of the ~~MSY~~ harvest control rule or may be developed or refined further in the event that biomass of a CPS stock reaches the overfished level.

4.6 ~~Maximum Sustainable Yield~~ Harvest Control Rules

(This paragraph was moved from Section 4.2). For CPS, a ~~MSY~~ harvest control rule is defined to be a harvest strategy that provides biomass levels at least as high as the F_{MSY} approach while also providing relatively high and relatively consistent levels of catch. According to federal regulations (50 CFR '600.310(b)(1)(ii)), an MSY control rule is "a harvest strategy which, if implemented, would be expected

to result in a long-term average catch approximating MSY." Similarly, MSY stock size "means the long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units, that would be achieved under an MSY control rule in which the fishing mortality rate is constant." ~~The definition of a MSY harvest control rule for CPS is more general, because it includes the definition in National Standard 1~~. Harvest specifications as estimated by the harvest control rule shall not exceed ABC or the harvest recommendations of the SSC. Rather, harvest control rules will be considered in conjunction with ABC control rules to prevent overfishing The ~~definition for~~ CPS harvest control rules for Actively managed species are more conservative than MSY-based management strategies, because the focus for CPS is oriented primarily towards stock biomass levels at least as high as the MSY stock size while reducing harvest as biomass levels approach overfished levels. The primary focus is on biomass, rather than catch, because most CPS (Pacific sardine, northern anchovy, and market squid) are very important in the ecosystem for forage.

~~MSY~~ Harvest control rules in the CPS fishery may vary depending on the nature of the fishery, management goals, assessment and monitoring capabilities, and available information. Under the framework management approach used for CPS, it is not necessary to amend the CPS FMP in order to develop or modify ~~MSY~~ harvest control rules or definitions of overfishing.

The use of an ~~MSY~~ harvest control rule for Actively managed stocks is to provide managers with a tool for setting and adjusting harvest levels on a periodic basis while preventing overfishing and overfished stock conditions. All Actively managed stocks must have stock-specific ~~MSY~~ harvest control rules, a definition of overfishing and a definition of an overfished stock.

The main use of an ~~MSY~~ harvest control rule for a Monitored stock is to help gauge the need for Active management. ~~MSY~~ harvest control rules and harvest policies for Monitored CPS stocks may be more generic and simple than those for Actively managed stocks with significant fisheries. Any stock supporting catches approaching the ABC or MSY levels should be Actively managed unless there is too little information available or other practical problems.

4.6.1 Default CPS MSY Control Rule

The Council may use the default ~~MSY~~ harvest control rule, defined below, for Monitored species unless a better species-specific rule is available. The default ~~MSY~~ harvest control rule can be modified under framework management procedures.

The default ~~MSY~~ harvest control rule (intended primarily for stocks that are Monitored) sets ABC for the entire stock (U.S., Mexico, Canada, and international fisheries) equal to 25% of the best estimate of the MSY catch level. Overfishing occurs whenever the total catch (U.S., Mexico, Canada, and international fisheries) exceeds ABC or whenever fishing occurs at a rate that is high enough to jeopardize the capacity of the stock to produce MSY. Overfishing of a Monitored CPS stock is "approached" whenever projections or estimates indicate that the overfishing will occur within two years.

In making decisions about Active management, Council may choose to consider ABC and catches in U.S. waters only. ABC in U.S. waters is the ABC for the entire stock prorated by an estimate of the fraction of the stock in U.S. waters. Active management may not be effective if U.S. catches are small and overfishing is occurring in Mexico, Canada, or in international waters outside the jurisdiction of federal authorities.

General MSY Control Rule for Actively Managed Species

The general form of the ~~MSY~~ harvest control rule utilized for the California CPS fisheries was designed to continuously reduce the exploitation rate as biomass declines. The general formula used is :

H = (BIOMASS-CUTOFF) x FRACTION x DISTRIBUTION

H is the harvest target level, CUTOFF is the lowest level of estimated biomass at which directed harvest is allowed and FRACTION is the fraction of the biomass above CUTOFF that can be taken by the fishery. BIOMASS is generally the estimated biomass of fish age 1+ at the beginning the season. DISTRIBUTION is the average portion of biomass assumed in U.S. waters. The purpose of CUTOFF is to protect the stock when biomass is low. The purpose of FRACTION is to specify how much of the stock is available to the fishery when BIOMASS exceeds CUTOFF. It may be useful to define any of the parameters in this general ~~MSY~~ harvest control rule so that they depend on environmental conditions or stock biomass. Thus, the ~~MSY~~ harvest control rule could depend explicitly on the condition of the stock or environment.

The formula generally uses the estimated biomass for the whole stock in one year (BIOMASS) to set harvest for the whole stock in the following year (H) although projections or estimates of BIOMASS, abundance index values or other data might be used instead. BIOMASS is an estimate only, it is never assumed that BIOMASS is a perfect measure of abundance. Efforts to develop a harvest formula must consider probable levels of measurement error in BIOMASS which typically have CVs of about 50% for CPS.

The general ~~MSY~~ harvest control rule for CPS (depending on parameter values) is compatible with the Magnuson-Stevens Act and useful for CPS that are important as forage. 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 of spawning stock that is protected from fishing and available for use in rebuilding if a stock becomes overfished. The combination of a spawning biomass buffer equal to CUTOFF and reduced harvest rates at low biomass levels means that a rebuilding program for overfished stocks may be defined implicitly. Moreover, the harvest rate never increases above FRACTION. If FRACTION is approximately equal to F_{MSY}, then the ~~MSY~~ harvest control rule harvest rate will not exceed F_{MSY}. In addition to the CUTOFF and FRACTION parameters, it may be advisable to define a maximum harvest level parameter (MAXCAT) so that total harvest specified by the harvest formula never exceeds MAXCAT. MAXCAT is used to guard against extremely high catch levels due to errors in estimating biomass, to reduce year to year variation in catch levels, and to avoid overcapitalization during short periods of high biomass and high harvest. MAXCAT also prevents the catch from exceeding MSY at high stock levels and spreads the catch from strong year classes over a wider range of fishing seasons.

Annual catch limits will be set no higher than ABC and may be sector specific. Additionally, a harvest guideline or ACT may be utilized below an ACL or sector-specific ACL to account for management uncertainty, discard or bycatch mortality, or research take. These provisions will be considered on an annual basis in response to changing resource status and fishery dynamics.

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

Other general types of control rules may be useful for CPS and this FMP does not preclude their use as long as they are compatible with National Standards and the Magnuson-Stevens Act.

Transboundary Issues

Management of transboundary stocks is one of the most difficult problems in management of CPS. Ideally, transboundary CPS stocks would be managed cooperatively by the U.S., Canada, and Mexico on the basis of common policy. At present, there are no cooperative management agreements with Mexico or Canada.

In the absence of a cooperative management agreement, the default approach in the CPS FMP sets harvest levels for U.S. fisheries by prorating the total target harvest level according to the portion of the stock resident in U.S. waters or estimating the biomass in U.S. waters only. In practice, this approach is similar to managing the U.S. and Mexican portions of a stock separately since harvest for the U.S. fishery in a given year depends ultimately on the biomass in U.S. waters.

Other approaches that may be developed in the future are not precluded by this default. If the portion of the stock in U.S. waters cannot be estimated or is highly variable, then other approaches may be used. It may be more practical, for example, to use of a high CUTOFF in the ~~MSY~~ harvest control rule to compensate for stock biomass off Mexico or Canada.

4.6.2 ~~MSY~~ Harvest Control Rule for Pacific Sardine

The ~~MSY~~ Harvest Control Rule for Pacific sardine sets ABC for the entire sardine stock based on an estimate of biomass for the whole sardine stock, a CUTOFF equal to 150,000 mt, a FRACTION between five percent and 15% (depending on oceanographic conditions as described below)), a U.S. DISTRIBUTION of 87%, and MAXCAT of 200,000 mt. The U.S. ABC is calculated from the target harvest for the whole stock by prorating the total ABC based on proportion of total biomass in U.S. waters.

FRACTION in the ~~MSY~~ harvest control rule for Pacific sardine is a proxy for F_{MSY} (i.e., the fishing mortality rate for deterministic equilibrium MSY). FRACTION depends on recent ocean temperatures because F_{MSY} and productivity of the sardine stock is higher under ocean conditions associated with warm water temperatures (Appendix B, Section 4.2.3.4). An estimate of the relationship between F_{MSY} for sardine and ocean temperatures is:

$$F_{MSY} = 0.248649805\ T^2 - 8.190043975\ T + 67.4558326$$

where T is the average three season sea surface temperature at Scripps Pier, California during the three preceding seasons. The ~~MSY~~ harvest control rule for sardine sets the control rule parameter FRACTION equal to F_{MSY} except that FRACTION is never allowed to be higher than 15% or lower than five percent.

Although F_{MSY} may be greater or lesser, FRACTION can never be greater than 15% or less than five percent unless the ~~MSY~~ harvest control rule for sardine is revised, because five percent and 15% are policy decisions taken by Council based on social, economic, and biological criteria. In contrast, relationships between FRACTION, F_{MSY} and environmental conditions are technical questions and estimates or approaches may be revised by technical teams to accommodate new ideas and data.

The temperature-dependent F_{MSY} for sardine is unique among F_{MSY} definitions for Council-managed species, to some extent, the existing sardine HCR provides OFL adjustments – particularly during warm temperature regimes.

4.6.2.1 Definition for Overfished Stock for Sardine

An overfished sardine population is one with an 1+ stock biomass on July 1 of 50,000 mt or less. No

directed fishing is allowed in any year or season while the stock is overfished. The Council is required to minimize fishing mortality on an overfished stock to the extent practicable and to undertake a rebuilding program which may be implicit to the ~~MSY~~ harvest control rule or explicit.

4.6.2.2 Live Bait Harvest Between the ~~Definition of Overfishing~~ ABC and CUTOFF

The live bait fishery which supplies live CPS to recreational and commercial fisheries ~~will~~ may be allowed to operate when estimated biomass falls below the CUTOFF~~, which is currently set at 150,000 mt (~~and other directed fishing is precluded~~)~~ but is still above the definition of an overfished stock and live bait harvest is not expected to exceed the ACL or ABC.~~., currently set at 50,000 mt~~. This does not prevent the Council from undertaking any measure authorized under this FMP, including a sector-specific ACL, that may be necessary to manage the live bait fishery and sardine stock. The live bait fishery could, for example, be managed by harvest guideline or quota, season, or gear restrictions at any point under the framework management process.

4.6.3 ~~Maximum Sustainable Yield~~ Harvest Control Rule for Pacific (Chub) Mackerel

The ~~MSY~~ harvest control rule for Pacific mackerel sets the CUTOFF and the definition of an overfished stock at 18,200 mt, FRACTION at 30%, and a U.S. DISTRIBUTION of 70%. Overfishing is defined as any fishing in excess of ABC calculated using the MSY control rule. No MAXCAT is defined because the U.S. fishery appears to be limited to about 40,000 mt per year by markets. The target harvest level is defined for the entire stock in Mexico, Canada, and U.S. waters (not just the U.S. portion), and the U.S. target harvest level is prorated based on relative abundance in U.S. waters.

4.6.4 Monitored Stocks

Northern anchovy (northern and central subpopulations), jack mackerel and market squid will be monitored at the outset of the CPS FMP. The default MSY control rule and overfishing specifications will be used for Monitored stocks.

4.6.4.1 Northern Anchovy-Central Subpopulation

The central subpopulation of northern anchovy ranges from approximately San Francisco, California, to Punta Baja, Mexico. The default MSY control rule gives an ABC of 25% of the total biomass estimate. The resulting ABC would then be prorated by the DISTRIBUTION of the stock in U.S. waters (82%) to arrive at ABC in U.S. waters.

4.6.4.2 Northern Anchovy-Northern Subpopulation

The northern subpopulation of anchovy ranges from San Francisco north to British Columbia with a major spawning center off Oregon and Washington that is associated with the Columbia River plume. The northern subpopulation supports small but locally important bait fisheries and is likely an important source of forage to local predators, including depleted and endangered salmonid stocks.

The recommended default MSY control rule gives an ABC for the entire stock equal to 25% of MSY catch but MSY catch has not been estimated. The portion of the northern subpopulation of northern anchovy resident in U.S. waters is unknown. It is likely that some biomass occurs in Canadian waters off British Columbia. ABC in U.S. waters cannot be calculated at this time.

4.6.4.3 Jack Mackerel

The ABC level for jack mackerel is calculated by age/area from mid-range potential yield values. ABC in

U.S. waters will be prorated according to the DISTRIBUTION of the stock in US waters (65%). If jack mackerel catches increase and become significant, managers may decide to address management of different age groups and areas independently. This question does not need to be addressed at this time because catches are low (generally less than 2,000 mt per year since 1990).

4.6.4.4 Market Squid

The MSY Control Rule for market squid is founded generally on conventional spawning biomass Aper recruit@ model theory. Specifically, the MSY Control Rule for market squid is based on evaluating (throughout a fishing season) levels of egg escapement associated with the exploited population. The estimates of egg escapement are evaluated in the context of a Athreshold@ that is believed to represent a minimum level that is considered necessary to allow the population to maintain its level of abundance into the future (i.e., allow for Asustainable@ reproduction year after year). In practical terms, the Egg Escapement approach can be used to evaluate the effects of fishing mortality (*F*) on the spawning potential of the stock and in particular, to examine the relation between the stock=s reproductive output and candidate proxies for the fishing mortality that results in MSY (F_{MSY}).

The fishing mortality (F_{MSY}) that results in a threshold level of egg escapement of at least 30% will be used initially as a proxy for MSY. However, it is important to note that the level of egg escapement will be reviewed on an intermittent basis as new information becomes available concerning the dynamics of the stock and fishery, to ensure that the proposed threshold meets its objective as a long-term, sustainable biological reference point for this marine resource. This is not a trivial exercise, given the need for ongoing research regarding the biology of this species, which may result in revised recommendations in the future. Ultimately, the market squid fishery can operate freely, within the constraints of currently adopted regulations as dictated by the CDFG (e.g., annual landings cap, weekend closures, closed areas) and NMFS, as long as egg escapement is equal to, or greater than, the threshold valueCassessments will be conducted on a yearly basis for the first two years (2002-04) and on a multi-year basis beginning in 2005. In the event that egg escapement is determined to be below the 30% threshold for two successive years, then a point-of-concern would be triggered under the FMP=s management framework and the Council could consider moving market squid from Monitored to Active management status. Current state regulations for squid are not anticipated to change in the near future, however, should existing laws limiting effort or harvest be rescinded, further management actions by the Council could also be considered.

As noted, the Council and state authorities will continue to monitor squid landings. If landings increase or a biological risk to the stock develops, the Council can be expected to promote squid to Active management quickly under the "point-of-concern" framework management procedures (Section 2.1.2).

4.6.5 Prohibited Harvest Species

Prohibited Harvest management includes all species of krill occurring in the West Coast EEZ and is intended to ensure that, to the extent practicable, fisheries will not develop that could put at risk krill stocks and the other living marine resources that depend on krill. This means that optimum yield (OY) for krill is zero, and the target, harvest and transhipment of krill is prohibited. Also, exempted fishing permits (EFPs) will not be issued under the EFP procedures of this FMP to allow individuals to harvest krill as an exception to the prohibition of harvest. These actions would fully achieve the objectives of the amendment to the extent practicable, but would not account for environmental conditions and the responses of krill and other resources to changes in environmental conditions. This management category recognizes that *de minimis* or trace amounts of krill may be retained by fishermen while targeting other species; such inadvertent action is not intended to be the subject of this prohibition.

4.7 Stock Assessment and Fishery Evaluation Report

The Coastal Pelagic Species Management Team (CPSMT) will prepare an annual Stock Assessment and Fishery Evaluation (SAFE) report describing the status of the CPS fishery. The SAFE report provides information to the Councils for determining annual harvest levels for each stock, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, and assessing the relative success of existing state and Federal fishery management programs. This includes landings, prices, revenues, and economic, biological or environmental conditions not covered elsewhere in assessments for Actively managed species. In particular, the SAFE report shall include:

1. Current status of CPS resources.
2. A description of the maximum fishing mortality threshold and the minimum stock size threshold for each stock or stock complex, along with information by which the Council may determine:
   (a) Whether overfishing is occurring with respect to any stock or stock complex, whether any stock or stock complex is overfished, whether the rate or level of fishing mortality applied to any stock or stock complex is approaching the maximum fishing mortality threshold, and whether the size of any stock or stock complex is approaching the minimum stock size threshold.
   (b) Any management measures necessary to provide for rebuilding an overfished stock or stock complex (if any) to a level consistent with producing the MSY in such fishery.
3. The total and U.S. target levels, if calculated, along with all available information about bycatch, domestic annual harvest (DAH), domestic annual processing (DAP), joint venture processing (JVP), and total allowable level of foreign fishing (TALFF) used to specify harvest guidelines or quotas.
4. Recent and historical catch statistics (landings and value).
5. Recommendations for use of harvest guideline or quotas by species.
6. A brief history of the harvesting sector for the fishery.
7. A brief history of CPS management.
8. A summary of recent economic conditions, including information such as status of fleet capacity**,** number of vessels and performance by gear type, including recreational and commercial fishing interests, fishing communities, and fish processing interests.
9. Safety considerations.
10. Ecosystem information.
11. Bycatch summary.
12. Any necessary expansions to previous environmental and regulatory impact documents, and ecosystem and habitat descriptions.
13. Other relevant biological, sociological, economic, and ecological information that may be useful to the Council.

The Council will make SAFE reports available to the public by such means as mailing lists and newsletters and will provide copies on request.

Monitored Species

The annual SAFE report prepared by the CPSMT will include all available information that may be used to determine if a point-of-concern exists (e.g., overfishing) or if a stock should be considered for Active management or for Monitored management. At a minimum, the report should contain landings= data for Monitored stocks and any available information about trends in abundance.

4.8 Annual Specifications and Announcement of Harvest Levels

Each year, the Secretary will publish in the *Federal Register* the final specifications for all CPS Actively managed by the Council. The total U.S. harvest will be allocated to the various fisheries as annual catch limits, annual catch targets, harvest guidelines or as quotas.

In calculating annual catch limits, annual catch targets, harvest guidelines and quotas for each species, an estimate of the incidental catch of each species caught while fishermen are targeting other species will be taken into account. Therefore, the total harvest guideline will consist of an incidental catch portion and a directed fishery portion. In general, harvest guidelines and or annual catch targets will be used to describe direct and incidental take and will set below the annual catch limit to take into account management uncertainty and additional sources of mortality such as discards, bycatch, research take, and live bait fisheries. This will be done to minimize the chances of exceeding the target harvest levels and the ACL.

If the harvest guideline or ACT for the directed fishery is reached the directed fishery will be closed by an automatic action and incidental catch will continue to be allowed under the incidental catch allowance, which is expressed in an amount of fish or a percentage of a load (Section 5.1). If the estimated incidental catch portion of the harvest guideline or ACT has been set too high, resulting in the probability of not attaining the target harvest level by the end of the fishing season, the remaining incidental catch portion may be allocated to the directed fishery through the "routine" management procedures. This reallocation of the remaining incidental catch portion of the harvest guideline to the directed fishery is not likely to be necessary unless substantial errors are discovered in calculations or estimates.

4.8.1 General Procedure for Setting Annual Specifications

The intent of the management approach under the FMP is to reassess the status of each Actively managed species at frequent intervals and preferably every year (although a full analytic stock assessment may not be necessary or possible in some cases). The general procedure for making the annual specifications for CPS is as follows:

1. The CPSMT will produce a SAFE report as specified in Section 4.7, that documents the current estimates of biomass for each coastal pelagic species assessed and status of the fishery. In the report, the CPSMT will recommend either harvest guidelines or quotas for Actively managed species, including a directed portion and an incidental portion, an initial incidental catch allowance to be used when harvest guidelines are reached together with an estimate of total incidental catch, and will make all calculations of the specifications as required by this FMP.
2. Documents will be sent to the NMFS Regional Administrator, Southwest Region, the Council, members of the Council=s Scientific and Statistical Committee (SSC), members of the Coastal Pelagic Species Advisory Subpanel (CPSAS), and all interested parties for review.
3. A public meeting or meetings will be announced in the *Federal Register* and held with the CPSMT and the CPSAS to discuss the proposed annual specifications and to obtain public comments.
4. At its first opportunity, the Council will review all information compiled for the annual specifications, consult with its SSC, CPSMT, CPSAS, and hear public comments. The Council also will review any important social and economic information at that time, then make a recommendation to the NMFS Regional Administrator on the final specifications, including OFL, ABC, OY levels, annual catch limits, annual catch targets, harvest guidelines, quotas, allocations, and other management measures for the fishing season.
5. Following the Council meeting, the NMFS Regional Administrator will consider all comments and make a determination of the final specifications. This determination will be published in the *Federal Register* with a request for additional public comment.
6. Alternate Procedure: If assessment and season schedules warrant, the NMFS Regional Administrator may make preliminary ~~OY, harvest guideline, and/or quota specifications~~ harvest specifications quickly (without prior discussion at a Council meeting) to allow fishing to begin without delay. As soon as practicable, the Council will review all background documents contributing to the determination of the biomass estimates and make a final recommendation for the resulting target harvest level, harvest guidelines and quotas. Following the meeting of the Council, the NMFS Regional Administrator will consider all comments and make a determination of whether any changes

in the final specifications are necessary. If such changes are warranted, they will be published in the *Federal Register*.

If assembling the data and producing a report would require enough time that permitting a complete public review before the beginning of the fishing season could reduce the season, then this alternate procedure should be used.

7. NMFS will monitor the fishery throughout the year, tracking incidental catch, annual catch targets, and harvest guidelines and quotas. If a harvest guideline or quota for any species is or is likely to be reached prematurely, a "point of concern" will occur, triggering a mandatory review of the status of the stock. If the directed harvest portion of an ACT, harvest guideline, or quota is reached, then directed fishing will be prohibited and the prespecified incidental trip limit will be imposed as an automatic action through publication of a notice in the *Federal Register*.

The NMFS Regional Administrator would be responsible for setting the harvest guidelines based on the estimated biomass and the standards set in the FMP. This is the same process that has been used in the northern anchovy fishery and would be adapted for Actively managed CPS. The formulas used to set harvest guidelines for CPS are straightforward and provide little latitude for judgment, therefore, there is less discretion involved in setting annual specifications for CPS than for other fisheries.

Harvest guidelines for CPS are based on the current biomass estimate multiplied by a fixed harvest rate. The portion of the resource in U.S. waters may change over time, but in any one year is the best estimate available. The amount of the harvest guideline needed for incidental trip limits when the fishery is nearing closure will vary depending on when the harvest guideline is projected to be achieved, but the incidental amount and the amount harvested directly must equal the total harvest guideline.

Following the determination of the estimated biomass, a public meeting would be held between the CPSMT and CPSAS. The biomass estimate and resultant harvest guideline would be reviewed, public comments obtained, and all information forwarded to the Council. At its meeting, the Council, after hearing public comments, would either adopt the annual specifications or recommend changes, accompanied by a justification for why the change should be made.

The intention of the proposed regulations is to have public review of and a Council recommendation on the estimated biomass and harvest guidelines before the fishing season begins; however, the NMFS Regional Administrator is not precluded from announcing the harvest guidelines in the *Federal Register* before the process is completed so that fishermen can plan their activities and begin harvesting when the fishing season begins.

4.8.2 Factors Considered

The following factors will be considered when making the annual specifications:

1. The current estimated biomass and any other biological information.
2. The ~~MSY~~ harvest control rule described in the FMP, which is specific for each Actively managed species.
3. Results of comments of domestic processors and joint venture operations about processing capacity and planned utilization.
4. Results of an analysis of the fishing capacity and planned utilization of recent years modified by new information and comments by the fishing industry relating to intended use.
5. Information on the status of the ecosystem, predator-prey interactions, or oceanographic conditions that may warrant additional ecological considerations.

6. Any relevant historical information on the utilization of CPS resources.

All data used to make annual specifications will be available for public inspection during normal business hours at the Southwest Regional Office of NMFS.

4.8.3 Guidelines for Choosing Between a Harvest Guideline and Quota

Quotas are specified numerical harvest objectives, the attainment of which results in automatic closure of the fishery for that species. Retention, possession, and landing of a species after attainment of its quota is prohibited. A quota is a single numerical value, not a range.

Harvest guidelines and annual catch targets are specified numerical harvest objectives that differ from quotas in that closure of a fishery (i.e., prohibition of retention, possession, and landing) is not automatically required upon attainment of the objective. A harvest guideline may be either a range or a point estimate.

The preferred approach for managing domestic coastal pelagic resources is by harvest guideline. Foreign fisheries will normally be managed by quotas. Harvest guidelines are used for the domestic fishery because bycatch of one coastal pelagic species is common when fishing for another, and curtailing the harvest of one species may limit the harvest of another and prevent achieving target harvest levels.

Harvest guidelines and ACTs will be used as long as the following conditions are met:

1. Allowing an imprecise cap on total harvest will still ensure long term productivity of the resource and the economic well-being of the fishery and dependent species and is unlikely to exceed and ACL.
2. Unavoidable bycatch would occur after a quota was reached and further landings prohibited, curtailing the harvest of other resources or creating discards.
3. Fishing in excess of a harvest guideline or ACT is not expected to significantly affect future yields or exceed an ACL.
4. Overfishing is not likely to occur.

Generally, a quota will not be used for domestic fisheries unless extra protection of an individual species becomes important. Foreign fishing allocations (TALFFs) will generally be quotas. Quotas should be used for domestic fisheries when:

1. A high degree of protection of one species is needed to ensure the future well-being of the fishery or dependent species.
2. Permitting bycatch after a harvest guideline is reached cannot be accepted if the objectives of the FMP are to be met.
3. Fishing in excess of a harvest guideline would significantly affect future yields or exceed an ACL.
4. Overfishing may occur and is less likely under quota management.

The choice of a numerical specification of a harvest guideline, ACT, or quota is based on a balance of its social, economic, biological, and ecological effects as stated above.

4.9 Annual Assessment and Management Cycles

This FMP specifies that annual schedules for Actively managed CPS be developed based on the Council's workload and meeting schedule, opportunity for industry and technical review of biomass estimates and harvest guidelines or quotas, seasonal patterns in the fishery, collection and processing of CalCOFI data during the peak spawning season, collection of other data, time required for notification of fishers, and workload of the CPSMT and CPSAS. The FMP does not specify what those schedules will be, since they

will be implemented through regulations.

The annual assessment and management cycles determine the start and close date (season) for each Actively managed fishery. These may be changed by abbreviated rulemaking as described in Section 2.1.

5.0 BYCATCH, INCIDENTAL CATCH, AND ALLOCATION

This fishery management plan (FMP) establishes incidental catch allowances for coastal pelagic species (CPS) and an allocation formula for Pacific sardine.

5.1 Incidental Catch Allowances

"Bycatch" is defined in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as Afish which are harvested in a fishery, but not sold or kept for personal use and includes economic discards and regulatory discards@. In the CPS fisheries, fish are caught and sold incidental to catching other species, because they sometimes school together. Incidental catch allowances permit fishermen to land a certain percentage of fish that would otherwise be considered bycatch. Incidental catch allowances can be expressed as an amount or percentage of catch, landings, or deliveries.

Incidental catch allowances will be set by the Council, based on recommendation from the Coastal Pelagic Species Management Team (CPSMT), and consistent with Sections 5.1.1 through 5.1.6 of this FMP. Estimates of total incidental catch expected under the incidental catch allowances will be factored into harvest guidelines and quota recommendations. As described in Section 4.8, estimates of total incidental catch will normally be combined with the directed fishery harvest guideline to arrive at a total optimum yield (OY). The purpose of this adjustment is to ensure that overfishing does not occur due to incidental catch.

Incidental catch allowances are the primary method for managing bycatch in the CPS fishery. Other management approaches, such as fishing seasons or area restrictions, might also be required to reduce bycatch or incidental catch. The incidental catch allowances described here do not exclude the possibility of trip limits or other regulations imposed to reduce bycatch, prolong the directed fishery, or for other purposes.

5.1.1 Incidental Catch Allowances When Stocks are Overfished

When a stock is overfished according to the definition of overfishing in this FMP, incidental catch allowances for commercial fishing shall be set at zero percent to 20% of landed weight, as recommended by the Council.

5.1.2 Incidental Catch Allowances When Stocks are Not Overfished

When a stock is not overfished according to the definition of overfishing in the FMP, incidental catch allowances for commercial fishing shall be set at zero percent to 45% of landed weight, as recommended by the Council.

5.1.3 Pacific (chub) Mackerel Landed Incidentally

When the Pacific (chub) mackerel resource is not overfished, and total landings for the directed fishery established under a harvest guideline have been caught, the Council may set an allowable incidental trip limit of one mt or lower.

5.1.4 Incidental Catch Allowances for Live Bait When Stocks are Overfished

When a stock is overfished according to the definition of overfishing in the FMP, incidental catch allowances for live bait fishing shall be set to no more than 15% of landed weight, as determined by the Council.

5.1.5 Incidental Catch Allowances for Live Bait When Stocks are Not Overfished

When a stock is not overfished according to the definition of overfishing in the FMP and an ACL is not anticipated to be exceeded, no restrictions are placed on live bait harvest.

5.1.6 Guidelines and Criteria For Setting Incidental Catch Allowances

In setting incidental catch allowances, Council will consider existing regulations, goals and objectives of this FMP, best available data, scientific and management advice available, guidelines given below, and other policies established by the Council. If decision by the by the NMFS Regional Administrator about incidental catch allowances is necessary due to time constraints, it will be made based on consultation with the Council Chair, Director of the California Department of Fish and Game, CPSMT, CPSAS, other representatives appointed by the Council, and interested parties as appropriate.

5.1.6.1 Overfished Stocks

In order of priority, the Council=s goals in setting incidental catch allowances for overfished stocks should be to (1) minimize fishing mortality on overfished stocks, and (2) minimize discards of overfished stocks. Incidental catch allowances for overfished stocks should approximate rates of incidental catch when fishing is conducted in a manner that minimizes catch of the overfished stock.

The Council must set incidental catch allowances for all overfished stocks. Once set, incidental catch allowances for overfished stocks remain in force until they are changed. Incidental catch allowances for overfished stocks can be revised during the fishing season if conditions warrant or new information becomes available.

5.1.6.2 Stocks Not Overfished

Incidental catch allowances for stocks that are not overfished are enforced once a the directed fishery harvest guideline has been reached, and the directed fishery has been closed. Goals in setting incidental catch allowances for stocks that are not overfished should be to (1) avoid unnecessary discard, (2) ensure that optimum yield is taken, but not exceeded, and (3) promote efficiency and profitability in the fishery. Estimates of total incidental catch (based on past or current incidental catch rates, incidental catch allowances, harvest guidelines and other conditions in the fishery) are normally considered when harvest guidelines are set. Thus, incidental catch allowances should be set at the same time and in concert with harvest guidelines.

Incidental catch allowances are meant to accommodate catches that are difficult to avoid during normal fishing directed at other species. Therefore, incidental catch allowances should be set at levels that approximate incidental catch rates during normal fishing activities.

5.2 Seasonal Allocation for the Directed Pacific Sardine Fishery

The non-tribal share of the Pacific sardine HG is allocated coastwide on a seasonal basis as follows:

1. 35 percent of the HG to be allocated coastwide on January 1.
2. 40 percent of the HG, plus any portion not harvested from the initial allocation, to be reallocated coastwide on July 1.
3. On September 15 the remaining 25 percent of the HG, plus any portion not harvested from earlier allocations, to be reallocated coastwide.

AMENDMENT 13 TO THE COASTAL PELAGIC SPECIES FISHERY MANAGEMENT PLAN - PARTIAL DRAFT ENVIRONMENTAL ASSESSMENT

ERRATA

An inadvertant error occurred when plotting Figure 4.3.1-4b on page 31 of Agenda Item F.2.a, Attachement 1. Please disregard the figure in the original document in favor of the version below.

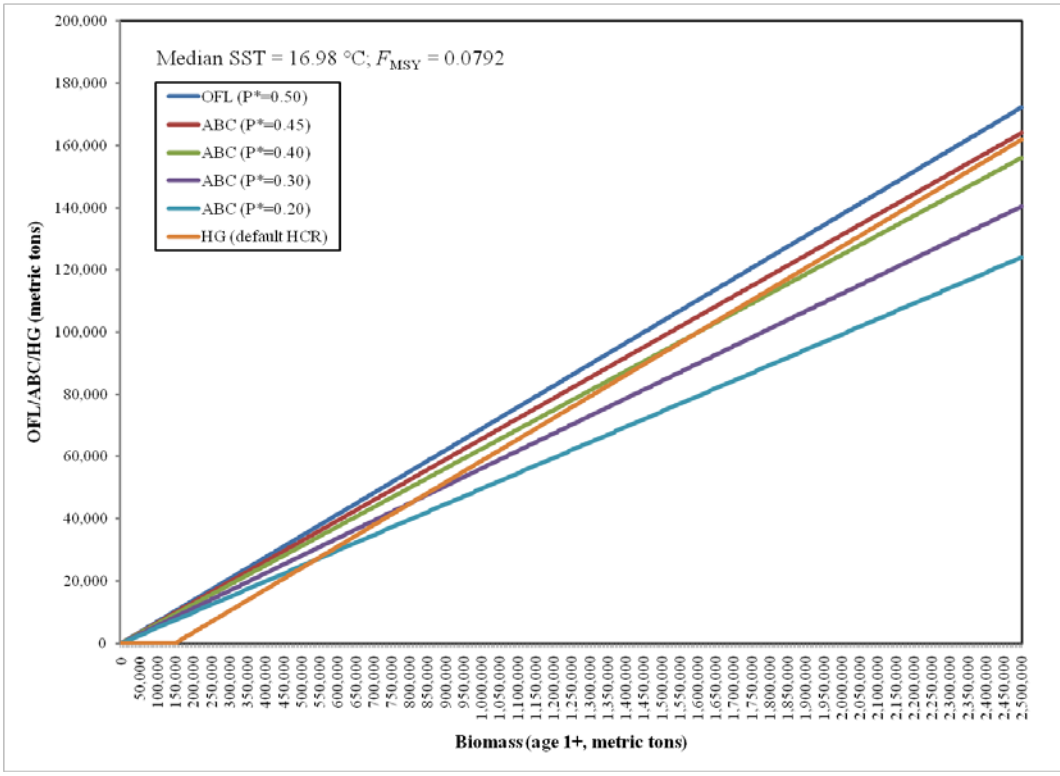

Figure 4.3.1-4b. Relationship between biomass and catch (OFL, ABC, HG) for the median of SSTs observed from 1916 to 1997. ACL would be equal to ABC or HG, whichever value is less.

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON FISHERY MANAGEMENT PLAN AMENDMENT 13, ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

The Coastal Pelagic Species Advisory Subpanel (CPSAS) heard a presentation from Mr. Mike Burner and Dr. Kevin Hill on Amendment 13 to the Coastal Pelagic Species (CPS) Fishery Management Plan (FMP): Measures for Integrating New Provisions of the Magnuson-Stevens Fishery Conservation and Management Act and National Standard 1 Guidelines into Coastal Pelagic Species Management.

The Subpanel engaged in extensive internal discussions with the Coastal Pelagic Species Management Team (CPSMT) regarding technical aspects and implications of various options. Dr. Kevin Hill provided an explanation for the proposed P* policy alternative.

The CPSAS recommends the following:

2.1 Summary Stock Classifications

A majority of the CPSAS supports Alternative 1 - all species currently listed in the FMP are "in the fishery," including krill, which is currently listed in the prohibited harvest category.

Regarding the addition of forage species not currently in the CPS FMP, the CPSAS points out that bycatch of species not already in the FMP is low. Further, incidental catches and interactions of non-target stocks are documented annually in the Stock Assessment Fishery Evaluation document.

To avoid applying a piecemeal approach to individual FMPs, and the resultant duplication of effort and cost, a majority of the CPSAS believes the Ecosystem FMP is the appropriate place to include forage species. The CPSAS encourages the Council to move forward expeditiously with development of the E-FMP, and agrees these forage species should be monitored to inform and improve ecosystem-based management.

The conservation representative on the CPSAS supports Alternative 3: adding additional forage species to the CPS FMP as ecosystem component species. In doing so, he urges the Council to recognize the ecosystem services these species provide, and the desire to develop management measures that protect these forage species. He notes further that while the Pacific Council may take up the issue of forage species management in the E-FMP, the purpose and scope of that analysis is still undecided.

2.2.1 Status Determination Criteria Alternatives

A majority of the CPSAS concurs with the CPSMT recommendation to support Alternative 2, maintain existing Stock Determination Criteria (SDCs) and develop a maximum sustainable yield (MSY) proxy for the northern subpopulation of Northern anchovy.

The conservation representative voiced concern that Table 3.2.1, CPS FMP specifications for SDCs, is incomplete. He does not support either alternative for SDCs, as neither approach meets the requirements in National Standard I, or the guidelines for how to calculate minimum stock size threshold (MSST). For example, the analysis should include an alternative for setting MSST at 1/2 Bmsy for the central population of northern anchovy and Pacific mackerel; and MSST proxy values for the northern subpopulation of Northern anchovy, market squid and jack mackerel.

2.3 Overfishing Levels, Acceptable Biological Catch, and Annual Catch Limits for actively managed stocks

The CPSAS reiterates the critical importance of more comprehensive research to understand the full extent of both the Pacific sardine and Pacific mackerel populations. We thank the Council for continuing to support the industry-sponsored surveys. We vigorously encourage the National Marine Fisheries Service to increase funding for Pacific sardine and mackerel cooperative research, as well as other CPS species.

If the Council chooses Alternative 3 for actively managed stocks as a preferred alternative, the potential for further, significant restrictions on fisheries is a strong likelihood unless scientific uncertainties are adequately addressed. The only way to reduce uncertainty is to do the research. The CPSAS could endorse Alterative 3 as a better management tool if the scientific research is developed to reduce uncertainty.

2.3.2 Monitored Species

The majority of the CPSAS supports Alternative 1 - would maintain the default harvest control rules as modified, in light of the low harvest levels on CPS finfish.

The CPSAS concurs with the statement in the Draft Environmental Assessment: "Market squid are also a monitored species under the CPS FMP, but the current MSY proxy for market squid is completely different from the finfish species, and uses an egg escapement method" [Agenda Item F.2a, Attachment 1, at Section 4.3.2.1].

2.3.3 Sector-specific Annual Catch Limits (ACLs)

The CPSAS acknowledges the importance of the live bait fishery and supports an outcome that preserves optimum fishing opportunity. In that regard, the CPSAS supports Alternative 4, adding sector-specific ACLs to the FMP framework as a management tool and assessing their applicability on an annual basis. Regarding a sector-specific ACL for exempted fishing permit research, the CPSAS believes this would be applied as needed.

2.4.4 Summary of ACT and Accountability Measures Alternatives

The CPSAS recommends that the CPS FMP supports Alternative 2 – Develop ACTs only for actively managed stocks. Under this option, the CPSAS agrees that setting aside a portion of the Pacific mackerel and Pacific sardine ACTs for incidental harvest in other CPS fisheries should be continued as is done currently.

PFMC
06/15/10

COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON FISHERY MANAGEMENT PLAN (FMP) AMENDMENT 13 – ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

The Coastal Pelagic Species Management Team (CPSMT) met June 13-14, 2010 to review Amendment 13 for the CPS Fishery Management Plan (FMP) and to discuss this topic with the Coastal Pelagic Species Advisory Subpanel (CPSAS). The CPSMT reviewed Agenda Item F.2.a, Attachment 1. Representatives of the CPSMT also met with the Scientific and Statistical Committee (SSC) on June 12, 2010 and presented the analyses related to Amendment 13 and scientific uncertainty buffers.

All alternatives are listed below. **The CPSMT recommends the alternative that is in bold type for each decision. The complete list of CPSMT recommended alternatives is compiled in Table 1.**

STOCK CLASSIFICATION CONSIDERATIONS

Alternative 1, **All species currently in the CPS FMP, including krill are included "in the fishery" in their existing category and no EC species are established.**

- Rationale: The CPSMT examined the criteria for designating ecosystem component (EC) species specified in the National Standard 1 (NS1) guidelines § 600.310 d.5.(i-iii) and does not believe designation of EC species under the CPS FMP is necessary at this time. The CPSMT analysis found that:
  1. Incidental catch and bycatch in CPS fisheries is dominated by other CPS and bycatch/incidental catch of non-CPS is extremely low.
  2. Monitoring incidental catch and bycatch already occurs in CPS fisheries through sampling and logbook programs, and this information will continue to be reported in the Stock Assessment and Fishery Evaluation (SAFE). Therefore adding EC species for the purposes of 'data collection' is not necessary.
  3. Krill are currently "in the fishery" as a prohibited species in the CPS FMP. Current management for krill is the best mechanism to maintain prohibited status.
  4. If the Council identifies a need to monitor forage species, the CPSMT suggests that the Council's developing Ecosystem FMP may be a more appropriate framework for monitoring and evaluating forage and predator species and their respective roles in the management of all Council-managed fisheries.

Alternative 2, Preliminary Preferred Alternative – 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.

Alternative 3, Add additional forage and/or bycatch species to the CPS FMP as EC species. (This alternative can be eliminated or coupled with Alternative 1 or 2 above).

STATUS DETERMINATION CRITERIA (SDC) CONSIDERATIONS

Alternative 1, No Action Alternative – Maintain existing SDCs for CPS FMP stocks.

***Alternative 2,* Preliminary Preferred Alternative – Maintain existing SDCs for CPS FMP stocks and develop an MSY proxy for the Northern subpopulation of Northern anchovy**.

- Rationale: CPSMT notes that there is no new information at this time to warrant a change to the current SDCs. When additional science becomes available, then updates to the SDCs may occur through the annual specification process.
  Regarding the northern subpopulation of northern anchovy, the CPSMT is working on a stock specific maximum sustainable yield (MSY) proxy, which will be based on available data on biomass estimates, catch, and stock productivity. The MSY proxy for the northern subpopulation of northern anchovy will be presented at the November Council meeting in time for the annual specification cycle and implementation of ACLs for the 2011 fishing year.

ACTIVELY MANAGED SPECIES

Alternative 1, No Action Alternative – Maintain the existing harvest control rules to specify the new management reference points.

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

Alternative 2, Modify existing harvest policy to specify the new management reference points with no additional buffering for scientific uncertainty.

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

***Alternative 3,* Scientific Uncertainty Buffer – Modify the existing harvest control rules to include a buffer or reduction in ABC relative to OFL to account for scientific uncertainty.**

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

- Rationale: The CPSMT has completed extensive analyses for these alternatives. Our preferred alternative is consistent with: 1) guidance from the SSC, and 2) the Magnuson-Stevens Act (MSA) guidelines.
  The current Harvest Control Rule has both scientific uncertainty and Optimum Yield (OY) considerations built into it and the CPSMT recommends that it be utilized when possible. However, the results of analyses conducted indicate that there are some conditions where P* will have an impact on the annual catch limit for Pacific sardine and Pacific mackerel to ensure that the chance of overfishing meets the NS1 specification.

MONITORED FINFISH AND SQUID SPECIES

Alternative 1, **Preliminary Preferred Alternative – 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.

- Rationale: The CPSMT agrees with the SSC recommendation that Alternative 1 should be regarded as ABC = OFL * Buffer, with Buffer = 0.25 serving as the best current value for scientific uncertainty. This value may be updated as additional analyses become available. Annual catch limits (ACLs) are not needed for market squid because of their short lifespan, < 1yr.

Alternative 2 – Scientific Uncertainty Buffer - Modify the existing harvest control rules to include a buffer or reduction in acceptable biological catch (ABC) relative to overfishing limits (OFL) to account for scientific uncertainty. This reduction would be in addition to the precautions built into the default control rule. In practice either a BUFFER recommended by the 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.

SECTOR-SPECIFIC ACLs

Alternative 1, No Action Alternative – No sector-specific ACLs.
Alternative 2, Assign a sector-specific ACL to exempted fishing permit (EFP) research activities.
Alternative 3, Assign a sector-specific ACL for the live bait fishery.
Alternative 4, **Preferred Alternative – Add sector-specific ACLs to the FMP framework as a management tool and assess their applicability on an annual basis.**

- Rationale: This alternative would provide the Council with maximum flexibility to consider sector-specific ACLs on an annual basis.

ACT AND AM ALTERNATIVES

Alternative 1, No Action Alternative – No annual catch targets (ACTs) and accountability measures (AMs).
Alternative 2, Develop ACTs and AMs only for actively managed stocks.
Alternative 3, **Preferred Alternative – Develop ACTs and AMs for actively managed and monitored stocks, as needed.**

- Rationale: The rationale for recommending this alternative is the same as for Sector-Specific ACLs, to allow the Council with maximum flexibility on an annual basis. The intent of both these alternatives is to prevent overfishing regardless of the mechanism(s) chosen (sector-specific ACL, AMs, or ACTs, or a combination thereof).

Table 1. Summary of CPSMT Recommended Alternatives

Topic	Alternative	Description
Stock Classification	1	CPS species and krill remain in the fishery; no EC species
Status Determination Criteria	2	Maintain existing SDCs for CPS FMP stocks and develop an MSY proxy for the Northern subpopulation of Northern anchovy.
Actively Managed Species	3	Modify the existing harvest control rules to include a buffer or reduction in ABC relative to OFL to account for scientific uncertainty.
Monitored Species	1	Maintain the default harvest control rules as modified to specify the new management reference points.
Sector-Specific ACLs	4	Add sector-specific ACLs to the FMP framework as a management tool and assess their applicability on an annual basis.
ACT and AMs	3	Develop ACTs and AMs for actively managed and monitored stocks, as needed.

PFMC
06/15/10

Agenda Item F.2.b
Supplemental HC Report
June 2010

HABITAT COMMITTEE REPORT ON FISHERY MANAGEMENT PLAN AMENDMENT 13, ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

The Habitat Committee (HC) has commented a number of times in the past on forage fish and krill management issues, especially as to their role as a prey item and as such its designation as Essential Fish Habitat (under the Groundfish Fishery Management Plan [FMP] and other FMPs) and their role in ecosystem.

The HC supports the conservative approach the Council has adopted toward Coastal Pelagic Species (CPS) management, and recommends including forage fish considerations in CPS management as well as in the Ecosystem FMP. Such a conservative approach is appropriate especially in light of climate change and ocean acidification effects on these species.

Also, the HC recommends that additional forage fish species listed in Table 4.1-1 of Agenda Item F.2.a, Attachment 1 be added to the ecosystem component species category in the CPS FMP. This will afford additional recognition of the important role that these species play in the ecosystem. Eventually these species should be included in the Ecosystem FMP being developed by the Council.

PFMC
06/11/10

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON FISHERY MANAGEMENT PLAN AMENDMENT 13, ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

Mr. Mike Burner presented an overview of the issues addressed in Draft Amendment 13 to the Coastal Pelagic Species (CPS) Fishery Management Plan (Agenda Item F.2.a, Attachment 1) with emphasis on items that the Council may want the Scientific and Statistical Committee (SSC) to address. Dr. Kevin Hill presented the CPS Management Team (CPSMT) analysis comparing the performance of current control rules for Pacific sardine and Pacific mackerel with the new National Standard 1 (NS1) benchmarks – overfishing limits (OFLs), acceptable biological catches (ABCs), annual catch limits (ACLs), and annual catch targets (ACTs) (Agenda Item F.2.a Attachment 1).

In drafting the Amendment, the CPSMT and Council Staff considered:

1. OFLs, ABCs, ACLs, and ACTs for the actively managed species (P. sardine and P. mackerel);
2. OFLs and ABCs for the monitored species;
3. possible additions to and removals from the monitored species and prohibited harvest species group; and
4. species to be categorized as Ecosystem Component Species (ECS).

With respect to (4), above, the CPSMT wrestled with the pros and cons of being all-inclusive in constructing the ECS list or limiting it to species taken in the various CPS fisheries. The CPSMT opted for the more parsimonious approach of adding species to the ECS list only if caught in substantial quantities with CPS gear. The SSC concurs with the CPSMT decision.

In March 2010, the SSC reviewed preliminary CPSMT work on OFLs and ABCs for Pacific sardine and made a number of suggestions for additional analysis that might clarify the performance of the current sardine harvest control rule (HCR) relative to the new NS1 guidelines. These additional analyses were conducted by the CPSMT and presented to the SSC at this meeting. The new work made clear how the current HCR performs compared to the application of OFL buffers designed to reflect scientific uncertainty. Based on the results, the CPSMT suggested three alternatives for the actively managed CPS. The SSC recommends that Alternative 3 as the preferred alternative as it best captures the intent of the new NS1 guidelines and is most consistent with other Council FMPs.

For the monitored species, either Alternative 1 or Alternative 2 can be used to achieve any desired ratio ABC/OFL, but Alternative 1 is conceptually simpler and more consistent with the ABC determination used in other Council FMPs. Alternative 1 should be regarded as ABC = OFL * BUFFER with BUFFER = 0.25 serving as the best current value for BUFFER. This value may be updated as additional analyses become available.

The SSC does not have specific recommendations on the draft FMP language at this time, but will work with Council staff to capture the intent of Council final action.

Finally, the SSC discussed the concept of formally including biological, ecological, economic, and social factors into the CPS FMP that could be used as optimal yield considerations in determining the appropriable ACLs for CPS. The potential factors are numerous and their relative weighting might be difficult to establish, but there may be some benefit to presenting them for Council consideration. The SSC sees some merit in formally considering such factors but suggests that the Council's newly-formed Ecosystem Plan Development Team may be in a better position to evaluate the numerous ecological and socio-economic factors that may be best incorporated into the Council's ACL considerations.

PFMC
06/14/10

Tribal Statement on Coastal Pelagic Species Fishery Management Plan Amendment 13

The Treaty Fishing right includes the ability to harvest all species of fish, including forage fish such as smelt and eulachon (U.S. v. Washington, 384 F. Supp. 312, 352). Treaty fishing rights can only be restricted when court-established standards are met to demonstrate that a conservation necessity exists. No analysis has been provided which evaluates the status of these species against these standards; therefore, the tribes cannot support restriction of their rights to take these species.

The tribes recommend that forage fish not be included in the CPS FMP and that the Council's efforts in Amendment 13 focus instead on the time-sensitive requirements of the Magnuson Stevens Act for the species presently managed under the FMP. If inclusion of forage fish in the FMP whether as managed, monitored or EC species is to be considered in the future, an analysis of the condition of each species relative to the conservation standards must be provided and each of the coastal treaty tribes must be formally consulted prior to any action being taken by the Council.

As co-managers, the tribes likewise expect to participate in any analysis on stock status, current harvest levels, or other factors that could result in future regulation of these culturally important species.

Agenda Item F.2

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

May 26, 2010

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

RE: CPS Fishery Management Plan Amendment 13--Annual Catch Limits and Accountability Measures

Dear Council Members,

The National Coalition for Marine Conservation (NCMC) is dedicated to conserving and managing marine fisheries through an ecosystem-based approach, one that considers and respects the broader food web each species is a part of. Coastal Pelagic Species, including sardine, mackerel and squid among others, are not only important to west coast-based fisheries, they are critical forage for numerous predators in the California Current ecosystem. As such, they must be managed in a manner that balances their contribution to both fisheries and predator needs.

We appreciate the Pacific Council's work in developing Amendment 13 to the Coastal Pelagic Species (CPS) Fishery Management Plan, which integrates new provisions of the Magnuson-Stevens Act National Standard 1 Guidelines into CPS management.

Our comments on the proposed alternatives in draft Amendment 13 deal specifically with those provisions of the NS1 Guidelines that require catch limits to maintain adequate forage for all components of the ecosystem[1]; stipulate that the catch specification process must explicitly address impacts of fishing on forage fish stocks and predator-prey interactions[2]; and recommend the adoption of more conservative and precautionary harvest guidelines for forage species "to enhance and protect the marine ecosystem"[3].

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[1] 50 CFR § 600.310(e)(3)(iii)(c)
[2] Id. at § 600.310(3)(iv)
[3] Id. at § 600.310(e)(3)(iv)(C)

Our recommendations are to include in the CPS FMP, through Amendment 13:

1. The addition of other forage species important to the west coast marine ecosystem for the purpose of monitoring and assessing the health of the overall forage base; and,

2. New harvest guidelines that explicitly account for the needs of the ecosystem, with emphasis on maintaining adequate forage for predators.

1. Adopt Stock Classification Alternative 3

The actively managed (and monitored) species in the CPS FMP are part of a larger California Current forage base. The NS1 objective of maintaining adequate forage for all components of the ecosystem underscores the need to consider, not only the status of the target fish, but the status of the forage base as a whole when setting catch limits for any single species. That is why we urge the Council to adopt Alternative 3 and add other important forage species not currently in the FMP as Ecosystem Component species, a designation the National Marine Fisheries Service (NMFS) included in the NS1 Guidelines to encourage the councils to take an ecosystem approach to fisheries.

There are many small pelagic species that are critical to the ecosystem as forage but which are not currently the target of commercial fisheries off the west coast. We strongly support adding these species to the CPS FMP as EC species, for the simple reason that information on the role of these species in the food web, on their population status and on trends in their status, considered within the context of gauging the health of the overall forage base, would greatly enhance CPS management and eventually lead to an ecosystem approach to managing west coast forage fisheries.

The CPS Advisory Subpanel agrees that additional forage species should be monitored to inform and improve ecosystem-based management.[4] The CPSAS, however, thinks it more appropriate to do this through the Ecosystem FMP, which is currently in the earliest stages of development. We would agree that these kinds of food web linkages and trophic level assessments should be a principal component of the council's E-FMP. However, given that this plan will be years in the making, and that management decisions regarding safe and sustainable catch levels for forage fisheries will continue to be made under the CPS FMP, we believe interim action is necessary. The inclusion of EC species in the CPS FMP is an interim measure, in that it is the first step in developing a framework for linking the monitoring and management of forage species to maintain an adequate biomass of forage in the California Current ecosystem.

[4] Supplemental CPSAS Report, March 2010.

Another interim measure we strongly recommend the council enact an explicit prohibition on the development of any new fisheries for EC species until such time as the E-FMP is adopted and regulatory measures, if appropriate, are implemented through the CPS FMP. The council has already taken similar action, for the sake of the forage base and dependent predators, to prevent the development of a commercial fishery for krill, as has the North Pacific Fishery Management Council with regard to a number of forage species including krill, sand lance and smelts.

2. Revise the Harvest Control Rules to Maintain Adequate Forage for the Ecosystem

In March, the council directed the CPS management team (CPSMT) and the Scientific and Statistical Committee (SSC) to conduct further analyses on the alternatives for overfishing levels (OFLs), acceptable biological catches (ABCs) and annual catch limits (ACLs) included in draft Amendment 13. In our testimony at the March meeting, we asked the council to more fully evaluate CPS harvest control rules for compliance with the new NS1Guidelines and to make this analysis available for public review before considering final action on Amendment 13 in June.

We had requested a review of the CPS control rules in writing a little over a year ago[5], shortly after publication of the NS1 Guidelines, noting that the current harvest control rules do not conform to the NMFS guidance because the forage needs of the ecosystem are not explicitly taken into account in the specification of OFL, ABC or ACL. The alternatives presented in draft Amendment 13 still do not specify where ecosystem needs, specifically the maintenance of a healthy forage base, are accounted for, or how. That is the analysis we've requested, and as of this writing we have yet to see it. Until an analysis of where and how the control rule alternatives address ecosystem needs is complete and available for review, it is impossible for us to support any of the proposed alternatives.

We reiterate our concerns. Alternatives employing the CUTOFF value as a buffer against scientific uncertainty and/or to address ecological issues are inherently problematic – regardless of whether CUTOFF is used in specifying the ABC (Alt. 1) or the ACL (Alt. 2) - since this value was determined as a minimum stock size threshold for rebuilding the spawning stock if the stock becomes overfished. Changing its stated purpose without re-determining its value is smoke and mirrors.

Alternative 2, which adds a buffer for scientific uncertainty in designating the ABC (with a P* value selected by the council according to its risk policy), is conceptually much better than the *status quo* (Alt. 1). However, this buffer only addresses uncertainty in the estimate of biomass. Uncertainties in the other components of the rule, including management uncertainty and ecosystem needs,

[5] NCMC Letter to the Pacific Council, May 27, 2009

are not considered. Instead, CUTOFF is used to reduce ABC to ACL addressing economic and ecological considerations (?).

Unfortunately, the revised Alt. 2 suggested by the CPSMT in March[6] only further confuses the issue. In this version, the ABC is reduced by scientific uncertainty. The ACL does not account for scientific uncertainty, but instead substitutes CUTOFF (again, posing as unspecified OY considerations). Then the council would go with whichever is lower; which is a given, since the ACL cannot exceed the ABC by statute. The rationale provided by the CPSMT as to what will determine which value will be lower, ABC or ACL, in the case of sardine and Pacific mackerel (biomass, temperature and P* policy) makes it clear that a buffer for ecological purposes does not figure into either equation.

Buffers used in the harvest control rules, no matter what they are called or where they are inserted, should specify how they address ecological needs, as the NS1 Guidelines require, and the council should state explicitly that these buffers are a set-aside for the ecosystem.

Thank you for considering our comments. We will be attending the June 9th CPS meeting and look forward to discussing this amendment further at that time.

Sincerely,

Ken Hinman

Ken Hinman
President

[6] Supplemental CPSMT Report 2, March 2010

marine fish conservation network
ACHIEVING HEALTHY OCEANS & PRODUCTIVE FISHERIES

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May 26, 2010

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

RE: F.2 Coastal Pelagic Species Fishery Management Plan Amendment 13

Dear Mr. Ortmann and Council Members:

The conservation and management of forage species in the Coastal Pelagic Species Fishery Management Plan (CPS FMP) is of great importance to the long-term sustainability of commercial and recreational fisheries and the health and biodiversity of the California Current ecosystem. Forage species like those identified in the CPS fishery and those under consideration as ecosystem component species, play a critical ecological role as prey for other commercially and recreationally important fishes like tunas and salmon, non-target fish, and the many whales, dolphins, seals, sea lions, and seabirds living and feeding in the California Current ecosystem. As the Pacific Fishery Management Council (Council) and National Marine Fisheries Service (NMFS) amend the Coastal Pelagic Species Fishery Management Plan (CPS FMP) to comply with the Magnuson Stevens Act (MSA) and the new implementing regulations in the National Standard One (NS1) guidelines, we request that you adopt approaches to protect the food web and ensure the health of the California Current ocean ecosystem and related fisheries.

We appreciate working with the Council and understand the importance of complying with the MSA and NS1 by addressing the following actions:

1. Include additional forage species as **ecosystem component species** and prohibit commercial harvest of those species unless and until the Council's Ecosystem Fishery Management Plan can address forage species conservation issues and be finalized.

2. Implement **maximum catch limits** for those species that are in the fishery, as is currently done for sardine.

3. **Account for ecosystem needs** both in the harvest control rule for determining Allowable Biological Catch and in the determination of Optimum Yield harvest levels.

4. Identify and evaluate all required **Status Determination Criteria** and **Accountability Measures** for stocks in the fishery.

5. Minimize the risk of overfishing all forage species stocks by **setting buffers** that fully and accurately account for **scientific uncertainty** in the determination of Allowable Biological Catch and **management uncertainty** in Annual Catch Limits.

It would be premature, if not illegal, to close this amendment process without addressing these forage species issues. The NS1 guidelines clearly state what Councils "must" include in the FMP because they are "requirements of the Magnuson-Stevens Act" and "logical extensions thereof"[1] and what the Councils

[1] 74 FR 11 at 3203 (January 16, 2009).

"may" do to advance single-species and ecosystem-based approaches. We believe that in either case, the guidelines provide the Council the opportunity to advance the conservation and management of sustainable fisheries and the ecological services they provide, including ecosystem health, productivity and resilience.

As we have previously mentioned, the FMP amendment process requires NMFS to follow the environmental review provisions of NEPA. In this instance, the Council made a preliminary decision on the FMP amendment in March based on an incomplete analysis that was not in form of a draft Environmental Assessment (EA) or Environmental Impact Statement (EIS). The PFMC is now scheduled to take final action on June 15, 2010, and a draft EA or EIS with a full range of alternatives and complete analyses of existing alternatives has yet to be provided to the public. We believe that more alternatives should be analyzed and therefore request that the Council not select any preferred alternatives until a draft environmental analysis can be prepared that fully informs the decisions that are to be made and allowing for meaningful public review and comment.

1. **Designate other forage species as ecosystem component species.**

We support adding forage species not currently managed under an existing FMP or "in the fishery" to the CPS FMP as Ecosystem Component (EC) species (Table 1). The NS1 guidelines encourage fishery management councils to incorporate ecosystem considerations into management and to protect marine ecosystems. The rule states that

> *[t]he benefits of protection afforded to marine ecosystems are those resulting from maintaining viable populations (including those of unexploited species), maintaining adequate forage for all components of the ecosystem…*[2]

To achieve this, NMFS encourages the designation of EC species:

> *While EC species are not explicitly provided in the MSA, in the MSRA, Congress acknowledged that certain Councils have made significant progress in integrating ecosystem considerations, and also included new provisions to support such efforts (e.g., MSA section 303(b)(12)). As noted in the preamble of this action,* ***NMFS wants to continue to encourage Councils to incorporate ecosystem considerations,*** *and having classifications for ''stocks in the fishery'' versus ''ecosystem component species'' could be helpful in this regard.*[3]

The Council has made progress in integrating ecosystem considerations and is continuing to do so. Amendment 12 to the CPS FMP prohibited the harvest of krill and is an excellent example. In designating krill as a prohibited species, the Council and NMFS articulated these very reasons.

The final rule stated that

> *protecting krill will help to maintain . . . important ecological relationships and to ensure the long-term health and productivity of the West Coast ecosystem . . .*

[2] 74 FR 11 at 3207 (January 16, 2009).
[3] Id. at 3185 [emphasis added].

> *NMFS believes it is critical to take preventive action at this time to ensure that a krill fishery will not develop that could potentially harm krill stocks, and in turn harm other fish and non-fish stocks.*[4]

We request that similar to krill, other non-target forage species are added to the FMP as EC species and measures are taken to prohibit directed commercial harvest *unless and until there is a plan in place that shows any such fishing can be conducted without harming the health of the marine ecosystem,* including the Ecosystem Fishery Management Plan, stock assessments, and a FMP amendment defining appropriate Annual Catch Limits and Accountability Measures. We stress that krill should retain its prohibited status, placed within the CPS FMP EC category. The below table modifies table 3.1-1 of the preliminary draft of Amendment 13, to list important forage species not already managed in an existing FMP, that we recommend be included in the EC category. We support adding these species to the CPS FMP as EC species.

Common Name	Scientific Name
Euphausiid (krill)	*Euphausiidae*
Neon flying squid	*Ommastrephes bartramii*
Boreal clubhook squid	*Onychoteuthis borealijaponica*
American shad	*Alosa sapidissima*
Pacific herring	*Clupea pallasi*
Smelts	*Osmeridae*
Surf smelt	*Hypomesus pretiosus*
Night smelt	*Spirinchus starksi*
Longfin smelt	*Spirinchus thaleichthys*
Eulachon	*Thaleichthys pacificus*
Whitebait smelt	*Allosmerus elongatus*
Topsmelt	*Atherinops affinis*
Jacksmelt	*Atherinops californiensis*
Lantern fish	*Myctophidae*
Pacific suary	*Cololabis saira*
Pacific sandlance	*Ammodytes hexapterus*

Table 1. List of important forage species for designation as Ecosystem Component species in CPS FMP (modified from Table 3.1-1, CPS Amendment 13 – Preliminary, February 2010 to exclude species that are "in the fishery" or in another FMP).

The Council has already demonstrated it has the authority and responsibility to take such actions and this authority is clearly stated in the NS1 Final Rule.[5] The final rule also reiterates that management of EC species can be undertaken in order to meet obligations to minimize bycatch and protect ecosystem health.[6] As with the management of krill, prohibiting directed commercial harvest of all EC species in table one would achieve these mandates.

[4] 74 FR 132 at 33372-33373 (July 13, 2009).
[5] Prohibition on directed catch and/or retention can be applied to either a stock that is ''in the fishery'' or an ''ecosystem component'' species. 74 FR 11at 3186 (January 16, 2009).
[6] Id. at 3205.

2. Include Control Measures that set a Maximum Catch Limit for targeted species.

An important element of harvest control for commercially harvested CPS is a maximum catch threshold (MAXCAT). The Pacific sardine control rule currently employs a maximum catch threshold of 200,000 metric tons but other targeted CPS do not have this control in place. We request MAXCAT threshold be adopted for other CPS that are "in the fishery", specifically anchovy and jack mackerel. This would provide an important control where stock assessments are either nonexistent or highly uncertain.

The CPS FMP states:

> *In addition to the CUTOFF and FRACTION parameters, it may be advisable to define a maximum harvest level parameter (MAXCAT) so that total harvest specified by the harvest formula never exceeds MAXCAT. The MAXCAT is used to guard against extremely high catch levels due to errors in estimating biomass, to reduce year-to-year variation in catch levels, and to avoid overcapitalization during short term periods of high biomass and high harvest. MAXCAT also prevents the catch from exceeding MSY at high stock levels and spreads the catch from strong year classes over a wider range of fishing seasons.*[7]

3. Account for ecosystem needs in the determination of ABC and OY.

The Magnuson-Stevens Act mandates that catch levels be set in a manner that protects marine ecosystems. Fisheries are to be managed at Optimum Yield, defined as the amount of fish which 'will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems.'[8] OY is prescribed as Maximum Sustainable Yield 'as reduced by any relevant economic, social, or ecological factor.'[9] The National Standard guidelines address ecological factors in several areas, including in the determination of the greatest benefit to the nation, the setting of Maximum Sustainable Yield, and the specification of Optimum Yield.

a. Account for ecological factors within the harvest control rule for all stocks that are in the fishery.

In the NS1 guidelines, NMFS encourages the Councils to account for ecosystem needs in the determination of MSY, stating:

> *"NMFS agrees that ecological conditions and ecosystem factors should be taken into account when specifying MSY and has added additional language to § 600.310(e)(1)(iv) of the final action to highlight this point. Such factors might include establishing a higher target level of biomass than normally associated with the specific stock's Bmsy."*

We agree that in the MSY control rule for sardine, there are some ecological factors considered, specifically sea surface temperatures, but it is entirely unclear as to the appropriateness of those

[7] Coastal Pelagic Species Fishery Management Plan. (Amendment 8 to the Northern Anchovy Fishery Management Plan) December 1998, at 4-3.
[8] 16 USC 1802 Sec. 3(33)(A).
[9] 16 USC 1802 Sec. 3(33)(B).

considerations.[10] At times of low biomass, for both sardine and pacific mackerel, it is especially unclear what is set aside for ecosystem needs, if anything, versus strictly for rebuilding the stock. In the MSY control rule, the FRACTION is considered "approximately equal to Fmsy".[11] The CUTOFF value in the MSY control rule appears to only provide a buffer of spawning stock to allow for rebuilding, not for ecosystem needs.[12] DISTRIBUTION is simply the proportion of the stock considered to be in U.S. waters, which is also highly uncertain.

We have repeatedly requested analysis of the harvest control rule for sardine and Pacific mackerel to determine whether or not the MSY control rule addresses ecosystem needs including the consumption needs of key predators and other commercially and recreationally important species. These should not just be assumed, especially at times of low stock abundance. What is more, for species in the fishery without stock assessments, like anchovy and jack mackerel, it is obvious that there are no ecosystem considerations given when determining catch levels. It remains our view that the MSY control rule does not explicitly account for the needs of the ecosystem. This must be true given the CPS FMP statement for why OY should not be set equal to MSY, as "this would prevent the Council from reducing harvest levels to accommodate ecological or economic factors not included in the MSY control rule used to calculate ABC."[13]

For forage species, we believe we should be fishing at an Ecologically Sustainable Yield (ESY) rather than MSY, and that such an ESY is in fact what is intended by the MSA definition of OY. ESY is the yield an ecosystem can sustain without shifting to an undesirable state.[14] This requires consideration of the impacts of all harvested forage species on the ecosystem and quantifying important qualities such as community stability and resilience.[15]

b. The FMP must address ecological factors used to establish Optimum Yield.

The preliminary draft Amendment 13 fails to specify and evaluate the ecological factors that must be addressed in determining Optimum Yield (OY). The final rule states that

> *[a]n FMP must contain an assessment and specification of OY, including a summary of information utilized in making such specification, consistent with requirements of section 303(a)(3) of the Magnuson-Stevens Act. A Council must identify those economic, social, and ecological factors relevant to management of a particular stock, stock complex, or fishery, and then evaluate them to determine OY.*[16]

Addressing ecological factors in the FMP is of specific importance, especially given the need to manage forage fish stocks for a higher biomass than B*msy*[17] and to enhance and protect the marine ecosystem.[18] It is clear that ecological factors must be specified in the FMP and evaluated in determining OY.

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[10] We note that: "The SSC would also like to see a critical examination of the SST dependent FMSY function." Agenda Item H.2.b Supplemental SSC Report, March 2010.
[11] CPS FMP Amendment 8, at B-84
[12] CPS FMP Amendment 8, at B-84
[13] CPS FMP Amendment 8, at B-79
[14] Zabel, W.R., C.J. Harvey, S.L. Katz, T.P. Good, and P.S. Levin. 2003. Ecologically Sustainable Yield. American Scientists Volume 91.
[15] Ibid.
[16] 74 FR 11 3178, at 3207 (January 16, 2009)
[17] 74 FR 11 3178, at 3208 (January 16, 2009)
[18] 74 FR 11 3178, at 3207 (January 16, 2009)

Currently, a wealth of existing data and analytical methods are available to address ecological factors relevant to the harvest strategy of CPS. Diet information, which indicates the existence and strength of predator-prey relationships has been published by NOAA for West Coast species.[19] In addition, food web models of the California Current have been published, including mass balance models (i.e., EcoPath with EcoSim)[20] and spatially-explicit dynamic models (i.e., Atlantis)[21]. These models provide the ability to qualitatively and quantitatively describe potential impacts of target species removals on other marine species as well as on ecosystem attributes such as mean trophic level, food web resilience, and biodiversity.

For example, Samhouri et al. (2009)[22] identified the effects of fishing rates on 22 ecological attributes of several ecosystem models, including some from the California Current marine ecosystem (a list of all 22 attributes can be found in Attachment 2). Such an approach could readily be applied to evaluate the effects of alternative harvest strategies for CPS species. These are precisely the "relevant ecological factors" that must be considered in any Fishery Management Plan. Claiming that such tools are unavailable or that these factors are not relevant can simply no longer be justified given the state of existing science, including the aforementioned work by NOAA.

Therefore, to comply with the MSA, Amendment 13 to the CPS FMP must list the relevant ecological factors, analyze how the control rules affect these ecological factors, and describe how these factors will reduce MSY to achieve appropriate OYs. Accordingly, the corresponding SAFE documents must include appropriate analyses of the impacts of specified ABC values on ecosystem attributes, other species, and other ecological factors to inform OYs set by the Council.

Attached is a suggested amendment to the CPS FMP section 4.82, "Factors Considered" to clearly identify the ecological factors that will be considered in setting OY, in addition to the social, economic and biological factors. These factors can be evaluated in the ecosystem chapter of the annual CPS SAFE document, and possibly later through the Ecosystem Fishery Management Plan, when the EFMP is finalized.

4. Status Determination Criteria alternatives must be expanded to include alternative criteria, including analyses of other Minimum Stock Size Thresholds.

Status determination criteria (SDC) are quantifiable factors, including Maximum Fishing Mortality Threshold (MFMT), Overfishing Limit (OFL), and Minimum Stock Size Threshold (MSST), or their proxies, that are used to determine if overfishing has occurred, or if the stock or stock complex is overfished. These are required reference points for stocks in the fishery.

The preliminary draft Amendment 13 document contains only two alternatives for status determination criteria—status quo and status quo plus an MSY proxy for the Northern subpopulation of Northern anchovy. Status quo MSST for Pacific mackerel and Pacific sardine is not sufficient, and alternative

[19] Dufault et al., November 2009. NOAA Technical Memorandum NMFS-NWFSC-103. A synthesis of diets and trophic overlap of marine species in the California Current.
[20] Field et al. 2006. Top-down modeling and bottom–up dynamics: linking a fisheries-based ecosystem model with climate hypotheses in the Northern California Current. Prog Oceanography 68:238-70.
[21] Horne et al. January 2010. NOAA Technical Memorandum NMFS-NWFSC-104. Design and Parameterization of a Spatially Explicit Ecosystem Model of the Central California Current.
[22] Samhouri, J., Levin, P., and Harvey, C. 2009. Quantitative Evaluation of Marine Ecosystem Indicator Performance Using Food Web Models. Ecosystems 12: 1283-1298.

MSST thresholds must be analyzed and considered.[23] MSST or a reasonable proxy must be determined for other stocks in the fishery, including anchovy, jack mackerel and market squid.[24]

5. Amendment 13 to the CPS FMP must address fundamental flaws in the proposed approach to setting scientific and management buffers.

We are concerned that the Council's approach to setting buffers to incorporate uncertainty is incomplete and not compliant with the reauthorized Magnuson-Stevens Act new requirements to prevent overfishing. As the SSC has repeatedly stated, many major uncertainties in the overfishing limit and ABC have not been incorporated into the Council's scientific buffers including uncertainty in the optimal harvest rate, the effects of climate, and ecosystem interactions. Furthermore, the Council's preliminary P* values are unacceptably high and not based on a formal risk analysis. We request that the Council address these other important sources of uncertainty and adopt a precautionary P* value that recognizes the probability of overfishing, both from a single species and an ecosystem context.

In closing, action by the PFMC that builds upon the foundation established with the management of krill and the promulgation of the new National Standard 1 guidelines can successfully advance the long-term conservation of both the California Current ecosystem and the fisheries that depend upon a healthy ecosystem. It is imperative that the PFMC take the time to address outstanding issues and chart a clear path to implementing the mandates of the MSA, the NS1 guidelines, and NEPA. Doing this the right way and legally is far superior to doing it the wrong way based on the argument of timeliness. Done the right way, this CPS amendment can provide a foundation upon which the Council and its ecosystem committees can build in meeting NEPA's broader programmatic requirements and the MSA's goals of ensuring the conservation of our national ocean resources.

We look forward to continuing to work with you on this important matter.

Sincerely,

Ben Enticknap
Pacific Project Manager
Oceana

Kenneth Stump
Policy Director
Marine Fish Conservation Network

Attachments:

1) Proposed CPS FMP amendment to identify Optimum Yield considerations.
2) Ecosystem attributes which could be used to measure the ecological impacts of CPS harvest strategies within existing models of the California Current Marine Ecosystem

[23] 74 FR 11 3178, at 3206 (January 16, 2009) ("MSST or reasonable proxy must be expressed in terms of spawning biomass or other measure of reproductive potential. To the extent possible, the MSST should equal whichever is greater: One-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years…")

[24] While market squid is exempt from ACL and AM requirements because of its life history characteristics, "FMPs or FMP amendments for these stocks must have SDC, OY, ABC, and an ABC control rule." 74 FR 11 at 3210 (January 16, 2009).

Attachment 1.

PROPOSED CPS FMP AMENDMENT TO IDENTIFY OPTIMUM YIELD CONSIDERATIONS
(Proposed language in *italics)*

Section 4.82 FACTORS CONSIDERED

The following factors will be considered when making the annual specifications:

Biological

- The current estimated biomass and any other biological information.
- The MSY control rule described in the FMP, which is specified for each [delete: actively] managed species *in the fishery.*
- *Evaluation of localized depletion, if any.*
- *Identification of key spawning areas and other biologically important areas for CPS species.*

Economic

- Results of comments of domestic processors and joint ventures operations about processing capacity and planned utilization.
- Results of any analysis of fishing capacity and planned utilization of recent years modified by new information and comments by the fishing industry.
- *Economic value of CPS as forage to other commercially and recreationally important species, including value of fisheries and tourism value associated with wildlife viewing.*

Social

- *Results of comments from the public.*
- Any relevant historical information on utilization of CPS resources.

Ecological

- *Contribution of CPS to diets and consumption levels of key predators (e.g. marine mammals, threatened and endangered species, birds and fishes).*
- *Population trends of key CPS predators (e.g. marine mammals, threatened and endangered species, birds and fishes).*
- *Spatial and temporal interactions, including consistent foraging grounds for key CPS predators.*
- *Sea surface temperature and other oceanographic conditions.*
- *Results of analyses from California Current ecosystem models (e.g. Ecopath, Atlantis, etc.) and Integrated Ecosystem Assessments in terms of effects of alternative harvest rates of CPS species on ecosystem attributes (e.g., resilience, mean trophic level, biodiversity, net primary productivity.*
- *The interaction strengths between CPS and key members of the food web, as determined from California Current ecosystem models.*

All data used to make annual specifications will be available for public inspection [delete: during normal business hours at the Southwest Regional Office NMFS] *and evaluated in annual SAFE documents.*

Attachment 2.

Ecosystem attributes which could be used to measure the ecological impacts of CPS harvest strategies within existing models of the California Current Marine Ecosystem (from Samhouri et al. 2009).

Table 2. Descriptions of Ecosystem Attributes Measured in the Ecopath with Ecosim Models, Along with Their Expected States When Unstressed

Attribute	Definition	Unstressed state	Reference
Diversity[1]	Both the number of species and the evenness of biomass distribution among species	High	Odum (1985)
Consumption[2]	The sum of somatic and gonadal growth, metabolic costs, and waste products for all species in the ecosystem	High	Odum (1985), Christensen and others (2005)
Net primary production (NPP)[2]	The sum of biomass produced by autotrophs	High	Odum (1985), Christensen and others (2005)
Production[2]	The sum of biomass accumulation, biomass lost to mortality, and biomass lost to migration for all species in the ecosystem	High	Odum (1985), Christensen and others (2005)
Respiration[2]	The portion of consumed energy that is not used for production or recycled as feces or urine	Low	Odum (1985), Christensen and others (2005)
NPP/Biomass[2]	The ratio of total autotrophic biomass production to total biomass abundance in the ecosystem	Low	Odum (1985)
NPP/Respiration[2]	The ratio of total autotrophic biomass production to total metabolic (or maintenance) costs in the ecosystem	Low	Odum (1985), Christensen and others (2005)
Respiration/Biomass[2]	The ratio of total metabolic (or maintenance) costs to total biomass abundance in the ecosystem	Low	Odum (1985), Christensen and others (2005)
Mean trophic level[3]	Biomass-weighted average trophic level of all species in the ecosystem	High	de Mutsert and others (2008)
Total biomass[3]	The biomass abundance of all functional groups in the ecosystem	High	
Target group biomass[3]	The biomass abundance of functional groups targeted by fisheries	High	
Path length[4]	The average number of functional groups that a unit of energy flows through in the system before being lost	High	Finn (1980), Christensen and others (2005)
Finn's cycling index[4]	The fraction of all flows in the ecosystem that is recycled	High	Finn (1976), Christensen and others (2005)
Predator cycling index[4]	The fraction of all flows in the ecosystem recycled through non-detrital paths	High	Christensen and others (2005)
Resilience[5]	The capacity of an ecosystem or foraging guild to absorb perturbations while retaining its essential structure and function, including the identities of the component species. (see equations 1 and 2)	High ($C \rightarrow 0$ or $R \rightarrow 0$)	Folke and others (2004)

The diversity attribute was calculated using the Shannon, Simpson, and Kempton's Q indices. Resilience was calculated as the average relative change in biomass for all functional groups (see equation 1), and as five different reorganization indices (ecosystem, piscivorous fish, zooplanktivorous fish, invertivore, and herbivore; see equation 2). The category of each ecosystem attribute: [1]Diversity, [2]Community energetics, [3]Food web structure, [4]Energy recycling, [5]Resilience.

Samhouri, J., Levin, P., and Harvey, C. 2009. Quantitative Evaluation of Marine Ecosystem Indicator Performance Using Food Web Models. Ecosystems 12: 1283-1298.

Berkeley Conservation Institute, Pure Fishing * Coastside Fishing Club * Native Fish Society * Northwest Guides and Anglers Association * Northwest Sportfishing Industry Association * Oceana * Pacific Coast Federation of Fishermen's Associations * The Pew Environment Group * Small Boat Commercial Salmon Fisherman's Association * United Anglers of Southern California

June 3, 2010

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

RE: F.2 Coastal Pelagic Species Fishery Management Plan Amendment 13

Dear Mr. Ortmann and Council Members:

Abundant populations of forage species are critical for maintaining healthy populations of recreationally and commercially important fish, like tunas, salmon, and others, as well as a healthy and diverse marine ecosystem. Forage species such as sardine, anchovy and smelts are the heartbeat of the ocean, the life giving sustenance that keeps the thousands of species of large food and sport fish alive and robust. Nothing, no other category of fish, determines the fate of our favorite seafood as much as the availability of sufficient forage to keep them healthy and reproductive. Forage fish are the transfer agents. They convert the microscopic phytoplankton and zooplankton into usable protein, protein that the entire upper oceanic food chain depends upon. Take too many forage species and the rest of the marine species are in trouble.

Given the importance of forage species like sardine, squid, anchovy, and krill, managed in the Coastal Pelagic Species Fishery Management Plan (FMP), we are writing to request that the PFMC take actions to amend the FMP to:

- Designate unmanaged forage species as "Ecosystem Component" species and prohibit development or expansion of commercial harvest of those species,
- Bring stocks that are "in the fishery" into compliance with National Standard One guidelines including Annual Catch Limits, Accountability Measures and all required Status Determination Criteria, and
- Designate all Coastal Pelagic Species that are directly targeted for commercial harvest as "in the fishery" and specify annual catch limits and accountability measures, as required.

All of the important sport fish are top level predators. They are at the top of the food chain so a threat to that food chain is a threat to their health and their reproductive potential. The more forage fish that are in the ocean, the more feed for higher order species and more feed means more fish and bigger, healthier fish. Thus, advancing the conservation and management of fisheries targeting forage species, plus taking ecosystem-based approaches that protect other forage fishes, will benefit the sustainability of other recreational and commercial fisheries that depend on healthy forage species populations.

1. **Designate Ecosystem Component species and prohibit directed commercial harvest of those species.**

The PFMC is considering amending the CPS FMP to identify a suite of important forage fish such as smelts, sand lance, lantern fish and others as "ecosystem component" species. We support including these species in the FMP and prohibiting directed commercial harvest to the extent that these important forage species are unmanaged by an existing FMP and not currently the target of commercial fisheries. Direct commercial harvest should be prohibited unless and until the Ecosystem Fishery Management Plan can be developed and it can be demonstrated that directed fishing would not harm the health of the ecosystem and other dependent fisheries.

There is growing concern about the potential for expansion of fishing activity into a suite of forage species that has never previously been fished which would only serve to aggravate the important ecosystem problems caused by poorly regulated forage fisheries. Partly this concern comes from recognizing the pattern of fishing down the food web. Globally, there is a clear pattern of fisheries beginning with top level predators and high value fish only to systematically begin to fish at lower and lower levels of the food web as species are overfished and depleted.

2. **Bring stocks that are "in the fishery" into compliance with National Standard One Guidelines**

As the PFMC considers changes to the management of existing fisheries to prevent overfishing and achieve an Optimum Yield harvest, we request that you adopt all key control measures that limit the overall catch and prevent overfishing, like the maximum catch value (MAXCAT) currently employed in the sardine fishery. We also ask that you adopt measures to implement Minimum Stock Size Thresholds for all species in the fishery.

Importantly, the CPS FMP must be amended to contain an assessment and specification of Optimum Yield (OY), including the other social, economic and ecological factors that will be evaluated in determining OY. The importance of these species for other social and economic uses, including prey for sport fish, other commercial fish, and marine life, must be considered when setting catch levels that provide the greatest overall benefit to the Nation and the protection of the marine ecosystem. For example, when considering OY, we encourage the Council to work with industry in developing fresh food markets for stocks such as sardine and anchovy to maximize the value of the catch for a higher price per pound, not higher levels of landings.

3. **Make certain that all coastal pelagic stocks targeted by commercial fisheries are "in the fishery" with required annual catch limits and accountability measures.**

It has been brought to our attention that an important Coastal Pelagic Species, Pacific bonito, is currently targeted by commercial fisheries, yet unmanaged in any of the existing Council FMPs.[1] Pacific bonito is a coastal pelagic schooling fish found off the coast of North America with concentrations along the U.S. West Coast in southern California. They have been fished

[1] NMFS Southwest Fisheries Science Center: http://swfsc.noaa.gov/textblock.aspx?Division=FRD&id=1115

commercially off California since at least the beginning of the 20th century.[2] They are targeted commercially by CPS seine vessels that also take anchovy, sardine and mackerel, troll gear, and they are also taken recreationally. In 2008, commercial vessels landed 1.7 million pounds of Pacific bonito in California.[3] Clearly Pacific bonito need to be classified as "in the fishery" with annual catch limits and accountability measures. As Pacific bonito are caught with CPS gear and, they are important prey to sharks (e.g. shortfin mako, aka. bonito shark), and they are technically a coastal pelagic, we recommend they be included in the CPS FMP.

Thank you for your time and consideration of the importance of managing for healthy populations of forage species.

Sincerely,

Jim Martin, Conservation Director, Berkley Conservation Institute, Pure Fishing

Darrell Ticehurst, Chairman of the Board, Coastside Fishing Club

Bill M. Bakke, Executive Director, Native Fish Society

Bob Rees, President, Northwest Guides and Anglers Association

Liz Hamilton, Executive Director, Northwest Sportfishing Industry Association

Jim Ayers, Vice President, Oceana

Zeke Grader, Executive Director, Pacific Coast Federation of Fishermen's Associations

Steve Ganey, Senior Officer and Director, Regional Fisheries Initiatives, The Pew Environment Group

Mike Hudson, President, Small Boat Commercial Salmon Fishermen's Association

Steven Fukuto, President, United Anglers or Southern California

[2] Collins et al. 1980. Pacific Bonito Management Information Document. California Department of Fish and Game. Marine Resources Tech Report No. 44.
[3] http://www.dfg.ca.gov/marine/fishing.asp