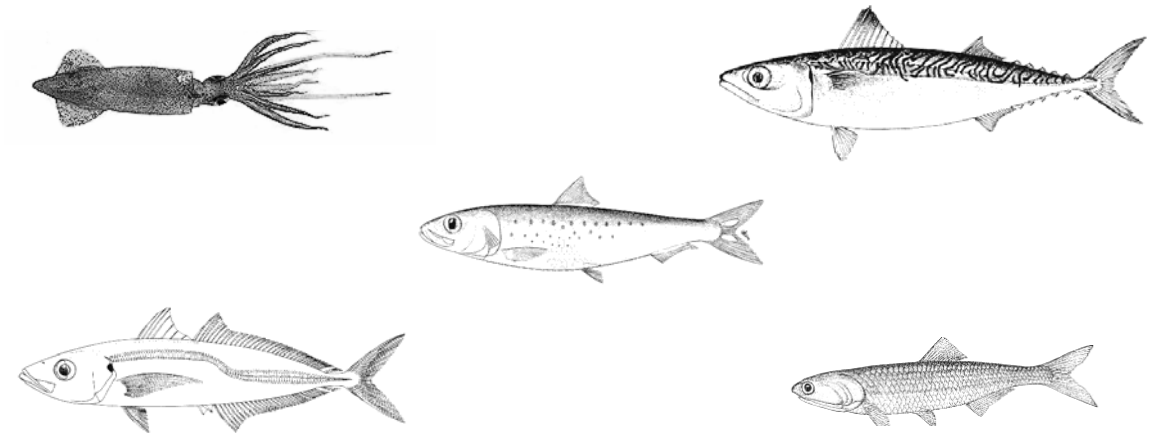
STATUS OF THE PACIFIC COAST COASTAL PELAGIC SPECIES FISHERY AND RECOMMENDED ACCEPTABLE BIOLOGICAL CATCHES

STOCK ASSESSMENT AND FISHERY EVALUATION 2009



PACIFIC FISHERY MANAGEMENT COUNCIL
7700 NE AMBASSADOR PLACE, SUITE 101
PORTLAND, OR 97220
503-820-2280
www.pcouncil.org

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COASTAL PELAGIC SPECIES MANAGEMENT TEAM

CHAIR:
Dr. Samuel Herrick, National Marine Fisheries Service, Southwest Fisheries Science Center

VICE CHAIR:
Mr. Dale Sweetnam, California Department of Fish and Game

Ms. Briana Brady, California Department of Fish and Game
Dr. Paul Crone, National Marine Fisheries Service, Southwest Fisheries Science Center
Dr. Robert Emmitt, National Marine Fisheries Service, Northwest Fisheries Science Center
Dr. Kevin Hill, National Marine Fisheries Service, Southwest Fisheries Science Center
Mr. Gregory Krutzikowsky, Oregon Department of Fish and Wildlife
Ms. Lisa Veneroso, Washington Department of Fish and Wildlife
Ms. Lorna Wargo, Washington Department of Fish and Wildlife

ADDITIONAL INFORMATION FOR THIS REPORT PROVIDED BY:

Mr. Mike Burner, Staff, Pacific Fishery Management Council
Ms. Donna Dealy, National Marine Fisheries Service, Southwest Fisheries Science Center
Mr. Josh Lindsay, National Marine Fisheries Service, Southwest Region
Dr. Jonathan Phinney, National Marine Fisheries Service, Southwest Fisheries Science Center

DOCUMENT PRODUCTION AND EDITORIAL SUPPORT PROVIDED BY:

Ms. Renee Dorval, Staff, Pacific Fishery Management Council
Ms. Carrie Montgomery, Staff, Pacific Fishery Management Council
Ms. Kim Merydith, Staff, Pacific Fishery Management Council

This document may be cited in the following manner:

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LIST OF ACRONYMS AND ABBREVIATIONS

ABC	acceptable biological catch
ADEPT	
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
HG	harvest guideline
INP	Instituto Nacional de la Pesca (México)
LE	limited entry
LME	large marine ecosystem
Magnuson-Stevens Act	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
ODFW	Oregon Department of Fish and Wildlife
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*), and market squid (*Loligo opalescens*). 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 occurred 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.

2.3 The CPS Fleet

During the 1940s and 1950s, approximately 200 vessels participated in the Pacific sardine fishery. 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.

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 2,000 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.

2.3.1 Limited Entry Fishery

The CPS LE fleet currently consists of 65 permits and 61 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 1940's 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 2008, but only 22 permits were actively utilized in the fishery. Table 2-5 contains information for vessels that participated in the 2008 fishery.

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 2008 Oregon issued 5 of the 15 developmental fishery permits available for the anchovy fishery.

2.3.2.2 Washington

Pacific sardines are the primary coastal pelagic species harvested in Washington waters. Participation in the sardine fishery has been managed under the Emerging Commercial Fishery provisions since 2000, 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 to 2002, WDFW had trial purse seine fisheries for Pacific sardines that did not limit the number of participants. 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 during those years. Landings into Washington were 4,842 mt in 2000 and increased to 15,212 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 was created, and the WDFW Director advanced the sardine fishery from a trial fishery to an experimental fishery under the Emerging Commercial Fisheries legislation. Experimental fisheries require participation to be limited.

In collaboration with the Sardine Advisory Board, WDFW developed and implemented an effort limitation program in 2003. The experimental fishery and LE program has continued through 2008. During the 2009 Washington State legislative session, WDFW proposed legislation that would establish a commercial license limitation program for the harvest and delivery of Pacific sardines into the state. The proposed bill allows for licenses to be issued to holders of a 2008 coastal sardine experimental fishery permit with an exception for past participants of the experimental fishery that became ineligible because of loss of their vessel at sea. WDFW estimates 18 licenses will be eligible for a license under this proposed legislation. The draft bill

also creates a new purse seine temporary annual permit that could be issued at the Director's discretion, provided the total number of licenses does not exceed 25. At the time of writing this update, the draft bill is still alive and working its way through the legislative process.

WDFW conducted a 5-year observer program from 2000 through 2004 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 permit conditions. The results of this observer program showed by-catch of non-targeted species in the Washington sardine fishery to be relatively low. A mandatory logbook program has been in place since the fishery began in 2000. All logbook records must be submitted, and any outstanding observer or permit fees owed must be paid prior to receiving a permit for the current season.

Table 2-6 lists vessels designated on 2008 Washington Sardine Experimental Fishery Permits. In 2008, limited experimental fishery permits were issued to 16 fishers meeting the necessary permit criteria of previously holding such a permit and who also held a minimum of 50 percent ownership in the vessel designated on their 2008 sardine permit. Of the 16 permits that were issued, only five permits participated in the 2008 fishery. 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 both the individual vessels and for processors.

Pacific sardines are the targeted catch in the Washington experimental fishery, but anchovy, mackerel, and squid can also be retained and landed. In 2008, landings for these other coastal pelagic species are as follows: 109 mt of anchovies, 2.7 mt of jack mackerel, and 9 mt of mackerel.

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 2008, 93 vessel permits, 62 light boat permits, 22 brail permits, and zero experimental permits were issued. Of the 93 vessel permits issued, 71 vessels made commercial landings in 2008, as compared to 65 active permitted vessels in 2007. Forty-two vessels made 90 percent of the landings in 2008. Market squid vessel permits allow a vessel to attract squid with lights and use large purse seines 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.

3.0 Stock Assessment Models

3.1 Pacific Sardine

The Pacific sardine resource is assessed each fall in support of the Council process that, in part, sets an annual HG (quota) for the U.S. commercial fishery. This process is centered on an environmentally-based control rule that establishes a U.S. coastwide HG for an annual (Jan. 1 to Dec. 31) management cycle. The primary purpose of the assessment is to provide an estimate of current biomass, which is used to calculate annual HGs. 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 2009 management (Hill *et al*. 2008; see Appendix 1) was conducted using 'Stock Synthesis 2' (SS2), a likelihood-based, length- and age-structured model. The general estimation approach used in the SS2 model 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 SS2 is described in Fournier and Archibald (1982), Deriso et al. (1985), Megrey (1989), and Methot (1990, 1998, 2005).

The final SS2 model was based on fishery-dependent data from three fisheries (Ensenada, Mexico; U.S. California; and U.S. Pacific northwest; 1981-2007) and a time series of relative SSB estimated from the SWFSC annual egg production surveys (see Lo et al. 1996, 2005, 2006, 2007a, 2008). 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. (2008; see Appendix 1). 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).

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 2004a). 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 2004b). 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).

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3.3 Section References:

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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.

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, e.g., the MSY-proxy approach adopted for market squid (see Section 4.3.4). The default MSY control rule can be modified under framework management procedures. The default MSY control rule sets 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 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 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.

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:

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

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 of the 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 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 coefficient of variations of about 50% for CPS.

The general MSY 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 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. 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 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.

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.

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 ABC calculated using the MSY control rule. No MAXCAT is defined because the U.S. fishery appears to be limited by markets and resource availability to about 40,000 mt per year. 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 70% relative abundance in U.S. waters.

4.3.4 MSY Control Rule for Market Squid

Although market squid is only a monitored species, a potential MSY Control Rule for market squid has been reviewed formally through a STAR conducted in 2001, as well as presented within the Council forum in 2002. The proposed MSY Control Rule is generally based on the Egg Escapement method, which currently serves as an informal assessment tool for this species (see Appendix 3 in PFMC (2002) for further discussion concerning specific details involved in this assessment approach, as well as review-related discussion). 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 practical terms, the market squid fishery is monitored through a state-based management plan that includes an annual landings cap (CDFG 2005) and various spatial/temporal constraints. Whereas, within a research context only, population dynamics and biological reference point (say MSY-related) evaluations regarding this species are addressed through the Egg Escapement method and simulation analysis. Given the “monitored” status of this population, the above management/research approach appears reasonable; however, “active” management may need to be considered in the future if fishery operations change substantially (e.g., spatially expand, harvest high amounts of immature squid) and/or ongoing modeling efforts identify areas (spatial or temporal) of concern regarding egg escapement levels associated with commercial fishery sample data. A brief description of the Egg Escapement method follows, with further discussion presented in Section 11.2.3.

The Egg Escapement method is founded on conventional spawning biomass “per-recruit” theory. In general, the proposed MSY Control Rule for market squid is based on evaluating (throughout a fishing season) levels of egg escapement associated with the exploited population(s). The estimates of egg escapement are evaluated in the context of a “threshold” that is hypothesized to represent (generally) a biological reference point that, if not exceeded (and over the long-term and given favorable oceanographic conditions), will support sustainable abundance levels and some degree of surplus for fishery-related purposes. It is important to note that the threshold

proposed currently (i.e., 30%) represents a strictly preliminary statistic and intended as a precautionary reference point, which ultimately, is expected to be revised (to some degree) as more sample data (spatially and temporally) are examined through egg escapement and simulation research. In this context, in fall 2006, the CPSMT reviewed results from ongoing research addressing egg escapement modeling efforts over the last two years. A working paper summarizing the results of this research was distributed in fall 2008 (Appendix 3).

4.4 Section References:

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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.

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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

NMFS 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 NMFS, Sustainable Fisheries Division (SFD), Southwest Region (SWR) has conducted eight consultations with other Federal agencies, including NMFS Protected

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

Most recently, NMFS, SFD, SWR, initiated a formal section 7 consultation with NMFS, PRD, SWR, 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 (2004 – 2008). The dynamic of the 2008 sardine fishery changed due to a decrease in the annual harvest guideline. Fishing activity no longer took place year around, but was 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 organisms in wetfish landings during 2008 were kelp, jellyfish, market squid, northern anchovy, California halibut, rays, jack mackerel, and California scorpionfish. Eighty-four incidental species were observed in total.

Kelp (specifically holdfasts), crustaceans, flatfish, California scorpionfish, and elasmobranchs can serve as an indication of shallow set depth. 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, which port samplers are not privy to, 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 2008, about 7 percent of round haul market squid landings 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 evaluations), but actual

amounts of incidental catch have not been quantified to date. During 2008, incidental catch consisted of 34 species (Table 6-7). Similar to previous years, most of this catch was other pelagic species, including Pacific sardine, Pacific mackerel, northern anchovy, and jack mackerel. However, kelp was also observed frequently.

The extent that market squid egg beds and bottom substrates are damaged by purse seine operations, which subsequently may contribute to mortality of early life stages is not definitively known at this time. However, information regarding the frequency of occurrence of market squid eggs in squid landings port-side generally indicates that egg bed-related impacts have increased over the last several years. For example, from October 1998 through September 2001, bycatch of market squid eggs had a 1.8 percent frequency of occurrence. In 2004, market squid egg capsule bycatch was 5.1 percent statewide, a 0.2 percent increase over 2003 (4.9 percent). In 2008, market squid egg cases were identified in 8.8 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 the effect of nets of egg beds may be a concern. If bycatch of market squid egg capsules continues to increase and eggs are found to be taken from the bottom, some gear regulations may need to be implemented in the future (e.g., restrictions to the depth at which nets could be set, spatio-temporal closures of some shallow water habitats).

According to CDFG market squid logbooks, fishing nets in the northern fishery make contact with 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 22,948.7 mt of Pacific sardine in 475 Oregon landings in 2008. The harvest was down 46 percent from the 42,151 mt of sardines landed in Oregon in 2007. All of the directed fishery harvest took place in allocation periods 2 and 3 during July, August and September. The decrease in harvest reflected the 42 percent reduction in the coastwide HG in 2008 from 2007 (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 eight different processors, with 6 landings in Newport. Sardine value varied from $0.00 to $0.145 per pound, with 96.8

percent of fish landed valued at greater than $0.05/lb. The exvessel value of sardine landed in Oregon in 2008 was roughly $5.66 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 482 trips (0.2 percent) was successfully observed. The observer viewed one Coho Salmon which was released alive by the crew with a dip net. 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 2008 season included Pacific and jack mackerel, Pacific herring, Northern anchovy, Pacific hake, salmon and sharks. Oregon LE sardine permit rules require logbooks that record incidental catch including salmonids and other species (Table 6-9). Approximately 885 sets were made targeting sardines. The estimated total catch of salmon for the fishery, based on log data, was 198 salmon. Based on this estimate, the incidental catch rate was 0.008 salmon per mt of sardines landed. An estimated 62 percent of all salmon were released alive. Based on Oregon fish tickets, bycatch in the fishery continues to be relatively low, with approximately 116.9 mt of non-target species caught for 22,948.9 mt of sardine (Table 6-10). More than half of the non-target species catch in the sardine fishery was Pacific mackerel (56.8 mt) which had an ex-vessel value of approximately $7,813. The other CPS components of incidental catch were 1.6 mt of jack mackerel and 2.4 mt of northern anchovy.

6.3.2 Washington

The Washington fishery opened by rule on April 1, 2008; however, the first landing into Washington did not occur until July 1 because the first period allocation for the January through June time period had been taken. WDFW issued a total of 16 permits and 5 of the permit holders participated in the fishery. Three primary vessels accounted for 73 percent of the harvest. A total of 6,432 mt of sardines were landed into Washington. Of the 150 landings into Washington, 78 (52 percent were made in July, 21 (14 percent) were made in August and 51 (34 percent) were made in September. A total of 191 sets were made, with 174 (91 percent) of them successful. The average catch per successful set was 36 mt.

As part of the trial fishery and the experimental LE fishery regulations 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 has been relatively low. Due to low bycatch levels, as well as a WDFW commitment to industry that an 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. Since a comparison of logbooks to observer data from 2000 to 2004 indicates that logbook data, in general, tends to be under-reported by 20 percent to 80 percent (Culver and Henry, 2006), salmon bycatch in the Washington sardine fishery for subsequent fishing years has been calculated using the 5-year

average bycatch rates from the observer program applied to total sardine catch. Bycatch and mortality estimates of incidentally captured salmon for the past eight years, by species, based upon 2000- 2004 observer information, is shown in Table 6-8.

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 California Live Bait Fishery

7.1 Introduction

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 Aplin (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).

7.2 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.

7.3 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.

7.4 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 5 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.

7.5 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.

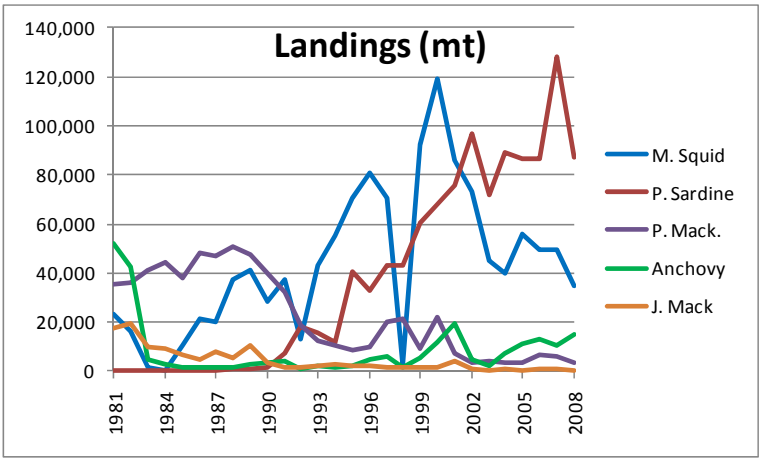
In January 2003, NMFS published final regulations to implement Amendment 10 to the CPS FMP, which allows LE permits to be transferred to another vessel and/or individual.

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.

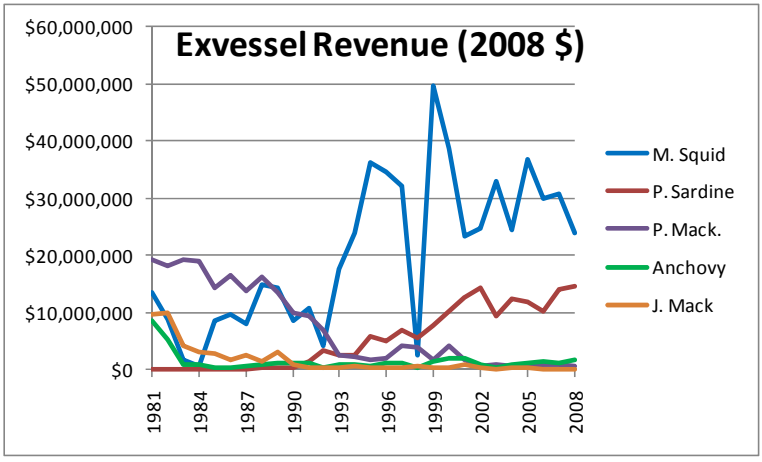
In 2008 and 2009 the directed Pacific sardine fishery experienced seasonal closures because harvest guidelines in these years have dropped while Pacific sardine continue to be available to the fishery and market demand is steady or increasing. This has lead to a “derby style” fishery where vessels compete 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 2008

This section summarizes economic data presented in Tables 9-1 through 9-11 (presented in the Tables section following Section 13) and Figures 9-1 through 9-8 (at the end of this Section). West coast landings of CPS totaled 140,292 mt in 2008, a 28 percent decrease from 2007. Market squid landings, all in California, totaled 34,639 mt in 2008, down 30 percent from 2007. Pacific sardine landings of 87,175 mt in 2008 decreased 32 percent from 2007 (127,766 mt). The exvessel revenue from all CPS landings was $40.9 million in 2008, down 13 percent from 2007 (2007 converted to 2008 dollars).



Market squid accounted for 25 percent and Pacific sardine 62 percent of total West coast, CPS landings in 2008. Landings of Pacific mackerel decreased 39 percent, and landings of northern anchovy rose 39 percent from 2007 to 2008. Real exvessel market squid revenues (2008 $) decreased 23 percent from 2007. The decrease in market squid landings was accompanied by an 11 percent increase in exvessel price from $623 to $689 per mt (2008 $). There was a 27 percent decrease in aggregate CPS finfish landings from 2007; exvessel revenue increased 4 percent, while the overall finfish exvessel price increased 43 percent from 2007. In 2008, market squid made up 7 percent of total West coast exvessel revenues, and CPS finfish accounted for almost 5 percent. Washington, Oregon and California shares of total west coast CPS landings in 2008 were 5 percent, 16 percent and 79 percent respectively.



California sardine landings were 57,791 mt in 2008 down 29 percent from 2007, 80,957 mt. Market squid ranked first in exvessel revenue generated by California commercial fisheries in 2008, with exvessel revenue of, $23.9 million, $2.1 million greater than that for Dungeness crab, in second place. Landings of Pacific sardine ranked fourth highest in California exvessel revenues in 2008 at $7.6 million. California Pacific mackerel landings were 3,449 mt in 2008, down 31 percent from 2007. California landings of northern anchovy were 14,285 mt in 2008, up 38 percent from 2007.

Oregon's landings of Pacific sardine decreased 46 percent in 2008, from 42,144 mt to 22,949 mt. Sardine generated $5.7 million in exvessel revenue for Oregon in 2008, 6 percent of the state's total exvessel revenues, ranking it seventh behind Dungeness crab in total exvessel revenues. Washington landings of Pacific sardine increased 38 percent from 4,665 mt in 2007 to 6,435 mt in 2008. With exvessel revenue less than 1 percent of the Washington total in 2008, sardine ranked 12th behind Dungeness crab in exvessel value.

Oregon landings of Pacific mackerel decreased from 702 mt in 2007 to 58 mt in 2008. Washington landings of Pacific mackerel decreased from 38 mt in 2007 to 9 mt in 2008 while anchovy landings fell from 153 mt to 109 mt.

In 2008, the number of vessels with West coast landings of CPS finfish was 196, down from 220 in 2007. With the decrease in vessels and a decrease in total CPS finfish landings, finfish landings per vessel, 539 mt in 2008, decreased 18 percent from 2007. Of the vessels landing CPS finfish in 2008, 21 percent depended on CPS finfish for the greatest share of their 2008 exvessel revenues. From 2007 to 2008, the number of vessels with West coast landings of market squid increased from 164 to 167, with 35 percent of these vessels dependent on market squid for the largest share of their total 2008 exvessel revenue. Market squid landings were 207 mt per vessel in 2008, down 31 percent from 2007. 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 averaged about 78 percent per vessel since 2000. In 2008 by far roundhaul gear accounted for the largest share of total CPS landings and exvessel revenue by gear in 2008, 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 2008, 34,535 mt of market squid were exported through West coast customs districts with an export value of $50.1 million; a 9 percent decrease in quantity, and a 3 percent decrease in the real value of West coast market squid exports from 2007. The primary country of export was China, 70 percent of the total, which received 24,026 mt, up 7 percent from the quantity exported to China in 2007. Eighty-five percent of market squid exports went to China and four additional countries: Japan (2,023 mt), Mexico (1,240 mt), U.K. (1,169 mt) and Spain (1,128 mt). Domestic sales were generally made to restaurants, Asian fresh fish markets or for use as bait.

In 2008, 75,095 mt, of sardines were exported through West coast customs districts down 31 percent from 2007. Sardine exports were valued at $59.8 million in 2008, down 18 percent from 2007. Almost 76 percent of sardine exports were in the frozen form, the balance was in the preserved form. Japan was the primary export market in 2008, receiving 19,708 mt, a 50 percent increase in its imports from 2007, and representing 26 percent of total West coast sardine exports in 2008. Australia was second with 16,643 mt, 22 percent of the total a 16 percent decrease from 2007, followed by Thailand, Malaysia and Nauru with 19 percent, 9 percent and 6 percent respectively. Together these five countries accounted for over 80 percent of total west coast sardine exports in 2008.

FIGURE 9-1. Annual West coast landings and real exvessel revenues for all CPS species, 1981-2008.

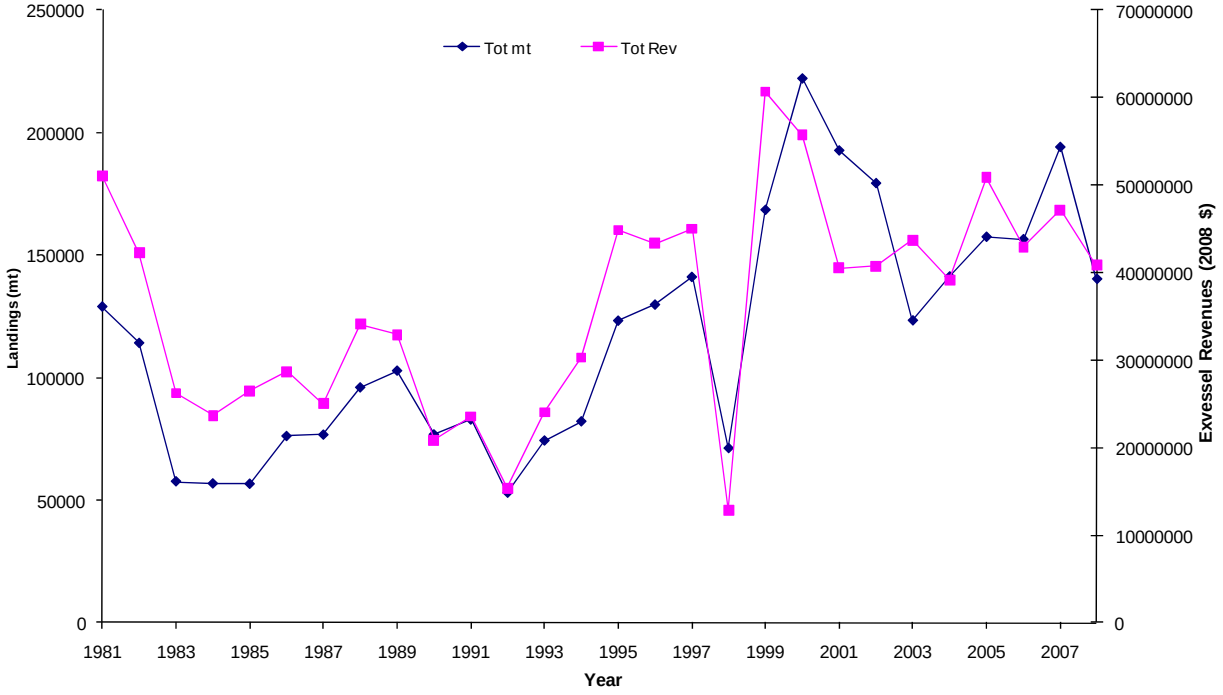


FIGURE 9-2. Percentage contribution of West coast CPS finfish and market squid landings to the total exvessel value of all Pacific coast landings, 1981-2008.

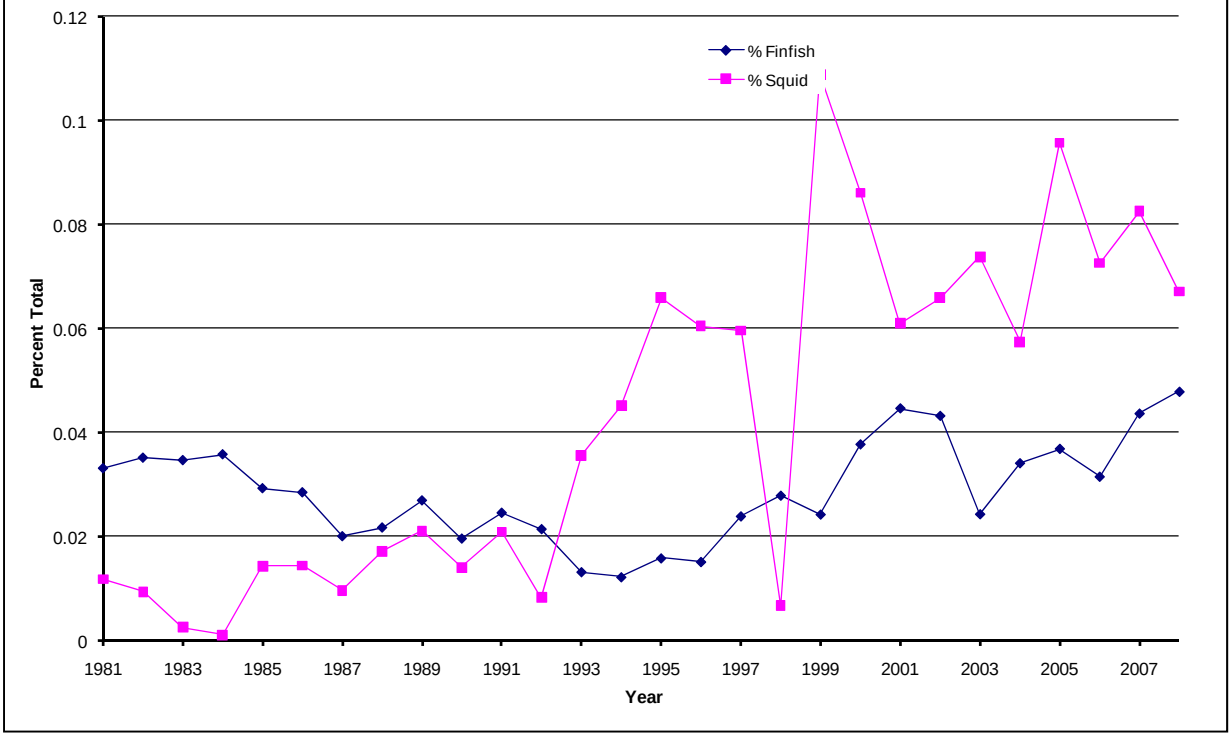


FIGURE 9-3. West coast CPS finfish landings and real exvessel price ($/lb, 2008 $), 1981-2008.

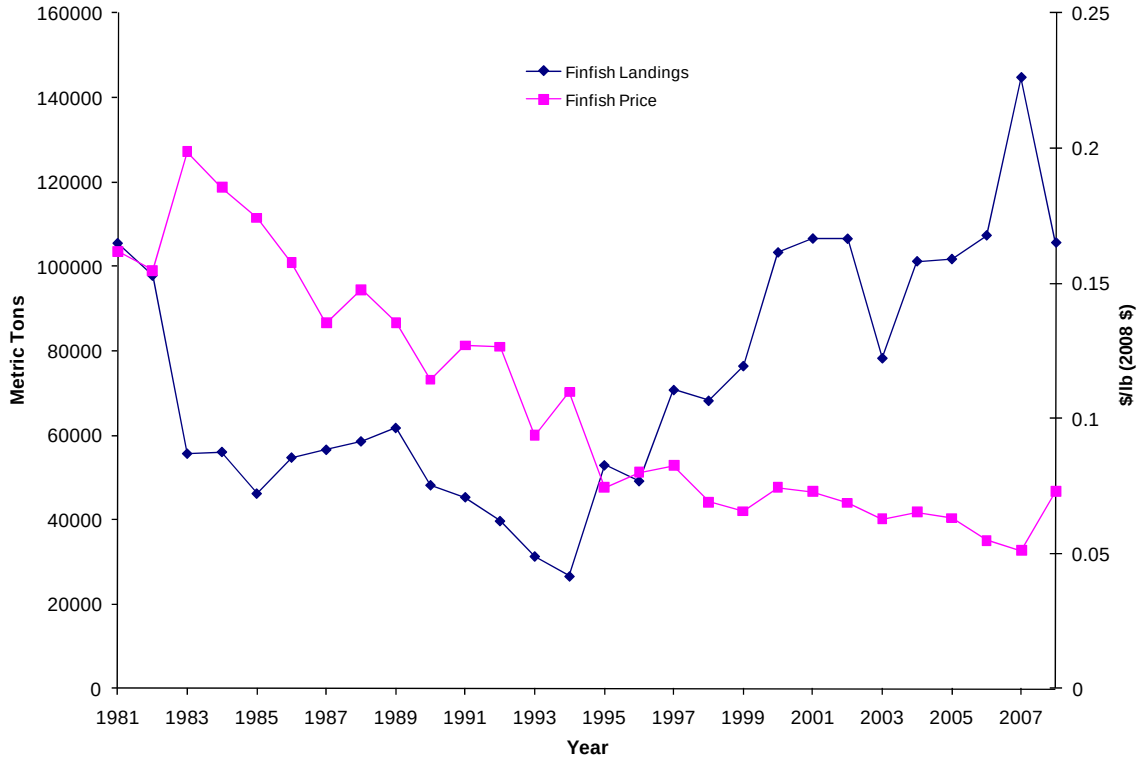


FIGURE 9-4. West coast market squid landings and real exvessel price ($/lb, 2008 $), 1981-2008.

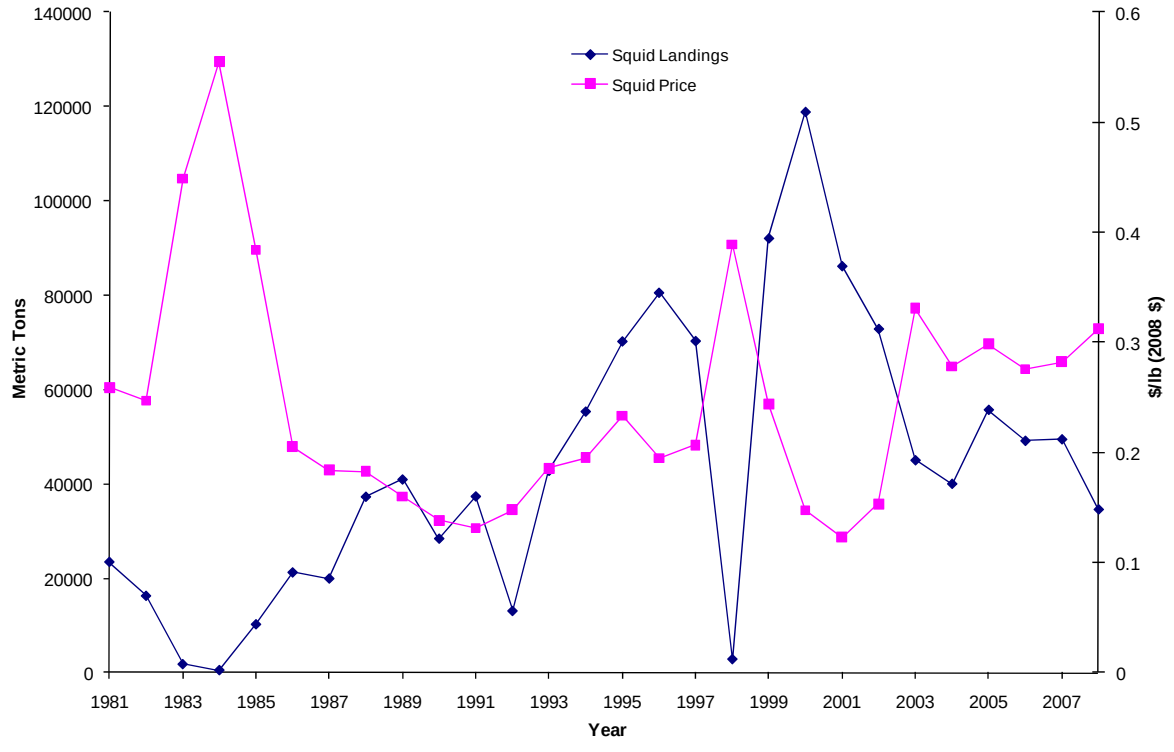


FIGURE 9-5. Number of vessels with West coast landings of CPS finfish, and number for which CPS finfish was the principle species, 1981-2008.

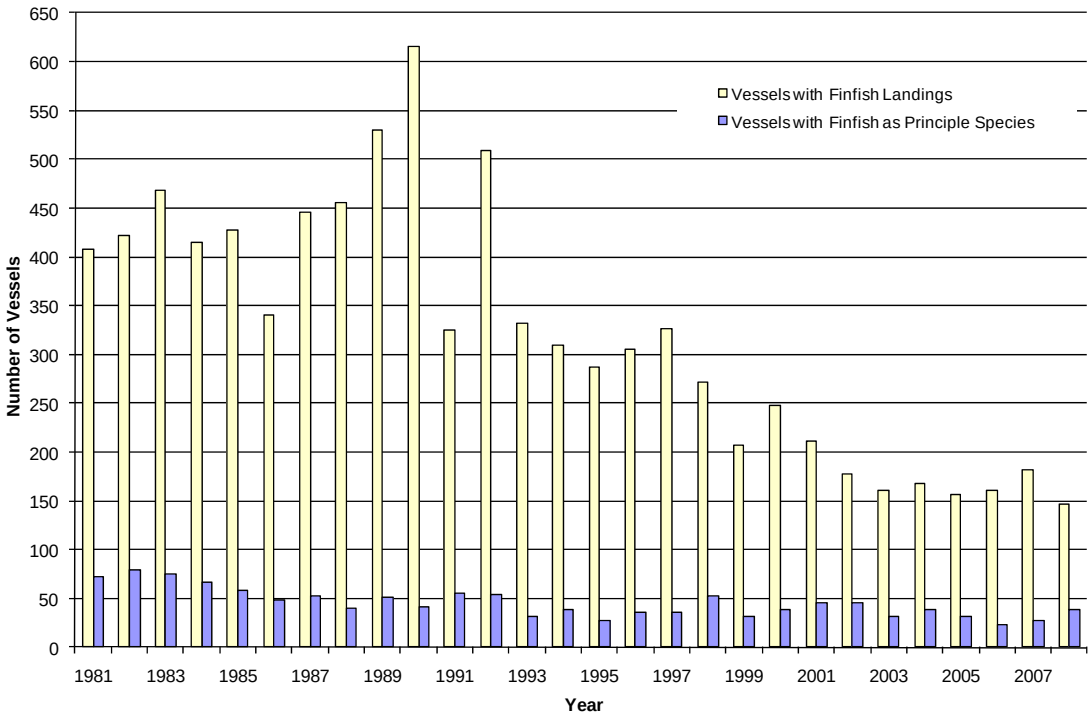


FIGURE 9-6. Number of vessels with West coast landings of market squid, and number for which market squid was the principle species, 1981-2008.

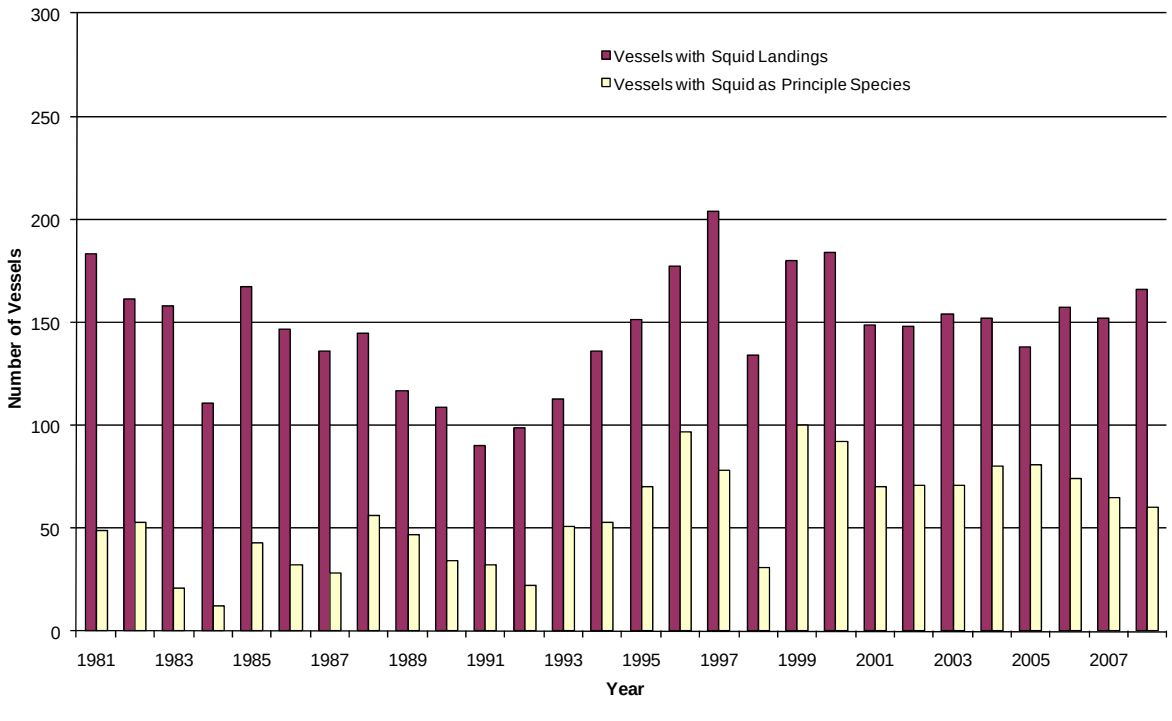


FIGURE 9-5. Number of vessels with West coast landings of CPS finfish, and number for which CPS finfish was the principle species, 1981-2008.

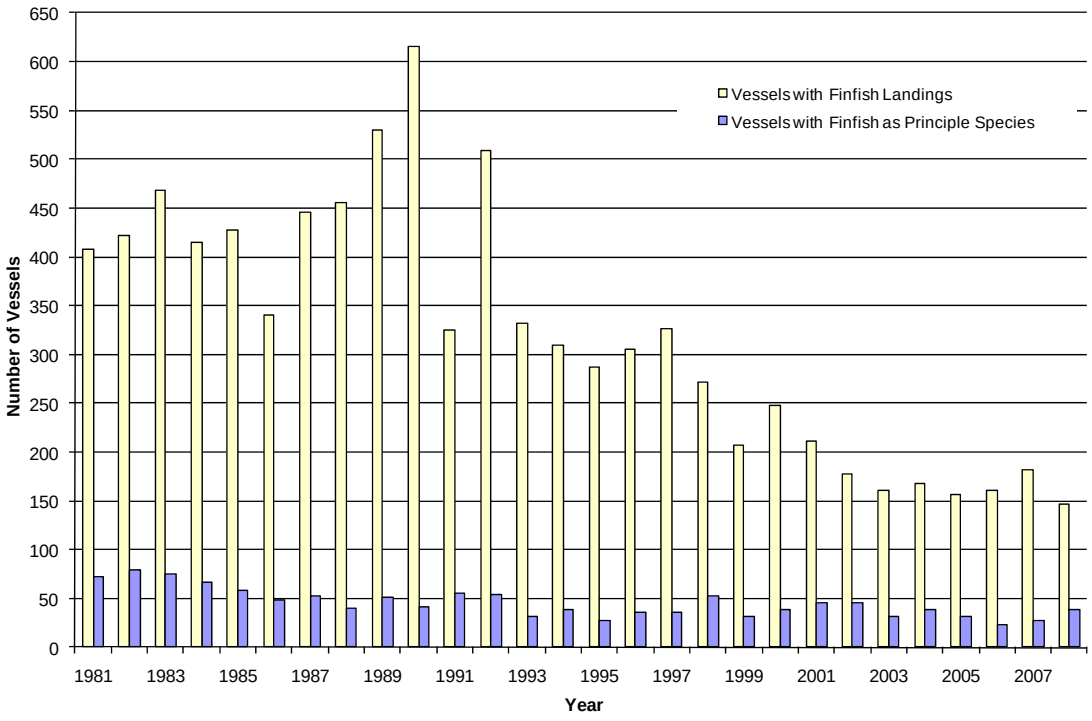


FIGURE 9-6. Number of vessels with West coast landings of market squid, and number for which market squid was the principle species, 1981-2008.

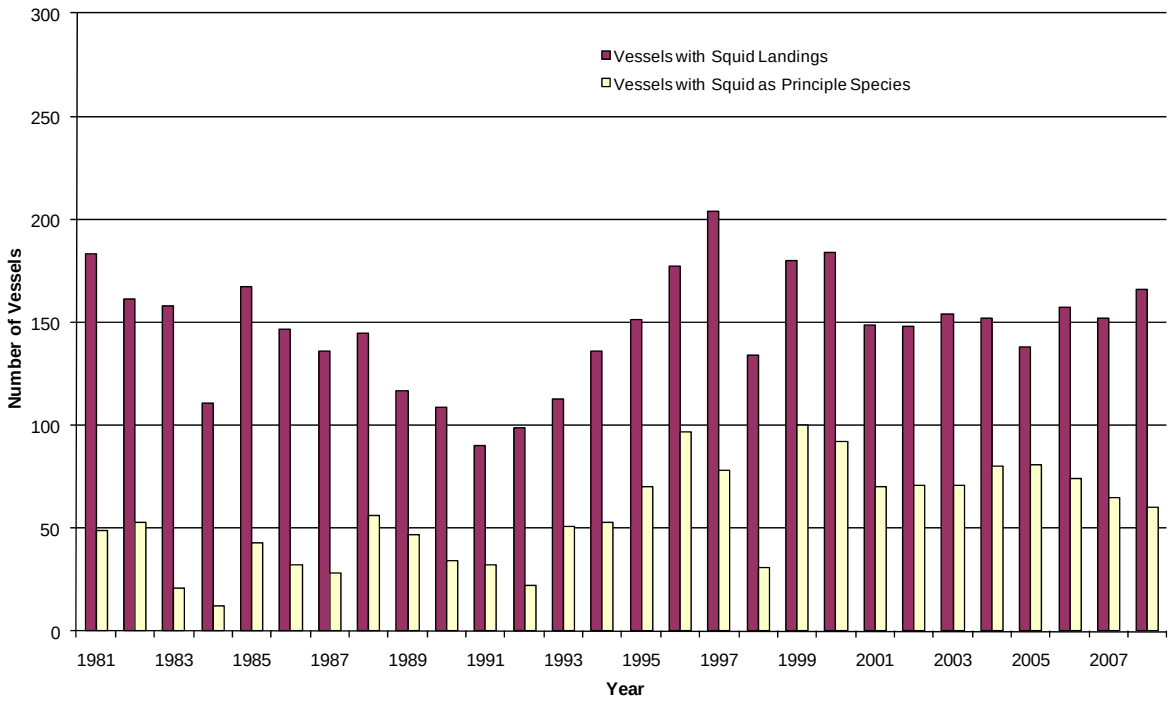
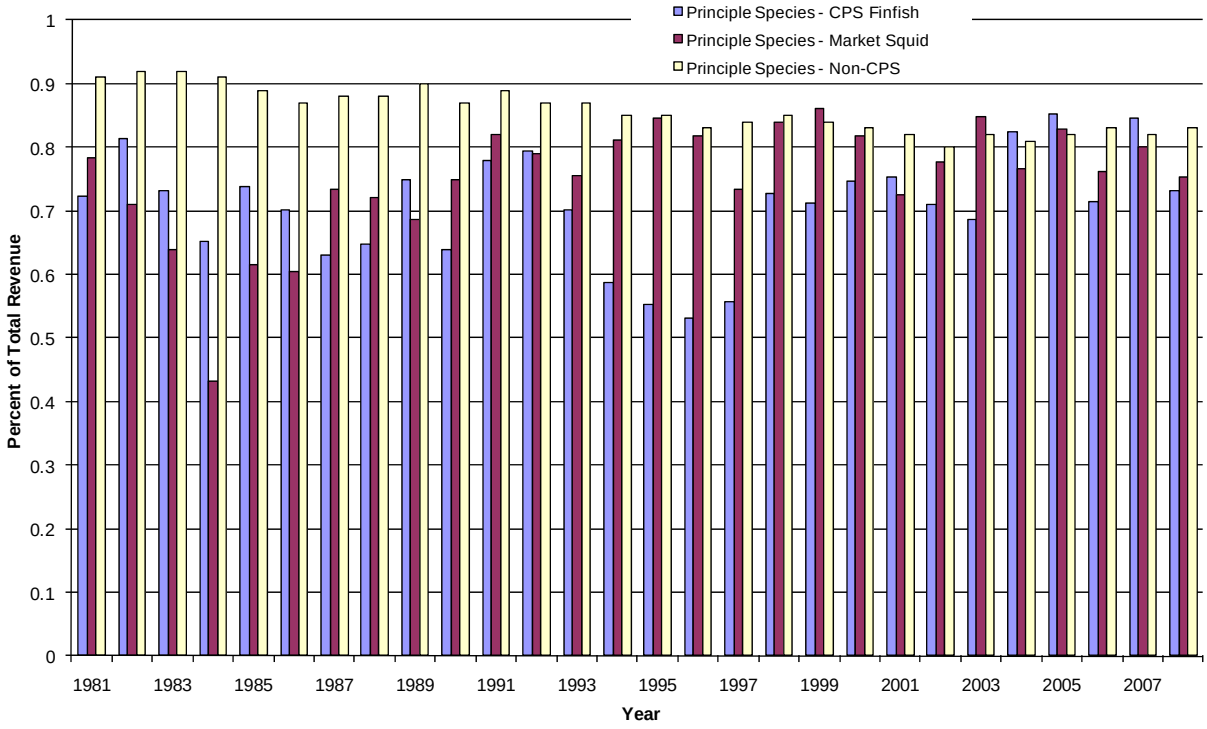
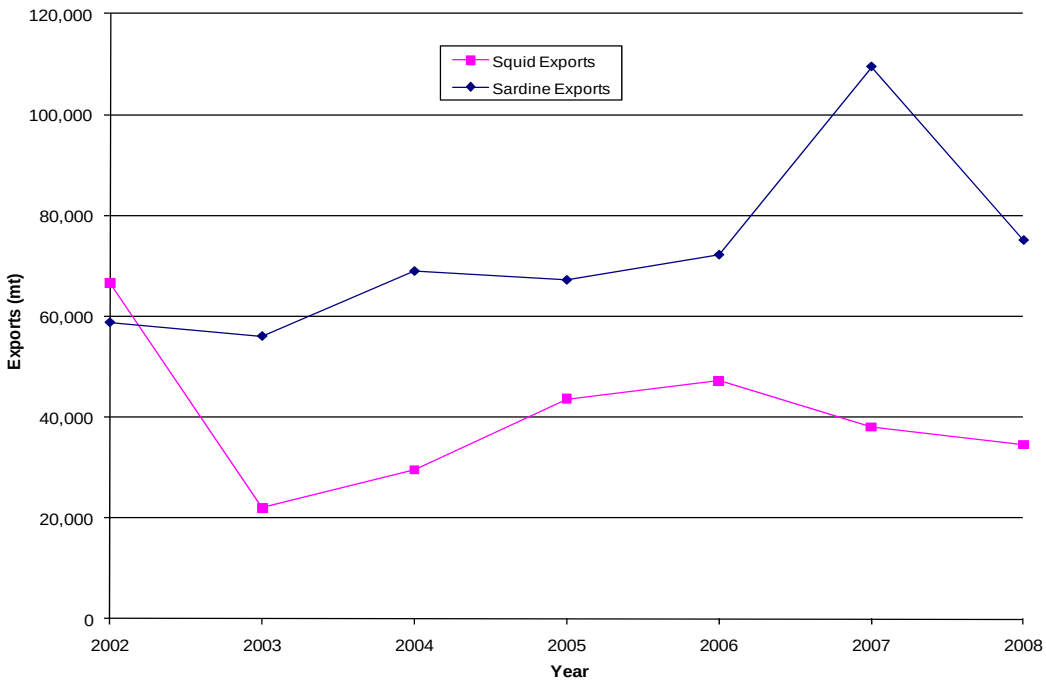


FIGURE 9-7. Average share principle species revenues of total revenues for vessels whose principle species was CPS finfish, market squid or non-CPS, 1981-2008.



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

FIGURE 9-8. West coast sardine and squid exports, 2002-2008



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. Additionally, Appendix D provided a description of CPS essential fish habitat that is closely related to ecosystem health and fluctuation. Recent efforts to learn more about ecosystem functions and trophic interactions will likely result in future research results that will improve our knowledge base for improved CPS management decisions.

10.2 Description of the California Current Large Marine Ecosystem

The California Current (CC) is formed by the bifurcation of the North Pacific Current at approximately Vancouver Island, Canada and flows southward along the West Coast to mid Baja, Mexico. The 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 (Figure 10-1).

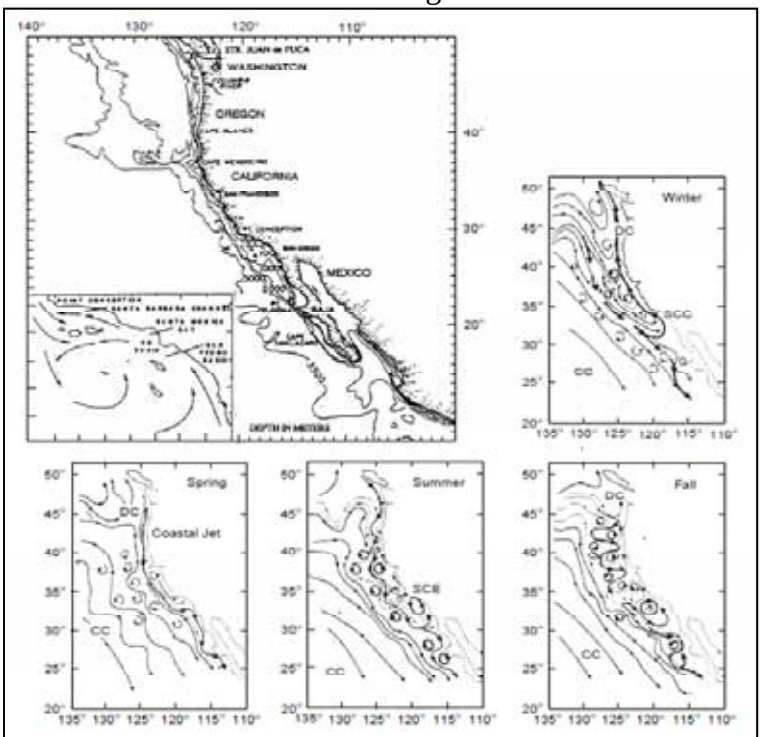


Figure 10-1. Seasonal variation of large-scale currents along the West Coast and rough bathymetry illustrate the dynamic conditions in the CCLME. The CC flows southward year round off shore from the shelf break to several hundred kilometers. Along the shelf break, several other currents affect the ecosystem to varying degrees including the Davidson Current (DC), Southern California Countercurrent, and the Southern California Eddy (SCE). (From Hickey and Royer 2001).

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[1]. NOAA's ecosystem based management approach uses the LME concept to define ecosystem boundaries.

The CCLME is characterized as having high biological productivity (>250 mg C/m2/day) that is primed by nutrients either upwelled along the shelf break or advected in surface currents from the Gulf of Alaska into the northern region (WA to Northern CA). The biological cornucopia can be seen in the extensive near shore kelp beds, large schools of CPS (e.g. sardine, anchovy, squid etc) and groundfish that, in turn, support large populations of marine mammals, sea birds and highly migratory species (e.g. tuna, sharks, billfish).

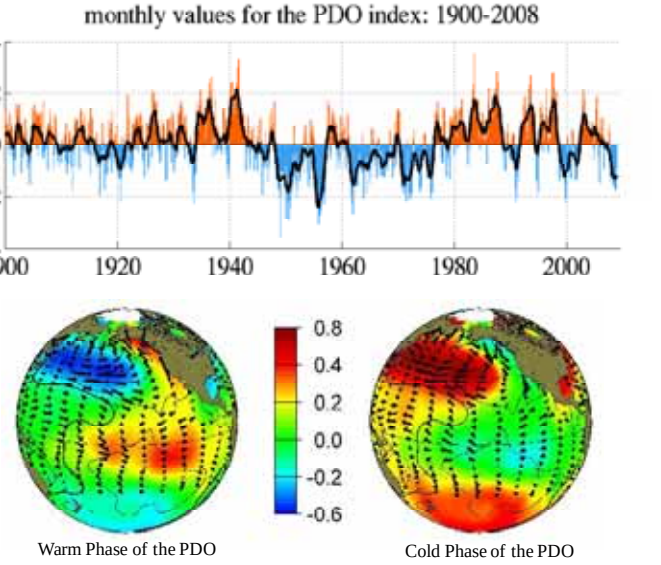


Figure 10-2. Phases of the Pacific Decadal Oscillation and associated changes in wind speed and direction as well as sea surface temperature. http://cses.washington.edu/cig/pnwc/aboutpdo.shtml

The CCLME is heavily influenced by climate at the annual, interannual and decadal time scales. Annually between the winter and spring, changes in large scale wind fields in the NE Pacific can reverse the prevailing shelf currents from a predominantly northward to southward direction. The transition in currents and concurrent increase in solar radiation in the spring leads to the dramatic increase in productivity labeled the 'spring transition'. The timing and duration of the Spring Transition is determined by NMFS' Newport, OR laboratory, which has conducted monthly surveys of the CCLME since 1997. Additional data from new survey lines off Trinidad Head (Humboldt Co.), CA (NMFS) and Bodega, CA (Sonoma Water Agency-UCD) confirm the Newport prediction. Additional data from new survey lines off Trinidad Head, CA (NMFS-HSU) and Bodega, CA (SWCA-UCD) will be used to augment analysis of the spring transition off Oregon and northern California" At present, our data (at least for Trinidad Head Line) are too sparse in time to determine spring transition

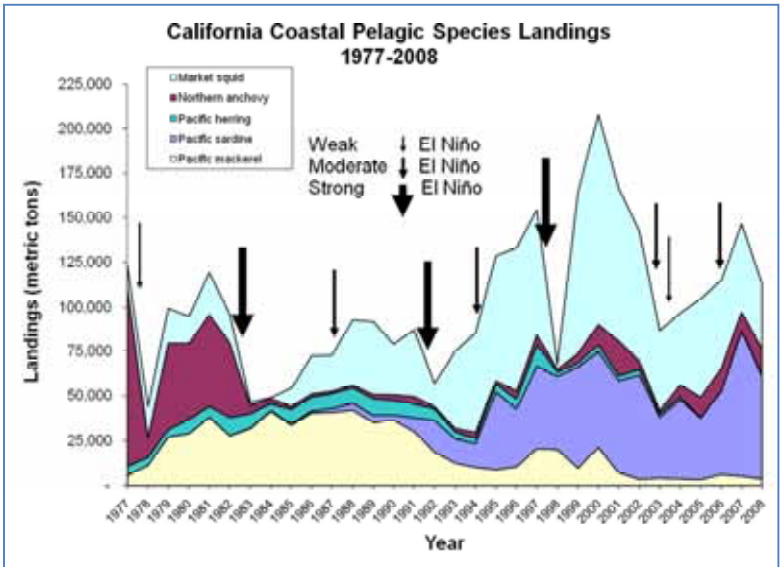


Figure 10-3 El Niño Events and California CPS Landings

[1] The CCLME is one of 10 LME's in the US EEZ and one of 64 worldwide. UN Atlas of the Ocean.

dynamics.

Along the OR coast, the timing and duration of the Spring Transition has been linked to coho salmon returns in the Columbia River (Peterson et al. 2006). The connection between the Spring Transition and CPS is not known at present.

On an interannual time scale of 3-7 years, the CCLME is affected by ENSO (El Niño Southern Oscillation) whereby either warmer, salty surface water from the equator (El Niño) or cool, upwelled water (La 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 10-3, CDFG 2008).

At periods between 20 to 50 years, low frequency climatic forcing from the Pacific Decadal Oscillation (PDO) affect the CCLME. 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 reduced landings of coho and Chinook salmon in the Pacific NW 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 generally low (Figure 10-4) (Takasura et al 2008).

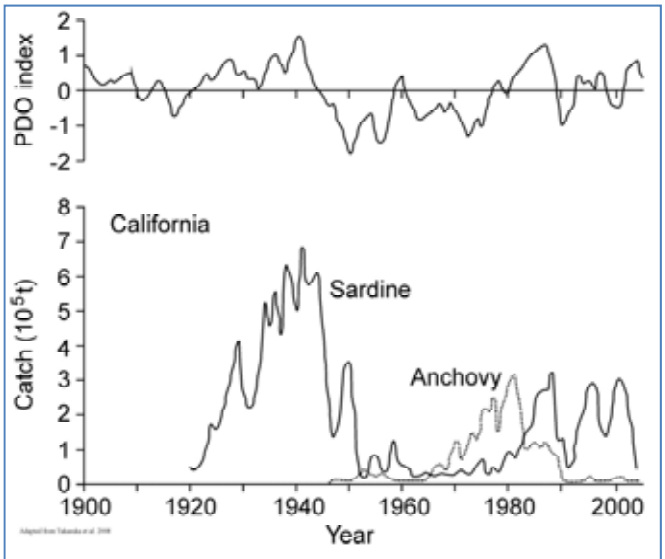


Figure 10-4. Sardine and Anchovy landings in California and PDO index for the same time period. (Adapted from Takasura et al (2008).

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 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).

10.3 Current Climate and Oceanographic Conditions.

10.3.1 Spring Transition

In 2008, the Spring Transition was early and very strong with temperature values at the lowest since conductivity, temperature, and depth data collection began in 1997. Upwelling was initiated early in the year (day 88; 28 March 2008), but did not become strong until one month later on 28 April. Winds remained steady through much of the summer except for a lull (and southwesterly storms) in August, from days 204 through 240.

The early Spring Transition portends to a good return of Columbia River coho salmon starting in 2010, but any inference to CPS is still not clear.

10.3.2 El Niño/Southern Oscillation

The Multivariate ENSO Index for the Northeast Pacific reflects La Niña conditions for 2008 with cold water dominating the CCLME with associated higher productivity along the coast (Figure 10-5). Based on model forecasts, La Niña conditions are expected to gradually weaken during the spring of 2009 leading to El Niño neutral conditions. Neutral conditions are still considered favorable for CPS.

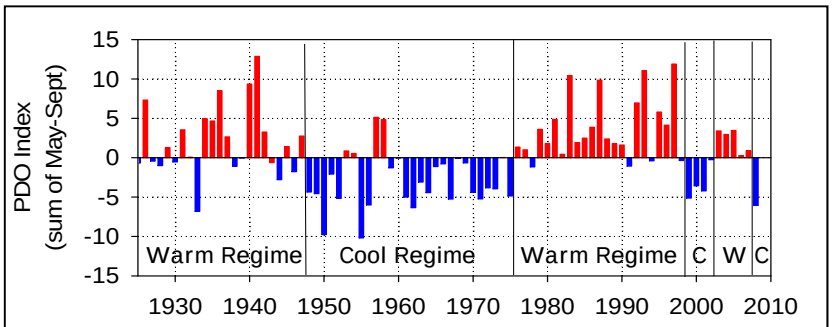


Figure 10-5. Time series of the PDO summed over May-September, 1925 to 2008. Note that the summer-time value in 2008 was the most negative since 1956. ***Source: Bill Peterson, NOAA*** http://jisao.washington.edu/pdo/PDO.latest, http://jisao.washington.edu/pdo/

10.3.3 Pacific Decadal Oscillation

The PDO has remained negative since September 2007. A negative PDO value is considered favorable for anchovy but not sardine. Effects on other CPS such as squid are not known at this time.

10.4. Trends in Ecosystem Indicators.

Biological indicators for the CCLME are under development by NOAA and partners. The following are draft indicators that may change or be replaced over time.

10.4.1 Copepods.

The copepod species richness, as surveyed by the NMFS, NWFSC at the Newport Hydrographic survey line, was low in 2008 and dominated by boreal

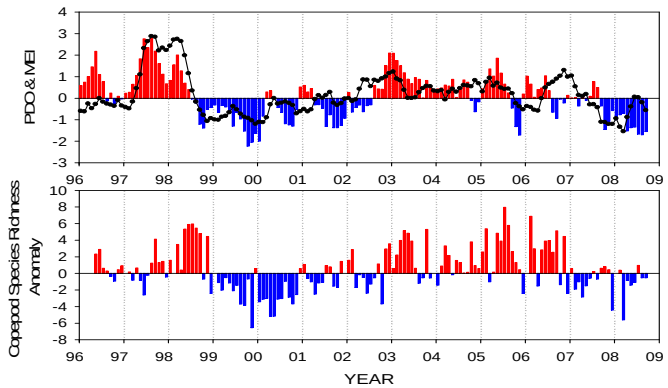


Figure 10-6. Time series of the monthly values of the Pacific Decadal Oscillation (PDO), Multivariate El Nino Index (MEI) and copepod species richness. Note that species richness tracks the PDO and MEI fairly closely; also note that richness has had negative anomalies since 2007. ***Source: Bill Peterson NOAA NWFSC.***

species (Figure 10-6). 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. Limited data from the Trinidad Head Line indicate that boreal and cold-water species dominated copepod assemblages off northern California during 2008.

10.4.2 Juvenile Fish.

Surveys for juvenile fish are conducted by the NMFS, SWFSC the Central California coast in the May-June time period since 1983 (Figure 10-7). Sardine numbers remain above the long-term average, but were down modestly while anchovy juveniles were down significantly in 2008. Market squid encounters were below average as well. Information on juvenile fish 2009 was unavailable at the time of this report.

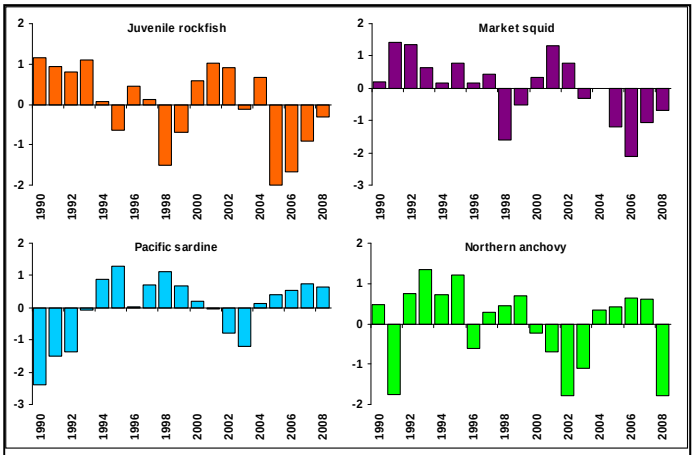


Figure 10-7. Standardized anomalies from the log of mean values by year for four key forage species from the annual juvenile fish survey. ***Source: Steve Ralston, John Field and Keith Sakuma, NOAA SWFSC.***

10.5 Pacific Sardine as Forage

Under a comprehensive, environmental-ecological-economic-based conservation and management approach or ecosystem-based fishery management (EBFM), the impacts of harvesting sardines will extend beyond directed commercial fisheries to consideration of the corresponding effects on sardine predators that constitute higher trophic level commercial and recreational fisheries, as well as non-commercial but ecologically important predators (e.g., marine mammals, seabirds). Ongoing work in this area is focused on the development of a modeling framework for enumerating the benefits provided by Pacific sardine in the CCLME, and evaluating sardine EBFM conservation and harvest policy in terms of the tradeoff between benefits from sardines as a directed harvest and sardines as forage (Figure 10-7).

–

Ecosystem Services of Pacific Sardine

- **Harvested** for human consumption, bait, aquafeeds, aquarium feeds
- **Forage**: direct consumption by commercial, non-commercial/recreational predators; indirect food web effects
- **Value added** from higher trophic level commercial fisheries
- **Value added** from higher trophic level recreational fisheries
- **Value added** from food for ecologically important species

Diagrammatically this problem can be illustrated in terms of an output transformation frontier (*TF*) and the values of the ecosystem services that the Pacific sardine resource provides. The stylized *TF* in Figure 10-8 represents the combination of ecosystem services in terms of forage (*F*) -- where forage is transformed into the annual production of commercial predators and non-commercial predators -- and commercial harvests (*H*) of sardines that the existing resource stock is capable of providing. The frontier will move inward or outward as the sardine biomass contracts or expands.

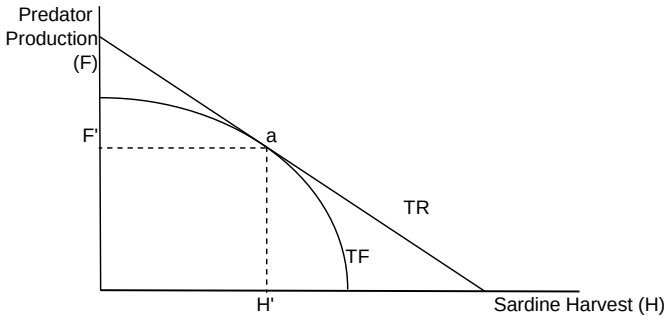


Figure 10-8 The Pacific sardine resource transformation frontier.

All points on the *TF* are points of maximum productive efficiency, meaning that each combination of *H* and *F* is being produced at the lowest possible cost so that the marginal cost of forage *(MC_F)* equals the marginal cost of harvest (MC_H). All points inside the *TF* are feasible but productively inefficient; all points outside the *TF* are infeasible for given sardine stock. Points along the *TF* describe the trade-off between *F* and *H*. If there is no increase in the sardine stock, increasing *F* has to entail decreasing *H* because biomass must be transferred to the first and away from the second. The sacrifice in the production of *H* is called the "opportunity cost" of *F*; an economic cost that is measured in the number of units of the *H* that are foregone for an additional unit of F. Concavity of the *TF* indicates increasing marginal opportunity costs.

Given the sardine forage-harvest *TF*, the management objective under EBFM would entail determining the combination of forage and harvest that maximizes the total social value from the sardine stock. If per unit monetary values for harvest (P_H) and forage (P_F) are available, a total revenue (*TR*) curve can be constructed (if per unit values are constant, $TR = HP_H + FP_F$, so that the marginal values of forage and harvest are P_F and P_H respectively). The socially optimum combination of sardine harvest and sardine for forage occurs at the point of tangency of the *TR* curve with the *TF* (point "a' in Figure 10-7). At point a, $MC_F = P_F$ and $MC_H = P_H$, and therefore the net social benefits from forage and harvest are equal. This is the condition, which achieves the socially optimum allocation of the sardine stock between forage and harvest production, from which follows the socially optimum levels of sardine predator production and sardine harvest, *F'* and *H'* in Figure 10-8 respectively.

To quantitatively model this situation will require a great deal of detailed economic and ecological data. An indication of the data requirements can be seen from the economic and ecological interactions shown in Figure 10-8. On the economic side, the net benefits of harvesting sardines and their commercial predators can be derived from the market revenues and costs associated with their harvest. The non-commercial predators are not subject to market exchange: recreational catches are not sold; ecologically important species are public goods. Therefore, evaluating the tradeoffs between harvesting sardines and leaving them in the ocean as food for non-commercial predators will require the use of non-market valuation techniques to enumerate the related benefits and costs of the ecosystem services sardine provide in this role. The net per unit values of the non-market predators can then be used to derive shadow prices for sardines as forage for the recreational and ecologically important predators. The sardine shadow

prices will then be incorporated into the existing modeling framework enabling it to evaluate various tradeoffs and determine the socially optimum allocation of the sardine resource as illustrated in Figure 10-8.

On the ecological side, current work in this area has relied on the ecosystem model of Field et al. (2006). This model was developed for dynamic simulations of the CCLME, starting in the 1960s but based on food habits data over a broader time period. At that time, sardines were at very low levels of abundance. As a result, the predation and food conversion parameters in the Field et al. (2006) model are not likely to be representative for periods with greater sardine abundance or for predators and prey in the southern part of the CCLME. The current work takes predation and food conversion parameters as being fixed at the 1960s levels. However, major changes in sardine abundance, catches and in predator stock levels that have occurred since then are likely to affect these parameters.

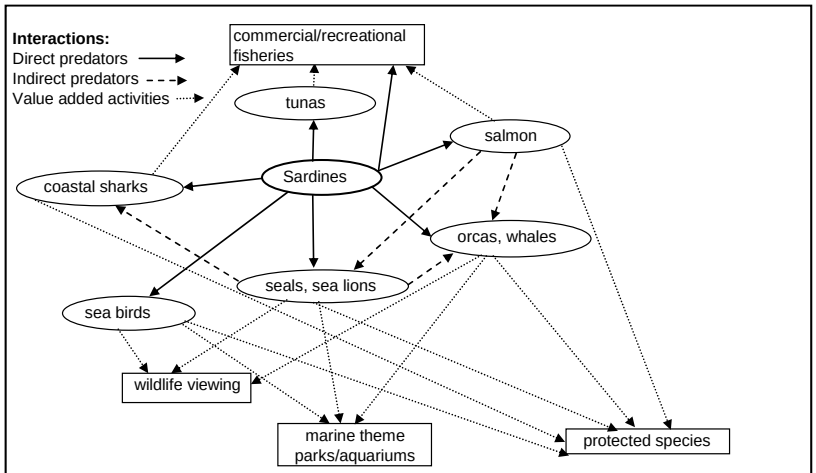


Figure 10-9 Sardine centric ecological and economic interactions.

Moreover, major changes in sardine stock levels and the spatial distribution of the sardine stock have been shown to be strongly influenced by climate induced environmental changes (Norton and Mason 2003, 2004, 2005; Herrick et al. 2007). These changes are propagated into the ecosystem, which reacts by reorganizing trophic relationships and relative species composition. Incorporating the relevant environmental factors into the modeling framework is expected to greatly enhance its predictive and dynamic capabilities, particularly with regard to different climate change scenarios. Therefore to confidently predict and evaluate the effects of a drastic change in sardine stock levels, like the return of the sardine fishery, a more comprehensive model is required; one that will take into account dynamic relationships between environmental, ecological, and economic variables.

While the data requirements for a comprehensive EBFM-based model may be monumental they are not insurmountable, and are expected to be realized in a gradual manner. Nevertheless, incremental results from modeling efforts such as this will be useful for indicating the direction of changes and to illustrate that strategic consideration of the tradeoffs could be an important element of the decision-making and management process. From a comprehensive fishery conservation and management standpoint, the insights and information provided by this modeling effort will contribute greatly to the development of an EBFM framework.

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Climate Indicators:
El Niño Southern Oscillation (ENSO):
Source: Bill Peterson, NOAA
Source: http://www.cdc.noaa.gov/people/klaus.wolter/MEI/mei.html
Pacific Decadal Oscillation (PDO):
Source: Jerrold Norton, NOAA (Jerrold.G.Norton@noaa.gov)
Environmental Research Division (ERD), NOAA, NMFS

The PDO and Sea Surface Temperature at Newport, Oregon:
Source: Bill Peterson, NOAA
http://jisao.washington.edu/pdo/, http://jisao.washington.edu/pdo/PDO.latest

California Current Ecosystem Indicators:
Copepods:
Source: Bill Peterson, NOAA
Source: Marc Trudel, Pacific Biological Station, Fisheries and Oceans Canada, Nanaimo, BC

Coastal Pelagics:
Ecosystem indicators for the Central California Coast, May-June 2008
Source: Steve Ralston, John Field and Keith Sakuma, Fisheries Ecology Division, SWFSC

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.* (2008; 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 the fisheries off the Pacific Northwest (Oregon-Washington-Canada), California, and Ensenada (Mexico) totaled 166,156 mt in calendar year 2007 (Table 11-4). In 2008, landings in California (57,800 mt) decreased considerably from the previous year (80,981 mt in 2007; Oregon-Washington landings were also lower in 2008 (29,384 mt) than in 2007 (46,809 mt; (Table 11-3). The U.S. sardine fisheries are regulated using a quota-based HG management scheme (see Section 11.1.1.1). Since the mid-1990s, landings from the U.S.-based fisheries have typically been lower than the recommended HGs (Table 11-3). However the 2008 HG was 42% lower than the previous year, so the U.S. fishery was subject to several inseason closures throughout the 2008 management year. 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 36,847 mt in 2007, down from 57,237 mt in 2006 (Table 11-4). Ensenada landings for 2008 are not yet available. The Canadian sardine fishery captured 10,435 mt in 2008, up from 1,520 mt in 2007 (Table 11-4).

Estimated stock biomass (ages 1+) from the assessment conducted in 2008 (Hill et al. 2008; see Appendix 1) indicates a decline in sardine abundance since the recent peak year (2000), with an estimate of roughly 662,886 mt in July 2008. Recent year class sizes are considerably lower than the recent peak of 14.06 billion fish in 2003. Biomass and recruitment estimates (1981-2008 from the most recent assessment are provided in Table 11-2 and Appendix 1).

Finally, estimates of Pacific sardine biomass from the 1930s (Murphy 1966 and MacCall 1979) indicate that the sardine population may have been more than three 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 show a downward trend in 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 2009

The Pacific sardine harvest guideline established for the U.S. fishery in calendar year 2009 was 66,932 mt. Statistics used to determine this harvest guideline are discussed below and in Sections 4.3.1-4.3.2. The MSY control rule defined in Amendment 8 of the CPS FMP, Option J, Table 4.2.5-1, PFMC (1998) was used to calculate the harvest guideline for 2009. 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 sardine is:

$$HG_{2009} = (BIOMASS_{2008} - CUTOFF) \bullet FRACTION \bullet DISTRIBUTION;$$

where HG_{2009} is the total USA (California-Oregon-Washington) harvest guideline in 2009, $BIOMASS_{2008}$ is the estimated July 1, 2008 stock biomass (ages 1+) from the current assessment (662,886 mt), CUTOFF is the lowest level of estimated biomass at which harvest is allowed (150,000 mt), FRACTION is an environment-based percentage (see below) of biomass above the CUTOFF that can be harvested by the fisheries, and DISTRIBUTION (87 percent) is the percentage of $BIOMASS_{2008}$ assumed in U.S. waters. The value for FRACTION in the MSY control rule for Pacific sardine is a proxy for F_{msy} (i.e., the fishing mortality rate that achieves equilibrium MSY). Given 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 percent and 15 percent. Based on the T values observed throughout the period covered by this stock assessment, the appropriate F_{msy} exploitation fraction has consistently been 15 percent; and this remains the case under current oceanic conditions (T_{2008} = 17.83 °C). The HG established for 2009 (66,932 mt) is 25 percent lower than the 2008 HG (89,093 mt), and 56 percent lower than the HG in 2007 (152,564 mt; Table 11-3), so the U.S. fishery will likely be constrained at various points during the 2009 management season.

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' (on an increasing limb of a historical distribution say) observed recently. 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.

Thus, 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.

Finally, 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.

11.1.2.1 Harvest Guideline for 2009-2010

Following the STAR in May 2009, the completed assessment was presented, reviewed, and approved by the following management bodies in June 2009: SSC; CPSMT; and the Pacific Council. The following harvest control rule has been in place since 2000 and provides a HG on an annual basis (i.e., July 1, 2009 – June 30, 2010):

$$\text{Harvest} = (\text{Biomass-Cutoff}) \bullet \text{Fraction} \bullet \text{Distribution},$$

where Harvest is the harvest guideline (HG), Biomass is the estimated total stock biomass (age 1+) in 2009 (282,049 mt), Cutoff (18,200 mt) is the lowest level of estimated biomass at which harvest is allowed, Fraction (30percent) is the proportion of biomass above the Cutoff that can be harvested by fisheries, and Distribution (70percent) is the average fraction of total biomass assumed in USA waters (PFMC 1998).

The HG for the 2009-10 fishing year based on SS model *AA* and the harvest control rule above was 55,408 mt (see Crone *et al.* 2009); however, ultimately, the Council recommended a lower quota of 10,000 mt, which potentially includes a 2,000 mt set-aside for incidental landings should the directed fishery close (see section 11.1.2). Finally, it is important to note that since the 2001 fishing year, from a management context, the fishery has failed to fully utilize HGs, with average yields since this time of roughly 5,000 mt

11.2 Monitored Species

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

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 until 2000. California landings of northern anchovy reported by Pacific coast Fisheries Information Network (PacFIN) totaled 11,752 mt in 2000; 9,187 mt in 2001; 4,650 mt in 2002; 1,676 mt in 2003; 6,877 mt in 2004; 68 mt in 2005; 12,788 mt in 2006 (mostly caught in the Monterey area), 12,116 mt in 2007, and 14,039 mt in 2008. There were no reported landings of northern anchovy in Oregon from 1981 through 2001, with 3.1 mt reported in 2002; 39 mt in 2003; 13 mt in 2004; 68 mt in 2005, 9 mt in 2006, 5 mt in 2007, and 260 mt in 2008. Washington reported about 42 mt in 1988, but didn't land more until 2003 when 214 mt was landed; no landings occurred from 2004 through 2006. In 2007 148 mt were landed, and in 2008 109 mt were reported. Through the 1970s and early 1980s, Mexican landings increased, peaking at 258,700 mt in 1981 (Table 18). 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 3,500 mt through 2003. Anchovy landings in Ensenada increased to 5,604 in 2005; however, no landings were reported (or were not available) for 2002 to 2008.

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.)

Currently, most landings of jack mackerel are incidental to Pacific sardine and Pacific mackerel in California; however, pure landings do occur sporadically. In California, CDFG landing receipts for jack mackerel totaled 1,269 mt in 2000, 3,624 mt in 2001(these may be somewhat over-reported – the jump in jack mackerel landings in 2001 coincided with an early closure of the Pacific mackerel HG), 1,006 mt in 2002, dropped to only 189 mt in 2003, 1,199 mt in 2004, 253 mt in 2005, 1,499 mt in 2006, 1,065 in 2007, and 264 mt in 2008. 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.

Oregon reported 161 mt in 2000, 183 mt in 2001, 9 mt in 2002, 74 mt in 2003, and 126 mt in 2004, 70 mt in 2005, 5 mt in 2006, 8 mt in 2007, and 46 mt in 2008. Washington reported 11.5 mt in 2002, 1.8 mt in 2003, and none from 2004 to 2006, 1.3 mt in 2007, and 2.7 mt in 2008.

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. Most of the contemporary catch is in small aggregations of young fish along rocky shores, or schooling with Pacific sardines or Pacific mackerel.

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 and simulation modeling currently serve as informal assessment tools, within a research context only, to evaluate population dynamics and biological reference points (say MSY-related) regarding this species. 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.

Currently, limited information is available on market squid population dynamics, and data on its historical and current levels of absolute biomass are unavailable. A STAR Panel was convened in May 2001 to evaluate assessment methods for use in the management of the squid fishery and to assess the appropriateness of defining MSY for this species. Preliminary attempts to estimate biological reference points (e.g., MSY, FMSY, and BMSY) from surplus production models were unsuccessful. In view of the difficulties in determining traditional estimates of MSY for market squid, and given that new, albeit limited, information on reproductive biology was available, the STAR Panel focused attention on reference points based on "egg escapement" and its related proxies, such as F. Egg escapement is defined here as the proportion of a female

squid's potential lifetime fecundity is spawned, on average, before being harvested in the fishery. An Egg Escapement method based on conventional yield and spawning biomass "per recruit" theories was fully developed by the Stock Assessment Team and the STAR Panel and subsequently, supported by the SSC, the CPSMT, and the CPSAS.

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 potential levels of fishing mortality that results in MSY (FMSY). However, it is important to note that this approach does not provide estimates of historical or current total biomass and thus, a definitive yield (i.e., quota or ABC) cannot be determined at this time. Ultimately, the Egg Escapement method can be used to assess whether the fleet is fishing above or below an a priori determination of sustainable exploitation, and in this context can be used as an effective management tool.

The STAR Panel provided general recommendations regarding analytical methods (i.e., the Egg Escapement method) and left determination of specific model configurations and other management-related parameters to the CPSMT. In this context, the CPSMT provided guidance concerning four critical areas of the Egg Escapement method, which were necessary to develop a pragmatic framework for monitoring/managing this species in the future, (1) selection of a "preferred" model scenario; (2) selection of a "threshold" level of egg escapement that can be considered a warning flag when tracking the status of the population; (3) fishery operations in (and after) ENSO events; and finally, (4) important management-related constraints. Readers interested in details regarding assessment methods, STAR-related discussion and conclusions, and CPSMT decisions should refer to papers presented in Appendix 3 of the PFMC (2002).

Data collection programs and subsequent laboratory analysis has continued to the present in attempts to complement baseline information that served as the foundation for developing the Egg Escapement method described above. That is, as generally discussed in previous CPS-related documents [e.g., Appendix 3 of the PFMC (2002)] further work surrounding the Egg Escapement assessment approach has addressed the following: (1) collecting much needed samples from the fisheries to bolster the original source of reproductive data that were relied upon initially when developing the overall Egg Escapement method: additional sample data now span from 1999 to 2005; (2) critically evaluating spatial/temporal patterns of the overall fishery through stratified sampling (spatially and temporally) and subsequent analysis including data from 1999 to 2005; (3) in concert with the CPSMT, preparing preliminary analysis-related schedules that could be accommodated within the Council forum and meet the stipulations required for 'monitored' species; and (4) conducting simulation modeling to further examine the relationship between critical biological reference points (i.e., 'threshold' levels) and absolute levels of squid population abundance off southern California–results from this research were presented in a working paper distributed (via CPSMT discussions) in the fall of 2008.

To date, preliminary analyses, including estimates of fishing mortality, egg escapement, and abundance estimates have been conducted on a regional/quarterly basis for data from 1999-2006. Furthermore, sensitivity analyses based on varying levels of influential (assumed) parameters, namely natural mortality and egg-laying rates, have also been completed for the same time period. Finally, simulation modeling has been performed to examine levels of fishing mortality and proportional egg escapement (eggs-per-recruit, relative to a maximum value, profiled across levels of fishing mortality) that are most likely to be sustainable, i.e., produce levels of recruitment that sustain long-term population abundance. Preliminary results from these

analyses were presented to the CPSMT in fall 2006, and a working paper was submitted to the CPSMT for review in fall 2008 (see Section 4.3.4).

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 2008, the market squid fishery was California's second largest fishery in the state, with landings estimated at 38,100 mt. This is 23 percent less than in 2007 (49,801 mt) and 68 percent less than the record high set in 2000 (118,827 mt). The total ex-vessel value dropped from $29.1 million in 2007 to $26.5 million in 2008. The ex-vessel price per ton of market squid appears to have increased with three prices accounting for 90% of the 2008 landings: $661/t (44%), $771/t (36%), and $716/t (10%). 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 474 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 98.6 percent of the total catch (33,576 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.

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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 indefinately.

12.1.2 Exempted Fishing Permits and Aerial Survey

At its March 2009 meeting, the Council reviewed proposals for aerial survey research on Pacific sardine to be conducted under an exempted fishing permit with the goal of developing a new index of sardine abundance. The Council adopted the proposals for public review and recommended that they ultimately combine the proposals into a single project managed under its own collaborative team guided by a scientifically sound survey design. Sardine industry representatives and scientists have since collaborated on a single proposal that is posted on the Council web site. The Council scheduled a stock assessment review panel May 4-8 in La Jolla, California to, in part, review survey methodologies proposed for 2009. The Council adopted final recommendations for 2009 exempted fishing permits at its June 13-18, 2009 meeting in Spokane, Washington.

The Council heard preliminary testimony that the survey proposals will likely require an increase in the 2009 research set-aside from 1,200 mt to 2,400 mt in order to conduct the survey work from Cape Flattery, Washington to Monterey Bay, California. Therefore the Council has recommended that NMFS conduct the necessary rulemaking to increase the research set-aside to 2,400 mt by reducing the directed sardine fishery in the second and third fishing periods. The Council continues to support limiting use of the research set-aside to the second allocation period (July 1 through September 14, 2009) with any unused portion of the research set-aside to be transferred to the third period of the directed fishery.

The Council understood that there was minimal time available for rulemaking before the July 1, 2009 start of the second period. Had this rulemaking effort failed, the Council intended to continue its consideration of an exempted fishing permit for 2009 Pacific sardine research under the existing management regime and the initial 1,200 mt research set-aside. Under this scenario, the scope of the proposed research would have been scaled back.

12.2 Pacific Mackerel

Pacific mackerel continue to be actively managed although recent landings have been well below the ABC. Pacific mackerel are currently undergoing the full assessment process. The assessment

was reviewed by the SSC and the CPS advisory bodies at the June 2009 Council meeting. The Council recommended that NMFS not conduct an update assessment in 2010, but rather focus on the research and data needs highlighted in the June 2009 reports of the CPSMT and the SSC. See Appendix 2**.**

12.3 Management Issues

Emerging management issues include implementation of new provisions is 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 potentially amendment of the CPS FMP to incorporate mechanisms to prevent overfishing such as annual catch limits and accountability measures. In accordance NMFS has revised is 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 is preparing a scoping summary and the Council is scheduled to review preliminary CPS FMP amendment alternatives in November 2009.

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 is currently pursuing the necessary funds to develop an EFMP and made preliminary recommendations on forming a plan development team that would include both scientists and industry representatives familiar with CPS.

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. and Mexico. 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. Mexico is tentatively scheduled to host the 2009 Trinational Sardine Forum.

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;

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

California's Pacific mackerel fishery has been sampled by CDFG for age composition and size-at-age since the late-1920s. The current stock assessment model incorporates a complete time series of landings and age composition data from 1929 onward. Ensenada (Baja California) landings have rivaled California's over the past decade; however, no biological information is readily available from Mexico's fishery. Landings are accounted for in the assessment, but size and age composition are assumed to be similar to the San Pedro, California fishery. Like sardine, there is a need to establish a program of port sample data exchange with Mexican scientists (Instituto Nacional de la Pesca, Ensenada) to fill this major gap in the stock assessment.

Fishery-independent survey data for measuring changes in mackerel recruitment and spawning biomass are generally lacking. The current CalCOFI sampling pattern provides information on mackerel egg distributions in the Southern California Bight, the extreme northern end of the spawning area. Mexican scientists have conducted a number of egg and larval surveys off of Baja California in recent years. Access to these data would enable us to continue the historical CalCOFI time series, which began in 1951. This information could be directly incorporated into the assessment model. Night-light surveys for newly recruited Pacific mackerel should be re-instituted in the Southern California Bight. Surveys following protocols employed during CDFG Sea Survey cruises (1950-1988) could allow splining the new recruitment data set to the historical time series. The new time series would represent the only recruitment index in the mackerel stock assessment and would strengthen the ability to accurately forecast age zero and total stock abundance for each fishing season.

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. Additionally, a well-designed logbook monitoring program associated with the current commercial (purse-seine) fishery warrants further consideration, given the

importance of alternative indices of abundance, particularly time series developed from major fisheries, such as the wetfish fleet off the U.S. Pacific coast.

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.

Finally, the MSY control rule utilized in the Pacific mackerel federal CPS FMP was developed in the mid-1980s using the historical time series of abundance. The harvest control rule should be re-examined using new data and simulation methods. Given substantial amounts of additional sample data have accumulated since the initial research that was undertaken to formally establish this harvest strategy, it would be prudent to conduct further simulation modeling work to address particular parameters included in the overall control rule (including 'cutoff,' 'fraction,' and 'distribution' values).

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 (see Section 11.2.3), are used to assess the status of the stock and evaluate biological reference points, such as MSY. 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 surround 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 is 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

Sweetnam, D., and L. Laughlin. 2005. Personal Communication, January 11, 2005. California Department of Fish and Game, La Jolla, California. Email address: Dale.Sweetnam@noaa.gov.

Appendices

The following appendices will be added to this document when it is published in its final draft following the June 2009 Council meeting:

Appendix 1: Assessment of the Pacific sardine resource in 2008 for U.S. management in 2009.

Appendix 2: Pacific mackerel assessment for U.S. management in the 2009-10 fishing year.

TABLE 2-1. HISTORY OF COUNCIL ACTIONS

- The Council initiated development of the FMP for northern anchovy in January of 1977. The FMP was submitted to the Secretary in June of 1978. Regulations implementing the FMP were published in the *Federal Register* on September 13, 1978 (43*FR*40868).

- 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, 197*9 (44*FR*41806).

- The second *a*mendment, which became effective on February 5, 1982, was published in the *Federal Register* on January 6, 1982 (47*FR*629). The purpose of this amendment was to increase the domestic fishing fleet's opportunity to harvest the entire OY of northern anchovy from the U.S. EEZ by releasing, inseason, unutilized portions of the northern quota.

- 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 (48*FR*34963) 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. Additionally, 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 was published in the *Federal Register* on March 14, 1984 (49*FR*9572).

- In 1990, the sixth amendment implemented a definition of overfishing for northern anchovy consistent with National Standard 7, and addresses vessel safety (56*FR*15299, April 16, 1991).

- The Council began developing the seventh amendment as a new FMP for CPS on a motion from NMFS and California 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, 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 SSC. Amendment 7 was submitted to the Secretary, but rejected by NMFS, SWR, as being inconsistent with National Standard 7. NMFS announced its intention to drop the FMP for northern anchovy (in addition to FMP's other species) in the *Federal Register* on March 26, 1996 (61*FR*13148), but the action was never completed.

- Development of Amendment 8 began in June, 1997 when 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 was partially approved by the Secretary on June 10, 1999, and final regulations were published on December 15, 1999 (64*FR*69888). The FMP was implemented on January 1, 2000.

- At its meeting in June 1999, the Council directed its CPSMT to recommend appropriate revisions to the FMP and report to the Council the following September. A public meeting of the CPSMT was held in La Jolla, California, on August 3 and 4, 1999, and August 24, 1999, and a meeting was held between the CPSMT and the CPSAS on August 24, 1999. At its September 1999 meeting, the Council gave further direction to the CPSMT regarding MSY for squid. At its March 2000 meeting, the Council asked the CPSMT for a more thorough analysis of the alternatives proposed for establishing MSY for squid and for bycatch. At a public meeting in La Jolla, California, on April 20 and 21, 2000, the CPSMT reviewed comments from the Council, the Council's SSC and prepared additional material for establishing MSY for squid based on spawning area.

- 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 and prepared a separate amendment that addressed OY and MSY for squid.

- The Secretary 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 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 November 2001, the Council reviewed the findings of the market squid 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.

- December 30, 2002, the Secretary approved Amendment 10. On January 27, 2003 NMFS issued the final rule and regulations for implementing Amendment 10.

- September 2002, the Council requested NMFS take emergency action to reallocate the unharvested portion of the Pacific sardine HG prior to October 1. The Council believed this action would minimize negative economic impacts in the northern fishery without causing market disruptions in the southern fishery. On September 26, 2002, through an emergency rule, NMFS reallocated the remaining Pacific sardine HG and reopened the northern subarea fishery, which had been closed on September 14, 2002.

- September 2002, the 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. A public meeting of the CPSMT was held on October 8, 2002. The CPSMT discussed information needs and prospective analyses for developing allocation management alternatives.

- On October 30, 2002, the Council initiated a regulatory amendment to address allocation issues.

- The CPSMT met January 30-31, 2003 to analyze various alternatives for revising the allocation framework and developed recommendations for Council consideration.

- 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.

- At the April 2003 Council meeting, the CPSAS reviewed the five management alternatives and developed recommendations for the Council. The Council took final action on the regulatory amendment. The proposed action adopted by the Council would (1) change 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) move the date when Pacific sardine that remains unharvested is reallocated to Subarea A and Subarea B from October 1 to September 1, (3) change the percentage of the unharvested sardine that is 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) reallocate all unharvested sardine that remains on December 1 coastwide. The Council's intent is for this interim revision to the allocation framework be in effect for the 2003 and 2004 seasons. The allocation regime could be extended to 2005 if the 2005 HG were at least 90 percent of the 2003 HG.

- The regulatory amendment for allocation of the Pacific sardine HG was approved on August 29, 2003. The final rule implementing the regulatory amendment was published September 4, 2003 (68*FR*52523).

- At the November 2003 Council meeting, the Council adopted a HG of 122,747 metric tons (mt) for the 2004 Pacific sardine fishery, within an incidental catch allowance of up to 45 percent. This HG was based on a biomass estimate of 1,090,587 mt. Per the revised allocation framework, on January 1, the HG was allocated 33 percent to the northern subarea and 66 percent to the southern subarea, with a subarea dividing line at Point Arena, CA. The final rule implementing the HG was published December 3, 2003 (68*FR*67638).

- At the June 2004 Council meeting, the Council adopted the following management measures for the July 2004-June 2005 Pacific mackerel fishery: 1) total fishery HG of 13,268 mt; 2) directed fishery guideline of 9,100 mt; and 3) set-aside for incidental catches of 4,168 mt and an incidental catch rate limit of 40 percent when mackerel are landed with other CPS species, except that up to one mt of Pacific mackerel could be landed without landing any other CPS. The Council also requested NMFS track utilization of the directed fishery guideline and advise the Council at the March 2005 meeting if additional action (e.g., a mop-up fishery) was warranted. Additionally, the Council initiated an amendment to the CPS FMP with the primary purpose of allocating the coastwide Pacific sardine HG. The Council discussed a schedule that included final Council action on the FMP amendment by June 2005, which would enable implementation by January 2006. To facilitate development of the amendment, the Council directed the CPSAS to draft a range of alternative sardine allocation scenarios. The Council also directed the CPSMT to formally review the CPS FMP issues raised by NMFS to identify issues that could be addressed through amendment to the CPS FMP and if they could be addressed in the short-term or would require more extensive time to complete.

- At the September 2004 Council meeting, the Council adopted STAR Panel reports for Pacific mackerel and Pacific sardine. New assessment methodologies were used for management of the 2005 sardine fishery and the 2005-2006 Pacific mackerel fishery. Relative to the CPS FMP amendment process, the Council requested the CPSAS to

narrow the current broad range of Pacific Sardine allocation alternatives for Council consideration at the November 2004 meeting. The Council received information from the CPSMT about their consideration of several FMP-related issues raised by NMFS, and directed Council staff to communicate to NMFS the Council plans for further review of CPS EFH.

- At the November 2004 Council meeting, the Council adopted a HG of 136,179 mt for the 2005 Pacific sardine fishery. This HG was based on a biomass estimate of 1.2 million mt. Per the FMP allocation framework, on January 1 the HG was allocated 33 percent to the northern subarea and 66 percent to the southern subarea with a subarea dividing line at Point Arena, California. Additionally, the Council directed the CPSMT and staff to begin development of Amendment 11 to the CPS FMP to include alternatives for sardine allocation, as recommended by the CPSAS as well as two additional alternatives The Council reviewed the draft analyses and considering formal adoption of allocation alternatives at the April 2005 Council meeting.

- At the March 2005 Council meeting, the Council reviewed a progress update from NMFS SWR on a proposed course of action for management of krill in the West Coast EEZ and National Marine Sanctuaries under the auspices of the CPS FMP. The Council approved a draft outline for an alternatives analysis.

- At the April 2005 Council meeting, the Council approved a range of alternatives for the allocation of Pacific sardine for further analysis and public review. After reviewing preliminary results on the range of alternatives approved for analysis in November 2004 and reports of the CPS advisory bodies, the Council eliminated two alternatives (Alternatives 2 and 5) from further consideration. The Council recommended that the CPSMT follow the advice of the SSC as they complete the analysis of allocation alternatives for public review.

- At the June 2005 Council meeting, the Council addressed three CPS matters, pacific mackerel HG and management measures, long-term Pacific sardine allocation, and CPS EFH.

  Regarding Pacific mackerel, the Council adopted the new assessment and the following management measures for the July 2005-June 2006 Pacific mackerel fishery: 1) total fishery HG of 17,419 mt; 2) directed fishery guideline of 13,419 mt; and 3) set-aside for incidental catches of 4,000 mt and an incidental catch rate limit of 40 percent, when mackerel are landed with other CPS, except that up to one mt of Pacific mackerel could be landed without landing any other CPS. The Council requested NMFS track utilization of the directed fishery guideline and advise the Council at the March 2006 meeting if release of the incidental set-aside was warranted.

  Regarding Pacific sardine allocation, the Council took final action on a long-term allocation of the annual Pacific sardine HG. The Council approved a modified version of Alternative 3, which provided the following allocation formula for the non-tribal share of the 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.

The Council also recommended a review of the allocation formula in 2008.

The Council adopted the 2005 SAFE document as drafted by the CPSMT including the required review of CPS EFH. The Council recommended no changes to the existing definition of EFH because the CPSMT review identified no new information on which to base EFH modifications. The Council agreed with the research needs identified by the CPSMT in the 2005 SAFE and stressed the importance of coastwide sardine research and harvest policy review.

- At the November 2005 Council meeting, the Council adopted a Pacific sardine HG of 118,937 mt for the 2006 season to be managed under the terms of the allocation arrangements under Amendment 11.

  The Council also approved a range of krill fishing alternatives for public review and additional analysis, including a preliminary preferred alternative to identify krill as a prohibited species in the EEZ. The proposed krill management measures were implemented as Amendment 12 to the CPS FMP. At the June 2005 Council meeting, the Council addressed three CPS matters, pacific mackerel HG and management measures, long-term Pacific sardine allocation, and CPS EFH.

- At the March 2006 Council meeting, the Council took final action adopting CPS FMP Amendment 12 to prohibit harvest of all species of krill in the U.S. EEZ. Additionally, the Council adopted an EFH designation for all species of krill that extends the length of the West Coast from the shoreline to the 1,000 fm isobath and to a depth of 400 meters. No habitat areas of particular concern were identified.

- At the June 2006 meeting, the Council adopted the new assessment model and the following management measures for the July 2006-June 2007 Pacific mackerel fishery: a total fishery HG of 19,845 mt, a directed fishery guideline of 13,845 mt; and a set-aside for incidental catches of 6,000 mt and an incidental catch rate limit of 40 percent when mackerel are landed with other CPS, except that up to one mt of Pacific mackerel could be landed without landing any other CPS.

- At the November 2006 meeting, the Council adopted a HG of 152,654 mt for the 2007 Pacific sardine fishery. This HG was based on a biomass estimate of 1.32 million mt. Per the FMP allocation framework adopted under Amendment 11, the Pacific sardine HG was allocated seasonally with 35 percent of the HG allocated coastwide January 1, 40 percent of the HG, plus any portion not harvested from the initial allocation reallocated coastwide July 1; and the remaining 25 percent of the HG, plus any portion not harvested from earlier allocations, to be reallocated coastwide September 15. The Council also

recommended a 45 percent incidental catch rate be allowed for other CPS fisheries in the event that a seasonal allocation be taken before the end of an allocation period or the HG was taken before the end of the year.

Additionally, the Council reviewed the draft Terms of Reference for the CPS stock assessment process scheduled for 2007 and directed Council staff to revise the document as recommended by the CPSAS, the CPSMT, and the SSC and distribute it for public review. The Council approved a final document in March 2007 for use during the review of full assessments for Pacific mackerel and Pacific sardine in May and September, respectively.

- At the March 2007 Council meeting, the Council approved the final Terms of Reference for the 2007 CPS stock assessment process. The final document was posted on the Council website and distributed for use during the review of full assessments for Pacific mackerel and Pacific sardine May 1-3 and September 18-21 respectively.

- At the June 2007 Council meeting, he Council adopted the new assessment model and the following management measures for the July 2007-June 2008 Pacific mackerel fishery: an acceptable biological catch (ABC) for U.S. fisheries of 71,629 mt, a directed fishery HG of 40,000 mt, and in the event the directed fishery reaches 40,000 mt, the directed fishery will revert to an incidental-catch-only fishery with a 45 percent incidental catch allowance when Pacific mackerel are landed with other CPS, except that up to 1 mt of Pacific mackerel could be landed without landing any other CPS. The Council and NMFS will track the 2007-08 Pacific mackerel fishery and will recommend an in-season review of the mackerel season for the March 2008 Council meeting, if needed, with the possibility of re-opening the directed fishery as a routine action. Additionally, the Council directed Council staff to send a letter to the U.S. State Department requesting increased coordination with Mexico on the exchange of data for the improvement of international management of CPS.

- In November 2007, the Council adopted an ABC or total harvest guideline (HG) of 89,093 mt for the 2008 Pacific sardine fishery. This ABC was based on a biomass estimate of 832,706 mt and the harvest control rule in the CPS FMP. The Council recommended 80,083 mt of the HG for the directed fishery to be allocated seasonally per the Amendment 11 framework. To allow for incidental landings of Pacific sardines in other CPS fisheries and to ensure the fishery did not exceed the ABC, the Council recommended a set aside of 8,910 mt allocated across seasonal periods as follows:

	Jan 1- June 30	July 1- Sept 14	Sept 15 - Dec 31	Total
Seasonal Allocation (mt)	31,183	35,637	22,273	89,093
Set Aside %	5.2%	1.2%	3.6%	10%
Set Aside (mt)	4,632	1,070	3,208	8,910
Adjusted Allocation (mt)	26,550	34,568	19,065	80,083

Regarding Pacific mackerel, the Council recommended no changes to Pacific mackerel assessment methodology for the 2008 assessment update and recommended the next CPS stock assessment review panel be convened in 2009 rather than 2010 to fully review the status of Pacific sardine and Pacific mackerel.

- In June 2008, the Council adopted an updated Pacific mackerel assessment and the following management measures for the July 2008-June 2009 Pacific mackerel fishery: 1) Establish a harvest guideline for the directed fishery at 40,000 mt, providing an 11,772 mt set-aside for incidental landings in other fisheries. 2) 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), except that up to 1 mt of Pacific mackerel could be landed without landing any other CPS. If needed, conduct an in-season review of the 2008-2009 Pacific mackerel fishery at the nearest feasible Council meeting, with the possibility of either releasing a portion of the incidental set-aside to the directed fishery or further constraining incidental landings to ensure total harvest remains below the ABC.

- In November 2008, the Council adopted a harvest guideline (HG) of 66,932 mt for the 2009 Pacific sardine fishery. This HG was based on a biomass estimate of 662,886 mt and the harvest control rule in the CPS FMP. The Council recommended that 1,200 mt of the HG be set-aside prior to allocation for dedicated Pacific sardine research activities in period 2. The Council recommended an adjusted allocation of 59,232 mt as the HG for the directed fishery to be allocated seasonally per the Amendment 11 framework. To allow for incidental landings of Pacific sardines in other CPS fisheries and to help to ensure the fishery does not exceed the total HG, the Council adopted a set aside of 6,500 mt allocated across seasonal periods as follows:

HG = 66,932 mt; Research set aside = 1,200 mt; Adjusted HG = 65,732 mt				
	Period 1	Period 2	Period 3	

	Jan 1- Jun 30	Jul 1- Sep 14	Sep 15 – Dec 31	Total
Seasonal Allocation (mt)	23,006	26,293	16,433	65,732
Incidental Set Aside (mt)	1,000	1,000	4,500	6,500
Adjusted Allocation (mt)	22,006	25,293	11,933	59,232

If a seasonal allocation to the directed fishery is reached or exceeded in any period NMFS would close the directed sardine fishery and the fishery would revert to an incidental fishery with an incidental landing allowance of no more that 20 percent Pacific sardine by weight.

Under this proposal, the Council recommends NMFS take the following inseason automatic actions:

- Any unused seasonal allocation to the directed fishery from Period 1 or Period 2 rolls into the next period's directed fishery.
- Any overage of a seasonal allocation to the directed fishery from Period 1 or Period 2 is deducted from the next Period's directed fishery.
- Any unused Seasonal Incidental Set-Aside from Period 1 or Period 2 rolls into the next period's directed fishery.
- If both the seasonal allocation to the directed fishery and the Seasonal Incidental Set-Aside are reached or exceeded in any period, the retention of Pacific sardine will be prohibited and the overage will be deducted from the next period's directed fishery.
- Any of the research set-aside that is not used in Period 2 rolls into the third seasonal period's directed fishery HG.

- In November 2008, the Council also adopted a public review draft of the Terms of Reference document for the 2009 STAR Panel process. The Council also tasked Council staff with scheduling two STAR Panels for 2009; one in May 2009 focused on a full Pacific mackerel assessment and Pacific sardine assessment methodology, and a second in September 2009 that focuses on the review of a full Pacific sardine assessment.

January 25, 2000. NMFS published HGs for Pacific sardine and Pacific mackerel for the fishing year beginning January 1, 2000. A HG of 186,791 mt was established for Pacific sardine, based on a biomass estimate of 1,581,346 mt. The HG was allocated for Subarea A, which was north of 35° 40' N latitude (Point Piedras Blancas) to the Canadian border, and for Subarea B, which was south of 35° 40' N latitude to the Mexican border. The northern allocation was 62,264 mt; the southern allocation was 124,527 mt. The sardine HG was in effect until December 31, 2000, or until it was reached and the fishery closed. A HG of 42,819 mt was established for Pacific mackerel based on a biomass estimate of 239,286 mt. The HG for Pacific mackerel was in effect until June 30, 2000, or until it was reached and the fishery closed. (65*FR*3890)

September 11, 2000. NMFS announced the annual HG for Pacific mackerel in the EEZ off the Pacific coast. Based on the estimated biomass of 116,967 mt and the formula in the FMP, a HG of 20,740 mt was calculated for the fishery beginning on July 1, 2000. This HG is available for harvest for the fishing season July 1, 2000 through June 30, 2001. (65*FR*54817)

November 1, 2000. NMFS announced the closure of the directed fishery for Pacific mackerel in the EEZ off the Pacific coast on October 27, 2000. The FMP and its implementing regulations require NMFS to set an annual HG for Pacific mackerel based on a formula in the FMP and to close the fishery when the HG is reached. The HG of 20,740 mt was reached before the end of the fishing season on June 30, 2001, which required closing the directed fishery and setting an incidental harvest limit for Pacific mackerel so that the harvest of other CPS would be further restricted. The intended effect of this action was to ensure conservation of the Pacific mackerel resource. For the reasons stated here and in accordance with the FMP and its implementing regulations at 50 CFR 660.509, the directed fishery for Pacific mackerel was closed October 27, 2000, after which time no more than 20 percent by weight of any landing of Pacific sardine could be Pacific mackerel. (65*FR*65272)

November 17, 2000. NMFS published a correction to the Pacific mackerel closure, which was published on November 1, 2000. In 65*FR*65272, the following correction was included: On page 65272, in the third column, under the heading SUPPLEMENTARY INFORMATION, the last sentence is corrected to read as follows: "For the reasons stated here and in accordance with the FMP and its implementing regulations at 50 CFR 660.509, the directed fishery for Pacific mackerel will be closed October 27, 2000, after which time no more than 20 percent by weight of a landing of Pacific sardine, northern anchovy, jack mackerel, or market squid may consist of Pacific mackerel." (65*FR*69483)

December 27, 2000. NMFS announced the annual HG for Pacific sardine in the EEZ off the Pacific coast for the January 1, 2001, through December 31, 2001, fishing season. This HG was calculated according to the regulations implementing the FMP. The intended effect of this action was to establish allowable harvest levels for Pacific sardine off the Pacific coast. Based on the estimated biomass of 1,182,465 mt and the formula in the FMP, a HG of 134,737 mt was calculated for the fishery beginning January 1, 2001. The HG was allocated one third for Subarea A, which was north of 35° 40' N latitude (Point Piedras Blancas) to the Canadian border, and two thirds for Subarea B, which was south of 35° 40' N latitude to the Mexican border. Any unused resource in either area would be reallocated between areas to help ensure that the OY would be achieved. The northern allocation is 44,912 mt; the southern allocation was 89,825 mt. (65*FR*81766)

February 22, 2001. NMFS announced changes to the restriction on landings of Pacific mackerel for individuals participating in the CPS fishery and for individuals involved in other fisheries who harvest small amounts of Pacific mackerel. The incidental limit on landings of 20 percent by weight of Pacific mackerel in landings of Pacific sardine, northern anchovy, jack mackerel, and market squid remained in effect; however, CPS fishermen could land up to one mt of Pacific mackerel even if they landed no other species from the trip. Non CPS fisherman could land no more than ome mt of Pacific mackerel per trip. After the HG of 20,740 mt was reached, all landings of Pacific mackerel would be restricted to one mt per

trip. This action was authorized by the FMP and was intended to ensure that the fishery achieved, but did not exceed, the HG while minimizing the economic impact on small businesses. For the reasons stated here, no fishing vessel could land more than one mt of Pacific mackerel per fishing trip, except that fishing vessels with other CPS on board could land more than one mt of Pacific mackerel in a fishing trip if the total amount of Pacific mackerel on board the vessel did not exceed 20 percent by weight of the combined weight of all CPS on board the vessel. (66*FR*11119)

March 30, 2001. NMFS announced the closure of the fishery for Pacific mackerel in the EEZ off the Pacific coast at 12:00 a.m. on March 27, 2001. The FMP and its implementing regulations require NMFS to set an annual HG for Pacific mackerel based on a formula in the FMP and to close the fishery when the HG is reached. The HG of 20,740 mt was reached. Following this date no more than one mt of Pacific mackerel could be landed from any fishing trip. The effect of this action was to ensure conservation of the Pacific mackerel resource. (66*FR*17373)

July 25, 2001. NMFS announced a HG of 13,837 mt for Pacific mackerel for the fishing season July 1, 2001 through June 30, 2002. A directed fishery of 6,000 mt was established, which, when attained, would be followed by an incidental allowance of 45 percent of Pacific mackerel in a landing of any CPS. If a significant amount of the HG remained unused before the end of the fishing season on June 30, 2002, the directed fishery would be reopened. This approach was taken because of concern about the low HG's potential negative effect on the harvest of Pacific sardine if the fishery for Pacific mackerel had to be closed. The two species occur together often and could present incidental catch problems. (66*FR*38571)

November 27, 2001. NMFS announced the closure of the directed fishery for Pacific mackerel in the EEZ off the Pacific coast at 12:00 noon on November 21, 2001. For the fishing season beginning July 1, 2001, 6,000 mt of the 13,837 mt HG was established for a directed fishery. More than 6,000 mt has been landed. Therefore, the directed fishery for Pacific mackerel was closed on November 21, 2001, after which time no more than 45 percent by weight of a landing of Pacific sardine, northern anchovy, jack mackerel, or market squid could consist of Pacific mackerel. The intended effect of this action was to ensure that the HG was achieved, but not exceeded, and to minimize bycatch of Pacific mackerel while other CPS were being harvested. (66*FR*59173)

December 27, 2001. NMFS published the HG for Pacific sardine for the fishing season beginning January 1, 2002. A HG of 118,442 mt was established for Pacific sardine based on a biomass estimate of 1,057,599 mt. The HG was allocated for Subarea A, which was north of 35° 40' N latitude (Point Piedras Blancas) to the Canadian border, and for Subarea B, which was south of 35° 40' N latitude to the Mexican border. The northern allocation is 39,481 mt; the southern allocation is 78,961mt. The sardine HG is in effect until December 31, 2002, or until it is reached and the fishery closed. (66*FR*66811)

April 5, 2002. NMFS announced the reopening of the directed fishery for Pacific mackerel in the U.S. EEZ off the Pacific coast on April 1, 2002. A significant portion of the Pacific mackerel HG remained unharvested (6,585 mt). Therefore, the incidental catch allowance that has been in effect since November 21, 2001 was removed, and any landing of Pacific mackerel could consist of 100 percent Pacific mackerel. This action was taken to help ensure that the HG was attained. If the HG was projected to be reached before June 30, 2002, the directed fishery would be closed and an appropriate incidental landing restriction imposed. (67*FR*16322)

July 11, 2002. NMFS proposed a regulation to implement the annual HG for Pacific mackerel in the EEZ off the Pacific coast. The CPS FMP and its implementing regulations require NMFS to set an annual HG for Pacific mackerel based on the formula in the FMP. This action proposes allowable harvest levels for Pacific mackerel off the Pacific coast. Based on the estimated biomass of 77,516 mt and the formula in the FMP, a HG of 12,456 was proposed for the fishery beginning on July 1, 2002, and continued through June 30, 2003, unless the HG was attained and the fishery closed before June 30. (67*FR*45952)

September 18, 2002. NMFS announced the closure of the fishery for Pacific sardine in the U.S. EEZ off the Pacific coast north of Point Piedras Blancas, California, (35° 40' N latitude) at 0001 hrs local time on

September 14, 2002. The closure remained in effect until the reallocation of the remaining portion of the coastwide HG was required by the CPS FMP. That reallocation was expected to occur on or about October 1, 2002. The purpose of this action was to comply with the allocation procedures mandated by the FMP. (67*FR*58733)

September 26, 2002. Emergency rule. NMFS announced the reallocation of the remaining Pacific sardine HG in the U.S. EEZ off the Pacific coast. The CPS FMP required that NMFS conduct a review of the fishery 9 months after the beginning of the fishing season on January 1, and reallocate any unharvested portion of the HG, with 50 percent allocated north and south of Point Piedras Blancas, California. The allocation north of Point Piedras Blancas was reached on September 14, 2002, and the fishery was closed until the scheduled time for reallocation on October 1, 2002. This action reallocated the remainder of the HG earlier than the date specified in the FMP in order to minimize the negative economic effects on fishing and processing, primarily in the Pacific Northwest, which would result from delaying the reallocation. (67*FR*60601)

October 3, 2002. NMFS issued a regulation to implement the annual HG for Pacific mackerel in the EEZ off the Pacific coast. The CPS FMP and its implementing regulations required NMFS to set an annual HG for Pacific mackerel based on the formula in the FMP. This action was to conserve Pacific mackerel off the Pacific coast. Based on the estimated biomass of 77,516 mt and the formula in the FMP, a HG of 12,456 was proposed for the fishery beginning on July 1, 2002, and continued through June 30, 2003, unless the HG was attained and the fishery closed before June 30. There was a directed fishery of at least 9,500 mt, and 3,035 mt of the HG was utilized for incidental landings following the closure of the directed fishery. After closure of the directed fishery, no more than 40 percent by weight of a landing of Pacific sardine, northern anchovy, jack mackerel, or market squid could consist of Pacific mackerel, except that up to one mt of Pacific mackerel could be landed without landing any other CPS. The fishery was monitored, and if a sufficient amount of the HG remained before June 30, 2003, the directed fishery would be reopened. The goal was to achieve the HG and minimize the impact on other coastal pelagic fisheries. 67*FR*61994)

October 30, 2002. NMFS proposed a regulation to implement Amendment 10 to the CPS FMP, which was submitted by the Council for review and approval by the Secretary of Commerce. Amendment 10 addressed the two unrelated subjects of the transferability of limited entry permits and maximum sustainable yield for market squid. Only the provisions regarding limited entry permits require regulatory action. The purpose of this proposed rule was to establish the procedures by which limited entry permits could be transferred to other vessels and/or individuals so that the holders of the permits have maximum flexibility in their fishing operations while the goals of the FMP were achieved. (67*FR*66103)

November 25, 2002. NMFS proposed a regulation to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season January 1, 2003, through December 31, 2003. This HG has been calculated according to the CPS FMP and establishes allowable harvest levels for Pacific sardine off the Pacific coast. Based on the estimated biomass of 999,871 mt and the formula in the FMP, a HG of 110,908 mt was determined for the fishery beginning January 1, 2003. The HG is allocated one third for Subarea A, which is north of 35° 40' N latitude (Point Piedras Blancas) to the Canadian border, and two thirds for Subarea B, which is south of 35° 40' N latitude to the Mexican border. The northern allocation is 36,969 mt; the southern allocation is 73,939 mt. (67*FR*70573)

December 31, 2002. NMFS issued a regulation to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season January 1, 2003, through December 31, 2003. This HG was calculated according to the CPS FMP and established allowable harvest levels for Pacific sardine off the Pacific coast. Based on the estimated biomass of 999,871 mt and the formula in the FMP, a HG of 110,908 mt was determined for the fishery beginning January 1, 2003. The HG was allocated one third for Subarea A, which was north of 35° 40' N latitude (Point Piedras Blancas, California) to the Canadian border, and two thirds for Subarea B, which was south of 35° 40' North latitude to Mexican border. The northern allocation was 36,969 mt; the southern allocation was 73,939 mt. If an allocation or the HG was

reached, up to 45 percent by weight of Pacific sardine could be landed in any landing of Pacific mackerel, jack mackerel, northern anchovy, or market squid. (67*FR*79889).

January 27, 2003. NMFS issued a regulation to implement Amendment 10 to the CPS FMP, which was submitted by the Council for review and approval by the Secretary. Amendment 10 addresses the two unrelated subjects of the transferability of limited entry permits and maximum sustainable yield for market squid. Only the provisions regarding limited entry permits require regulatory action. The primary purpose of this final rule was to establish the procedures by which limited entry permits could be transferred to other vessels and/or individuals so that the holders of the permits have maximum flexibility in their fishing operations while the goals of the FMP were achieved. (68*FR*3819)

June 26, 2003. NMFS proposed a regulatory amendment to the CPS FMP. This amendment was submitted by the Council for review and approval by the Secretary. The proposed amendment would change the management subareas and the allocation process for Pacific sardine. The purpose of this proposed amendment was to establish a more effective and efficient allocation process for Pacific sardine and increase the possibility of achieving OY. (68*FR*37995)

July 29, 2003. NMFS proposed a regulation to implement the annual HG for Pacific mackerel in the EEZ off the Pacific coast. The CPS FMP and its implementing regulations require NMFS to set an annual HG for Pacific mackerel based on the formula in the FMP. (68*FR*44518)

September 4, 2003. NMFS issued a final rule to implement a regulatory amendment to the CPS FMP that changed the management subareas and the allocation process for Pacific sardine. The purpose of this final rule was to establish a more effective and efficient allocation process for Pacific sardine and increase the possibility of achieving OY. (68*FR*52523)

September 9, 2003. NMFS announced the reallocation of the remaining Pacific sardine HG in the EEZ off the Pacific coast. On September 1, 2003, 59,508 mt of the 110,908 mt HG was expected to remain unharvested. The CPS FMP required that a review of the fishery be conducted and any uncaught portion of the HG remaining unharvested in Subarea A (north of Pt. Arena, California) and Subarea B (south of Pt. Arena, California) be added together and reallocated, with 20 percent allocated to Subarea A and 80 percent to Subarea B; therefore, 11,902 mt was allocated to Subarea A and 47,600 mt was allocated to Subarea B. The intended effect of this action was to ensure that a sufficient amount of the resource was available to all harvesters on the Pacific coast and to achieve OY. (68*FR*53053)

October 3, 2003. NMFS issued a final rule to implement the annual HG for the July 1, 2003 - June 30, 2004 Pacific mackerel fishery in the EEZ off the Pacific coast. The CPS FMP and its implementing regulations require NMFS to set an annual HG for Pacific mackerel based on the formula in the FMP. Based on this approach, the biomass for July 1, 2003, was 68,924 mt. Applying the formula in the FMP results in a HG of 10,652 mt, which was lower than last year but similar to low HGs of recent years. (68*FR*57379)

October 28, 2003. NMFS announced the closure of the fishery for Pacific sardine in the EEZ off the Pacific coast north of Pt. Arena, California (39° N latitude) at 12:01 a.m. local time on October 17, 2003. The purpose of this action was to comply with the allocation procedures mandated by the CPS FMP. (68*FR*61373)

December 3, 2003. NMFS proposed a regulation to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season January 1, 2004 through December 31, 2004. This HG was calculated according to the regulations implementing the CPS FMP and established allowable harvest levels for Pacific sardine off the Pacific coast. (68*FR*67638)

February 25, 2004. NMFS issued a regulation to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season January 1, 2004 through December 31, 2004. This action adopted a HG and initial subarea allocations for Pacific sardine off the Pacific coast that were calculated according to the regulations implementing the CPS FMP. Based on a biomass estimate of 1,090,587 mt (in U.S. and Mexican waters), using the FMP formula, the HG for Pacific sardine in U.S.

waters for January 1, 2004 through December 31, 2004 was 122,747 mt. The biomass estimate was slightly higher than last year's estimate; however, the difference between this year's biomass was not statistically significant from the biomass estimates of recent years. Under the FMP, the HG was allocated one third for Subarea A, which was north of 39° N latitude (Pt. Arena, California) to the Canadian border, and two thirds for Subarea B, which was south of 39° N latitude to the Mexican border. Under this final rule, the northern allocation for 2004 would be 40,916 mt and the southern allocation would be 81,831 mt. (69*FR*8572). July 20, 2004. NMFS proposed a regulation to implement the annual HG for Pacific mackerel in the EEZ off the Pacific coast for the fishing season July 1, 2004 through June 30, 2005. The CPS FMP and its implementing regulations required NMFS to set an annual HG for Pacific mackerel based on the formula in the FMP. This action proposed allowable harvest levels for Pacific mackerel off the Pacific coast. (69 *FR* 43383)

September 14, 2004. Information memorandum. NMFS announced the reallocation of the remaining Pacific sardine HG in the U.S. EEZ off the Pacific coast. A regulatory amendment (69 *FR* 8572, February 25, 2003) required that NMFS conduct a review of the fishery 10 months after the beginning of the fishing season on January 1, and reallocate any unharvested portion of the HG, with 20 percent allocated north of Point Area, California, and 80 percent allocated south of Point Arena, California. (69 *FR* 55360)

October 21, 2004. NMFS issued a final rule to implement the annual HG for the July 1, 2004 - June 30, 2005 Pacific mackerel fishery in the EEZ off the Pacific coast. The CPS FMP and its implementing regulations required NMFS to set an annual HG for Pacific mackerel based on the formula in the FMP. Based on this approach, the biomass for July 1, 2003, was 81,383 mt. Applying the formula in the FMP resulted in a HG of 13,268 mt. (69 *FR* 61768)

December 8, 2004. NMFS proposed a regulation to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season January 1, 2005 through December 31, 2005. This HG was calculated according to the regulations implementing the CPS FMP and established allowable harvest levels for Pacific sardine off the Pacific coast. (69 *FR* 70973)

June 22, 2005. NMFS issued a regulation to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season January 1, 2005 through December 31, 2005. This HG was calculated according to the regulations implementing the CPS FMP and established allowable harvest levels for Pacific sardine off the Pacific coast. Based on a biomass estimate of 1,193,515 mt (in U.S. and Mexican waters) and using the FMP formula, NMFS calculated a HG of 136,179 mt for Pacific sardine in U.S. waters. Under the FMP, the HG was allocated one-third for Subarea A, which was north of 39°00′ N. lat. (Pt. Arena, California) to the Canadian border, and two-thirds for Subarea B, which was south of 39° 00′ N. lat. to the Mexican border. Under this final rule, the northern allocation for 2005 would be 45,393 mt, and the southern allocation would be 90,786 mt. (70 *FR* 36053)

August 29, 2005. NMFS proposed a regulation to implement the annual HG for Pacific mackerel in the U.S. EEZ off the Pacific coast. For specific regulations, see final rule language from October 21, 2005 below. (70 *FR* 51005)

October 21, 2005. NMFS issued a final rule to implement the annual HG for Pacific mackerel in the U.S. EEZ off the Pacific coast. The biomass estimate for July 1, 2005, was 101,147 mt. Applying the formula in the FMP resulted in a HG of 17,419 mt, which was 32 percent greater than last year but similar to low HGs of recent years. For the last three years, the fishing industry has recommended dividing the HG into a directed fishery and an incidental fishery, reserving a portion of the HG for incidental harvest in the Pacific sardine fishery so that the Pacific sardine fishery was not hindered by a prohibition on the harvest of Pacific mackerel. At its meeting on June 15, 2005, the CPSAS recommended for the 2005–2006 fishing season that a directed fishery of 13,419 mt and an incidental fishery of 4,000 mt be implemented. An incidental allowance of 40 percent of Pacific mackerel in landings of any CPS would become effective if the 13,419 mt of the directed fishery was harvested. The CPSAS also recommended

allowing up to 1 mt of Pacific mackerel to be landed during the incidental fishery without the requirement to land any other CPS. (70 *FR 61235*)

October 28, 2005. NMFS announced that the Council submitted Amendment 11 to the CPS FMP for Secretarial review. Amendment 11 would change the framework for the annual apportionment of the Pacific sardine HG along the U.S. Pacific coast. The purpose of Amendment 11 was to achieve optimal utilization of the Pacific sardine resource and equitable allocation of the harvest opportunity for Pacific sardine. The public comment period on Amendment 11 was open through December 27, 2005. (70 *FR* 62087)

January 17, 2006. NMFS proposed a regulation to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season of January 1, 2006 through December 31, 2006. This HG was calculated according to the regulations implementing the CPS FMP and established allowable harvest levels for Pacific sardine off the Pacific coast. (71 *FR* 2510)

June 29, 2006. NMFS issued the final rule to implement Amendment 11 to the CPS FMP, which changed the framework for the annual apportionment of the Pacific sardine HG along the U.S. Pacific coast. The purpose of this final rule was to achieve optimal utilization of the Pacific sardine resource and equitable allocation of the harvest opportunity for Pacific sardine. (71 *FR* 36999)

July 5, 2006. NMFS issued a final rule to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season of January 1, 2006, through December 31, 2006. This HG was calculated according to the regulations implementing the CPS FMP and established allowable harvest levels for Pacific sardine off the Pacific coast. Based on the estimated biomass of 1,061,391 mt and the formula in the FMP, a HG of 118,937 mt was determined for the fishery beginning January 1, 2006. (71 *FR* 38111)

August 21, 2006. This notice retracted the Notice of Intent (NOI) to prepare an Environmental Impact Statementto analyze a range of alternatives for the annual allocation of the Pacific sardine HG proposed action published on July 19, 2004. Further scoping subsequent to the publication of the NOI revealed additional information indicating that it was unlikely the proposed action would result in significant environmental impacts. An EA was completed and a subsequent Finding of No Significant Impact was signed. (71 *FR* 48537)

October 20, 2006. NMFS proposed a regulation to implement the annual HG for Pacific mackerel in the U.S. EEZ off the Pacific coast. (71 *FR* 61944).

December 7, 2006. NMFS proposed a regulation to implement new reporting and conservation measures under the CPS FMP. These reporting requirements and prohibitive measures would require CPS fishermen/vessel operators to employ avoidance measures when southern sea otters are present in the area they are fishing and to report any interactions that may occur between their vessel and/or fishing gear and sea otters. The purpose of this proposed rule was to comply with the terms and conditions of an incidental take statement from a biological opinion issued by the U.S. Fish and Wildlife Service regarding the implementation of Amendment 11 to the CPS FMP. (71 *FR* 70941).

January 31, 2007. NMFS issued a final rule to implement the annual HG and management measure for the 2006-2007 Pacific Mackerel fishery. Based on the estimated biomass of 112,700 mt and the formula in the FMP, a HG of 19,845 mt was in effect for the fishery which began on July 1, 2006. This HG applied to Pacific mackerel harvested in the U.S. EEZ off the Pacific coast from July 1, 2006 through June 30, 2007, unless the HG was attained and the fishery was closed before June 30, 2007. All landings made after July 1, 2006, will be counted toward the 2006–2007 HG of 19,845 mt. There was a directed fishery of 13,845 mt, followed by an incidental fishery of 6,000 mt. An incidental allowance of 40 percent of Pacific mackerel in landings of any CPS would become effective after the date when 13,845 mt of Pacific mackerel was estimated to have been harvested. A landing of one mt of Pacific mackerel per trip was permitted during the incidental fishery for trips in which no other CPS is landed. (72 *FR* 4464).

May 30, 2007. This action implemented new reporting and conservation measures under the CPS FMP. The purpose of this action was to prevent interactions between CPS fisherman and southern sea otters, as well as establish methods for fishermen to report these occurrences. These reporting requirements and conservation measures require CPS fishermen/vessel operators to employ avoidance measures when southern sea otters are present in the area they are fishing and to report any interactions that may occur between their vessel and/or fishing gear and sea otters. (72 *FR* 29891).

September 28, 2007 NMFS proposed a regulation to implement the annual HG for Pacific mackerel in the U.S. EEZ Based on a total stock biomass estimate of 359,290 mt, the ABC for U.S. fisheries for the 2007-2008 management season was 71,629 mt. The estimated stock biomass for the 2006-2007 season was 112,700 mt, resulting in an ABC of 19,845 mt. off the Pacific coast for the fishing season of July 1, 2007 through June 30, 2008. (72 *FR* 55170).

October 25, 2007 NMFS issued the final rule to implement the annual HG for Pacific sardine in the U.S. EEZ off the Pacific coast (California, Oregon, and Washington) for the fishing season of January 1, 2007 through December 31,2007. The Pacific sardine HG was apportioned based on the following allocation scheme established by Amendment 11 to the CPS FMP: 35 percent (53,397 mt) was allocated coastwide on January 1; 40 percent (61,025 mt), plus any portion not harvested from the initial allocation was reallocated coastwide on July 1; and on September 15 the remaining 25 percent (38,141 mt), plus any portion not harvested from earlier allocations was released. (72 *FR* 60586).

January 31, 2008 NMFS issued the final rule to implement the annual HG for Pacific mackerel for the fishing season of July 1, 2007 through June 30, 2008. The HG for the 2007–2008 fishing season is 40,000 mt. If this total was reached, Pacific mackerel fishing would be closed to directed harvest and only incidental harvest would be allowed at a 45 percent by weight incidental catch rate when landed with other CPS, except that up to one mt of Pacific mackerel could be landed without landing any other CPS. (73 *FR* 5760).

August 20, 2008 NMFS proposed a regulation to implement the annual HG for Pacific mackerel in the EEZ off the Pacific coast for the fishing season of July 1, 2008 through June 30, 2009. (73 *FR* 49156).

August 20, 2008 NMFS issued a final rule that noticed effectiveness of reporting requirements of interactions that may occur between a CPS vessel and/or fishing gear and sea otters originally published on May 30, 2007 (see above). The May 30th final rule contained information collection requirements that at the time of publication had not yet been approved by OMB. The final rule stated that NMFS would publish a subsequent Federal Register notice announcing the effectiveness of those requirements. Therefore NMFS announces that OMB approved the collection of information requirements contained in the May 30, 2007, final rule under Control Number 0648-0566 with an expiration date of August 31, 2010. (73 *FR* 60191).

October 10, 2008 NMFS issued a final rule that notices effectiveness of reporting requirements of interactions that may occur between a CPS vessel and/or fishing gear and sea otters originally published on May 30, 2007 (see above). The May 30th final rule contained information collection requirements that at the time of publication had not yet been approved by OMB. The final rule stated that NMFS would publish a subsequent Federal Register notice announcing the effectiveness of those requirements. Therefore NMFS announces that OMB approved the collection of information requirements contained in the May 30, 2007, final rule under Control Number 0648-0566 with an expiration date of August 31, 2010. (73 *FR* 60191).

November 18, 2008 NMFS issued a final rule to implement the annual HG for Pacific mackerel in the EEZ off the Pacific coast for the fishing season of July 1, 2008, through June 30, 2009. The HG for the 2008–2009 fishing season is 40,000 mt. If this total is reached, Pacific mackerel fishing will be closed to

directed harvest and only incidental harvest will be allowed at a 45 percent by weight incidental catch rate when landed with other CPS, except that up to one mt of Pacific mackerel can be landed without landing any other CPS. (73 *FR* 68362).

TABLE 2-3. Coastal pelagic species limited entry permit vessel listing, with U.S. Coast Guard registered measurements and calculated gross tonnage (GT) values for each vessel. (Page 1 of 2)

Vessel Name	Coast Guard Number	Year Built	Registered Measurements (ft)[1]			Calculated Vessel GT[2]	Permit No.	Permit GT Endorsement	Permit Transfer Allowance
			Length	Breadth	Depth				
PROVIDER	D572344	1976	49.60	19.00	10.10	63.8	1	63.8	70.2
PALOMA	D280452	1960	47.40	16.50	8.30	43.5	2	43.5	47.9
SEA VENTURE	D238969	1939	71.40	21.20	9.70	107.3	3	98.4	108.2
BARBARA H	D643518	1981	64.90	24.00	11.60	121.1	4	121.1	133.2
PACIFIC BULLY	D1186583	1937	72.10	19.50	8.70	82.0	5	82.0	90.2
MARY VINCENT	D632207	---	---	---	---	57.0	6	98.1	107.9
SAN PEDRO PRIDE	D549506	1973	79.60	24.50	12.30	160.7	7	160.7	176.8
FERRIGNO BOY	D602455	1978	69.60	23.70	12.60	139.3	8	139.3	153.2
KING PHILLIP	D1061827	1997	79.00	26.00	11.40	156.9	9	156.9	172.6
SEA WAVE	D951443	1989	78.00	22.00	18.00	206.9	10	206.9	227.6
UNASSOCIATED	---	---	---	---	---	---	11	56.2	61.8
BAINBRIDGE	D236505	1937	78.60	22.70	9.60	114.8	12	114.8	126.3
PIONEER	D246212	---	---	---	---	141.9	13	141.9	156.1
MARIA	D236760	1937	70.70	20.50	9.20	89.3	14	89.3	98.2
ST. JOSEPH	D633570	1981	62.90	22.00	9.10	84.4	15	84.4	92.8
UNASSOCIATED	---	---	---	---	---	---	16	137.5	---
RETRIEVER	D582022	1977	54.20	19.60	8.70	61.9	17	61.9	68.1
ATLANTIS	D649333	1982	49.60	19.00	10.10	63.8	18	63.8	70.2
G. NAZZARENO	D246518	1944	78.00	22.70	10.50	124.6	19	124.6	137.1
UNASSOCIATED	---	---	---	---	---	---	20	111.9	123.1
PACIFIC LEADER	D643138	1981	59.50	21.00	9.20	77.0	21	77.0	84.7
OCEAN ANGEL	OR868ADK	---	---	---	---	69.9	22	63.5	69.9
PACIFIC JOURNEY	OR661ZK	2001	64.30	22.01	10.30	97.7	23	97.7	107.5
OCEAN ANGLE I	D584336	1977	49.60	19.00	10.10	63.8	24	63.8	70.2
MARIA T	D509632	1967	57.30	18.10	9.80	68.1	25	68.1	74.9
MANANA	D253321	1947	40.10	13.20	6.70	23.8	26	23.8	26.2
NEW QUEEN[4]	OR588ADB	---	---	---	---	112	27	55.5	61.1
MINEO BROS.	D939449	1989	58.00	21.00	9.00	73.4	28	73.4	80.7
LONG BEACH CARNAGE	D955501	1977	49.00	16.00	8.00	42.0	29	42.0	46.2
UNASSOCIATED	---	---	---	---	---	---	30	40.8	44.9
CAITLIN ANN	D960836	1990	98.00	33.00	15.70	340.2	31	340.2	374.2
ELDORADO	D690849	1985	56.00	17.00	8.60	54.9	32	54.9	60.4
SEA PRINCESS	D630024	1980	87.00	26.00	12.80	194.0	33	194.0	213.4
CAROL N ROSE	D1211776	2008	68.00	23.02	11.00	116.2	34	125.6	138.2
ENDURANCE	D613302	1979	49.00	16.00	8.00	42.0	35	42.0	46.2
NEW SUNBEAM	D284470	1961	50.30	20.00	4.00	27.0	36	27.0	29.7
CALOGERA A	D984694	1992	57.75	21.00	10.50	85.3	37	85.3	93.8
EILEEN	D252749	1947	79.40	22.10	10.20	119.9	38	119.9	131.9
PAMELA ROSE	D693271	1985	54.00	19.00	9.00	61.9	39	61.9	68.1
NEW STELLA	D598813	1978	58.00	22.00	8.40	71.8	40	71.8	79.0
TRAVELER	D661936	1983	56.00	17.00	6.90	44.0	41	44.0	48.4
LUCKY STAR	D295673	1964	49.90	17.00	7.30	41.5	42	41.5	45.7
OCEAN ANGEL II	D622522	1980	74.50	28.00	10.70	149.5	43	149.5	164.5
CRYSTAL SEA	D1061917	1997	66.00	26.00	12.00	137.0	44	137.0	151.8
TRIONFO	D625449	1980	63.80	19.30	9.60	79.2	45	79.2	87.1
UNASSOCIATED	---	---	---	---	---	---	46	85.0	93.5
HEAVY DUTY	D655523	1983	58.00	21.30	10.20	84.4	47	84.4	92.8
ALIOTTI BROS	D685870	1985	67.60	26.00	9.10	107.2	48	107.2	117.9
LADY J	D647528	1982	50.30	17.00	7.10	40.7	49	40.7	44.8
SEABOUND[5]	AK9671AF	---	---	---	---	67.8	50	50.2	55.2
ENDEAVOR	D971540	1990	57.40	19.00	9.90	72.3	51	72.3	79.5

TABLE 2-3. Coastal pelagic species limited entry permit vessel listing, with U.S. Coast Guard registered measurements and calculated gross tonnage (GT) values for each vessel. (Page 2 of 2)

Vessel Name	Coast Guard Number	Year Built	Registered Measurements (ft)[1/]			Calculated Vessel GT[2/]	Permit No.	Permit GT Endorsement	Permit Transfer Allowance
			Length	Breadth	Depth				
ANTOINETTE W	D606156	1978	45.40	16.00	7.60	7.0	52	37.0	40.7
CAPE BLANCO	D648720	1982	73.20	25.00	12.90	158.2	53	158.2	174.0
OCEAN ANGEL III	OR108ADL	---	---	---	---	70.67	54	126.5	139.2
UNBELIEVABLE	D650376	1982	42.00	16.70	8.60	40.4	55	40.4	44.4
KATHY JEANNE	D507798	1967	65.90	22.20	8.80	86.3	56	86.3	94.4
MERVA W	D532023	1971	56.70	17.90	8.00	54.4	57	54.4	59.8
SANTA MARIA	D236806	1937	79.20	19.50	8.80	91.1	58	91.1	100.2
STIKINE	D602429	---	58.00	19.00	10.10	74.6	59	74.5	82.0
MIDNIGHT HOUR	D276920	1958	61.10	18.00	8.60	63.4	60	63.4	69.7
ST. KATHERINE	D542513	1972	56.40	18.00	8.80	59.9	61	59.9	65.9
SEABOUND[/5]	AK9671AF	---	---	---	---	67.8	62	39.7	43.7
EMERALD SEA	D626289	1980	62.70	26.00	7.90	86.3	63	86.3	94.9
NEW QUEEN[/4]	OR588ADB	---	---	---	---	112	64	54.5	60.0
BOUNTY	D629721	1980	40.90	14.70	6.60	26.4	65	26.4	29.0

1 Vessel dimension information was obtained from the Coast Guard Website at: http://psix.uscg.mil/.
/2 Vessel Gross Tonnage GT=0.67(Length*Breadth*Depth)/100. See 46 CFR 69.209.
/3 Maximum transfer allowance is based on permit GT + 10%.
/4 Vessel New Queen is associated with permits 27 and 64
/5 Vessel Seabound is associated with permits 50 and 64

TABLE 2-4. Vessel age and calculated gross tonnage (GT) for the initial and current Federal limited entry fleet.

	Initial Fleet	Current Fleet
Number of Vessels	65	63
Average Vessel Age	35 years	33 years
Range of Ages	12 to 66 years	2 to 68 years
Average GT	71.3	89.7
Range of GT	12.8 to 206.9	7.0 to 340.2
Sum of Fleet GT	4,635.9	5,202.37
Capacity Goal (GT)[1/]	---	5,650.9
Transferability Trigger	---	5,933.5

1/ Established in Amendment 10 to the CPS FMP.

TABLE 2-5. 2008 Oregon limited entry sardine vessel information..

Vessel Name	Coast Guard Number	Year Built	Registered Measurements (ft)[1/]			Calculated Vessel GT [2/]
			Length	Breadth	Depth	
EXCELLER	659770	1983	57.8	24	10	92.9
ANTHONY G	605599	1979	58	24	8	74.6
PACIFIC PURSUIT	OR873ABY	1993	63	---	---	---
D C COLE	566145	1975	49.6	19	10.1	63.8
DARLENE Z	611694	1979	49.6	19	10.1	63.8
PACIFIC JOURNEY	OR661ZK	1996	71	22	10	104.7
LAUREN L KAPP	OR072ACX	---	72	---	---	---
EVERMORE	248555	1944	76.3	22.2	11.4	129.4
PACIFIC RAIDER	972638	1991	57.7	22.7	11	96.5
PACIFIC KNIGHT	OR155ABZ	1978	62	19.6	7.6	61.9
PAPA GEORGE	549243	1973	70.4	22.8	12	129.1
CRYSTAL SEA	1061917	1997	66	26	12	138.0
SUNRISE	238918	1939	80.2	22.2	10.2	121.7
DELTA DAWN	647246	1982	49.6	19	10.1	63.8
SPARTAN	607367	1979	58	19	10.1	74.6
RESOLUTION II	WN9665RJ	1979	59	---	---	---
EMERALD SEA	626289	1980	62	26	7.9	85.3
ST. TERESA	623983	1980	49	18.5	8.5	51.6
LADY LAW	1131965	2002	74.7	25	13.3	166.4
OCEAN ANGEL II	622522	1980	74.5	28	10.7	149.5
SEABOUND	AK9671AF	1982	67	20.5	9	82.8
OCEAN ANGEL I	584336	1977	49	19	10.1	63.0

1/ Vessel dimension information was obtained from NOAA at www.st.nmfs.noaa.gov/st1/CoastGuard/VesselByName.html.
2/ Vessel Gross Tonnage GT=0.67(Length*Breadth*Depth)/100 (The CPSMT is working on discrepancies between Tables 2-3 through 2-6.).

TABLE 2-6. Vessels designated on a Washington Sardine Experimental Fishery Permit in 2008.

Vessel Name	Coast Guard Number	Year Built	Registered Measurements (ft)[1/]			Calculated Vessel GT [2/]
			Length	Breadth	Depth	
ATLANTIS	649333	1982	49.6	19.0	10.1	63.8
BAINBRIDGE	236505	1937	78.6	22.7	9.6	114.8
DELTA DAWN	647246	1982	49.6	19.0	10.1	63.8
HUSTLER	943301	1989	55.0	17.0	8.2	51.4
KING PHILIP	1061827	1997	79.0	26.0	11.4	156.9
MARAUDER	975597	1991	58.0	22.8	10.5	93.0
	OR761ABL	2004	25.7			0.0
PACIFIC JOUNEY	OR661ZK	2001	64.3	22.0	10.3	97.7
PACIFIC LEADER	643138	1981	59.5	21.0	9.2	77.0
PACIFIC RAIDER	972638	1991	57.7	22.7	11.0	96.5
	OR108ADL	1980	68.0			
SPARTAN	607367	1979	58.0	19.0	10.1	74.6
ST. TERESA	623983	1980	49.0	18.5	8.5	51.6
ST. ZITA	648115	1982	49.6	21.5	10.5	75.0
VOYAGER	248217	1945	66.7	20.2	9.3	84.0
	WN1264JE	1973	16.0			0.0

1/ Vessel dimension information was obtained from NOAA at www.st.nmfs.noaa.gov/st1/CoastGuard/VesselByName.html.
2/ Vessel Gross Tonnage GT=0.67(Length*Breadth*Depth)/100 (The CPSMT is working on discrepancies between Tables 2-3 through 2-6.).

TABLE 6-1. Preliminary catch summary for vessels targeting Pacific sardine from NMFS-SWR coastal pelagic species pilot observer program. (Page 1 of 2).

Target species - Pacific sardine					
Species	**Target Catch**	**Incidental Catch**	**Bycatch Returned**		
			Alive	**Dead**	**Unknown**
Sardine	1495 mt		80 mt	100 lbs	100 lbs
Anchovy		9 mt	82	1300 lbs	
Bat Ray		1	143	14	1
Bat Star			5		
CA Barracuda		2	1	3	
CA Halibut		9		4	
Giant Sea Bass			2		
Jacksmelt		1			
Jack Mackerel		2 mt			
Midshipman			1	13	1
Moon Jelly		1			
Pacific Bonito		10 lbs			
Pacific Butterfish		3			
Pacific Electric Ray			2		
Pacific Mackerel		1 mt	100 lbs		
Pacific Tomcod		1			
Pompano		167			
Queenfish		49			
Sanddab			25 lbs	10 lbs	
Scorpionfish		1			1
Sculpin				1	3
Shovelnose Guitarfish			1		
Spanish Mackerel		100 lbs			
Squid		1 mt	2 mt		
Starry Flounder			2		
Stingray		2			
Thornback Ray			2		
Unid. Crab			1		1
Unid. Croaker		40			
Unid. Flatfish		78	8	130	12
Unid. Jellyfish		3	3		
Unid. Mackerel		8 mt	12 mt		
Unid. Octopus					2
Unid. Ray					2
Unid. Rockfish		2	1		
Unid. Seastar			41	135	1
Unid. Scorpionfish/Sculpin					1
Unid. Shark				2	
Unid. Skate				3	

TABLE 6-1. Preliminary catch summary for vessels targeting Pacific sardine from NMFS-SWR coastal pelagic species pilot observer program. (Page 2 of 2).

Target species - Pacific sardine					
Species	**Target Catch**	**Incidental Catch**	**Bycatch Returned**		
			Alive	**Dead**	**Unknown**
Unid. Smelt		2			
Unid. Surf Perch		1			
Unid. Turbot				60	
White Croaker		31 lbs	50 lbs		
Yellowfin Croaker		10 lbs			
CA Sea Lion			49		
Harbor Seal			1		
Unid. Gull			3	2	4

TABLE 6-2. Preliminary catch summary for vessels targeting market squid from NMFS-SWR coastal pelagic species pilot observer program.

Target species - Squid					
Species	**Target Catch**	**Incidental Catch**	**Bycatch Returned**		
			Alive	**Dead**	**Unknown**
Squid	1274 mt		28 mt	350 lbs	2 mt
Anchovy		100 lbs	120 lbs		
Jack Mackerel		2 mt	18 lbs	2 lbs	
Pacific Mackerel		20 mt	20 mt	180 lbs	1 lb
Sardine		12 mt	13 mt	1077 lbs	3 lbs
Spanish Mackerel		20 lbs			
Bat Ray			53		1
Bat Star			1		
Blue Shark			2		
Common Mola			1		
Pelagic Stingray			60		
Pacific Butterfish		19			1
Sunstar		30	4		
Squid Eggs					505 lbs
Lobster			3		
Brittle Star				3000	
Unid. Batfish				2 lbs	
Unid. Crab		1	1		93
Unid. Croaker		3	2	16 lbs	
Unid. Flatfish		1	1	6	2
Unid. Jellyfish		4			
Unid. Mackerel		2 lbs	102 lbs		
Unid. Octopus		1			
Unid. Rockfish		1	1	4	
Unid. Ray			4		1
Unid. Sanddab		4	3		4
Unid. Seastar		1			
Unid. Seaslug					21
Unid. Scorpionfish		1			
Unid. Surfperch				3	
Unid. Skate		3		1	
Unid. Smelt		49			
Unid. Stingray		9	17		
Unid. Shark					1
Thresher Shark		1			
CA Sea Lion			98		
Harbor Seal			3		
Common Dolphin				1	
Unid. Gull			16	1	

TABLE 6-3. Preliminary catch summary for vessels targeting Pacific mackerel from NMFS-SWR coastal pelagic species pilot observer program.

Target species - Pacific mackerel					
Species	**Target Catch**	**Incidental Catch**	**Bycatch Returned**		
			Alive	**Dead**	**Unknown**
Pacific Mackerel	40 mt				
Bat Ray			2		
CA Yellowtail			1		
Midshipman			1		
Sardine		16 mt			
Sea Cucumber		5			
Unid. Crab		1			
Unid. Flatfish			3		
Unid. Jellyfish			3		
Unid. Shark			1		

TABLE 6-4. Preliminary catch summary for vessels targeting northern anchovy and northern anchovy/Pacific sardine from NMFS-SWR coastal pelagic species pilot observer program.

Target species - Anchovy and Anchovy/Sardine					
Species	**Target Catch**	**Incidental Catch**	**Bycatch Returned**		
			Alive	**Dead**	**Unknown**
Anchovy	373 mt		2 mt	1 mt	
Sardine		21 mt	2 mt		
Bat Ray			4		
CA Lizardfish			4		
Kelp Bass		1			
Midshipman					5
Pacific Bonito			20 lbs		
Pacific Mackerel		2			
Queenfish		50 lbs	11 lbs		
Round Stingray			1		
Sculpin		2			
Spiny Dogfish			1		
Unid. Croaker		20	45		
Unid. Flatfish		10			
Unid. Hake		4			
Unid. Seastar			1		
Unid. Smelt		2			
Unid. Turbot			1	1	20
White Croaker		50 lbs	35 lbs		
Yellowfin Croaker		50 lbs	10 lbs		
CA Sea Lion			5		
Sea Otter			1		

TABLE 6-5. Percent frequency of bycatch in observed incidents of CPS finfish, by port, 2004-2008. (Page 1 of 4). *Includes Santa Barbara port complex. **Included in 2008.

	All Ports					San Pedro					Monterey				
Common Name	**2004**	**2005**	**2006**	**2007***	**2008**	**2004**	**2005**	**2006**	**2007***	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Finfish															
Anchovy, northern	7.4	6.1	9.2	5.6	5.4	4.2	5.8	3.5	1.7	4.9	32.6	18.2	24	10.8	6.4
Barracuda, California	0.5	0.4	0.4	0.9	0.2	0.6	0.4	0.3	0.8	0.4			0.4	0.9	
Bass, barred sand	1.1	1.1	0.6	0.6		1.2	1.2	0.9	1.0						
Bass, kelp		1.1	0.7		0.5		1.2	1		0.8					
Bass, striped					0.2					0.4					
Blacksmith			0.1	0.2				0.2	0.3						
Bonito, Pacific			2.1	0.7	0.5			2.9	1.3	0.8					
Butterfish, Pacific (Pompano)	4.7	5.5	6	2.8	1.2	5.1	5.2	6.4	3.2	1.9	2.3	18.2	4.9	2.2	
Cabezon			0.1										0.4		
Combfish, longspine			0.7	0.3	1.0			1	0.1	1.5				0.6	
Corbina, California			0.5	0.6				0.7	1.0						
Croaker, unspecified					0.5					0.8					
Croaker, white (kingfish)	6.9	0.2	5.8	4.3	1.7	5.7	0.2	6.4	5.1	1.5	16.3		4.4	3.2	2.1
Croaker, yellowfin				0.2					0.4						
Cusk-eel, basketweave					0.2					0.4					
Cusk-eel, spotted			0.9	0.5				0.9	0.4				0.9	0.6	
Cusk-eel, unspecified	1.3	4.7	2.1	0.5		1.5	4.8	2.9	0.8						
Eel, unspecified					0.2					0.4					
Eel, yellow snake															
Eel, wolf															
Fish, unspecified				0.3	0.7				0.4	1.1				0.2	
Flatfish, unspecified	1.8	0.2	0.6	2.2	1.7	2.1	0.2	0.7	3.4	2.7			0.4	0.7	
Flounder, starry	0.3		0.5	0.6	1.0						2.3		1.8	1.5	2.8
Flounder, unidentified					0.2					0.4					
Flyingfish	0.3	0.6				0.3	0.6								
Greenling, kelp				0.1										0.2	
Grunion, California	0.3		0.1		0.2			0.2		0.4	2.3				
Hagfish				0.1					0.1						
Halfmoon			0.1										0.4		
Halibut, California	4.2	7.6	2.5	3.7	4.0	4.8	7.7	3.3	5.9	5.7			0.4	0.7	0.7
Herring, Pacific			0.1	0.2	0.5								0.4	0.6	1.4
Jacksmelt	0.8	1.5	1.9	2.2	0.7	0.6	1	0.9	2.4	0.4	2.3	27.3	4.4	2.0	1.4
Kelpfish, giant			0.1	0.2				0.2	0.3						
Lingcod				0.1	0.2									0.2	0.7
Lizardfish, California	2.1	5.7	2.1	1.5	1.5	2.4	5.8	2.9	2.7	2.3					
Mackerel, jack**				2.5	3.5				0.7	1.5				4.8	7.1
Midshipman, plainfin			1.6	1.8	1.5			1.7	2.0	0.8			1.3	1.7	2.8
Midshipman, specklefin	1.3		1.6	0.6	1.2	1.5		2.2	1.1	1.9					
Midshipman, unspecified	2.1	0.6				2.4	0.6								
Opaleye					0.5					0.8					
Perch-like, unspecified					0.2					0.4					
Pipefish, bay				0.2					0.1					0.2	
Pipefish, kelp	1.1	0.6	0.1		0.2	1.2	0.6	0.2		0.4					

TABLE 6-5. Percent frequency of bycatch in observed incidents of CPS finfish, by port, 2004-2008. (Page 2 of 4). *Includes Santa Barbara port complex. **Included in 2008.

	All Ports					San Pedro					Monterey				
Common Name	**2004**	**2005**	**2006**	**2007***	**2008**	**2004**	**2005**	**2006**	**2007***	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Finfish															
Poacher, unspecified			0.1					0.2							
Queenfish			3.1	0.8	2.2			4.3	1.4	3.4					
Rockfish, chilipepper			0.1										0.4		
Rockfish, unspecified				0.5					0.8						
Salema			0.1					0.2							
Salmon, chinook				0.1										0.2	
Sanddab, longfin			0.2	0.1	0.2			0.3	0.1	0.4					
Sanddab, Pacific			1.4	3.4	2.2			1.9	1.1	0.8				6.3	5.0
Sanddab, speckled			0.1	0.7	1.2			0.2	0.4	0.0				1.1	3.5
Sanddab, unspecified	4	2.1	2.6	0.9	0.2	3.9	1.9	1.4	1.0		4.7	9.1	5.8	0.7	0.7
Scorpionfish, California	10	8.7	3.4	2.5	3.5	11.3	8.9	4.7	4.4	5.3					
Sculpin, pithead	1.3	0.2	0.1			0.3	0.2	0.2			9.3				
Sculpin, roughback				0.1										0.2	
Sculpin, staghorn			0.1	0.4					0.1				0.4	0.7	
Sculpin, unspecified			0.2		1.2			0.3		1.9					
Seabass, giant (black)			0.1					0.2							
Shad, American			0.9	0.8	0.2								3.1	1.9	0.7
Sheephead, California			0.1					0.2							
Silversides			0.5	0.1				0.7	0.1						
Smelt, surf				0.2										0.4	
Smelt, true				0.1	0.2				0.1						0.7
Snapper, Mexican				0.1					0.1						
Sole, C-O			0.6	0.2				0.3	0.1				1.3	0.2	
Sole, English			0.2	1.3	0.7				0.3				0.9	2.6	2.1
Sole, fantail				0.2	0.5				0.3	0.8					
Sole, petrale				0.2										0.6	
Sole. Rock				0.1										0.2	
Sole, sand	0.3		0.5	0.2	1.0					0.0	2.3		1.8	0.4	2.8
Sole, slender			0.1					0.2							
Sole, unspecified			0.2	0.1									0.9	0.2	
Sunfish, ocean			0.1										0.4		
Surfperch, barred			0.1										0.4		
Surfperch, black			0.1	0.1				0.2						0.2	
Surfperch, kelp				0.1										0.2	
Surfperch, pink			1.1	0.5	1.0			0.9	0.4	0.8				0.6	1.4
Surfperch, rainbow				0.1										0.2	
Surfperch, rubberlip			0.1					0.2					1.8		
Surfperch, shiner			0.9	0.5	0.2			1	0.7	0.0			0.4	0.2	0.7
Surfperch, unspecified			0.4	0.4	0.2			0.3	0.7	0.4			0.4		
Surfperch, walleye	0.3			0.2					0.3		2.3				
Tonguefish	2.1	1.9	1.4	0.9	0.5	2.4	1.9	1.7	1.1	0.8			0.4	0.6	
Topsmelt				0.4	0.2				0.7	0.4					
Turbot, curlfin			0.1	0.2				0.2	0.1					0.2	

TABLE 6-5. Percent frequency of bycatch in observed incidents of CPS finfish, by port, 2004-2008. (Page 3 of 4). *Includes Santa Barbara port complex. **Included in 2008.

	All Ports					San Pedro					Monterey				
Common Name	**2004**	**2005**	**2006**	**2007***	**2008**	**2004**	**2005**	**2006**	**2007***	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Finfish															
Turbot, diamond			0.2	0.6	1.0			0.3	1.0	1.5					
Turbot, hornyhead	4	6.1	2.9	2.6	2.5	4.5	6.2	3.6	3.7	3.4				1.3	0.7
Turbot, spotted			0.6	0.1					0.1						
Turbot, unspecified		1.1	1		0.2		1.2	1.4		0.4					
Whiting, Pacific			0.1	1.0	0.2								0.4	2.2	0.7
Total % Freq. Incidents	**58.2**	**56**	**64.4**	**53.8**	**50.7**	**56**	**55.6**	**64.7**	**54.9**	**54.0**	**76.7**	**72.8**	**62.9**	**52.3**	**44.7**
Elasmobranchs															
Guitarfish, shovelnose		1.5	0.2	0.6	0.7		1.5	0.3	1.1	1.1					
Ratfish, spotted			0.1	0.3	0.7			0.2	0.1	0.8				0.6	0.7
Ray, Bat	7.4	6.3	3	3.3	3.0	7.1	6.4	3.6	5.2	4.6	9.3		1.3	0.7	
Ray, California butterfly		0.2					0.2								
Ray, Pacific electric	0.3		1.2	3.3	3.7	0.3		0.9	0.3	0.8			2.2	7.3	9.2
Ray, Unspecified				0.2	0.2				0.4	0.4					
Shark, brown smoothhound			0.1	0.4	0.2			0.2	0.7	0.4	2.8				
Shark, gray smoothhound			0.2	0.3				0.3	0.6						
Shark, horn			0.6	0.2	0.2			0.9	0.4	0.4					
Shark, leopard				0.2					0.1					0.2	
Shark, Pacific angel			0.2	0.2				0.3	0.3						
Shark, pelagic thresher					0.2					0.4					
Shark, smooth hammerhead					0.2					0.4					
Shark, spiny dogfish	0.3		0.1	0.7	0.5					0.0	2.3		0.4	1.7	1.4
Shark, Unspecified				0.1	0.2				0.1	0.4					
Skate, Big			0.6	0.8	0.7			0.2	0.3	0.4			1.8	1.5	1.4
Skate, California			0.5	0.3	0.5			0.7	0.1	0.8				0.6	0.0
Skate, longnose	0.8					0.9									
Skate, thornback	2.4	3.6	1.6	1.8	0.7	2.7	3.7	1.9	3.1	1.1				0.2	
Skate, Unspecified			0.1					0.2							
Stingray, round	0.3	1.5	0.2	0.9	0.7	0.3	1.5	0.3	1.4	1.1				0.4	
Total % Freq. Incidents	**11.5**	**13.1**	**8.7**	**13.8**	**12.9**	**11.3**	**13.3**	**10**	**14.4**	**12.9**	**14.4**		**5.7**	**13.1**	**12.8**
Invertebrates and Plants															
Algae, marine			1.2	0.1	0.2					0.4			1.2	0.2	
Bryozoans			0.1	0.1									0.1	0.2	
Crab shells	0.8		0.3			0.9		0.3					0.4		
Crab, box			0.1	0.3				0.2	0.6				0.1		
Crab, decorator			0.2		0.2					0.0			0.2		0.7
Crab, Dungeness			0.1	0.2	0.2					0.4			0.1	0.4	
Crab, globe				0.3					0.6						
Crab, rock unspecified	1.3	0.2	0.2	1.5		1.5	0.2	0.3	2.4				0.2	0.4	
Crab, sheep			0.1	0.2				0.2	0.3				0.1		
Crab, slender				0.2	0.7					0.4				0.6	1.4
Crab, swimming			0.3	0.2				0.5	0.3				0.4		

TABLE 6-5. Percent frequency of bycatch in observed incidents of CPS finfish, by port, 2004-2008. (Page 4 of 4). *Includes Santa Barbara port complex. **Included in 2008.

	All Ports					San Pedro					Monterey				
Common Name	**2004**	**2005**	**2006**	**2007***	**2008**	**2004**	**2005**	**2006**	**2007***	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Invertebrates and Plants															
Crab, unspecified			0.5	0.3	0.2			0.7	0.4	0.4			0.5	0.2	
Eelgrass	1.1	1.5	2	0.6		1.2	1.5	1.4	0.7				2.1	0.4	
Gorgonians			0.6					0.9					0.6		
Invertebrate, unspecified					0.2					0.4					
Jellies	1.3	2.3	0.2	3.5	6.7	0.3	2.3	0.3	0.1	0.4	9.3		0.2	7.8	18.4
Kelp	15.3	15	10.4	10.6	13.9	17.3	14.9	10.4	11.8	16.7		18.2	11.2	8.9	8.5
Kelp, feather boa			0.3	0.2	1.2				0.4	1.5			0.4		0.7
Lobster, California spiny				0.2					0.4				0.9		
Nudibranch				0.1										0.2	
Octopus, unspecified			0.8	0.5	0.5			1	0.8	0.8			0.1		
Pleurobranch													0.5		
Prawn, ridgeback				0.2					0.3						
Prawn, spot			0.1		0.2			0.2		0.4			1.7		
Salps	0.5	0.2		0.1		0.6	0.2	0.7	0.1				0.1		
Sea cucumber	0.3	0.6	0.5	0.6	0.7	0.3	0.6		1.1	1.1			0.1		
Sea pansies		0.2		0.1		0	0.2	1.2					4.2	0.2	
Sea star	0.3	0.8	1.6	1.6	1.7	0.3	0.8		1.6	1.5				1.7	2.1
Shrimp, black-spotted bay		0.2		0.6	0.5	0	0.2			0.0				1.5	1.4
Shrimp, unspecified			7.6	1.8	1.0			0.2	3.2	1.5					
Snail, top				0.1					0.1						
Snail, Unspecified				0.2	0.2				0.3	0.4					
Sponge, unspecified			0.1		0.2			0.2							0.7
Squid, jumbo				0.1					0.1						
Squid, market (Egg Cases)	0.5			0.1		0.6								0.2	
Squid, market	9.2	10.2	3.9	5.9	6.2	10.1	10.3	5.9	4.8	6.1	2.3	9.1		7.3	6.4
Surfgrass				2.0	0.2									4.7	0.7
Tunicates				0.2					0.1					0.2	
Turkish Towel					0.5										1.4
Total % Freq. Incidents	**30.6**	**31.2**	**31.2**	**32.5**	**35.9**	**33.1**	**31.2**	**24.6**	**30.7**	**32.3**	**11.6**	**27.3**	**25.4**	**34.9**	**42.6**
Total All Incidents	**379**	**528**	**804**	**1,246**	**404**	**336**	**517**	**579**	**709**	**263**	**43**	**11**	**225**	**537**	**141**
Total Observed Landings	**205**	**199**	**266**	**253**	**148**	**180**	**199**	**172**	**142**	**106**	**33**	**25**	**94**	**111**	**42**

TABLE 6-6. Market squid incidental catch for CPS finfish for 2004 - 2008. Incidental catch includes species landed with market squid and recorded on landing receipts (round haul gear).

	2004		2005		2006		2007		2008	
Species name	**Number of Landings**	**Metric Tons**	**Number of Landings**	**Metric Tons**	**Number of Landings**	**Metric Tons**	**Number of Landings**	**Metric Tons**	**Number of Landings**	**Metric Tons**
Anchovy, northern	17	616.1	31	1,042.9	19	122.3	38	89.7	28	84.4
Bonito	1	<0.1	1	1.3	3	3.3			8	1.9
Mackerel, jack	19	38.8	19	21.0	28	45.6	36	47.1	64	68.0
Mackerel, Pacific	23	143.1	187	571.5	169	360.3	127	351.9	146	442.3
Sardine, Pacific	122	1,525.7	179	1,076.9	184	534.6	287	1,596.7	305	1,826.1

TABLE 6-7. Percent frequency of bycatch in observed loads of California market squid by port, 2004-2008 (Page 1 of 4).

	Total All Ports					San Pedro					Santa Barbara/Ventura					Monterey/Moss Landing				
Common Name	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Finfish																				
Anchovy, northern	5.2	5.7	5.1	7.6	2.2	4.6	5.9	5.0	2.9	2.1	7.4	3.8	7.8	9.1	2.6	5.4	6.5	3.2	11.1	
Baracuda, California		0.3	1.3		1.1			0.8		1.4			3.9				0.7			
Bass, kelp			0.4		0.6			0.8		0.7										
Blacksmith			0.4					0.8												
Bonito, Pacific			0.4	0.4	0.6					0.7			2.0	0.5						
Butterfish, Pacific (Pompano)	1.4	0.5	2.6			2.0	0.7	4.2					2.0			1.2	0.7			
Combfish, longspine	0.3					0.7														
Croaker, white (kingfish)	0.3			0.4					1.5							0.6				
Croaker, unspecified	0.3					0.7														
Cusk-eel	0.3					0.7														
Eel, wolf	0.3															0.6				
Flatfish, unspecified	0.3		0.4		1.1	0.7				1.4								1.6		
Flounder, starry	0.6				0.6					0.7						1.2				
Flyingfish					0.6					0.7										
Greenling, painted	0.3					0.7														
Halibut, California					1.7					2.1										
Herring, Pacific	0.9	0.5														1.8	1.3			
Herring, round																				
Jacksmelt	7.5	3.1	0.4	0.4		0.7	0.7							0.5		14.9	7.2	1.6		
Lizardfish, California	0.3					0.7														
Mackerel, jack	7.2	6.5	12.4	6.2	8.8	7.8	10.5	15.0	4.4	11.2	7.4		2.0	6.5		6.5	5.9	15.9	11.1	
Mackerel, Pacific	8.9	21.0	18.8	17.4	13.3	11.1	25.7	17.5	20.6	13.3	25.9	41.3	33.3	17.1	13.2	4.2	5.9	9.5		
Mackerel, unspecified				1.5										2.0						
Midshipman, plainfin																				
Midshipman, specklefin			0.4	1.1	0.6			0.8	2.9	0.7				0.5						
Midshipman, unspecified	1.1	0.5			0.6	0.7				0.7		1.3				1.8	0.7			
Poacher , unspecified				0.4					1.5											

TABLE 6-7. Percent frequency of bycatch in observed loads of California market squid by port, 2004-2008 (Page 2 of 4).

	Total All Ports					San Pedro					Santa Barbara/Ventura					Monterey/Moss Landing				
Common Name	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Finfish																				
Rockfish, blue		0.3		0.4			0.7							0.5						
Rockfish, bocaccio	0.3					0.7														
Rockfish, chilipepper	0.9	0.3														1.8	0.7			
Rockfish, unspecified					0.6					0.7										
Roughback Sculpin																				
Salmon, Chinook	0.3		0.4													0.6		1.6		
Sanddab, longfin	0.3					0.7														
Sanddab, Pacific	1.4	2.1	1.3	1.8		2.0	1.3	0.8	1.5			1.3		1.5		1.2	3.3	3.2	11.1	
Sanddab, speckled	0.3				0.6	0.7				0.7										
Sanddab, unspecified	2.9	0.5		0.4	1.7	0.7				0.7				0.5	5.3	5.4	1.3			
Sardine, Pacific	17.8	21.6	22.2	26.8	23.2	21.6	23.7	26.7	27.9	18.2	44.4	25.0	33.3	27.1	42.1	10.1	17.6	4.8	11.1	
Scorpionfish, California	0.6	0.8		1.8	0.6	1.3	2.0		4.4	0.7				1.0						
Sculpin, pithead				0.4					1.5											
Sculpin, staghorn		0.3		0.4	0.6		0.7			0.7				0.5						
Sculpin, unspecified	0.3				0.6	0.7				0.7										
Silversides (jack- or topsmelt)		0.3					0.7													
Sole, sand	0.3															0.6				
Sole, unspecified	0.3										3.7									
Sunfish, ocean			0.4										2.0							
Surfperch, pink			0.4																	
Surfperch, shiner	0.9		0.4			2.0		0.8												
Surfperch, unspecified								0.8												
Topsmelt	0.6	0.3				0.7					3.7	1.3								
Turbot, hornyhead	0.3	0.3		0.4	0.6	0.7			1.5	0.7							0.7		11.1	
Turbot, spotted					0.6					0.7										
Turbot, unspecified	0.9	0.3				0.7										1.2	0.7			
Whitefish, ocean				0.4										0.5						
Total % Freq. Incidents	**63.2**	**65.2**	**67.7**	**68.2**	**60.2**	**62.7**	**72.6**	**74.0**	**70.6**	**59.4**	**92.6**	**74.0**	**86.3**	**67.8**	**63.2**	**58.9**	**53.2**	**41.4**	**55.5**	**0.0**

TABLE 6-7. Percent frequency of bycatch in observed loads of California market squid by port, 2004-2008 (Page 3 of 4).

	Total All Ports					San Pedro					Santa Barbara/Ventura					Monterey/Moss Landing				
Common Name	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Elasmobranchs																				
Ray, bat	1.1	2.1	1.3	1.8		1.3	3.3	0.8				3.8	3.9	2.5		1.2				
Ray, Pacific electric	3.2	3.9	0.4													6.5	9.8	1.6		
Ray , thornback																				
Ray, unspecified					1.1					1.4										
Shark, horn		0.3		0.7			0.7		1.5					0.5						
Shark, unspecified			0.4															1.6		
Skate, Long nosed					0.6					0.7										
Skate, unspecified		0.3															0.7			
Stingray, round	1.4					3.3														
Total % Freq. Incidents	**5.7**	**6.6**	**2.1**	**2.5**	**1.7**	**4.6**	**4.0**	**0.8**	**1.5**	**2.1**	**0.0**	**3.8**	**3.9**	**3.0**	**0.0**	**7.7**	**10.5**	**3.2**	**0.0**	**0.0**
Invertebrates and Plants																				
Algae, marine			0.9	0.4	0.6					0.7									11.1	
Cnideria (Sea Anenomes)			0.4															1.6		
Crab, box					0.6					0.7										
Crab, Dungeness	1.1					0.7										1.8				
Crab, elbow																				
Crab, sheep		0.3		0.7			0.7							1.0						
Crab, slender				0.4	0.7									0.5						
Crab, swimming				0.4										0.5						
Crab, rock unspecified		0.3		1.1	1.1		0.7			0.7				1.5	2.6					
Crab, shore					1.1					0.7					2.6					
Crab, unidentified					0.6					0.7										
Eelgrass	2.3	0.8	0.9	0.7	1.1	5.2	2.0	1.7		1.4				0.5						
Gorgonians	0.3		0.4			0.7		0.8												
Jellies	7.2	2.6	0.4									1.3				14.9	5.9	1.6		
Kelp	10.9	17.4	16.7	20.7	18.8	13.7	18.4	15.0	22.1	18.2	3.7	13.8	7.8	20.1	21.1	9.5	18.3	27.0	22.2	

TABLE 6-7. Percent frequency of bycatch in observed loads of California market squid by port, 2004-2008 (Page 4 of 4).

	Total All Ports					San Pedro					Santa Barbara/Ventura					Monterey/Moss Landing				
Common Name	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004**	**2005**	**2006**	**2007**	**2008**
Invertebrates and Plants																				
Kelp, Feather boa					2.2					2.8										
Lobster, California spiny		0.3		0.4			0.7							0.5						
Octopus, unspecified																				
Salps	1.1					2.6														
Sea cucumber				0.4	1.1					1.4				0.5						
Sea cucumber, warty				0.4					1.5											
Sea hare					0.6					0.7										
Sea slug					0.6										2.6					
Sea star	1.1	0.5	1.3	1.1	2.2	0.7	1.3	0.8	1.5	1.4	3.7			1.1	5.3	1.2		3.2		
Squid, market, egg cases	6.6	1.6	8.5	1.1	7.2	8.5		5.8		8.4			2.0	1.5	2.6	6.0	3.9	19.0		
Squid, jumbo	0.3	4.9	0.4			0.7		0.8				7.5					8.5			
Turkish towel																				
Turtle grass				0.7										0.5					11.1	
Urchin, purple				0.4										0.5						
Total % Freq. Incidents	**31.0**	**28.7**	**29.9**	**28.9**	**38.3**	**32.7**	**23.8**	**24.9**	**25.1**	**37.8**	**7.4**	**22.6**	**9.8**	**28.7**	**36.8**	**33.3**	**36.6**	**52.4**	**44.4**	**0.0**
Total All Incidents	**348**	**384**	**234**	**276**	**181**	**153**	**152**	**120**	**68**	**143**	**27**	**79**	**51**	**199**	**38**	**168**	**153**	**63**	**9**	**0**
Total Observed Landings	**160**	**178**	**136**	**114**	**86**	**86**	**100**	**73**	**61**	**67**	**32**	**42**	**37**	**51**	**19**	**42**	**36**	**26**	**2**	**0**

TABLE 6-8. Expanded salmonid bycatch in Pacific sardine fisheries in Oregon and Washington, 2000-2008.

	Chinook (live)	Chinook (dead)	Coho (live)	Coho (dead)	Pink (live)	Unid (live)	Unid (dead)	Total (live)	Total (dead)	Grand Total
2008										
Oregon[2/]								123	75	198
Washington[3/]										
2007										
Oregon[2/]								349	170	519
Washington[3/]	33	108	20	124				53	232	285
2006										
Oregon[2/]								164	93	257
Washington[3/]	31	101	19	116				50	217	267
2005										
Oregon[2/]								411	176	587
Washington[3/]	47	156	29	178				76	334	410
2004										
Oregon[2/]								518	305	823
Washington	35	225	19	105	0	39	0	93	330	423
2003										
Oregon[2/]								315	185	500
Washington	92	262	81	231	0	173	0	346	493	839
2002										
Oregon[2/]								199	81	280
Washington	150	356	61	765	0	200	0	411	1211	1532
2001										
Oregon[1/]	45	45	201	134	22	45	0	313	179	492
Washington	449	170	571	504	0	80	0	1100	674	1774
2000										
Oregon[1/]	43	72	159	43	0	303	43	505	158	663
Washington	38	3	276	116	0	7	0	321	119	440

1/ Oregon salmon bycatch data 2000-2001 are expanded from a bycatch rate of salmon/trip based on vessel observation program.
2/ Oregon salmon bycatch data 2002-2008 are from logbooks.
3/ 2005 Washington totals calculated from observed 2000-2004 observed bycatch rates.

TABLE 6-9. Reported logbook and observed catches of non-target species caught in Oregon sardine fishery, 2006-2008.

Species	2006 Logbook data	2007 Logbook data	2008 Logbook data
Blue shark	3	0	1
Thresher shark	2	3 (2 of 3 released alive)	0
unknown shark	1	5	0
Salmonids	257 (55% alive; 45% dead)	519 (67% alive; 33% dead)	198 (62% alive, 38% dead)
Mackerel	292,150 lbs.	473,441 lbs.	59,205 lbs.
Anchovy	1,000 lbs.	500 lbs.	8,300 lbs.
Pacific Herring	0	0	52,200 lbs.
Pacific Hake	250 lbs.	0	525 lbs.
Squid	150 lbs.	0	225 lbs.
Jelly fish	<100 lbs	0	0

TABLE 6-10. Recorded incidental catch (mt) in Oregon sardine fishery, 2001-2008 (from fish ticket data).

	2001	2002	2003	2004	2005	2006	2007	2008
Pacific mackerel	52.8	126.3	158.3	161.5	316.1	665	699.7	56.8
Jack mackerel	1.2	0.3	3.2	24.1	3.6	1.4	8	1.6
Pacific herring	-	3.3	-	10.3	0.1	1.2	-	55.8
Northern anchovy	-	0.2	-	1.0	68.4	8.6	-	2.4
American shad	-	0.3	-	1.2	-	0.44	-	0.3
Pacific hake	-	-	0.1	-	-	-	-	0.005
Sharks	-	-	0.3	0.3	0.4	0.16	0.14	0.01
Squid	-	-	-	13.9	-	-	-	-
Jellyfish	-	-	-	5.5	-	-	-	-

TABLE 6-11. Species noted as encountered on CDFG Live Bait Logs, 1996-2008.

Year	Days Fished	Jack Mackerel	Pacific Mackerel	Barracuda	Herring	Grunion	Smelts (Atherinids)	Shiner Surfperch	White Croaker	Queenfish	Market Squid	Pacific Bonito
2008	891	2	92	7							2	6
2007	970	2	245	22			2		1	1	7	12
2006	940	7	169	3								2
2005	1,045	49	188	27							1	6
2004	1,059	87	214	13						1	1	8
2003	1,123	18	140	23							2	
2002	1,105	9	147	1						1		
2001	1,052	11	176	56		1						
2000	488	25	87	34		1						
1999	449	16	77	7	1		1					
1998	809	8	189	69	1			1				
1997	773	46	190	104				3				
1996	522	10	45	27	3		5					

TABLE 6-12. Estimates of Pacific sardine and Northern anchovy live bait harvest in California. Data for 1939-1992 from Thomson et al. (1994), and 1993-2008 from CDFG live bait logs. Values are in metric tons with the assumption that 1 scoop =12.5 lbs.

Year	Anchovy	Sardine	Year	Anchovy	Sardine
1939	1,364	0	1975	5,577	0
1940	1,820	0	1976	6,202	0
1941	1,435	0	1977	6,410	0
1942	234	0	1978	6,013	107
1943	World War II	World War II	1979	5,364	0
1944	World War II	World War II	1980	4,921	12
1945	World War II	World War II	1981	4,698	6
1946	2,493	0	1982	6,978	38
1947	2,589	0	1983	4,187	193
1948	3,379	0	1984	4,397	53
1949	2,542	0	1985	3,775	11
1950	3,469	0	1986	3,956	17
1951	4,665	0	1987	3,572	216
1952	6,178	0	1988	4,189	50
1953	5,798	0	1989	4,594	100
1954	6,066	0	1990	4,842	543
1955	5,557	0	1991	5,039	272
1956	5,744	0	1992	2,572	1,807
1957	3,729	0	1993	669	176
1958	3,843	0	1994	2,076	1,506
1959	4,297	0	1995	1,278	2,055
1960	4,225	0	1996	703	1,801
1961	5,364	0	1997	1,077	2,344
1962	5,595	0	1998	304	2,037
1963	4,030	0	1999	453	2,411
1964	4,709	0	2000	834	1,270
1965	5,645	0	2001	1,238	1,245
1966	6,144	0	2002	965	1,701
1967	4,898	0	2003	1,085	3,028
1968	6,644	0	2004	192	3,900
1969	4,891	0	2005	1,464	2,949
1970	5,543	0	2006	476	3,629
1971	5,794	0	2006	476	3,629
1972	5,307	0	2007	700	3,358
1973	5,639	0	2008	686	2,943
1974	5,126	0			

TABLE 6-13. Ratio of anchovy to sardine in reported live bait catch in California, 1994-2008. Values are in metric tons with the assumption that 1 scoop =12.5 lbs.

Year	Anchovy	Sardine	Total	Proportion Anchovy	Proportion Sardine
2008	686	2,943	3,629	0.19	0.81
2007	700	3,358	4,058	0.17	0.83
2006	476	3,629	4,105	0.12	0.88
2005	1,464	2,949	4,413	0.33	0.67
2004	192	3,900	4,092	0.05	0.95
2003	1,085	3,028	4,113	0.26	0.74
2002	965	1,701	2,666	0.36	0.64
2001	1,238	1,245	2,483	0.50	0.50
2000	834	1,270	2,104	0.40	0.60
1999	453	2,411	2,864	0.16	0.84
1998	304	2,037	2,341	0.13	0.87
1997	1,077	2,344	3,420	0.31	0.69
1996	703	1,801	2,504	0.28	0.72
1995	1,278	2,055	3,333	0.38	0.62
1994	2,076	1,506	3,582	0.58	0.42

TABLE 9-1. West coast landings (mt) and real[1] exvessel revenues (2008 $) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid, 1981-2008.

Year	Pacific P. Sardine	Pacific Sardine Rev	Pacific P. Mack.	Pacific Mackerel Rev	Jack J. Mack	Jack Mackerel Rev	Anchovy	Anchovy Rev	M. Squid	Squid Rev
1981	15	$7,991	35,388	$19,280,334	17,778	$9,672,664	52,309	$8,666,324	23,510	$13,443,422
1982	2	$1,339	36,065	$18,075,914	19,617	$9,914,080	42,155	$5,387,321	16,308	$8,897,575
1983	1	$417	41,479	$19,148,958	9,829	$4,271,234	4,430	$994,481	1,824	$1,806,480
1984	1	$1,979	44,086	$18,886,904	9,154	$3,122,979	2,899	$946,853	564	$690,552
1985	6	$3,106	37,772	$14,415,987	6,876	$2,837,926	1,638	$524,045	10,276	$8,707,191
1986	388	$176,459	48,089	$16,611,481	4,777	$1,768,042	1,557	$500,508	21,278	$9,638,002
1987	439	$129,392	46,725	$13,685,803	8,020	$2,448,021	1,467	$634,433	19,984	$8,107,845
1988	1,188	$341,183	50,864	$16,337,850	5,068	$1,582,983	1,518	$829,634	37,316	$15,036,173
1989	837	$375,317	47,713	$13,566,117	10,745	$3,187,185	2,511	$1,341,577	40,974	$14,450,086
1990	1,664	$350,323	40,092	$9,848,401	3,254	$813,745	3,259	$1,149,272	28,447	$8,694,312
1991	7,587	$1,593,510	32,067	$9,531,287	1,712	$443,732	4,068	$1,162,286	37,389	$10,836,222
1992	18,056	$3,280,045	19,045	$7,007,961	1,526	$417,747	1,166	$391,321	13,112	$4,275,540
1993	15,347	$2,638,176	12,129	$2,572,854	1,950	$470,116	2,003	$815,902	42,830	$17,531,340
1994	11,644	$2,520,850	10,293	$2,390,385	2,906	$634,378	1,859	$915,849	55,383	$23,858,761
1995	40,256	$5,761,948	8,823	$1,863,383	1,877	$472,717	2,016	$597,203	70,252	$36,157,048
1996	32,553	$4,995,621	9,730	$2,087,866	2,437	$483,834	4,505	$1,110,217	80,561	$34,654,035
1997	43,290	$6,908,085	20,168	$4,326,778	1,533	$384,494	5,779	$1,262,515	70,329	$32,125,530
1998	43,312	$5,541,266	21,561	$3,885,325	1,777	$585,564	1,584	$375,093	2,895	$2,484,590
1999	60,476	$7,712,231	9,094	$1,625,270	1,557	$297,104	5,311	$1,426,107	92,101	$49,645,921
2000	67,982	$10,352,798	22,058	$4,171,648	1,451	$389,899	11,832	$2,055,992	118,903	$38,740,420
2001	75,801	$12,643,852	7,618	$1,666,590	3,839	$839,764	19,345	$1,981,766	86,203	$23,410,013
2002	96,897	$14,305,676	3,744	$708,254	1,026	$281,082	4,882	$840,776	72,895	$24,632,010
2003	71,923	$9,444,987	4,213	$853,994	231	$94,727	1,929	$443,180	45,056	$32,904,215
2004	89,339	$12,520,072	3,708	$714,504	1,160	$331,995	7,019	$1,018,042	40,068	$24,581,119
2005	86,464	$11,901,627	3,586	$676,004	294	$254,111	11,414	$1,315,186	55,755	$36,726,559
2006	86,608	$10,313,528	6,610	$977,956	1,174	$221,228	12,960	$1,481,903	49,180	$29,927,300
2007	127,766	$14,000,685	5,759	$897,450	646	$153,251	10,548	$1,260,006	49,499	$30,846,567
2008	87,175	$14,594,993	3,516	$684,886	308	$53,033	14,654	$1,657,965	34,639	$23,866,799

Source: PacFIN - 2006-2008 data extracted January-February 2009.

[1]Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 2008.

[2]Pacific mackerel landings and revenues also include landings and revenues of unspecified mackerel.

TABLE 9-2. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by landing area, 1981-2008.

	Landings (mt)					Exvessel Revenues (2008 $)				
Year	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
					San Diego					
1981		*	*	*	*		*	*	*	*
1982		29.9	0.1		*		$33,136	$324		*
1983		*	*	*	1.2		*	*	*	$1,709
1984	*	*	*		*	*	*	*		*
1985		*	*		*		*	*		*
1986		*	*		*		*	*		*
1987	*	*	*	*	*	*	*	*	*	*
1988	0.1	17.4	<0.1	5.5	18.6	$109	$23,812	$1	$6,425	$13,932
1989	0.1	7.6	<0.1	93.5	*	$301	$12,250	$28	$455,861	*
1990	0.2	7.7	0.1	18.4	*	$356	$10,613	$116	$76,438	*
1991		*	*	*			*	*	*	
1992	*	*	*	*	*	*	*	*	*	*
1993	*	*	*	*	*	*	*	*	*	*
1994	*	*	*	*	0.8	*	*	*	*	$360
1995	*	*	*	*	*	*	*	*	*	*
1996	*	*		*	1.8	*	*		*	$726
1997	*	*	*	*	2.6	*	*	*	*	$1,119
1998	*	*		*	*	*	*		*	*
1999	*	*	*	*	*	*	*	*	*	*
2000	19.2	1.7	0.2	4.3	*	$10,428	$3,043	$323	$2,465	*
2001	0.2	2.8	0.1	1.5	*	$137	$3,510	$152	$1,026	*
2002	*	*	*	*		*	*	*	*	
2003	*	*	*	*		*	*	*	*	
2004	*	*			*	*	*			*
2005	*	*		*		*	*		*	
2006	*	*		*	1.4	*	*		*	$891
2007	<0.1	0.4	<0.1	<0.1	*	$79	$440	$6	$49	*
2008		0.2			<0.1		$322			$84
					Orange/LA					
1981	14.7	29,084.7	14,699.9	38,216.3	*	$7,970	$15,968,575	$7,988,489	$6,175,638	*
1982	1.8	29,827.6	18,131.1	32,514.7	*	$1,232	$14,908,383	$9,185,391	$3,792,362	*
1983	0.6	33,902.3	6,785.8	900.2	853.6	$385	$16,134,849	$3,284,978	$243,347	$776,471
1984	*	*	*	*	66.3	*	*	*	*	$82,538
1985	3.4	32,012.6	5,860.1	43.1	3,095.9	$1,789	$12,610,763	$2,403,302	$38,537	$2,238,416
1986	286.6	41,071.7	4,289.0	140.8	*	$128,997	$14,369,358	$1,530,181	$46,960	*
1987	317.3	39,863.3	7,801.2	108.8	*	$95,919	$11,781,833	$2,374,519	$41,176	*
1988	1,172.1	47,656.6	4,939.1	92.9	*	$333,666	$15,198,685	$1,520,663	$34,346	*
1989	505.0	41,717.5	10,703.7	479.0	*	$112,120	$12,439,242	$3,124,433	$98,180	*
1990	1,179.4	37,123.6	2,968.0	193.2	*	$235,609	$9,161,899	$724,320	$53,458	*
1991	6,415.1	31,602.9	1,640.2	414.3	*	$1,361,880	$9,383,343	$408,308	$86,904	*
1992	13,950.8	18,071.7	1,095.7	136.6	1,700.5	$2,410,320	$6,805,946	$380,536	$46,771	$454,962
1993	13,977.6	11,714.9	1,268.9	118.7	12,889.7	$2,399,380	$2,499,429	$301,668	$29,157	$4,608,704
1994	9,031.7	9,842.3	2,459.8	136.6	*	$1,566,474	$2,268,785	$452,165	$27,441	*
1995	34,137.0	7,864.0	1,596.2	297.8	*	$4,855,802	$1,668,105	$314,443	$45,996	*
1996	23,922.6	8,764.9	2,054.0	239.1	14,993.9	$3,452,833	$1,798,467	$436,010	$39,179	$6,955,820
1997	26,533.7	14,002.6	822.6	1,120.8	17,779.1	$3,950,572	$3,437,007	$280,446	$148,509	$9,078,539
1998	31,702.3	18,149.6	1,012.4	338.1	227.5	$4,380,483	$3,519,469	$488,905	$56,721	$200,184
1999	39,084.2	8,551.1	927.4	1,418.2	27,684.1	$5,218,512	$1,541,076	$275,352	$324,177	$13,588,278
2000	39,104.1	21,646.1	1,209.5	1,280.1	44,839.9	$5,952,324	$4,116,716	$321,242	$209,123	$16,153,353
2001	40,763.6	6,676.6	3,623.8	3,657.7	39,170.6	$6,189,817	$1,473,807	$776,336	$445,373	$11,738,863
2002	39,308.0	3,367.8	1,003.5	1,205.7	28,136.9	$5,165,451	$657,763	$272,758	$137,063	$8,667,809
2003	22,882.7	3,941.3	133.4	205.5	7,758.8	$2,378,758	$805,583	$66,509	$39,721	$5,771,051
2004	23,677.4	3,018.3	1,027.1	147.2	10,504.3	$2,804,831	$620,479	$308,960	$45,359	$6,021,627
2005	*	*	*	*	31,846.0	*	*	*	*	$21,802,657
2006	*	*	*	*	37,107.1	*	*	*	*	$22,640,867
2007	*	*	*	*	*	*	*	*	*	*
2008	*	*	*	*	17,595.2	*	*	*	*	$12,074,753

TABLE 9-2. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by landing area, 1981-2008.

	Landings (mt)					Exvessel Revenues (2008 $)				
Year	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
					Ventura/Santa Barbara					
1981	<0.1	4,872.1	2,846.6	9,034.5	*	$20	$2,658,337	$1,545,635	$1,479,042	*
1982		4,095.4	1,195.0	6,440.7	*		$2,172,848	$581,504	$867,256	*
1983	<0.1	3,905.0	559.1	2,727.1	3.2	$2	$1,690,802	$218,475	$373,149	$4,946
1984		1,263.2	52.1	141.0	7.1		$521,899	$23,012	$102,790	$19,239
1985		*	*	*	2,959.4		*	*	*	$1,668,586
1986	17.5	5,004.5	296.9	160.9	6,411.8	$6,413	$1,702,353	$111,352	$90,444	$2,275,186
1987	74.3	5,877.7	8.0	140.2	8,406.6	$22,528	$1,642,067	$3,369	$76,364	$3,104,172
1988	13.2	3,119.6	6.5	154.3	16,334.4	$5,842	$1,064,769	$2,230	$93,152	$6,138,529
1989	93.3	5,907.6		160.9	16,861.9	$20,561	$1,069,147		$100,347	$5,750,234
1990	*	*	*	*	10,600.5	*	*	*	*	$3,533,093
1991	186.4	138.1	8.6	189.9	16,904.8	$38,201	$27,111	$1,699	$105,339	$4,416,739
1992	973.4	92.2	<0.1	89.8	2,809.2	$121,646	$13,364	$4	$50,047	$781,255
1993	691.7	34.5	<0.1	298.1	17,367.2	$88,052	$6,179	$14	$143,290	$6,244,787
1994	315.0	39.5	47.5	340.8	21,333.6	$38,370	$13,314	$5,356	$232,473	$8,537,161
1995	354.5	249.1	0.4	346.3	41,184.3	$64,682	$38,501	$305	$231,065	$22,636,242
1996	461.1	66.8	11.1	374.5	46,435.3	$61,287	$47,556	$2,498	$236,790	$19,302,673
1997	3,357.3	1,160.3	7.4	510.4	34,610.6	$365,356	$160,739	$3,978	$140,677	$14,473,482
1998	899.3	1,305.7		239.1	2,175.6	$139,276	$104,980		$120,966	$1,900,557
1999	*	*	*	*	52,718.7	*	*	*	*	$29,881,167
2000	3,072.2	230.0	9.1	3,548.3	48,747.0	$424,028	$30,582	$1,240	$556,999	$14,213,907
2001	3,956.7	72.4	<0.1	3,909.3	31,876.3	$510,486	$9,179	$41	$623,009	$7,319,239
2002	5,064.5	<0.1	<0.1	732.2	11,814.1	$841,006	$18	$2	$245,053	$4,215,015
2003	*	*	*	*	13,199.8	*	*	*	*	$9,677,023
2004	4,711.0	67.4	<0.1	2,722.2	15,397.0	$535,916	$9,918	$10	$508,459	$9,655,338
2005	*	*	*	*	13,639.5	*	*	*	*	$8,607,188
2006	1,928.9	126.6		4,167.0	6,003.5	$199,926	$9,439		$691,601	$3,665,532
2007	*	*	*	*	17,772.8	*	*	*	*	$11,003,902
2008	*	*	*	*	8,441.1	*	*	*	*	$5,751,317
					San Luis Obispo					
1981		*	*	*	0.1		*	*	*	$202
1982		*	*		0.3		*	*		$597
1983		0.7			0.2		$765			$310
1984		5.0			0.1		$4,441			$176
1985	*	*	*	*	0.3	*	*	*	*	$585
1986		*	*	*	0.1		*	*	*	$180
1987		0.8		2.4	0.4		$940		$1,285	$532
1988	<0.1	0.2			*	$1	$414			*
1989		1.2	<0.1	0.2	*		$1,152	$6	$61	*
1990	121.1	1.9	16.5		0.1	$20,024	$1,554	$2,701		$99
1991		1.0	<0.1		*		$843	$15		*
1992		0.4	<0.1		0.2		$428	$95		$174
1993	*	*	*	*	*	*	*	*	*	*
1994	*	*	*	*	*	*	*	*	*	*
1995		<0.1	<0.1		182.5		$25	$5		$64,782
1996		*			216.8		*			$97,844
1997	*	*		*	<0.1	*	*		*	$19
1998	<0.1	0.3	<0.1		*	$49	$228	$61		*
1999		*		*	16.7		*		*	$6,904
2000		*	*		*		*	*		*
2001		*		*	*		*		*	*
2002	*				*	*				*
2003		*	*	*	*		*	*	*	*
2004		*			*		*			*
2005					*					*
2006	*					*				
2007		*			*		*			*
2008										

TABLE 9-2. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by landing area, 1981-2008.

	Landings (mt)					Exvessel Revenues (2008 $)				
Year	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
					Monterey/Santa Cruz					
1981		*	*	*	12,822.7		*	*	*	$10,319,639
1982	*	*	*	*	10,607.3	*	*	*	*	$7,085,474
1983	*	*	*	*	500.0	*	*	*	*	$527,613
1984	0.3	7,151.1	5,486.0	1,894.7	*	$605	$1,799,100	$1,472,994	$259,024	*
1985	*	*	*	*	3,813.1	*	*	*	*	$4,328,215
1986	*	*	*	*	5,487.9	*	*	*	*	$2,830,569
1987	*	*	*	*	5,611.0	*	*	*	*	$2,491,638
1988	*	*	*	*	*	*	*	*	*	*
1989	*	*	*	*	7,145.5	*	*	*	*	$3,027,289
1990	*	*	*	*	7,917.5	*	*	*	*	$2,580,090
1991	*	*	*	*	6,703.2	*	*	*	*	$2,919,917
1992	*	*	*	*	6,111.3	*	*	*	*	$2,202,729
1993	*	*	*	*	*	*	*	*	*	*
1994	*	*	*	*	*	*	*	*	*	*
1995	*	*	*	*	2,449.1	*	*	*	*	$1,327,179
1996	*	*	*	*	*	*	*	*	*	*
1997	*	*	*	*	*	*	*	*	*	*
1998	10,009.0	1,456.7	32.5	901.2		$937,277	$217,183	$16,899	$103,215	
1999	*	*	*	*	*	*	*	*	*	*
2000	11,367.0	39.4	50.0	6,804.3	*	$1,378,092	$9,057	$38,324	$1,128,765	*
2001	7,102.5	172.2		11,660.3	*	$1,982,557	$26,155		$786,787	*
2002	*	*	*	*	25,084.8	*	*	*	*	$9,167,113
2003	*	*	*	*	*	*	*	*	*	*
2004	*	*	*	*	*	*	*	*	*	*
2005	*	*	*	*	*	*	*	*	*	*
2006	*	*	*	*	509.3	*	*	*	*	$282,104
2007	34,756.1	123.4	166.8	7,704.4	32.3	$3,369,123	$19,985	$38,263	$903,103	$8,088
2008	26,211.3	206.4	59.4	12,216.0	*	$4,021,274	$33,535	$10,801	$1,306,109	*
					San Francisco					
1981	*	*	*	*	*	*	*	*	*	*
1982		*	*	*	*		*	*	*	*
1983		*	*	*	*		*	*	*	*
1984		*	*	*	97.0		*	*	*	$123,370
1985		*	*	*	77.0		*	*	*	$74,643
1986		*		*	*		*		*	*
1987	*	*	*	*	*	*	*	*	*	*
1988	*	*	*	*	*	*	*	*	*	*
1989	*	*	*	*	*	*	*	*	*	*
1990	*	*	*	*	128.8	*	*	*	*	$56,608
1991		*	*	*	*		*	*	*	*
1992	*	*	*	*	*	*	*	*	*	*
1993		*	*	*	*		*	*	*	*
1994	*	*	*	*	*	*	*	*	*	*
1995	*	*	*	*	*	*	*	*	*	*
1996		*	*	*	*		*	*	*	*
1997	*	*	*	*	204.5	*	*	*	*	$107,691
1998	*	*	*	*	14.1	*	*	*	*	$23,716
1999	*	*	*	*	*	*	*	*	*	*
2000	0.5	<0.1	0.4	116.5	*	$297	$29	$965	$90,209	*
2001	*	*		*	*	*	*		*	*
2002	*	*		*	*	*	*		*	*
2003	0.1	<0.1	<0.1		*	$653	$187	$29		*
2004	370.1	0.1	<0.1	<0.1	164.5	$42,732	$148	$7	$34	$112,730
2005	309.0	<0.1	<0.1	<0.1	*	$31,808	$27	$4	$34	*
2006	130.9	0.7	0.2	70.5	*	$10,154	$923	$362	$5,175	*
2007	2.0	<0.1	<0.1		*	$136	$57	$17		*
2008	*		*	*	*	*		*	*	*

TABLE 9-2. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by landing area, 1981-2008.

	Landings (mt)					Exvessel Revenues (2008 $)				
Year	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
					Northern California					
1981		1.9	<0.1		2.1		$1,332	$23		$2,641
1982		3.0	1.1		1.7		$1,376	$719		$2,263
1983		2.9	0.1		<0.1		$1,904	$40		$78
1984		0.1	<0.1	0.5	*		$100	$3	$1,369	*
1985					*					*
1986		*			*		*			*
1987		<0.1	<0.1		*		$21	$3		*
1988			*		*			*		*
1989		0.1	<0.1		*		$62	$2		*
1990		0.4			*		$320			*
1991		0.1			*		$80			*
1992		*	*	*	0.5		*	*	*	$1,936
1993		0.2	55.4	0.1	*		$192	$13,155	$87	*
1994	4.9	0.3	0.1	8.4	37.6	$2,419	$263	$110	$4,768	$17,424
1995	*	*	*		*	*	*	*		*
1996	0.3	3.1				$185	$2,714			
1997		5.7	2.2		3.4		$4,885	$1,896		$3,069
1998	*	*	*		*	*	*	*		*
1999		*	*		*		*	*		*
2000		1.7	0.1		*		$477	$128		*
2001	*			*	*	*			*	*
2002		0.2	0.1		*		$644	$48		*
2003	*		*			*		*		
2004	*	*	*		*	*	*	*		*
2005		*	*				*	*		
2006		<0.1	<0.1		*		$2	$14		*
2007										
2008			*					*		
					Oregon					
1981		<0.1					$3			
1982		<0.1		0.1			$103		$248	
1983		8.3					$18,599			
1984		3.0					$1,842			
1985		<0.1	<0.1	<0.1			$4	$2	$85	
1986		*					*			
1987		1.5					$1,067			
1988		*		*			*		*	
1989		4.7		<0.1			$2,154		$29	
1990		10.3					$6,614			
1991		0.5	19.3				$304	$4,327		
1992		462.3	316.5				$270	$1,395		
1993		279.9	276.6				$1,464	$4,541		
1994		252.2	202.3	0.9			$15,985	$12,883	$333	
1995		*	*	*			*	*	*	
1996		61.4	257.7				$6,062	$12,153		
1997		1,611.0	373.0				$3,559	$1,167		
1998	1.0	537.7	686.0			$1,186	$13,215	$66,944		
1999	*	*	*			*	*	*		
2000	*	*	*	*		*	*	*	*	
2001	12,780.4	322.0	183.1			$2,237,737	$44,300	$55,567		
2002	22,711.0	126.6	8.9	3.1		$3,802,562	$8,721	$5,163	$2,397	
2003	25,257.9	160.0	73.6	39.1		$3,812,116	$24,156	$20,624	$4,033	
2004	36,111.0	106.9	125.8	13.1		$6,051,956	$13,974	$21,005	$5,757	
2005	45,110.1	317.8	69.6	68.4	14.5	$7,233,620	$41,507	$189,335	$1,839	$8,626
2006	35,668.1	665.0	5.3	8.6	27.2	$4,154,926	$38,711	$99	$19	$17,356
2007	42,143.9	702.3	13.5	5.0	0.6	$4,805,635	$52,447	$1,045	$2,344	$312
2008	22,949.0	57.6	45.6	259.5		$5,665,290	$7,811	$415	$56,674	

TABLE 9-2. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by landing area, 1981-2008.

	Landings (mt)					Exvessel Revenues (2008 $)				
Year	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
					Washington					
1981				*					*	
1982				*					*	
1983				*					*	
1984		*		*			*		*	
1985				*					*	
1986				*					*	
1987				*					*	
1988				*					*	
1989		*		*			*		*	
1990		*		*			*		*	
1991		*		*			*		*	
1992		*		*			*		*	
1993		*		*			*		*	
1994		*		*			*		*	
1995		7.5		118.3			$1,324		$105,909	
1996		*	*	*			*	*	*	
1997		*	*	*			*	*	*	
1998		*	*	*			*	*	*	
1999	*	*	*	*		*	*	*	*	
2000	*	*	*	*		*	*	*	*	
2001	*	*	*	*		*	*	*	*	
2002	*	*	*	*		*	*	*	*	
2003	*	*	*	*		*	*	*	*	
2004	8,934.3	22.2	7.1	213.4		$1,547,160	$2,893	$1,983	$79,422	
2005	6,721.1	23.6	10.8	163.7		$992,055	$4,185	$3,199	$41,706	
2006	4,363.1	41.2	1.8	161.1		$497,347	$14,988	$334	$41,729	
2007	*	*	*	*		*	*	*	*	
2008	*	*	*	*		*	*	*	*	
					Other Unknown					
1981		*	*	*	0.2		*	*	*	$131
1982		48.5	9.5	190.9	0.4		$31,074	$6,476	$89,484	$1,288
1983		179.1	25.5	144.7	*		$73,117	$33,854	$81,850	*
1984		49.7	49.3	110.1	2.7		$30,894	$19,882	$61,052	$3,399
1985		*	*	*	*		*	*	*	*
1986		*	*	*	*		*	*	*	*
1987	*	*		*	199.2	*	*		*	$63,345
1988	*	*	*	*	*	*	*	*	*	*
1989	*	*	*	*	*	*	*	*	*	*
1990	*	*	*	*	0.3	*	*	*	*	$382
1991		*	*	*	2.6		*	*	*	$1,942
1992	*	*	*	*	*	*	*	*	*	*
1993	*	*	*	*	*	*	*	*	*	*
1994		*	*	*	*		*	*	*	*
1995	*	*	*	*	*	*	*	*	*	*
1996	*	*	*	*	13,908.6	*	*	*	*	$5,944,814
1997	36.1	8.2		2.4	*	$108,597	$4,974		$1,260	*
1998	*	*			475.0	*	*			$357,728
1999	3.0	0.2	0.8	0.1	11,370.7	$431	$32	$694	$9	$6,041,809
2000	*	*	*	*	18,154.9	*	*	*	*	$5,630,202
2001	70.4	0.5	0.1		*	$9,627	$519	$132		*
2002	9.2	<0.1	<0.1		6,634.6	$1,458	$105	$9		$2,188,174
2003	1,547.2	16.8		122.9	*	$165,924	$2,396		$13,366	*
2004	*	*	*	*	*	*	*	*	*	*
2005	*	*	*	*	8,297.7	*	*	*	*	$5,131,984
2006	*	*		*	5,530.1	*	*		*	$3,320,294
2007	*	*	*	*	18,317.3	*	*	*	*	$11,243,583
2008	*	*		*	*	*	*		*	*

Source: PacFIN - 2006-2008 data extracted January-February 2009.

TABLE 9-2. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by landing area, 1981-2008.

	Landings (mt)					Exvessel Revenues (2008 $)				
Year	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid

[1]Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 2008.

[2]Pacific mackerel landings and revenues also include landings and revenues of unspecified mackerel.

*Exvessel landings and revenues not reported because less than three vessels, with CPS finfish or market squid as principle species by principle landing area or not, or less than three processors accounted for total landings.

TABLE 9-3. Average annual real[1] exvessel prices ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid, 1981-2008.

Year	Pacific Sardine $/lb	Pacific Mackerel $/lb	Jack Mackerel $/lb	Anchovy $/lb	Squid $/lb
1981	$0.24	$0.25	$0.25	$0.08	$0.26
1982	$0.30	$0.23	$0.23	$0.06	$0.25
1983	$0.19	$0.21	$0.20	$0.10	$0.45
1984	$0.90	$0.19	$0.15	$0.15	$0.55
1985	$0.23	$0.17	$0.19	$0.15	$0.38
1986	$0.21	$0.16	$0.17	$0.15	$0.21
1987	$0.13	$0.13	$0.14	$0.20	$0.18
1988	$0.13	$0.15	$0.14	$0.25	$0.18
1989	$0.20	$0.13	$0.13	$0.24	$0.16
1990	$0.10	$0.11	$0.11	$0.16	$0.14
1991	$0.10	$0.13	$0.12	$0.13	$0.13
1992	$0.08	$0.17	$0.12	$0.15	$0.15
1993	$0.08	$0.10	$0.11	$0.18	$0.19
1994	$0.10	$0.11	$0.10	$0.22	$0.20
1995	$0.06	$0.10	$0.11	$0.13	$0.23
1996	$0.07	$0.10	$0.09	$0.11	$0.19
1997	$0.07	$0.10	$0.11	$0.10	$0.21
1998	$0.06	$0.08	$0.15	$0.11	$0.39
1999	$0.06	$0.08	$0.09	$0.12	$0.24
2000	$0.07	$0.09	$0.12	$0.08	$0.15
2001	$0.08	$0.10	$0.10	$0.05	$0.12
2002	$0.07	$0.09	$0.12	$0.08	$0.15
2003	$0.06	$0.09	$0.19	$0.10	$0.33
2004	$0.06	$0.09	$0.13	$0.07	$0.28
2005	$0.06	$0.09	$0.39	$0.05	$0.30
2006	$0.05	$0.07	$0.09	$0.05	$0.28
2007	$0.05	$0.07	$0.11	$0.05	$0.28
2008	$0.08	$0.09	$0.08	$0.05	$0.31

Source: PacFIN - 2006-2008 data extracted January-February 2009.

[1]Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 2008.

[2]Pacific mackerel landings and revenues also include landings and revenues of unspecified mackerel.

TABLE 9-4. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by state, 1981-08.

Year	Pacific Sardine mt	Pacific Sardine Rev	Pacific Mackerel mt	Pacific Mackerel Rev	Jack Mackerel mt	Jack Mackerel Rev	Anchovy mt	Anchovy Rev	Squid mt	Squid Rev
	California									
1981	15	$7,991	35,388	$19,280,331	17,778	$9,672,664	52,308	$8,665,542	23,510	$13,443,422
1982	2	$1,339	36,065	$18,075,811	19,617	$9,914,080	42,150	$5,363,483	16,308	$8,897,575
1983	1	$417	41,471	$19,130,359	9,829	$4,271,234	4,427	$981,673	1,824	$1,806,480
1984	1	$1,979	44,083	$18,884,866	9,154	$3,122,979	2,889	$924,027	*	*
1985	6	$3,106	37,772	$14,415,982	6,876	$2,837,923	1,626	$497,976	10,276	$8,707,191
1986	388	$176,459	48,089	$16,611,480	4,777	$1,768,042	1,535	$458,200	21,278	$9,638,002
1987	439	$129,392	46,724	$13,684,736	8,020	$2,448,021	1,390	$514,024	19,984	$8,107,845
1988	1,188	$341,183	50,863	$16,337,167	5,068	$1,582,983	1,478	$764,752	37,316	$15,036,173
1989	837	$375,317	47,708	$13,563,867	10,745	$3,187,185	2,449	$1,237,520	40,974	$14,450,086
1990	1,664	$350,323	40,081	$9,841,484	3,254	$813,745	3,208	$1,072,443	28,447	$8,694,312
1991	7,587	$1,593,510	32,066	$9,530,912	1,693	$439,404	4,014	$1,095,755	37,389	$10,836,222
1992	18,052	$3,280,045	18,577	$7,002,848	1,209	$416,350	1,124	$333,659	13,112	$4,275,540
1993	15,346	$2,638,176	11,819	$2,564,288	1,673	$465,575	1,959	$769,688	42,830	$17,531,340
1994	11,644	$2,520,850	10,008	$2,369,509	2,704	$621,495	1,789	$835,466	55,383	$23,858,761
1995	40,256	$5,761,948	8,626	$1,856,288	1,728	$461,070	1,886	$472,332	70,252	$36,157,048
1996	32,553	$4,995,621	9,603	$2,050,270	2,177	$470,596	4,419	$1,009,740	80,561	$34,654,035
1997	43,290	$6,908,085	18,401	$4,296,242	1,160	$383,203	5,720	$1,197,779	70,329	$32,125,530
1998	43,311	$5,540,080	20,978	$3,865,815	1,052	$513,247	1,481	$282,492	2,895	$2,484,590
1999	59,700	$7,582,108	8,788	$1,618,327	952	$278,905	5,214	$1,327,557	92,101	$49,645,921
2000	53,612	$7,775,501	21,920	$4,160,178	1,269	$362,225	11,753	$1,987,665	118,903	$38,740,420
2001	51,893	$8,692,808	6,925	$1,515,470	3,624	$776,662	19,277	$1,885,645	86,203	$23,410,013
2002	58,353	$7,890,685	3,369	$659,839	1,005	$273,492	4,650	$743,153	72,895	$24,632,010
2003	34,745	$3,727,642	3,999	$820,507	156	$73,949	1,676	$353,676	45,056	$32,904,215
2004	44,293	$4,920,956	3,579	$697,637	1,027	$309,006	6,793	$932,862	40,068	$24,581,119
2005	34,633	$3,675,951	3,244	$630,311	213	$61,577	11,182	$1,271,641	55,740	$36,717,933
2006	46,577	$5,661,256	5,904	$924,258	1,167	$220,794	12,791	$1,440,155	49,153	$29,909,944
2007	80,957	$8,678,020	5,018	$834,649	631	$151,964	10,390	$1,219,771	49,499	$30,846,255
2008	*	*	*	*	*	*	*	*	34,639	$23,866,799

TABLE 9-4. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by state, 1981-08.

Year	Pacific Sardine mt	Pacific Sardine Rev	Pacific Mackerel mt	Pacific Mackerel Rev	Jack Mackerel mt	Jack Mackerel Rev	Anchovy mt	Anchovy Rev	Squid mt	Squid Rev
	Oregon									
1981			<1	$3						
1982			<1	$103			<1	$248		
1983			8	$18,599						
1984			3	$1,842						
1985			<1	$4	<1	$2	<1	$85		
1986			*	*						
1987			1	$1,067						
1988			*	*			*	*		
1989			5	$2,154			<1	$29		
1990			10	$6,631						
1991			<1	$304	19	$4,327				
1992			462	$270	317	$1,397				
1993			280	$1,464	277	$4,541				
1994			252	$15,985	202	$12,883	1	$333		
1995			*	*	*	*	*	*		
1996			61	$6,062	258	$12,153				
1997			1,611	$3,559	373	$1,167				
1998	1	$1,186	538	$13,215	686	$66,944				
1999	*	*	*	*	*	*				
2000	*	*	*	*	*	*	*	*		
2001	12,780	$2,237,737	322	$44,300	183	$55,567				
2002	22,711	$3,802,562	127	$8,721	9	$5,163	3	$2,397		
2003	25,258	$3,812,116	160	$24,156	74	$20,624	39	$4,033		
2004	36,111	$6,051,956	107	$13,974	126	$21,005	13	$5,757		
2005	45,110	$7,233,620	318	$41,507	70	$189,335	68	$1,839	14	$8,626
2006	35,668	$4,154,926	665	$38,711	5	$99	9	$19	27	$17,356
2007	42,144	$4,805,635	702	$52,447	14	$1,045	5	$2,344	1	$312
2008	22,949	$5,665,290	58	$7,811	46	$415	260	$56,674		

TABLE 9-4. West coast landings (mt) and real[1] exvessel revenues ($ 2008) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by state, 1981-08.

Year	Pacific Sardine mt	Pacific Sardine Rev	Pacific Mackerel mt	Pacific Mackerel Rev	Jack Mackerel mt	Jack Mackerel Rev	Anchovy mt	Anchovy Rev	Squid mt	Squid Rev
	Washington									
1981							*	*		
1982							*	*		
1983							*	*		
1984			*	*			*	*		
1985							*	*		
1986							*	*		
1987							*	*		
1988							*	*		
1989			*	*			*	*		
1990			*	*			*	*		
1991			*	*			*	*		
1992			*	*			*	*		
1993			*	*			*	*		
1994			*	*			*	*		
1995			7	$1,324			118	$105,909		
1996			*	*	*	*	*	*		
1997			*	*	*	*	*	*		
1998			*	*	*	*	*	*		
1999	*	*	*	*	*	*	*	*		
2000	*	*	*	*	*	*	*	*		
2001	*	*	*	*	*	*	*	*		
2002	*	*	*	*	*	*	*	*		
2003	*	*	*	*	*	*	*	*		
2004	8,934	$1,547,160	22	$2,893	7	$1,983	213	$79,422		
2005	6,721	$992,055	24	$4,185	11	$3,199	164	$41,706		
2006	4,363	$497,347	41	$14,988	2	$334	161	$41,729		
2007	*	*	*	*	*	*	*	*		
2008	*	*	*	*	*	*	*	*		

Source: PacFIN - 2006-2008 data extracted January-February 2009.

[1]Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values

TABLE 9-5. West coast CPS landings (mt) and real[1] exvessel revenues ($ 2008) by gear group, 1981-2008.

Year	Roundhaul or Lampara	Dip Net	Pot or Trap	Trawl	Hook and Line	Gillnet	Other or Unknown
Landings (metric tons)							
1981	120,578	8,231	<1	11	9	80	
1982	110,254	3,693	1	13	27	82	
1983	56,944	490	<1	8	2	44	40
1984	56,285	64	<1	4	1	189	
1985	55,494	495	1	20	9	430	<1
1986	75,784	88	4	3	<1	135	
1987	75,048	213	1	6	7	1,314	<1
1988	94,190	140	1	39	1	1,395	<1
1989	102,026	248	<1	132	3	100	
1990	76,010	489	1	15	34	72	
1991	81,817	724	37	128	4	63	
1992	47,666	4,322	3	802	15	31	
1993	68,346	5,171	2	592	3	44	
1994	78,350	2,997	59	510	49	11	13
1995	120,940	1,410	1	386	121	9	42
1996	128,354	855	1	401	64	23	
1997	138,534	247	<1	2,157	90	14	
1998	69,660	37	<1	1,334	44	5	
1999	166,933	528	72	961	12	10	
2000	219,844	1,568	45	275	420	4	<1
2001	190,196	1,791	1	621	153	3	
2002	178,656	761	<1	10	10	2	
2003	123,128	133	<1	76	10	<1	<1
2004	140,277	790	<1	110	7	<1	63
2005	154,875	2,504	11	106	9	<1	
2006	154,731	1,582	97	33	84	<1	
2007	193,312	826	36	15	25	<1	<1
2008	139,792	444		51	3	<1	
Revenues (2008 $)							
1981	$48,676,012	$2,216,896	$395	$10,266	$12,670	$76,169	
1982	$40,992,785	$1,127,765	$5,330	$10,343	$21,881	$60,881	
1983	$25,666,874	$457,428	$2,208	$6,490	$3,139	$31,640	$16,777
1984	$23,334,517	$79,197	$4,026	$4,437	$2,133	$111,073	
1985	$25,408,420	$683,851	$1,535	$20,116	$8,548	$289,474	$1,823
1986	$28,480,346	$56,713	$2,188	$3,869	$279	$88,233	
1987	$24,341,345	$83,271	$3,989	$4,878	$3,625	$501,437	$18
1988	$33,399,508	$64,713	$1,403	$57,863	$984	$502,663	$3
1989	$32,354,239	$82,417	$83	$57,451	$1,672	$48,209	
1990	$20,576,738	$84,495	$1,344	$12,289	$53,050	$54,401	
1991	$23,304,066	$95,947	$12,255	$42,373	$8,309	$33,171	
1992	$14,401,932	$835,070	$3,337	$12,418	$34,234	$19,622	
1993	$22,507,933	$1,339,296	$2,976	$15,582	$6,103	$32,362	
1994	$29,299,074	$780,873	$29,261	$46,418	$68,563	$9,235	$3,998
1995	$43,986,095	$585,050	$851	$28,135	$86,626	$7,429	$14,540
1996	$42,775,067	$301,406	$784	$63,906	$99,034	$17,524	
1997	$44,620,702	$132,732	$156	$47,146	$141,845	$10,465	
1998	$12,600,423	$37,734	$207	$118,238	$88,592	$4,504	
1999	$60,293,757	$279,639	$23,612	$50,043	$37,780	$8,806	
2000	$54,923,416	$561,514	$14,346	$37,807	$125,802	$2,832	$136
2001	$39,725,239	$529,974	$550	$184,829	$54,946	$2,250	
2002	$40,469,716	$251,228	$162	$7,418	$32,521	$1,768	
2003	$43,581,953	$96,526	$85	$22,005	$34,805	$157	$25
2004	$38,609,406	$462,417	$2	$18,974	$24,153	$127	$42,875
2005	$48,901,236	$1,734,799	$7,315	$203,184	$19,261	$182	
2006	$41,905,787	$955,589	$16,912	$17,272	$22,459	$191	
2007	$46,570,350	$530,115	$21,162	$3,775	$28,636	$70	$41
2008	$40,546,334	$296,145		$1,976	$10,718	$39	

Source: PacFIN - 2006-2008 data extracted January-February 2009.

[1]Real values are current values adjusted to eliminate the effects of inflation. This adjustment has been made by dividing current values by the current year GDP implicit price deflator, with a base year of 2008.

Tables 9-6 (finfish) and 9-7 (squid). Number of vessels with West coast landings of CPS finfish or market squid by landing area, 1981-2008.

Year	San Diego	Orange & LA	Ventura & Santa Barbara	San Luis Obispo	Monterey & Santa Cruz	San Francisco	Northern CA	Other CA	Oregon	Washington	Other
					CPS Finfish						
1981	64	136	71	46	82	9	6	*	5	4	24
1982	60	135	38	53	109	18	7		4	*	30
1983	53	113	28	49	117	47	15		64	*	15
1984	54	103	35	44	121	65	3	*	3	*	26
1985	51	124	49	34	115	74			4	*	24
1986	39	116	37	33	85	48	*	*	*	*	13
1987	38	110	41	30	77	63	5		92	*	21
1988	39	104	40	22	97	77	*		79	3	21
1989	46	99	31	28	62	111	5	*	152	3	20
1990	48	95	34	50	122	106	6		162	4	30
1991	53	96	34	33	48	21	4		39	4	18
1992	53	86	12	27	152	138	7		38	11	26
1993	46	103	14	16	73	41	5		28	10	23
1994	49	94	17	7	52	53	8	4	38	12	14
1995	40	96	32	3	35	38	*		44	6	18
1996	35	99	29	*	41	37	4		41	14	31
1997	27	102	20	3	49	53	7		50	18	14
1998	21	77	15	10	35	56	11		46	9	10
1999	17	80	17	*	24	21	5		44	10	7
2000	17	83	18	*	40	35	7		43	19	10
2001	18	76	17	3	27	14	4		43	28	6
2002	8	80	9	*	22	7	4		42	24	7
2003	8	58	14	*	22	6	*		43	20	9
2004	6	60	11	*	19	9	4		46	21	17
2005	4	66	12		14	7	*		42	25	16
2006	4	56	20	*	20	13	5		39	26	7
2007	6	52	25	*	22	9		*	47	34	22
2008	4	54	26		20	3	*		47	19	22

Tables 9-6 (finfish) and 9-7 (squid). Number of vessels with West coast landings of CPS finfish or market squid by landing area, 1981-2008.

Year	San Diego	Orange & LA	Ventura & Santa Barbara	San Luis Obispo	Monterey & Santa Cruz	San Francisco	Northern CA	Other CA	Oregon	Washington	Other
					Market Squid						
1981	6	61	26	9	53	*	10				3
1982	*	51	25	7	53	*	7				3
1983	4	44	12	4	32	22	3				7
1984	*	9	17	6	31	8	*				4
1985	*	44	32	5	59	10	*				23
1986	*	43	27	7	41	4	*				8
1987	7	41	30	3	33	17	*				7
1988	10	51	32	4	30	7	*				11
1989	3	48	31	7	28	3	*				5
1990	7	42	26	3	36	9	*				3
1991		36	24	*	30	7	*				3
1992	*	18	14	4	36	16	4				*
1993	*	43	25	13	33	13	*				9
1994	3	42	31	11	34	6	3	*			9
1995	*	59	44	8	28	4	*				27
1996	4	62	66	8	28	*					39
1997	3	55	50	3	28	4	11				22
1998	3	19	45	*		3	*				18
1999	*	76	80	3	13	*	*				43
2000	*	86	63	*	23	*	*				42
2001	4	62	50	*	18	3	3				27
2002		72	61	5	33	3	*				32
2003		43	54	9	36	17					29
2004	3	72	50	8	23	3	*				42
2005		90	40	*	12	*			28		28
2006	3	89	30		11	*	*		37		24
2007	*	61	41	*	4	*			13		40
2008	4	80	35		*	*			3		43

Source: PacFIN - 2006-2008 data extracted January-February 2009.

*Number of vessels not reported because less than three vessels accounted for total landings.

TABLE 9-8 (finfish) and 9-9 (squid). Number of vessels with CPS finfish or market squid as principle species[1] by principle landing area[2], 1981-2008.

Year	San Diego	Orange & LA	Ventura & Santa Barbara	San Luis Obispo	Monterey & Santa Cruz	San Francisco	Northern CA	Other CA	Oregon	Washington	Other
					CPS Finfish						
1981	4	53	6	*	3	*				*	5
1982	10	49	8	*	*	*				*	7
1983	8	50	7		7					*	3
1984	3	35	4		18	*				*	4
1985	*	40	6	*	3	*				*	*
1986	*	33	8	*	3	*				*	
1987	*	39	6		*	*				*	
1988	3	28	3		*	*			*	*	
1989	6	32	6		4	*				*	*
1990	5	28	3		*					*	*
1991	6	37	4		5					*	*
1992	5	37	4		3	*	*			*	*
1993	*	23	3	*	*	*					*
1994	*	27	6	*	*			*			
1995	*	18	5		*				*		
1996	*	19	7		9						
1997	*	26	3	*	5						
1998	3	37	4		8		*				
1999	*	19	*		7	*			*	*	
2000		26	3		3				6	*	
2001		24	3		3				11	6	
2002	*	23	4		*				10	8	
2003	*	10	*		*		*		10	5	
2004	*	13	3		5				13	6	
2005	*	8	*		*				14	4	*
2006	*	6	3		4				8	3	*
2007		9	*		6				8	*	*
2008		8	*		10	*			13	6	*

TABLE 9-8 (finfish) and 9-9 (squid). Number of vessels with CPS finfish or market squid as principle species[1] by principle landing area[2], 1981-2008.

Year	San Diego	Orange & LA	Ventura & Santa Barbara	San Luis Obispo	Monterey & Santa Cruz	San Francisco	Northern CA	Other CA	Oregon	Washington	Other
					Market Squid						
1981	x	14	3		33					*	
1982		16	*		35					*	
1983		6			4	*			*	7	*
1984					*				4	7	
1985		6	6		28				3		*
1986		9	4		16	*					*
1987	*	6	8		14						
1988	3	18	18		15						*
1989	*	16	12		15						*
1990	*	7	13		12						
1991		5	15		12	*					
1992			4		16	*					
1993		15	13	3	16						*
1994		8	18		19	*					4
1995		24	31		3	*				*	6
1996		30	41		7					*	15
1997		28	33		8						9
1998		3	22								6
1999		31	47		*						19
2000	*	43	30		8						9
2001	*	32	22		8	*					5
2002		33	11		17	*					6
2003		20	21		15	*					15
2004	*	41	15		8						9
2005		59	12		*						8
2006		61	4								6
2007		29	14								22
2008		43	5								11

Source: PacFIN - 2006-2008 data extracted January-February 2009.

[1]Principle species is the species that accounts for the greatest share of a vessel's total exvessel revenues across all species landed.

[2]Principle landing area is the area that accounts for the greatest share of a vessel's total exvessel revenues across all areas in which it had landings.

*Number of vessels not reported because less than three vessels accounted for total landings.

TABLE 9-10 and 9-11. Number of processors and buyers, by landing area, whose annual purchases of CPS finfish or market squid represents the largest share of their total annual exves expenditures, 1981-2008.

Year	San Diego	Orange & LA	Ventura & Santa Barbara	San Luis Obispo	Monterey & Santa Cruz	San Francisco	Northern CA	Other CA	Oregon	Washington	Other
					CPS Finfish						
1981	*	5	4	*	*	*					*
1982		3	7							*	5
1983	*	4	5		*	*				*	3
1984	*	*	3		3	*				*	3
1985		5	*	*	*	*				*	*
1986		5	4		*	*				*	*
1987	*	6	5		*	*				*	*
1988		7	4		*	*				*	*
1989	3	8	3		*	*				*	*
1990	6	5	*		*	*				*	*
1991	*	10	3		*	*				*	*
1992	*	7	4		*	*				*	
1993		4	5		*	*				*	
1994	*	6	4		*	*		*		*	
1995	*	7	4			*			*		*
1996	*	4	6		*	*				*	*
1997	*	9	6		*	*				*	
1998	*	11	6		3	*	*			*	*
1999	*	5	4		*	3	*			*	
2000		10	4		3				*	*	*
2001		6	6	*		*	*		4	*	
2002	*	7	6		*	*			3	*	
2003	*	8	5		*		*		3	*	
2004	*	7	8	*	*		*		5		*
2005	*	*	3		*				6		
2006	*	*	3		*				5		*
2007		*	*	*	3				4		
2008		*	*						3	*	*

TABLE 9-10 and 9-11. Number of processors and buyers, by landing area, whose annual purchases of CPS finfish or market squid represents the largest share of their total annual exves expenditures, 1981-2008.

Year	San Diego	Orange & LA	Ventura & Santa Barbara	San Luis Obispo	Monterey & Santa Cruz	San Francisco	Northern CA	Other CA	Oregon	Washington	Other
					Market Squid						
1981		*	*		5	4					
1982		*			7	*				*	
1983						3				3	
1984					*					*	
1985			3		5						*
1986		*	3		6	*					*
1987		*	3		4	*					
1988		*	3	*	*	*					
1989		*	11	*	3	*					
1990		*	6		4						
1991		*	6			*					
1992			4			3					
1993	*		8	*	*	*					
1994		*	16	*	*			*			*
1995		*	16								*
1996		4	10		*					*	3
1997		6	10		*						*
1998	*		3								
1999		6	19								5
2000	*	9	20	*	*						5
2001	*	3	14	*	*		*				*
2002		4	11	*							4
2003		4	11	*	*						*
2004		3	16	*	*						*
2005		7	9		*						3
2006		8	5	*							3
2007		*	6			*					5
2008			8								*

Source: PacFIN - 2006-2008 data extracted January-February 2009.

*Number of processors and buyers not reported because less than three accounted for total purchases.

TABLE 11-1. Commercial harvest (metric tons) of CPS finfish in Ensenada, Baja California, Mexico, for calendar years 1978-2007[1,2,3,4/]. Data not yet available for 2008. Market squid are not commercially fished off Ensenada.

Year	Pacific sardine	Northern anchovy	Pacific mackerel	Jack mackerel
1978	0	135,036	0	---
1979	0	192,476	0	---
1980	0	242,907	0	---
1981	0	258,745	0	---
1982	0	174,634	0	---
1983	274	87,429	135	---
1984	0	102,931	128	---
1985	3,722	117,192	2,582	---
1986	243	93,547	4,883	---
1987	2,432	124,482	2,082	---
1988	2,035	79,495	4,484	902
1989	6,224	81,811	13,687	0
1990	11,375	99	35,767	25
1991	31,391	831	17,500	30
1992	34,568	2,324	24,345	---
1993	32,045	284	7,741	---
1994	20,877	875	13,319	85
1995	35,396	17,772	4,821	0
1996	39,065	4,168	5,604	47
1997	68,439	1,823	12,477	78
1998	47,812	972	50,726	480
1999	58,569	3,482	10,168	781
2000	51,173	1,562	7,182	0
2001	22,246	76	4,078	0
2002	43,437	0	7,962	0
2003	30,540	1,287	2,678	0
2004	44,382	1,797	1,530	0
2005	55,323	4,873	2,343	0
2006	57,237	1,567	2,318	0
2007	36,847	4,058	3,057	0
2008	---	---	---	---

1/ Data for 1978 to 2002 from García and Sánchez (2003).
2/ Data for Jan-Nov 2003 provided by Dr. Celia Eva-Cotero, CRIP-INP Ensenada (pers. comm.).
3/ Sardine landings for 1989 through 2004 provided by Manuel Nevarrez, CRIP-INP Guaymas (pers. comm.).
4/ CPS landings from 2005 through 2007 from CONAPESCA:
http://www.conapesca.sagarpa.gob.mx/wb/cona/cona_anuario_estadistico_de_pesca

TABLE 11-2. Pacific sardine population numbers (millions), spawning and age 1+ biomasses (mt) at the beginning of each biological year, 1981-82 to 2008-09 (July-June) (Hill et al. 2008). Recruitment is defined as number at age-0. Age 1+ biomass as of July 2008 (bold) served as the basis for setting a HG for the U.S. fishery in calendar year 2009.

Biological	---------- Population Numbers-at-age (millions) ----------									Spawning	Age 1+
Year	0 (*R*)	1	2	3	4	5	6	7	8+	Biomass	Biomass
1981-82	22	15	2.8	1.0	0.3	0.2	0.1	0.5	1.1	1,257	1,315
1982-83	52	15	10	2	1	0.2	0.1	0.1	1	1,871	1,944
1983-84	93	35	9	5	1	0.3	0.1	0.0	0.5	2,803	2,904
1984-85	106	62	23	6	3	0.4	0.1	0.0	0.3	2,902	5,292
1985-86	137	71	34	5	0	0.2	0.0	0.0	0.0	5,193	5,919
1986-87	491	92	44	15	2	0.1	0.0	0.0	0.0	8,891	9,029
1987-88	909	329	57	22	6	1	0.0	0.0	0.0	18,480	19,674
1988-89	875	609	204	25	7	2	0.2	0.0	0.0	41,784	42,191
1989-90	882	587	399	120	13	4	1	0.1	0.0	60,375	70,887
1990-91	1,751	591	375	215	56	6	2	0.4	0.0	75,604	88,376
1991-92	2,869	1,172	374	201	102	26	3	1	0.2	92,485	117,160
1992-93	1,779	1,922	741	182	78	37	9	1	0.3	119,235	170,236
1993-94	5,194	1,160	853	278	82	41	21	5	1	153,156	170,178
1994-95	7,816	3,429	661	459	160	50	26	14	4	247,078	271,031
1995-96	3,067	5,112	1,836	342	260	97	31	17	11	389,916	437,942
1996-97	3,969	2,035	3,023	1,047	206	164	63	20	18	449,743	531,859
1997-98	7,841	2,635	1,204	1,714	629	130	105	41	25	415,710	559,613
1998-99	16,351	5,147	1,318	537	880	360	79	66	42	503,942	589,564
1999-00	3,649	10,795	2,764	673	302	531	226	50	70	778,204	887,809
2000-01	1,903	2,384	6,082	1,620	427	198	352	150	80	817,219	1,002,330
2001-02	7,086	1,222	1,249	3,421	997	272	127	226	148	676,213	878,841
2002-03	1,076	4,423	513	601	1,984	617	171	80	238	572,520	785,200
2003-04	14,063	682	1,938	241	338	1,193	378	106	197	471,793	610,683
2004-05	7,158	9,044	333	965	135	199	717	229	183	591,628	730,489
2005-06	9,820	4,689	4,979	171	536	79	119	429	247	688,977	847,585
2006-07	2,299	6,416	2,619	2,673	98	320	48	72	413	754,290	949,717
2007-08	2,603	1,468	3,341	1,409	1,574	60	200	30	304	625,704	867,100
2008-09	2,101	1,584	579	1,541	798	951	37	123	207	479,519	**662,886**

TABLE 11-3. Annual U.S. Pacific sardine landings and HGs (metric tons), 1981-2009.

Year	Southern California	Northern California	California Total	Oregon	Washington	U.S. Total	HG South	HG North	HG Total
1981	34.4	0.0	34.4	0.0	0.0	34.4	n/a	n/a	n/a
1982	1.8	0.0	1.8	0.0	0.0	1.8	n/a	n/a	n/a
1983	0.6	0.0	0.6	0.0	0.0	0.6	n/a	n/a	n/a
1984	0.9	0.3	1.2	0.0	0.0	1.2	n/a	n/a	n/a
1985	3.7	2.2	5.9	0.0	0.0	5.9	n/a	n/a	n/a
1986	304.0	84.4	388.4	0.0	0.0	388.4	n/a	n/a	n/a
1987	391.6	47.8	439.4	0.0	0.0	439.4	n/a	n/a	n/a
1988	1,185.4	3.0	1,188.4	0.0	0.0	1,188.4	n/a	n/a	n/a
1989	598.7	238.0	836.7	0.0	0.0	836.7	n/a	n/a	n/a
1990	1,537.1	127.1	1,664.2	0.0	0.0	1,664.2	n/a	n/a	n/a
1991	6,601.4	985.9	7,587.3	0.0	0.0	7,587.3	n/a	n/a	n/a
1992	14,821.9	3,127.6	17,949.5	4.0	0.0	17,953.5	n/a	n/a	n/a
1993	14,669.6	675.6	15,345.2	0.2	0.0	15,345.4	n/a	n/a	n/a
1994	9,348.5	2,300.0	11,648.5	0.0	0.0	11,648.5	n/a	n/a	n/a
1995	34,645.7	5,683.2	40,328.9	0.0	0.0	40,328.9	n/a	n/a	n/a
1996	24,565.0	7,988.6	32,553.6	0.0	0.0	32,553.6	n/a	n/a	n/a
1997	29,885.4	13,359.7	43,245.1	0.0	0.0	43,245.1	n/a	n/a	n/a
1998	32,462.1	10,514.3	42,976.4	1.0	0.0	42,977.4	n/a	n/a	n/a
1999	42,017.2	17,246.3	59,263.5	775.5	1.0	60,040.0	n/a	n/a	n/a
2000	42,248.0	11,367.5	53,615.5	9,527.9	4,842.0	67,985.4	124,527.3	62,263.7	186,791.0
2001	44,721.5	7,104.0	51,825.5	12,780.3	11,127.1	75,732.9	89,824.7	44,912.3	134,737.0
2002	44,464.0	13,881.0	58,345.0	22,710.8	15,820.0	96,875.8	78,961.3	39,480.7	118,442.0
2003	24,832.0	7,921.5	32,753.5	25,257.6	11,920.1	69,931.2	73,938.7	36,969.3	110,908.0
2004	32,393.4	15,308.3	47,701.8	36,110.7	8,911.0	92,723.5	81,831.3	40,915.7	122,747.0
2005	30,252.6	7,940.1	38,192.7	45,109.7	6,714.0	90,016.4	90,786.0	45,393.0	136,179.0
2006	33,285.8	17,743.1	51,028.9	35,648.2	4,362.3	91,039.4	n/a	n/a	118,937.0
2007	34,782.1	46,198.6	80,980.7	42,143.6	4,664.9	127,789.2	n/a	n/a	152,564.0
2008	26,711.0	31,089.3	57,800.2	22,948.8	6,435.2	87,184.2	n/a	n/a	89,093.0
2009	---	---	---	---	---	---	n/a	n/a	66,932.0

1/ As of 2003, the 'Southern Subarea' comprises fisheries and landings from Pt. Arena, California (39°N latitude) to the Mexican border.
2/ As of 2006, the U.S. sardine HG was no longer managed by subarea. HG's are now allocated coastwide and released on a seasonal basis.

TABLE 11-4. West Coast Pacific sardine landings by country, 1981-2008. Landings made by commercial fisheries based in Southern Baja California and the Gulf of California are not included. Ensenada landings for 2008 not yet available.

Year	Ensenada México	United States	Canada	Total
1981	0.0	34.4	0.0	34.4
1982	0.0	1.8	0.0	1.8
1983	274.0	0.6	0.0	274.6
1984	0.0	1.2	0.0	1.2
1985	3,722.0	5.9	0.0	3,727.9
1986	243.0	388.4	0.0	631.4
1987	2,432.0	439.4	0.0	2,871.4
1988	2,035.0	1,188.4	0.0	3,223.4
1989	6,224.0	836.7	0.0	7,060.7
1990	11,375.0	1,664.2	0.0	13,039.2
1991	31,391.0	7,587.3	0.0	38,978.3
1992	34,568.0	17,953.5	0.0	52,521.5
1993	32,045.0	15,345.4	0.0	47,390.4
1994	20,877.0	11,643.5	0.0	32,520.5
1995	35,396.0	40,326.9	25.0	75,747.9
1996	39,065.0	32,553.1	88.0	71,706.1
1997	68,439.0	43,245.1	34.0	111,718.1
1998	47,812.0	42,956.4	745.0	91,513.4
1999	58,569.0	60,040.0	1,250.0	119,859.0
2000	51,173.0	67,985.4	1,718.0	120,876.4
2001	22,246.0	75,732.4	1,600.0	99,578.4
2002	43,437.0	96,875.8	1,044.0	141,356.8
2003	30,540.0	69,917.2	954.0	101,411.2
2004	44,382.0	92,723.5	4,258.8	141,364.3
2005	55,322.5	90,016.4	3,200.0	148,539.0
2006	57,236.9	91,039.4	1,558.0	149,834.3
2007	36,846.8	127,789.2	1,520.0	166,156.0
2008	---	87,184.2	10,435.2	---

TABLE 11-5. RecFIN estimated recreational harvest of Pacific (chub) mackerel by state (type 'A+B1' estimate in metric tons), 1980-2008.

Year	California	Oregon	Washington	Total
1980	2,754.44	0.00	0.00	2,754.44
1981	1,394.47	0.00	0.00	1,394.47
1982	1,667.49	0.00	0.00	1,667.49
1983	1,467.35	1.50	0.00	1,468.85
1984	1,445.11	0.24	0.00	1,445.36
1985	1,076.62	0.02	0.00	1,076.64
1986	1,002.60	0.00	0.00	1,002.60
1987	1,271.19	0.00	0.00	1,271.19
1988	800.08	0.00	0.00	800.08
1989	610.57	0.00	0.00	610.57
1990	---	---	---	---
1991	---	---	---	---
1992	---	---	---	---
1993	621.92	2.08	0.00	624.00
1994	947.13	0.21	0.00	947.34
1995	1,026.32	0.12	0.00	1,026.44
1996	693.85	0.10	0.00	693.95
1997	966.96	0.31	0.00	967.27
1998	448.23	0.04	1.00	449.26
1999	196.04	0.00	0.33	196.37
2000	250.00	0.07	0.00	250.07
2001	561.39	0.05	0.00	561.44
2002	279.11	0.11	0.00	279.22
2003	341.35	0.27	0.00	341.61
2004	546.44	0.10	0.00	546.53
2005	312.06	0.07	0.00	312.13
2006	463.22	0.11	0.00	463.33
2007	239.35	0.92	0.00	240.27
2008	291.21	0.02	0.00	291.23

TABLE 11-6. RecFIN estimated recreational harvest of Pacific (chub) mackerel by fishing mode (type 'A+B1' estimate in metric tons), 1980-2008. Estimates for 'Man Made Structures' and 'Beach/Bank' were included in 'Shore Modes.'

Year	Shore Modes	Party/ Charter	Private/ Rental	Total
1980	424.8	1,320.5	1,009.2	2,754.4
1981	288.1	590.7	515.7	1,394.5
1982	274.7	865.1	527.6	1,667.5
1983	361.9	702.6	404.3	1,468.9
1984	281.9	577.9	585.5	1,445.4
1985	142.0	544.7	389.9	1,076.6
1986	91.6	520.1	390.9	1,002.6
1987	450.8	244.6	575.8	1,271.2
1988	105.5	239.1	455.4	800.1
1989	256.7	134.8	219.1	610.6
1990	---	---	---	---
1991	---	---	---	---
1992	---	---	---	---
1993	88.8	172.5	362.7	624.0
1994	205.9	245.1	496.3	947.3
1995	121.2	373.5	531.8	1,026.4
1996	93.4	319.4	281.1	694.0
1997	148.3	168.6	650.4	967.3
1998	96.7	131.2	221.4	449.3
1999	62.4	60.7	73.3	196.4
2000	51.3	76.8	121.9	250.1
2001	347.0	52.2	162.2	561.4
2002	92.9	25.7	160.6	279.2
2003	208.4	25.4	107.8	341.6
2004	406.3	20.3	119.9	546.5
2005	225.0	45.5	41.6	312.1
2006	406.2	14.7	42.4	463.3
2007	187.0	19.1	34.1	240.3
2008	253.7	19.9	17.6	291.2

TABLE 11-7. Pacific mackerel HGs and landings (mt) by July-June fishing season.

Fishing Season	Quota or HG[/a]	Landings
1992-93	34,010	25,584
1993-94	23,147	10,787
1994-95	14,706	9,372
1995-96	9,798	7,615
1996-97	8,709	9,788
1997-98	22,045	23,413
1998-99	30,572	19,578
1999-00	42,819	6,732
2000-01	20,740	20,937
2001-02	13,837	8,436
2002-03	12,535	3,541
2003-04	10,652	5,972
2004-05	13,268	5,012
2005-06	17,419	4,572
2006-07	19,845	7,531
2007-08	40,000	5,593
2008-09[/b]	40,000	*2,051*

[a/] California Quotas 1992-03 through 1998-99. PFMC HGs from 1999-00 onward.
[b/] 2008-09 landings through March, 2009.