Exhibit F.1
Situation Summary
June 2004

NATIONAL MARINE FISHERIES SERVICE REPORT ON COASTAL PELAGIC SPECIES MANAGEMENT

Situation: National Marine Fisheries Service (NMFS) will briefly report on recent developments in the coastal pelagic species fishery and other issues of relevance to the Council.

Council Task:

1. Council discussion.

Reference Materials:

1. Exhibit F.1.a, Attachment 1: May 18, 2004 letter from Mr. Rod McInnis.

Agenda Order:

a. Informational Update — Svein Fougner
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Discussion

PFMC
05/26/04

Exhibit F.1.a
Attachment 1
June 2004

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

F/SWR2:SF
MAY 1 8 2004 1504–13-CPS-OB-010

Donald K. Hansen
Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Dear Mr. Hansen:

In preparation for the meeting of the Pacific Fishery Management Council (Council) in June, my staff and I have been giving some thought to the decisions the Council will need to make in coming months on the scope and timing of actions under the Coastal Pelagics Species Fishery Management Plan (FMP).

The Council has already decided that the sardine allocation process now in place has a fixed term; it is scheduled to end after the 2005 fishing year. I expect that the Council will affirm its intent to have the CPS management team analyze and evaluate the impacts and implications of extending the current system and of alternatives to the current system, considering both recent fishery information and any new information from recent research into the northern component of the sardine stocks. This is clearly the top priority for the team at this time.

However, I would ask that the Council also consider directing the team to look at some additional issues. First, I note that there will be a Stock Assessment Review Panel looking at the sardine and Pacific mackerel stock assessment methodologies and advising as to their scientific soundness and future use. In that context, I understand that an alternate stock assessment method for Pacific mackerel is being or has been developed. It may be that this would provide a basis for considering changes in the harvest guideline formula for Pacific mackerel or possibly even Pacific sardine. This might be considered in the next amendment.

Second, the Southwest Region (SWR) has received calls in recent months from California vessel owners expressing concern about the incompatibility of the State of California market squid limited entry program with the CPS finfish limited entry program under the FMP. I think both the management team and the advisors should take a fresh look at this issue and advise the Council if they believe that a change in the FMP would be a reasonable way to resolve any such issues. In addition, with respect to market squid, it appears that there is a need to address further the prospective use of the egg escapement value as a proxy for maximum sustainable yield and as a value for determining if the stock is overfished or is subject to overfishing (i.e., minimum stock size and maximum fishing mortality threshholds). Based on our most recent review for the annual National Marine Fisheries Service (NOAA Fisheries) Report to Congress on the status of

fish stocks, the current FMP language is ambiguous. I note in this context that NOAA Fisheries is considering amendments to the National Standard Guidelines, and any changes could affect the way in which this issue might be addressed. Nonetheless, it would be prudent to direct the team to consider this issue and to be prepared to advise the Council as to possible "fixes" once any changes to the guidelines have been proposed.

Third, as the SWR indicated in its March 2004 report to the Council, the FMP needs to be revised to address the bycatch provisions of the Magnuson-Stevens Fishery Conservation and Management Act more fully. The States of Oregon and Washington have had observers on vessels indicating there is not a bycatch problem to the north, but we have very little field information to the south. While port sampling suggests there is not a bycatch problem in the south, I believe that port sampling alone is insufficient to demonstrate with assurance that there is not a bycatch problem. Therefore, the SWR is planning to place observers on some CPS vessels operating out of Southern California in a pilot project intended to provide better information on the extent to which there is bycatch in the CPS fishery in that area. We would provide the results to the CPS management team to consider the need for additional field observations and possibly consider alternative ways to address any bycatch issues identified, as required by the Magnuson-Stevens Act.

Fourth, as indicated in a recent letter from Dr. William Hogarth, regional councils are being asked to review and assess the need for changes in essential fish habitat (EFH) designations under their fishery management plans. This would include the CPS FMP. It would seem prudent to have the team at least complete an initial reassessment in this next planning effort to determine if there are any major problems with the current EFH designations.

Having identified these additional issues for consideration, I also note that the last Environmental Impact Statement (EIS) for the CPS fisheries management program was prepared with Amendment 8, which established the CPS FMP. That occurred more than 5 years ago, and as you know, there have been major changes in the fishery since then. Therefore, I believe it is appropriate for the Council to initiate scoping to determine if a full EIS process is warranted for the next amendment to the CPS FMP. If scoping results in a conclusion to keep adjustment of the FMP to a moderate level, then an EIS may not be needed. However, only after scoping would the Council have a solid information base for that decision. If an EIS is warranted, then the SWR would do all we can to help design and carry out the process consistent with the principles and protocols of regulatory streamlining under the new Operational Guidelines.

In summary, I urge the Council to consider the full range of possible adjustments to the FMP and to engage in scoping to determine the scope of review and the manner in which to proceed. I appreciate all the hard work that goes into preparation of FMP amendments and associated documents, and look forward to working with the Council to assist in any way we can.

Sincerely,

for Rodney R. McInnis
Acting Regional Administrator

PACIFIC MACKEREL HARVEST GUIDELINE FOR THE 2004/2005 SEASON

Situation: The Council is scheduled to review the current Pacific mackerel stock assessment and adopt a harvest guideline for the 2004-2005 Pacific mackerel fishing season, which opens July 1, 2004.

In 2003, a harvest guideline of 10,652 mt was established based on a biomass estimate of 68,924 mt. Because this relatively small harvest guideline could have interfered with harvest of other coastal pelagic species (CPS), a directed fishery was allotted 7,500 mt. The remaining 3,152 mt of the harvest guideline were to be used for incidental landings following closure of the directed fishery. However, by May 2004 less than 6,000 mt of Pacific mackerel had been harvested and the directed fishery remains open.

The Coastal Pelagic Species Management Team (CPSMT) and the Coastal Pelagic Species Advisory Subpanel (CPSAS) have reviewed the new stock assessment and the recommended harvest guideline. They will present their respective advice to the Council.

The CPSMT has completed the fifth annual *Status of the Pacific Coast Coastal Pelagic Species (CPS) Fishery and Recommended Harvest Guidelines – Stock Assessment and Fishery Evaluation (SAFE) – 2004* document. This is included in the briefing book as Attachment 1. The current stock assessment and management recommendations are summarized in Attachment 1, Appendix 2.

Council Action:

1. Adopt Pacific Mackerel Harvest Guideline for the 2004/2005 Season.

Reference Materials:

1. Exhibit F.2.a, Attachment 1: *Status of the Pacific Coast Coastal Pelagic Species (CPS) Fishery and Recommended Harvest Guidelines – Stock Assessment and Fishery Evaluation (SAFE) – 2004.*
2. Exhibit F.2.b, CPSMT Report.
3. Exhibit F.2.b, CPSAS Report.

Agenda Order:

a. Agendum Overview — Dan Waldeck
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action**: Adopt Pacific Mackerel Harvest Guideline for the 2004/2005 Season

PFMC
05/26/04

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

STOCK ASSESSMENT AND FISHERY EVALUATION – 2004

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JUNE 2004

ACKNOWLEDGMENTS

COASTAL PELAGIC SPECIES MANAGEMENT TEAM

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LIST OF ACRONYMS AND ABBREVIATIONS

ABC	acceptable biological catch
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CANSAR-TAM	Catch-at-age Analysis for Sardine - Two Area Model
CDFG	California Department of Fish and Game
CESA	California Endangered Species Act
Commission	California Fish and Game Commission
Council	Pacific Fishery Management Council
CPFV	commercial passenger fishing vessel
CPS	coastal pelagic species
CPSMT	Coastal Pelagic Species Management Team
CPSPDT	Coastal Pelagic Species Plan Development Team
CUFES	Continuous Underway Fish Egg Sampler
CV	coefficient of variation
DEPM	daily egg production method
EEZ	exclusive economic zone
EFH	essential fish habitat
ENSO	El Niño southern oscillation
FMP	fishery management plan
GIS	Geographic Information System
GT	gross tonnage
HG	harvest guideline
LE	limited entry
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MAXCAT	maximum harvest level parameter
MSY	maximum sustainable yield
NMFS	National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife
OY	optimum yield
PacFIN	Pacific Coast Fisheries Information Network
PFAU	Pelagic Fisheries Assessment Unit
RecFIN	Recreation Fishery Information Network
RFA	Regulatory Flexibility Act
RIR	regulatory impact review
ROV	remotely operated vehicle
SAFE	stock assessment and fishery evaluation
Secretary	U.S. Secretary of Commerce
SSC	Scientific and Statistical Committee
SST	Sea surface temperature
STAR	Stock Assessment Review (Panel)
STAT	Stock Assessment Team
SWFSC	Southwest Fisheries Science Center (NMFS)
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 fifth *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 stocks assessments for Pacific mackerel and Pacific sardine, 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).

Members of the CPSMT are: Dr. Sam Herrick, Chair (NMFS); Dr. Paul Crone (NMFS); Mr. Brian Culver (WDFW); Dr. Kevin Hill (NMFS); Ms. Leeanne Laughlin (CDFG); Ms. Jean McCrae (ODFW); and Mr. Dale Sweetnam (CDFG). Ms. Tonya Ramsey (NMFS), Mr. Dan Waldeck (Council staff), Ms. Michele Robinson (WDFW), Ms. Heather Mann, and Ms. Diane Pleschner-Steele also provided information for this report.

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 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 (which would have resulted 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, but rejected by NMFS Southwest Region 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

Amendment 8

Development of Amendment 8 to the northern anchovy FMP[1/] 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 the management unit species; CPS fishery management areas, consisting of a limited entry zone and two

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1/ This document was subsequently re-titled the Coastal Pelagic Species Fishery Management Plan. References to Amendment 8 and CPS FMP refer to the same document.

subareas; a procedure for setting annual specifications including harvest guidelines, quotas, and allocations; provisions for closing directed fisheries when the directed portion of a harvest guideline or quota is taken; fishing seasons for Pacific sardine and Pacific mackerel; catch restrictions in the limited entry zone and, when the directed fishery for a CPS is closed, limited harvest of that species to an incidental limit; a limited entry program; authorization for NMFS to issue exempted fishing permits for the harvest of CPS that otherwise would be prohibited; and 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 limited entry permits were effective immediately. Other provisions, such as harvest guidelines, were effective January 1, 2000.

Amendment 9

During 1999 and 2000, the CPSMT developed Amendment 9 to the CPS FMP. Originally, Amendment 9 addressed both disapproved provisions of the FMP – bycatch, and market squid MSY. The amendment also included provisions to ensure 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 of Commerce (Secretary) approved Amendment 9 on March 22, 2001, and the final rule implementing Amendment 9 was published August 27, 2001 (66*FR*44986).

Amendment 10

In April 2001, the Council adopted a capacity goal for the CPS limited entry 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 limited entry fishery, the amendment established a capacity goal, provided for limited entry permit transferability to achieve and maintain the capacity goal, and established a process for considering new limited entry permits. The purpose of this action was to ensure fishing capacity in the CPS limited entry

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 of Commerce approved Amendment 10. On January 27, 2003, NMFS issued the final rule and regulations implementing Amendment 10 (68*FR*3819).

Sardine Allocation Regulatory Amendment

In 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. 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, CA) to 39° N latitude (Point Arena, CA), (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 will be in place for the 2003 and 2004 fishing seasons. It could also be used in 2005 if the 2005 harvest guideline is at least 90% of the 2003 harvest guideline.

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

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 are typically sold as bait for Asian longline tuna fisheries.

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. One vessel in Oregon landed 7.8 mt in 2003.

- 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 limited entry (LE) fleet currently consists of 63 permits and 62 vessels (Table 3). The LE vessels range in age from 3 to 67 years, with an average age of 32 years (Table 4). Average vessel age has decreased by approximately 3 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 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 Coast Guard database, and each vessel's calculated GT was attached to the permit under Amendment 10. Original GT endorsements (specified in Table 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 88.1 GT (Tables 3 and 4). Total fleet GT decreased from 5,775.2 GT to 5,462.9 GT during 2003. This decrease was due to the permanent loss of two permits (numbers 6 and 16) and the loss of the "Miss Juli" (permit 27; sank in 2001), which is yet to be replaced by the owner. The "Jenny Lynn" (permit 46) sank in 2003 and the permit was transferred by owner to the "Corva May", which has a slightly smaller GT. 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 limited entry fleet is 5,462.9 GT, well within the bounds of the capacity goal.

2.3.2 Northern Fisheries

In Oregon, Pacific sardine is managed as a developmental fishery. In 2003, all 20 developmental fishery permits were issued. Permit stipulations include: permit is not transferable; logbook is required; observers are allowed on board; a grate must be placed over the hold to sort out larger fish; renewal of the permit is subject to meeting minimum annual landing requirements of 5 landings of sardines of at least 500 pounds each, or one landing of at least 5,000 pounds.

In Washington, sardines are managed under the Emerging Commercial Fishery provisions, which provide for the harvest of a newly classified species, or harvest of a previously classified species in a new area or by new means. From 2000 through 2002, WDFW had trial purse seine fisheries for Pacific sardines, under which the number of participants, by law, cannot be limited. Since participation could not be limited, the Washington fishery was managed to a state harvest guideline of 15,000 mt. Following an extensive public process which included establishing and meeting with a formal Sardine Advisory Board, the Director of WDFW decided to advance the sardine fishery from a trial to an experimental fishery in 2003. Experimental fisheries, under the Emerging Commercial Fisheries legislation, require participation to be limited. In collaboration with the Sardine Advisory Board, WDFW developed and implemented an effort limitation program in 2003. A total of 17 fishing permits were issued; of these, 10 vessels made landings during the season. Permit requirements require vessels to maintain logbooks and carry observers when requested, and to reimburse the agency, in part, for observer costs.

2.3.3 Treaty Tribe Fisheries

As of June 2004, no treaty tribe fisheries for CPS have occurred.

3.0 Stock Assessment Models

3.1 Pacific Sardine

Conser *et al.* (2003) summarized the status of the Pacific sardine resource in California and Baja California, Mexico. An age-structured stock assessment model (CANSAR-TAM, Catch-at-age ANalysis for SARdine - Two Area Model; see Hill *et al.* 1999a) is applied to fishery-dependent and fishery-independent data to derive estimates of population abundance and age-specific fishing mortality rates. In 1998, the original CANSAR model (Deriso *et al.* 1996) was modified to account for the expansion of the population northward to waters off the Pacific northwest. The model is based on a "forward-simulation" approach (see Megrey 1989) for a description of the general modeling approach), whereby parameters (e.g., population sizes, recruitments, fishing mortality rates, gear selectivities, and catchability coefficients) are estimated after log transformation using the method of nonlinear least squares. The terms in the objective function (to be minimized) include the sum of squared differences in ($\log_e$) observed and ($\log_e$) predicted estimates from the catch-at-age and various sources of auxiliary data used for "tuning" the model; e.g., indices of abundance from survey (fishery-independent) data. Bootstrap procedures are used to calculate variance and bias (95% confidence intervals) of sardine biomass and recruitment estimates generated from the assessment model. The CANSAR-TAM model is based on two fisheries (California, U.S., and Ensenada, Mexico); and semesters within a year are used as time steps, with ages being incremented between semesters on July 1 and spawning that is assumed to occur on April 1 (middle of the first semester).

Fishery-dependent data from the California and Ensenada fisheries (1983 through the first semester of the most recent year) are used to develop the following time series, (1) catch (in mt); (2) age distributions (catch-at-age in numbers of fish); and (3) estimates of weight-at-age (fishery- and population-specific). Fishery-independent data (time series) from research surveys include the following indices, which are developed from data collected from Area 1 (*Inside Area*, primarily waters off southern California) and used as relative abundance measures; (1) index (proportion-positive stations) of sardine egg abundance from California Cooperative Oceanic and Fisheries Investigations (CalCOFI) survey data (*CalCOFI Index*; see Deriso *et al.* 1996); (2) index of spawning biomass (mt) based on the Daily Egg Production Method survey data (*DEPM Index*; see Lo *et al.* (1996); (3) index of spawning area (Nmi^2) from CalCOFI and DEPM survey data (*Spawning Area Index)*; and (4) index of pre-adult biomass (mt) from aerial spotter plane survey data (*Aerial Spotter Index*; see Lo *et al.* 1992). Time series of sea-surface temperatures recorded at Scripps Pier, La Jolla, California are used to determine appropriate harvest guidelines (*Sea-surface Temperature Index*), see the Coastal Pelagic Species Fishery Management Plan, Option J, Table 4.2.5-1, PFMC (1998).

3.2 Pacific Mackerel

A modified virtual population analysis (VPA) model "ADEPT" (Jacobson 1993), based on Gavaris' (1988) ADAPT procedure, is used to estimate biomass of Pacific mackerel. The ADEPT model has been used to assess Pacific mackerel for the past eleven years and is described in detail in Jacobson (1993), Jacobson et al. (1994), and Hill et al. (1999b). Conventional VPAs back-calculate age-structured abundance utilizing catch-at-age and weight-at-age data, as well as assumptions

regarding both age-specific natural mortality in each year of the time series and fishing mortality (F) estimates for the most recent year (referred to as "terminal F"). The ADEPT model improves upon a conventional VPA by evaluating terminal F and other parameters to obtain the best statistical fit between VPA output and survey indices of relative abundance. The crux of the statistical procedure lies in the model's ability to estimate terminal F based upon the survey indices, using them to adjust the conventional VPA output.

The ADEPT model uses a standard suite of subroutines to estimate parameters in a VPA model, based on a slightly modified simplex algorithm and subroutine from Press et al. (1990). The standard program for parameter estimation is similar to that described by Mittertreiner and Schnute (1985). The ADEPT approach is based on the estimation method of maximum likelihood. Parameters are estimated by minimizing an objective function, which in the case of ADEPT, is the negative log-likelihood of the data, given the model and parameter estimates (rather than the equivalent sums of squares used by Gavaris 1988). Two types of parameters are estimated in the ADEPT model: observation parameters (survey-based q's and exponents) and terminal F parameters. Observation parameters are used to interpret index data, which are used in turn to estimate terminal F values. Terminal F parameters are highly influential for estimating population biomass for recent years. Natural mortality is assumed to be 0.5 yr for all ages in all analyses (Parrish and MacCall 1978).

The assessment model uses an annual time step and now incorporates 75 years (1929-2003) of fishery data, including landings, age composition, and mean estimates of weight-at-age. Fishery data for the early historical period (1929-1965) were obtained from previously published assessments (Parrish and MacCall 1978; Prager and MacCall 1988). Abundance estimates from the VPA are adjusted by the model to better match trends in the survey data, which includes aerial spotter sightings (Lo *et al.* 1992), CalCOFI larval data, recreational fishery catch-per-unit-effort information, triennial shelf survey data, and power plant impingement rates. Component likelihoods for most surveys are weighted equally to a value of 1.0. The power plant impingement index (age-0 mackerel caught in cooling water at San Onofre Nuclear Generating Station) represents a small portion of the coastline and is down-weighted to 0.1. The ADEPT model also accommodates weighted annual survey observations based on coefficients of variation (CVs) associated with the individual estimates.

References for Section 3:

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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 maximum sustainable yield 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 maximum sustainable yield in such fishery [50 CFR §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} 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.

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 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% 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:

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

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 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 CVs 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. 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) 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 (chub) 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

The MSY Control Rule for market squid is defined within the framework of the Egg Escapement method, which serves as the assessment-related tool for this species and was formally adopted by the Council in 2002. 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 gauge the need for "active" management. 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 that supports catches approaching the ABC or MSY levels should come under active management, unless there is too little information available or other practical problems. Overfishing of a monitored CPS stock is "approached" whenever current estimates or projections indicate that a minimum stock threshold will be realized within two years.

The Egg Escapement method is founded on conventional spawning biomass "per recruit" model 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," which represents a rate of escapement that can allow the population to realize "sustainable" levels of abundance into the future, i.e., given favorable environmental conditions exist for this species. It is important to note that the threshold proposed currently (i.e., 30%) necessarily represents a "baseline" statistic (i.e., preliminary, but intended to be precautionary), given that such biological reference points have not been definitively determined for coastal pelagic stocks specifically, as well as numerous fish stocks in general. In this regard, the CPSMT recognizes that there exists too little information at this time to define the threshold in more detailed terms and further, recommends treating the 30% escapement rate as one that is more in line with "MSY," rather than "minimum stock size," points of reference. Finally, the relationship between reproductive-related thresholds and sustainable population levels for this species will receive further scrutiny in the near future as much needed data accumulate and

simulation modeling research gets underway (see section 9.2.3). Finally, further discussion concerning specific details involved in this assessment approach, as well as review-related discussion can be found in the Appendix 3 of the 2002 SAFE document.

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 U.S. Secretary of Commerce 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 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 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 are commonly used in Oregon and Washington fisheries to sort larger non-CPS from the catch, at-sea observers record discard in these fisheries. 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 is developing an FMP for the state-managed fishery. California's market squid FMP would establish 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 proposed 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 limited entry 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 Tables 13, 14, and 15.

6. CDFG has implemented a logbook program for the squid fishery. The data to be collected includes bycatch. See table 8a and 8b.

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 describes the California fishery, section 6.2 provides information on Oregon and Washington fisheries.

See Amendment 9 to the CPS FMP (Environmental Assessment/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.

NMFS has proposed a pilot at-sea observer program for CPS purse seine vessels operating in California to determine the amounts and types of bycatch, and to confirm bycatch rates derived from CDFG dock-side sampling. Additionally, the pilot observer program would collect data on possible protected species interactions, information about fishing operations, and fishing economics. As of publication of this document funding had not yet been allocated for the observer program, NMFS intends to begin at-sea observations in the summer 2004 and continue through the fall 2004. The data will be analyzed by the CPSMT and management options will be assessed in conjunction with the fishing industry.

6.1 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 bycatch in the California fishery (Tables 5, 6, 7a, 7b, and 7c). The behavior of predators, which tend to dart through a school of prey rather than linger in the school, and can more easily avoid encirclement with a purse seine, may help to minimize bycatch. Large predators, such as blue sharks, have been observed on occasion, but are by no means a common occurrence.

CDFG port samples 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 bycatch by CDFG port samplers confirm small and insignificant landings of bycatch at California off-loading sites (Tables 5, 6, 7a, and 7b). These data are likely representative of actual bycatch, because (as noted) fish are pumped from the sea into fish holds aboard the fishing vessel. Fishers do not sort catch at sea that pass through the pump. Generally, whatever is caught is pumped into the hold and landed. Unloading of fish also occurs with pumps. The fish is either pumped into ice bins and ferried away to processors or to a conveyor belt leading into a processing facility.

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% occurrence. Up to 1999 reports of incidental catch were sparse, and prior to 1992 none was 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%, and northern anchovy at 12% incidence within samples (not by load composition). CDFG port sample information provides a useful database for determining the significance of bycatch in the CPS fishery off California (south of Pigeon Point).

In 2001, California wetfish port samplers were directed to tally bycatch observed during landings in greater detail, and recorded 343 fish, items or animals that were not the targeted species (Table 7a). These included 210 finfish (61%), 44 elasmobranchs (sharks or rays) (13%), and 89 incidents

of vegetation, invertebrates, and various debris (26%). Seventy three incidents (21% of total) represented other CPS finfish that were not the target species of that trip.

In 2002, there was a similar result to 2001 observations, with 181 non-targeted finfish, 37 elasmobranchs, and 150 incidents of invertebrates, vegetation, or other non-fish items noted by CDFG port samplers in CPS landings (Table 7b). Of incidental catches observed, finfish comprised 49%, sharks and rays 10%, and invertebrates, vegetation, or other items occurred as 41% of non-targeted catches.

In 2003, there were 365 incidents of bycatch in CPS landings in the Los Angeles County area. Finfish accounted for 201 incidents (55%), elasmobranchs 64 incidents (18%), and invertebrates and vegetation 100 incidents (27%). In Monterey, bycatch was also enumerated for the first time. There were 106 incidents of bycatch in the Monterey region. Finfish accounted for 69 incidents (65%), elasmobranchs 16 incidents (15%), and invertebrates/vegetation 21 incidents (20%). All of these incidents occurred in the first semester of landings. None were recorded after July in Monterey.

Kelp (specifically holdfasts), flatfish, California scorpionfish, and elasmobranchs can serve as an indication of shallow set depth. Larger fish and animals are typically sorted either for market, personal consumption, or nutrient recycling in the harbor. As the collection of bycatch information in the CPS fishery is not a funded portion of the project, further study will require additional support from outside of CDFG. An additional concern may be that at some processors, the entire load is observable for bycatch because it goes by the sampler on conveyors; at others, only the surface layer of a bin can be observed. Some processors think they may be being scrutinized more closely than others.

6.1.1 Incidental Catch Associated with the Market Squid Fishery

Because squid frequently school with CPS finfish, mixed landings of market squid and incidentally caught CPS finfish occur occasionally. In 2002, about 7% of round haul squid landings included "incidental" catch of CPS species (Table 8a) and in 2003, there were 9%. Squid also occurred as incidental catch (about two tons in 2002 and 2003) in trawl fisheries for sea cucumber and ridgeback prawn, and in various other gears.

Another type of incidental catch is defined here as "bycatch" (i.e., species that are landed along with squid that are not recorded through landing receipt processes [i.e., not sold] as is typically done for incidentally-caught species). Although non-target catch in market squid landings is considered minimal, the presence of bycatch has been documented through the CDFG port sampling program. The port sampling program records bycatch observed (i.e., presence or absence evaluations), but actual amounts of bycatch have not been quantified to date. During 2002, bycatch was present in slightly more than half of squid landings observed (Table 8b). Similar to previous years, most of this catch was other pelagic species, including Pacific sardine, Pacific mackerel, northern anchovy, jack mackerel, and squid egg cases.

Finally, the extent that squid egg beds and bottom substrate are damaged by recent purse seine operations and subsequently, contribute to significant mortality of early life stages is not definitively known at this time. However, information regarding bycatch of squid eggs determined from squid

landings port-side generally indicate that egg bed-related impacts have increased over the last several years. For example, from October 1998 through September 2001, bycatch of squid eggs had a 1.8% frequency of occurrence. In 2003, squid egg bycatch was 10.9% statewide, which represents more than a six-fold increase from 2001 in the amount of squid egg cases taken as bycatch in this fishery. If bycatch of squid eggs continues to increase, 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). In this context, further investigations regarding potential damage to squid spawning beds from fishery-related operations would likely benefit status-based analyses concerning the overall squid population off California, given eggs-per-recruit theory underlies the recently adopted squid assessment method. Such investigations should involve collaborative research efforts between the CPSMT, CDFG, and NMFS-Southwest Fisheries Science Center.

6.2 Fishery North of Pigeon Point

Since 2000, limited fisheries for Pacific sardine occurred off the Pacific Northwest. Oregon and Washington closely monitor these fisheries and collect information about landings and the environmental effects of these fisheries. Information on salmon bycatch from Oregon and Washington (2000 through 2003) is summarized in Table 9.

In 2003, Oregon and Washington agreed on a similar season opening date of June 22; landings continued through mid October. Seventeen vessels made 712 landings for a total of 25,253 mt, averaging over 35 mt per trip, with nine vessels making over 80% of the landings. Based on logbook data, 65% of the pounds landed were taken off Oregon and 35% off Washington.

Oregon's permit stipulations include allowing observers when requested and requiring a grate over the hold opening to sort out larger species of fish. As in 2003, due to budget restriction, Oregon did not hire a seasonal employee in 2003 to ride along on sardine vessels and observe bycatch of non-target species: permanent staff was able to observe three trips. Vessel skippers were also required to submit logbooks, which record all species caught. Logbooks submitted accounted for 92% of the landings.

Based on both observer and logbook data, bycatch continues to be low. Bycatch included salmon and sharks (Table 10). Salmon were the major species of concern. Based on logbooks, salmon catch averaged 0.8 salmon per trip, with 63% being released alive. The estimated total catch of salmon for the fishery, based on logbook data, was 500 salmon (0.020 salmon/mt) (Table 11).

Incidental catch recorded on fishtickets consisted of 158.3 mt of Pacific mackerel, 3.2 mt of jack mackerel, 0.1 mt of Pacific whiting, and 0.3 mt of thresher shark, for a total of 0.6% of the total catch.

Washington's purse seine fishery in previous years has opened on May 15, although landings typically have not occurred until around the second week of June. However in 2003, the season was delayed until June 22 as a result of an agreement with Oregon Department of Fish and Wildlife and the northwest sardine industry. Reasons for the delay included a desire to avoid an early closure in late August as a result of attaining the northern harvest guideline, and to promote fishing during a time when the fish had higher oil content and greater market value. The 2003 season also marked

the first year of effort limitation in Washington; 17 permits were issued, however only 10 vessels participated in the fishery. The fishery opened on June 22 and continued through October 17 when the allocation to the northern area was attained.

Landings for the year totaled 11,604 mt, which is a decrease from the 15,212 mt landed in 2002. Average landing size was approximately 40 mt. The majority of the catch (67%) was taken in waters adjacent to Washington. In 2002, 57% of the catch was taken off the Oregon coast. There were a total of 288 landings for the season and most of the catch (88%) was delivered into the port of Ilwaco.

As part of the limited entry permit in the experimental fishery regulations, WDFW requires fishers to carry at-sea observers, primarily to collect bycatch information. Since the beginning of the Washington sardine fishery in 2000, bycatch information has been collected in terms of species, amount, and condition; observers noted whether the fish were released or landed, and whether the fish were alive, dead, or in poor condition. Overall observer coverage was 27% of the total catch, up slightly from the 24% coverage in 2002. Based on observer data, the bycatch of non-targeted species was fairly low. Bycatch included chinook and coho salmon, Pacific and jack mackerel, spiny dogfish, blue shark, and other species (Table 12a). A complete list of non-targeted species and the amounts observed (numbers of individuals) compared with amounts reported in logbooks is contained in Table 12b.

7.0 Live Bait Fishery (California)

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 Commercial Passenger Fishing Vessel (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, 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 (*Scomber*

japonicus and *Trachurus symmetricus*), and various small fishes collectively known as "brown bait" that can include juvenile barracuda (*Sphyraena argentea*), Osmerids, Atherinids, and market squid (Table 13). 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 Southwest Fisheries Science Center (SWFSC) in La Jolla presently archives the CDFG Live Bait Logs. Preliminary estimates of the reported total live bait harvest in California through 2003 have been appended to previously reported estimates from Thomson et al. (1991, 1992, 1994) (Table 14).

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 (Table 14).

Through the years 1994 to 2003 the proportion of anchovy in the total reported harvest ranged from a low of 13% in 1998, to a high of 58% in 1994. The proportion of sardine ranged from a low of 42% in 1994, to a high of 87% in 1998 (Table 15).

References for Section 7:

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 Vessel Safety 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 limited entry 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 limited entry permits to be transferred to another vessel and/or individual.

As discussed in Section 2.2, NMFS recently implemented a regulatory amendment related to the CPS FMP. Under the regulatory amendment, 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 1. 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 in this time of year.

9.0 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. Harvest guidelines, fishing seasons, and other management controls are used. Other CPS species (northern anchovy, jack mackerel, 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. For information on commercial harvest of CPS finfish landed into Ensenada, Mexico (1978-2001) (Table 16, Eva-Cotero 2003).

9.1 Actively Managed Species

9.1.1 Pacific Sardine

The CDFG Code Section 8150.7 states that it was the intent of the Legislature that the Pacific sardine resource off California be rehabilitated, and that once the spawning population was estimated to reach 18,144 mt, a 907 mt directed fishery would be established. This happened in the 1980s and the quota was expanded as the population increased. The Pacific sardine has made a strong recovery in waters off the U.S. Pacific Coast since the late 1980s. The sardine biomass increase approximately 30% annually through the late 1990s, with a leveling off at approximately 1 million mt observed in recent years. Estimates of sardine biomass in waters off Oregon were greater than 50,000 mt in 1994 (Bentley *et al.* 1996), and greater than 100,000 mt in waters around Vancouver Island, B.C. in 1998 (S. McFarlane, Canada Department of Fisheries and Oceans, personal communication, 1999).

Conser *et al.* (2003) summarized the status of the Pacific sardine resource off California and Baja California, Mexico. Total landings of Pacific sardine for the directed fisheries off California, U.S., and Ensenada, Mexico were generally similar to levels observed in the previous year, with a total harvest of approximately 94,000 mt in 2003. Note that landing values presented here differ slightly than those presented in Conser *et al.* (2002), given semester 2 landings from 2002 used in the previous analysis were projected estimates based on landing patterns observed in the fisheries over the last decade. Total landings in California in 2003 (50,382 mt) declined slightly from the previous year (63,444 mt), while landings in northern Mexico in 2003 (43,693 mt) were similar to the harvest in 2002 (43,437 mt). Currently, the U.S. fishery (California landings) is regulated using a quota-based (e.g., harvest guideline) management scheme, whereas the Mexico fishery (Ensenada landings) remains largely unregulated. Since the mid 1990s, actual landings from the California fishery have been less than the recommended harvest guidelines. Further, as was the case generally observed in recent years, landings from the U.S. coastwide (i.e., California, Oregon, and Washington) sardine fishery composed just under 75% (roughly, 82,000 mt) of the harvest guideline recommended for 2003 (111,000 mt).

Estimated stock biomass (age 1+ fish on July 1, 2003) from the assessment conducted in 2003 indicated the sardine population has remained at a relatively high abundance level, with a bias-corrected estimate of roughly 1 million mt. Estimated recruitment (age-0 fish on July 1, 2003) in

2003 was nearly 13 billion recruits, which translated to a relatively strong year class when evaluated over the entire time series from 1983-2003. However, it should be noted that recent recruitment was not estimated precisely (i.e., 95% confidence interval of 5-37 billion recruits) and thus, definitive determinations regarding the apparent "plateau" reached by the sardine population should be interpreted accordingly, given the inherent uncertainty surrounding estimated recruitment (see below). See Table 17 for biomass and recruitment time series, 1983-2003.

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 the 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 produced per spawner in recent years, which may be indicative of a stock that has reached a threshold under current environmental conditions.

9.1.1.1 Harvest Guideline for 2004

The harvest guideline recommended for the U.S. Pacific Coast fishery for 2003 was 110,908 mt. Statistics used to determine this harvest guideline are discussed below. The harvest guideline for 2004 is based on the MSY control rule defined in the CPS FMP. This formula is intended to prevent Pacific sardine from being overfished and maintain relatively high and consistent catch levels over a long-term horizon. The CPS FMP harvest formula for sardine is:

$$HG_{2004} = (\text{TOTAL STOCK BIOMASS}_{2003} - \text{CUTOFF}) \bullet \text{FRACTION} \bullet \text{U.S. DISTRIBUTION},$$

where HG_{2004} is the total U.S. (California, Oregon, and Washington) harvest guideline recommended for 2004, TOTAL STOCK $BIOMASS_{2003}$ is the estimated stock biomass (age 1+ fish) from the assessment conducted in 2003, CUTOFF is the lowest level of estimated biomass at which harvest is allowed, FRACTION is an environment-based percentage of biomass above the CUTOFF that can be harvested by the fisheries (see below), and U.S. DISTRIBUTION is the percentage of TOTAL STOCK $BIOMASS_{2003}$ 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 MSY under "equilibrium" assumptions). Given F_{MSY} and the productivity of the sardine stock have been shown to increase when relatively warm-water 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 years. Ultimately, FRACTION is constrained and ranges between 5% and 15%.

Based on the T values observed throughout the period covered by this stock assessment (1983-2003), the appropriate F_{MSY} exploitation fraction (FRACTION) has consistently been 15% and this remains the case under current oceanographic conditions (T_{2003} = 17.5 °C). However, it should be noted that

the decline in T generally observed in recent years (2000-2003) may invoke an environment-based reduction in the FRACTION value in the near future if sea-surface temperatures off the southern extreme of the U.S. Pacific Coast continue to decline from those observed in the latter part of the 1990s.

The 2004 U.S. HG (122,747) is 11% greater than the 2003 HG (110,908). Recent fishing practices and market conditions indicate that it may not be constraining with regard to U.S.-based fishery landings in 2004. However, recent recruitment levels are not well estimated, resulting in a high degree of uncertainty with respect to stock productivity over the last few years. If the actual recruitment in recent years is less than that estimated in the model and/or should the general sea-surface temperature decline continue, it is likely that HGs in the upcoming years will constrain USA fishery practices and removals to some degree.

Further, when viewed on a larger spatial scale and considering the landings of Mexico and Canada as well as the U.S., adherence to an implied "population-wide" HG may constrain fisheries even without potential declines in recruitment and/or water temperature. See the current sardine assessment (Conser *et al.* 2003) in Appendix 2 for comparisons concerning recent international-based landings with the annual HGs that would have resulted from applying the CPS FMP harvest formula (see above) without the "U.S. Distribution" term. Finally, should Oregon and Washington landings continue to increase at rates comparable to those observed over the past few years and/or Mexico landings continue to increase to historically high levels (i.e., those observed since the late 1990s), the implied population-wide HG will be exceeded again in 2004, as has been the case since 2002.

See Tables 18 and 19 for a retrospective of U.S. West Coast Pacific sardine landings, 1981-2003.

9.1.2 Pacific Mackerel

The coast-wide harvest of Pacific mackerel decreased 35% in calendar year 2003. The directed fisheries off California and northern Baja California (Ensenada, Mexico) had a combined yield of 8,341 mt, compared to 12,778 mt in 2002. California's directed fishery for calendar year 2003 landed 5,185 mt – an increase of about 14% from the 2002 yield. The Ensenada fishery experienced a 65% decrease in yield, from 7,963 mt in 2002 to 2,815 mt in 2003 (Celia Eva Cotero, INP-Ensenada, pers. comm.). The RecFIN estimate of recreational harvest was 341 mt in 2003, up from 279 mt in 2002. The U.S. commercial fishery was provided a 10,652 mt HG for the 2003-2004 (July-June) season, based on a July 1, 2003 biomass forecast of 68,924 mt (Hill *et al.* 2003). Through the PFMC management process, it was determined that in order to stay within the HG, there would be an initial directed fishery of 7,500 mt, with 3,152 mt set aside for incidental catch in other CPS fisheries. The 2003-2004 season has progressed slowly, with only 5,545 mt of the directed HG allocation being landed from July 2003 through March 2004. The directed fishery will likely remain open through June 30, 2004.

Status of the Pacific mackerel population was assessed using the modified VPA model "ADEPT" (see section 3.0). An executive summary of the latest assessment (Hill and Crone 2004), including tables and figures, may be found in Appendix 2 of this SAFE document. The ADEPT model recalculates biomass and recruitment for all years in the 75-year time series. Differences in biomass

estimates among assessment years can be caused by changes in landings, shifts in fishery age compositions, trends in fishery-independent surveys, and assumptions regarding terminal year fishing vulnerability. As is true for all age-structured population models, abundance-at-age estimates are the least certain for the most recent years when the youngest year classes have not yet become fully vulnerable to, or utilized by, the fishery. Compounding this uncertainty is the general lack of fishery or survey data for Pacific mackerel outside the Southern California Bight and the lack of fishery-independent information on recruitment. Catch-at-age and weight-at-age data are not yet available from the Ensenada fishery, which is comparable in volume to California's commercial fishery.

Pacific mackerel biomass peaked in 1982 at approximately 1.39 million mt, declining steadily to a low of 10,438 mt in 2001. The peak biomass observed twenty years ago was primarily built by exceptional year classes in the late 1970s and early 1980s. These recruitment pulses occurred after a decade of extremely low biomass from the mid-1960s to mid-1970s. The decline in biomass since 1982 has resulted from a steady decline in year class strength and relatively low reproductive success (recruits per spawning stock biomass) since that time. Model estimates of 2001 and 2003 year class abundance are slightly higher than for the previous few years and recent reproductive success (recruits per spawning stock biomass) is more optimistic relative to the past 18 years.

The recent trend in age 1+ biomass for the current assessment was similar to that estimated in the 2003 stock assessment (Hill *et al.* 2003). A precipitous decline in biomass was observed from 1997 to 2001. This decrease is attributed to relatively weak year classes in 1998 to 2000, combined with high fishing mortality during the 1998 fishery (i.e., keeping in mind that environmental conditions are also believed to strongly influence abundance associated with coastal pelagic stocks in general). The 1998 fishery was the second largest on record (71,355 mt), with the majority (50,726 mt) of the total harvest being landed in Ensenada, Mexico. Despite the lower overall estimates of biomass compared with Hill *et al.* (2003), the current time series indicates a stabilization in biomass in the past two years. This may be attributed to what appears to be a relatively strong 2001 year class that contributes substantially to the exploitable biomass. Finally, this stabilization should be interpreted in the context of the historical estimated abundance levels and thus, the population remains at relatively low levels compared with that realized during the 1980s and early 1990s.

The July 1, 2004 biomass projection, used to calculate the 2004-2005 HG, was based on ADEPT outputs and certain assumptions about recruitment and fishing mortality during the first half of 2004. Estimates of year class strength (age-0 abundance) for the terminal year (2003) are included in the forecast. The projected estimate of July 1, 2004 population biomass (age 1+ fish) is approximately 81,383 mt.

9.1.2.1 Harvest Guideline for 2004-2005

In Amendment 8 to the CPS FMP (PFMC 1998), the recommended maximum sustainable yield control rule for Pacific mackerel was:

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

where HARVEST is the U.S. HG, CUTOFF (18,200 mt) is the lowest level of estimated biomass at which harvest is allowed, FRACTION (30%) is the fraction of biomass above CUTOFF that can

be taken by fisheries, and STOCK DISTRIBUTION (70%) is the average fraction of total BIOMASS in U.S. waters. CUTOFF and FRACTION values applied in the Council's harvest policy for mackerel are based on analyses published by MacCall *et al.* (1985). BIOMASS (81,383 mt) is the estimated biomass of fish age 1 and older for the whole stock as of July 1, 2004. Based on this formula, the 2004-2005 season HG would be 13,268 mt. The recommended HG is 2,616 mt higher (+25%) than the 2003-2004 HG, and comparable to the average yield (~12,000 mt) realized by the fishery since the 1992-1993 season.

HARVEST GUIDELINE = (BIOMASS - CUTOFF) X FRACTION X STOCK DISTRIBUTION
= (81,383 mt - 18,200 mt) x 0.30 x 0.70
= 13,269 mt of HG for 2004-2005

9.2 Monitored Species

Figure 1 illustrates distribution of northern anchovy and jack mackerel eggs for areas surveyed off of Southern California, April 2003.

9.2.1 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; and 4,650 mt in 2002. Minor landings (< 1 mt annually) of northern anchovy into Oregon were reported from 1981 through 2001, with 3.1 mt reported in 2002 and 39.1 mt in 2003. During the 1980s and 1990s, Washington landings of northern anchovy ranged from 10 to 130 mt. In 2002 and 2003, landings increased to over 200 mt, annually. Through the 1970s and early 1980s, Mexican landings increased, peaking at 258,700 mt in 1981. Mexican landings decreased to less than 2,324 mt per year during the early 1990s. There was an increase in Mexican landings to 21,168 mt in 1995, primarily during the months of September through November.

Catches in Ensenada were 4,168; 1,823; 972; 3,482; 1,562; and 76 mt in 1996-2001, respectively. There have been no catches reported since 2001.

Jacobson et al. (1995, 1997) summarized the disposition of northern anchovy landed in California. Beginning in 1965, when a reduction quota was first established separately from non-reduction uses, statistics for each use became available. All non-reduction uses are combined and include fresh, frozen, processed for human consumption, and dead bait. Mexican landings data first appear for 1962.

Total age 1+ biomass of northern anchovy rose in the early 1970s to a maximum estimate of 1,598,000 mt in 1973, and decreased to 392,000 mt in 1994. Further estimates of spawning biomass (age 1+) peaked in 1975 at 1,069,000 mt, and declined to 388,000 mt in 1994. Fishing mortality estimates in 1990 to 1994 did not exceed 0.03%, and declined to zero in 1993 and 1994.

9.2.2 Jack Mackerel

Until 1999, jack mackerel were managed under the Council's Pacific Coast 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. 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 1 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 (EEZ). (PFMC. 1998.)

In California, CDFG landing receipts for jack mackerel totaled 1,269 mt in 2000; 3,624 mt in 2001; and 1,006 mt in 2002. Oregon reported 161 mt in 2000, 183 mt in 2001, 8.9 mt in 2002, and 73.6 mt in 2003. 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.

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.

9.2.3 Market Squid

Currently, only limited information is available regarding market squid population dynamics and further, data concerning historical and current levels of absolute biomass are unavailable. A Stock Assessment Review (STAR) Panel was convened in May 2001 to evaluate assessment methods for use in the management of the squid fishery and ultimately, to assess the appropriateness of defining MSY for this species. Preliminary attempts to estimate biological references points (e.g., MSY, F_{MSY}, and B_{MSY}) from surplus production models were unsuccessful. In view of the difficulties in determining traditional estimates of MSY for market squid, and given new, albeit limited, information on reproductive biology was available, the STAR Panel focused attention on reference

points based on "egg escapement" and its related concepts. Egg escapement is defined here as the number (or proportion) of a female squid's potential lifetime fecundity that she is able to spawn, on average, before being harvested in the fishery. An Egg Escapement Method (see Appendix 3 in the 2002 SAFE document) based on conventional yield and spawning biomass "per recruit" models was fully developed by the Stock Assessment Team (STAT) 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 candidate proxies for the fishing mortality that results in MSY (F_{MSY}). 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-determined sustainable level of exploitation and in this context, can be used as an effective management tool. See also Sections 4.3.4 and 10.3 for further discussion concerning an MSY Control rule and future research activities, respectively, for this species.

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 was 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) El Niño/Southern Oscillation (ENSO) events; and finally, (4) necessary 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 2002 SAFE.

Finally, data collection programs and subsequent laboratory analysis continued throughout 2003 in attempts to complement baseline sample information that served as the foundation for developing the Egg Escapement Method described above. That is, as discussed generally in CPS-related documents presented in Appendix 3 of the 2003 SAFE, further work surrounding the Egg Escapement assessment approach has addressed the following: (1) collecting much needed reproductive sample information from the fisheries to bolster the original source of data that was relied upon initially when developing the overall Egg Escapement Method from 2000-2001; (2) critically evaluating spatial/temporal patterns of the overall fishery through stratified sampling and subsequent analysis; (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 (see also Section 6.1.1); 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 will be presented in a working paper that will be distributed in early 2005.

9.2.3.1 California's Market Squid Fishery

The California market squid fishery is separated at Point Conception into northern and southern fisheries. Historically, the northern fishery accounted for the majority of the catch. Since the early 1980s, the southern fishery has continually increased its landings and has been dominant since the mid-1980s. Typically, the northern fishery occurs during the summer months and the southern fishery in the winter months. In 1999, the southern California fishery began operating nearly year-round, because market squid was readily available during most of the year in southern California. This trend has continued to date, although landings generally decrease in the summer months as compared to the rest of the year.

A moderate El Niño event in 2002 and 2003 (Venrick et al. 2003) likely contributed, to some degree, to an overall decrease in landings coastwide (44,965 mt). However, this oceanographic phenomenon continued to bring high landings to the northern market squid fishery, while hampering the southern fishery. In the 1990s, landings for the northern fishery averaged just less than 7,000 mt. Since 1999, the northern fishery has landed higher amounts, with the 2003 landing estimate of 17,359 mt. This increase in landings for the northern fishery has been largely an outcome of expanding market opportunities as well as expansion of the fleet's fishing grounds, both north and south of Monterey Bay.

During ENSO events, the availability of squid to the fishery is greatly reduced and this was evident in landings for the southern fishery, where only 27,606 mt of squid were harvested in 2003. The previous ENSO event that occurred in 1998 resulted in landings that plummeted to 2,894 mt. It is generally believed that movement out of established spawning grounds into favorable habitat and reduced reproduction by the population are responsible for the changes in availability. Further, there is no clear indication of short-term detrimental effects to the squid population (i.e., as evident in the relatively high landing amounts that have immediately followed ENSO-related events observed over the last decade or so).

La Niña conditions in 1999 contributed to record-high market squid landings of 91,517 mt for California, surpassing the previous high in 1996 of 80,402 mt. This record took place primarily in the southern California fishery, which accounted for 99.7% of all landings that year. Landings for the northern California fishery were only 289 mt during this time period. In 2000, an abundance of squid and somewhat favorable market conditions contributed to another record-high for market squid landings (117,962 mt). New landing records were set six times since 1990, reflecting a continued expansion of the southern California fishery and increased international demand for this marine resource. In 2001, market squid landings were 86,186 mt, a 27% decrease from 2000. The immediate reason for the decline in landings is not known, but anecdotal information suggests that squid were not as available at typical spawning sites, and fishers had to go to alternate areas to locate good quality squid. The lower harvest might be reflective of pre-El Niño conditions, when the abundance of market squid at known fishing areas is likely strongly affected by environmental conditions.

In 2001, legislation transferred the authority for management of the market squid fishery to the California Fish and Game Commission (Commission). Legislation requires that the Commission adopt a market squid fishery management plan and regulations to protect and manage the squid

resource. CDFG has prepared a draft market squid fishery management plan (April 12, 2004) with management recommendations for the market squid fishery which should be in place for the April 1, 2005 squid fishing season. The management plan takes into account the level of fishing effort and ecological factors, including, but not limited to, the species' role in the marine ecosystem and oceanic conditions. The plan includes a limited entry program geared to maintain the long-term economic viability of the fishery and seeks to match the level of fishing effort to the health of the resource. The management alternatives recommended by CDFG are intended to provide sustainability of the market squid resource both as a forage item and for those that rely upon squid for their livelihood. The management alternatives are based on precautionary principles and utilize the best science available. Starting in 1998, vessels participating in the squid fishery were required to possess one of two permits: the first requires a commercial market squid vessel permit to land more than two short tons daily; the second permit is to operate a light boat for the purpose of attracting market squid by light. Participants must have purchased a permit the previous year to renew their permit. A moratorium placed on the number of vessels in the squid fishery (starting in 1998) continues until adoption of the management plan. Originally, there were 248 vessel permits and 54 light boat permits during the 1998-1999 season. For the 2003-2003 season, 173 market squid vessel permits and 39 light boat permits were sold. Permit fees were set at $2,500 for three years beginning with the 1998-1999 fishing season after which time they were dropped to $400 annually. The sale of market squid permits during the initial three years provided funds for biological assessment of the resource and development of management recommendations, which were provided by the CDFG to the State Legislature in April 2001.

In developing a restricted access program, the CDFG supports a "moderately productive and specialized" fleet capacity goal of 52 round-haul vessels, 34 light boats, and 18 brail boats. These goals are within the range of the number of vessels actively participating in the fishery in a given year and maintains a ratio of one round haul vessel to one vessel attracting squid (both light boats and brail boats) currently observed in the fleet. The recommendations include establishing limited entry permit criteria based on prior catch or fishing history and provide for full transferability of vessel permits only between vessels of comparable capacity.

Additionally, CDFG recommends enacting a seasonal catch limitation to prevent expansion of the fishery beyond current limits and limit future participation by vessels of a significantly larger size. The proposed project recommends a statewide seasonal catch limitation of 107,047 mt (118,000 short tons) and restricts transferability of permits to vessels of similar capacity (within 10%). A seasonal landings catch limit of 113,400 mt (125,000 short tons) was adopted in 2001 and was in place for the 2003-2004 season.

In response to potential negative effects on nesting seabirds on several of the Channel Islands of vessels using lights to attract squid and to reduce potential light impacts on coastal communities, interim regulations went into effect May 2000 restricting lights to a maximum of 30,000 watts and requiring that lights be shielded. However, in April 2002, a petition was filed with the U.S. Fish and Wildlife Service and Commission to consider listing of Xantus's murrelets under the Endangered Species Act, citing high predation on nesting birds in 1999 "almost certainly resulted, in part, from high light levels caused by squid fishing boats." Xantus's murrelets are small nocturnal seabirds, 80% of the U.S. breeding population nest in the Channel Islands, primarily at Santa Barbara Island (also found at San Miguel, Santa Cruz, and Anacapa islands). On February 5, 2004, the Commission

voted to list the Xantus's murrelet as a threatened species under the California Endangered Species Act (CESA), with implementation of the listing scheduled for the fall of 2004. The proposed project in the market squid management plan includes a recommendation by CDFG to close Anacapa and Santa Barbara islands to squid fishing using attracting lights from February 1 through September 30 to mitigate potential fishery impacts on the nesting seabirds while recommending that the existing interim wattage and shielding regulations be maintained. An additional recommendation to reduce the maximum wattage is being considered by the Commission.

In the State of California's draft management plan, CDFG recommends a general habitat closure area from Pillar Point in central California to the Oregon border. A general habitat closure is intended to prevent squid fishery interactions in areas that have not been traditionally utilized for commercial squid fishing and where there is the potential for interactions with non-target species such as salmon, seabirds and marine mammals. It would also provide a forage reserve for species that utilize the squid resource. In 2003, a network of marine reserves at the Channel Islands went into effect. A total 132 square nautical miles of the Channel Islands National Marine Sanctuary have been set aside in April 2003. Preliminary analysis of logbook data from the three fishing seasons prior to the closure suggest that 14-19% of southern California landings were reported from the closed areas although reporting.

Maintaining the closure of the fishery on weekends statewide in the spirit of precautionary management is the preferred alternative in the management plan. In the absence of conclusive biological information upon which to base a quota or other management approach, a two-day, per week period provides assurance that there is some uninterrupted spawning in areas where squid are present. Unlike a seasonal quota or seasonal closure, this measure spreads escapement of squid throughout the year, rather than concentrating it at the beginning or end.

Continuing squid research and fishery monitoring is also strongly encouraged. This includes sampling efforts conducted at ports statewide, requiring logbooks for all permitted vessels participating in commercial squid fishing, monitoring of catch information and continuation of independent research contracts, especially those focused on developing population models useful for management. Finally, in their draft plan, CDFG recommends the permit fee be increased to offset the costs of squid research and monitoring programs.

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10.0 Emerging Issues

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

10.1 Pacific Sardine

In April, 2003 the Council adopted an interim[2/] allocation framework that seeks optimal use of the annual Pacific sardine harvest guideline with minimal impacts on any sector of the West Coast sardine fishing industry and fishing communities. The CPSMT generally agreed that the impacts of the interim allocation scheme used to partition the Pacific sardine harvest guideline were primarily socioeconomic. However, the development of a long-term allocation framework would require that the biological-based implications of different allocation schemes be further evaluated to provide management guidance regarding how the operations of the sectoral fisheries might effect the dynamics of the sardine population at large. To this end, while coastwide the species is genetically homogenous, as pertains to a long time scale, it is divided into habitat groups which may be important to the contemporary management time horizon. Therefore, a more comprehensive analysis of alternative allocation frameworks in terms of long-term socioeconomic and biological impacts is warranted.

The biological questions relating to allocation and differential impacts on the coastwide resource from the Southern California, Northern California, and Pacific Northwest fishery sectors generally include:

- Impacts to the coastwide sardine resource from a fishery that targets older, mature fish.
- Impacts to the coastwide sardine resource from a fishery that targets younger, immature fish.
- Recent indications of changes in maturity rates (i.e., delayed maturity) in the southern fishery resulting from density-dependent factors.
- Potential refinements to the Pacific sardine assessment and/or harvest control rule in response to new biological information

To address these issues, future biological information will include NMFS research surveys off the Pacific Northwest (PNW). PNW research surveys occurred in July 2003 and March 2004, and are scheduled for similar periods during summer 2004 and winter 2005. Additional information will be available from a CPS stock assessment review scheduled for June 2004.

PNW research cruises are designed to conduct sardine acoustic trawl and Continuous Underway Fish Egg Sampler (CUFES) surveys off the coast of Oregon and Washington in summer and winter (acoustic-trawl only). Information from these surveys should fill major gaps in knowledge of sardine populations, by measuring the age structure and reproductive rates, and assessing the extent the fishery is dependent on migration and on local production of sardine. The objective of the surveys is to estimate the biomass present at these two times of the year, with the ratio of the two values

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2/ The interim measure will be in place for 2003, 2004, and conditionally for 2005.

providing an estimation of the relative proportion and size and age structure of the sardine stock that over-winters off the coast of Oregon and Washington.

A CPS STAR workshop is scheduled for June 2004. The goals and objectives for the CPS assessment and review process are: ensure that CPS stock assessments provide the kinds and quality of information required by all members of the Council family; satisfy the Magnuson-Stevens Act and other legal requirements; provide a well-defined, Council oriented process that helps make CPS stock assessments the "best available" scientific information and facilitates use of the information by the Council. In this context, "well-defined" means with a detailed calendar, explicit responsibilities for all participants, and specified outcomes and reports; emphasize external, independent review of CPS stock assessment work; increase understanding and acceptance of CPS stock assessment and review work by all members of the Council family; identify research needed to improve assessments, reviews, and fishery management in the future; and use assessment and review resources effectively and efficiently.

As data become available, this information, along with more robust economic information on producer profit and surplus, will be considered in crafting longer-term management alternatives for annual allocation of the Pacific sardine harvest guideline.

The current Harvest Control Rule (HCR) for Pacific sardine directly considers both environmentally- (e.g., sea-surface temperature, SST) and biologically-based (e.g., distribution of stock in U.S. waters) parameters that have received little scrutiny since the HCR went into with implementation of the CPS FMP in 1999. That is, the CPSMT recommends that this HCR be re-evaluated in efforts to: (1) get a better understanding of how recent estimates of productivity (particularly, this species' stock-recruitment relationship over the last decade) influence the current hypothesis regarding the relationship between absolute population abundance/distribution and oceanographic conditions (i.e., SSTs); and ultimately, (2) provide management the best available information for determining sustainable allocation strategies in the future.

10.2 Pacific Mackerel

At this time, emerging issues for Pacific mackerel are similar to those described for Pacific sardine. New assessment methodology for Pacific mackerel will be included in the June 2004 CPS STAR.

As the Pacific mackerel abundance estimate has decreased over the past several years, the CPSMT discussed overfishing concerns related to this fishery. Based on the current modeling approach and the harvest control rules in the fishery management plan (FMP), there is, currently, not a concern related to overfishing of Pacific mackerel. Historically, intermittent periods of high recruitment have supported relatively high amounts of fishing pressure. However, more recently, protracted periods of generally lower recruitment have contributed to lower levels of spawning stock and total biomass. Fishing pressure is largely influenced by availability of the resource to the fishery, as well as market factors. The U.S. West Coast Pacific mackerel fishery targets the mackerel in the northern parts of its overall range and in inshore waters. It is possible that mackerel abundance could be strong south of the U.S. border and/or in offshore waters beyond the range of the U.S. West Coast CPS fleet. Also, as in other CPS fisheries, market dynamics greatly influence total harvest. While mackerel is desirable it is not as important to the CPS fishery as Pacific sardine and market squid. In addition,

most commercial harvest of Pacific mackerel occurs within the area under limited entry as defined by the CPS FMP. Under the limited entry system, overall effort on Pacific mackerel is constrained by a cap on harvest capacity. Thus, given the reasons above, the level of fishing effort relative to mackerel abundance should not give rise to immediate concern. However, model estimates of the spawning stock and recruitment relationship indicate little to no reproductive-related compensation at low levels of spawning stock biomass. Thus, issues surrounding recruitment-based overfishing should be monitored closely.

Overfishing for Pacific mackerel is defined in the CPS FMP as harvest exceeding ABC for two concurrent years. Recent landings have been well below ABC. Also, the cutoff value in the harvest control rule serves as a proxy for determining if mackerel is overfished. The cutoff value equates to a biomass estimate of 18,200 mt. The current biomass estimate, 81,383 mt is well above the cut off value.

10.3 Market Squid: Development of Long-Term Monitoring/Analysis Schedule for Market Squid off California

Recently, it has been observed that the northern fishery that exploits the squid resource off California does not operate in a similar manner as observed in the southern fishery, e.g., patterns of fishing in the day vs. the night (see Sections 6.1.1 and 9.2.3) and gear-related impacts to squid egg beds on or near the ocean floor. The differences between the two fisheries may have considerable influence to the state-wide monitoring programs currently in place, as well as results generated from the assessment method recently adopted for this marine resource. This issue should not be considered a trivial one, given that due to limited amounts of sample information, the population analysis recently developed for this species (i.e., the Egg Escapement method, see Section 9.2.3) was strictly based on rather broad stock distribution assumptions. That is, the recent observations regarding differences in fishery operations north and south of Point Conception necessarily dictate more detailed data collection programs and subsequent analysis to ensure that spatio-temporal patterns related to the squid population(s) are considered when assessing the overall status of the exploited resource. In this context, over the next year, the CPSMT will discuss, develop, and bring forth to the Council a workable monitoring/analysis schedule that is based on more detailed (stratified spatially and temporally) analysis of the accumulated data to date. Since fall 2003, the SWFSC and CDFG have coordinated research efforts that involve simulation modeling that will generally focus on important biological reference points included in the Egg Escapement method, such as the relationship between reproductive-based thresholds and absolute population abundance levels for this species (see also Section 4.3.4). Preliminary results from this research should be available in early 2005.

10.4 Management Issues

Emerging management issues include market squid overfishing definition; international CPS fisheries;, review of CPS FMP environmental impact statement (EIS), including essential fish habitat provisions (EFH); and standardized bycatch reporting, including at-se observers in California-based CPS fisheries.

With respect to market squid, it appears that there is a need to address further the prospective use of the egg escapement value as a proxy for maximum sustainable yield and as a value for determining if the stock is overfished or is subject to overfishing (i.e., minimum stock size and maximum fishing mortality threshholds). Based on the most recent review for the annual NMFS Report to Congress on the status of fish stocks, NMFS notified the Council that the current FMP language is ambiguous. However, because NMFS is considering amendments to National Standard 1 Guidelines and changes could affect the way in which this issue might be addressed. Nonetheless, NMFS believes it would be prudent for the Council to direct the CPSMT to consider this issue and to be prepared to advise the Council as to possible revisions once any changes to the Guidelines have been proposed.

Second, 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. At the recent U.S.-Mexico bilateral meetings Mexico indicated a willingness to continue scientific data exchange and cooperation on research, and has expressed a willingness to engage in some discussions of coordinated management. Mexico suggested that the Trinational Sardine Forum would be a good venue for starting that discussion. Mexico also agreed to host a Mexico-U.S. scientific meeting to discuss CPS. The meeting is slated to take place in Mexico City, in October of 2004.

Third, an environmental impact statement (EIS) for the CPS fisheries management program was prepared with Amendment 8, which established the CPS FMP. That occurred more than 5 years ago. There have been major changes in the fishery since then. Therefore, it may be appropriate for the Council to initiate scoping to determine if a full EIS process is warranted for the next amendment to the CPS FMP. Moreover, NMFS has asked regional councils to review and assess the need for changes in essential fish habitat (EFH) designations under their fishery management plans. This review of EFH information likely would include the CPS FMP. Thus, it would seem prudent for the CPSMT to at least complete an initial reassessment to determine if there are any major problems with the current EFH designations.

Fourth, the CPS FMP may not currently fully comply with bycatch provisions of the Magnuson-Stevens Act. The States of Oregon and Washington have had observers on vessels indicating there is not a bycatch problem to the north, but very little field information is available for the California fishery. While CDFG port sampling suggests there is not a bycatch problem, port sampling alone is insufficient to demonstrate with assurance that there is not a bycatch problem. Therefore, NMFS is planning to place observers on some California-based CPS vessels in a pilot project intended to provide better information on the extent to which there is bycatch in this fishery. NMFS would work with the CPSMT to consider the need for additional field observations and possibly consider alternative ways to address any bycatch issues identified, as required by the Magnuson-Stevens Act.

Finally, recent reports from Ft. Bragg, California indicate interest in developing a small sardine fishery in Northern California, above 39° N lat. If this fishery were to occur it would be prosecuted in the open access area (i.e., outside of the limited entry fishery area). Under the current allocation framework, landings from this fishery would count against the northern subarea allocation. The CPSMT will continue to monitor this situation.

11.0 Research and Data Needs

There is an ongoing need to enhance current assessment procedures to meet the requirements of the FMP. Recent issues include (1) the 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.

The highest priority research and data needs for CPS are:

- Strengthen and broaden laboratory-related research activities in support of all CPS population assessments, i.e., federal research Centers (SWFSC) and state fishery agencies (WDFW, ODFW, and CDFG) will need additional support to meet ongoing work, as well as establish new research areas, as stipulated in current (and future) FMPs.

- 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.

- 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.

- Develop socioeconomic profiles and data bases for West Coast communities for which CPS make an important contribution to the local economy.

11.1 Pacific Sardine

The Trinational Sardine Forum (Mexico, U.S., and Canada) met again in 2003 to discuss issues related to the rapidly recovered sardine population and fishery along the West Coast of North America. The Forum has identified several issues for priority work. Issue 1 is developing cooperative relationships with the fishing industry to provide fishing vessel platforms for critical studies of the life history of sardine. Issue 2 is to standardize fishery-dependent data collection among agencies, particularly age and size data, and improve exchange of this data in summarized form to stock assessment scientists. Issue 3 is the need to assemble mutually compatible fishery assessments off of the West Coast of Mexico, U.S., and Canada to form a baseline of stock status

and variability of possibly more than one interbreeding stock of sardines, or a temperature-derived phenotype with radically heterogeneous population parameters influencing harvest guidelines. Coastwide sea surveys which include egg and adult samples are viewed as a top priority. Otolith microchemistry and DNA analyses are promising tools to improve our knowledge of sardine stock structure. The final report of the Trinational Forum 2003 will be available soon.

http://swfsc.ucsd.edu/frd/Trinational/text/lj-03-05.pdf

There is currently a need to formalize the Trinational Forum. This would provide a means to seek more secure funding and organizational support. The next meeting is scheduled for November 15.

11.2 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 (INP, 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 (e.g., IMECOCAL program). Access to this data would enable us to continue the historical CalCOFI time series, which begins 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 assessment and would strengthen the ability to accurately forecast age zero and total stock abundance for each coming fishing season.

Pacific mackerel biomass has been declining since the early 1980s, but recent El Niño events have concurrently extended their northern range to British Columbia. Pacific mackerel are caught incidentally in the Pacific whiting and salmon troll fisheries. Pacific mackerel are regularly caught in triennial survey trawls off the Pacific Northwest. A simple reporting system is needed to document incidental take of mackerel in fisheries to the north. Presence-absence information may allow us to detect southward movement or further decreases in biomass.

11.3 Market Squid

Currently, there exists only limited understanding of market squid population dynamics, which necessarily 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 6 to 7 months. However, at this time, there is considerable variability (uncertainty) surrounding many of these estimated parameters. In this context, the CPSMT strongly advises that extensive 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 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 newly-implement 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 essential fish habitat (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 (see Section 6.1.1). 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.

Currently, market squid fecundity estimates, based on the Egg Escapement Method (see Section 9.2.3), 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. Also, the CDFG logbook program should be maintained (and bolstered) for purposes of developing alternative tools for assessing the status of the resource. 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).

11.4 Live Bait Fishery

Although tonnage of CPS and 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 squid is 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 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 voluntary logbooks provided by some bait haulers, and estimates provided by the CPFV industry. Since the sale of live bait in California is not documented in a manner similar to that used for the commercial sale of CPS, estimates of tonnage and value are imprecise. No estimates of volume or value for the sale of market squid for live bait are available at this time.

11.5 Socio-Economic Data

Economic or social welfare evaluation of options for a long-term, north-south sardine allocation framework will entail a cost-benefit analysis focusing on the economic values of the incremental production of sardine products, under each allocation option as measured by changes in short-run profits or producer surplus (Regulatory Impact Review (RIR) requirement). This analysis will require detailed, representative cost and earnings data for the sardine harvesters and processors making up each fishery sector (Southern California, Northern California, and Pacific Northwest).

In addition to the social welfare considerations, the impact of allocation alternatives on the private profitability of harvesting and processing operations will also be evaluated (Regulatory Flexibility Act [RFA] requirement). Estimating the impacts on firm profitability entails a financial analysis based on the concept of private financial profit. The financial analysis would nonetheless rely on the same cost-earnings data required of the C-B analysis.

The economic impacts of options for a long-term, sardine allocation framework on CPS fishing communities will also be taken into account (community impacts, National Standard 8 requirement). Community impacts will be evaluated using various economic impact "multipliers" to gauge the

affects of allocation options on the level of economic activity within a particular area; i.e., if you increase/decrease sardine landings in a particular area, how much does the level of economic activity increase/decrease in that area. Some of the applicable multipliers are available in the Council's "Draft Communities Document" and from the West Coast Fisheries Economic Assessment Model. Others will have to be researched and developed from socioeconomic profiles and data bases compiled for West Coast communities in which CPS make an important contribution to the local economy.

12.0 Economic Status of Washington, Oregon, and California CPS Fisheries in 2003

This section summarizes economic data presented in the Economic Appendix – Economic Status of Washington, Oregon, and California CPS Fisheries in 2003. Pacific Coast landings of CPS totaled 118,800 mt in 2003, a 34% decrease from 2002. Market squid landings, all in California, were 41,078 mt in 2003, down 44% from 2002. Pacific sardine landings decreased in 2003 to 71,478 mt, down 6% from 2002. The exvessel value of 2003 CPS landings was $32.4 million in 2003, up 5% from 2002 (2002 converted to 2003 dollars). Market squid accounted for 35%, and Pacific sardine 60% of total landings in 2003. Landings of Pacific mackerel increased 13%, and landings of northern anchovy fell 63% from 2002 to 2003. Real exvessel market squid revenues (2003 $) increased 29% from 2002; decreased landings were accompanied by a 129% increase in exvessel price from $255 to $583 per mt (2003 $). Aggregate CPS finfish landings decreased 27% from 2002; exvessel revenue dropped 31% and the overall finfish exvessel price fell 5%. In 2003, market squid made up slightly over 7% of the exvessel value of total Pacific Coast landings, and CPS finfish accounted for almost 3%. California accounted for 68% of coastwide CPS landings in 2003, down from 77% in 2002.

California sardine landings were 34,300 mt in 2003 down 41% from 2002, 58,353 mt. Market squid ranked second in exvessel value among California commercial fisheries in 2003, with exvessel revenue of, $23,943,030, 32% less than that for Dungeness crab, the most valuable California fishery in 2003. Landings of Pacific sardine ranked eighth highest in California exvessel value in 2003 at $2,939,372.

Pacific sardine landings in Oregon increased 9% in 2003, from 23,126 mt in 2002 to 25,258 mt. Sardine generated $2,944,988 in exvessel revenue for Oregon in 2003, 4% of total exvessel revenue, ranking it eighth behind Dungeness crab in total exvessel value. Washington landings of Pacific sardine decreased 25% from 15,933 mt in 2002 to 11,920 mt. With an exvessel revenue of $1,469,888, 1% of the Washington total in 2003, sardine ranked 13th behind Dungeness crab in exvessel value.

Oregon landings of P. mackerel fell to 160 mt from 248 mt in 2002. Washington landings of mackerel decreased from 248 mt to 54 mt and anchovy landings fell from 229 mt to 214 mt from 2002 to 2003.

In 2003, the number of vessels with Pacific Coast landings of CPS finfish was 179, down from 198 in 2002. With the decrease in vessels and a decrease in total CPS finfish landings, finfish landings per vessel, 434 mt in 2003, decreased 19% from 2002. Of the CPS finfish vessels active in 2003, 19% depended on CPS finfish for the largest share of their 2003 exvessel revenues. From 2002 to 2003, the number of vessels with Pacific Coast landings of market squid decreased from 207 to 187, with 37% of these vessels dependent on market squid for the largest share of their total 2003 exvessel revenue. Market squid landings were 219 mt per vessel in 2003, down 37% from 2002. Market squid total revenue shares for vessels that depend mainly on market squid have been higher on average than average finfish total revenue shares for vessels that depend primarily on CPS finfish over the period 1981-2003, 74% vis a vis 63%, suggesting that market squid vessels tend to be more specialized than CPS finfish vessels. Roundhaul gear accounted by far for the largest share of total CPS landings in 2003, 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 Oregon-Washington Columbia River port areas. The exvessel markets for market squid are mainly in the Los Angeles, Santa Barbara-Ventura and Monterey.

In 2003, 21,954 mt of market squid were exported through West Coast customs districts with an export value of $29 million; a 67% decrease in quantity, and a 45% decrease in the real value of West Coast market squid exports from 2002. The primary country of export was China, 47% of the total, which received 10,385 mt, 65% less than the quantity exported to China in 2002. Eighty percent of market squid exports went to China and four additional countries: Japan (4,111 mt), Greece (1,589 mt), Mexico (1,320 mt), and Spain (1,030 mt). Domestic sales were generally made to restaurants, Asian fresh fish markets or packaged for use as frozen bait.

Seventy-eight percent, 56,080 mt, of Pacific sardine landings were exported in 2003, down 5% from 2002; most of the remaining landings were consumed domestically as canned Pacific sardine. Pacific sardine exports were valued at $40.7 million in 2003, up 12% from 2002. Almost 76% of Pacific sardine exports were in the frozen form, the balance was in the preserved form. Japan was the primary export market in 2003, receiving 27,902 mt, 50% of total exports, down 9% from 2002. Australia was second with 8,719 mt, 16% of the total a 10% drop from 2001. Japanese demand for Pacific sardine is for both human consumption and use as bait in its longline fisheries. West Coast Pacific sardine exports to Australia are primarily for feed in Australia's bluefin tuna farming operations.

In 2003 approximately 80% of the Oregon and Washington sardine exports were to Japan for human consumption or for longline bait. Only the highest quality sardine is eligible for use in the longline fishery. The amount destined for human consumption is expected to grow as additional food markets are developed, and the longline bait market becomes saturated. A very small amount of Pacific northwest sardine was sold for the domestic human consumption market (i.e., restaurants in Portland).

California sardine landings declined in 2003 due to a variety of factors. These included weather limitations, the continued presence of small fish on the grounds during most of the year, and the virtual absence of fish from both Monterey and southern California in November, an anomalous phenomenon occurring at a time when larger fish are usually available. In addition, an extended domoic acid advisory statewide beginning May 18, and another advisory in Monterey in September, curtailed sales of non-eviscerated sardine for human consumption and animal food. Exports to Australia declined due to a significant increase in the quota for Australian sardine fishery. However, California exports for human consumption and bait increased to Japan, South America, the Philippines, China and the EU. Demand for sardines increased in Japan, due to reduced production from their domestic fishery.

Pacific mackerel landings increased in the 2002-2003 fishery to 4,602 mt, virtually all caught in Southern California Large mackerel appeared in Southern California landings in August and September; mackerel dominated CPS landings in Southern California in September, with sardines an incidental catch. Southern California mackerel was exported primarily for human consumption

to markets worldwide, with a smaller amount destined for tuna feed and bait. About 20 percent of Southern California mackerel exports went to South American countries, 25 percent went to Europe, 15 percent went to the Philippines for canning and 29 percent to Australia.

California landed 1,495 mt of Northern anchovy in 2003, with 747 mt from Southern California. Southern California anchovy was utilized primarily for bait purposes in domestic and export markets.

Table 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 U.S. Secretary of Commerce (Secretary) in June of 1978. Regulations implementing the FMP were published in the *Federal Register* on September 13, 1978 (43*FR*40868). Subsequently, the Council has considered seven amendments.

- The first amendment changed the method of specifying the domestic annual harvest for Northern anchovy and added a requirement for an estimate of domestic processing capacity and expected annual level of domestic processing. Approval for this amendment was published in the *Federal Register* on July 18, 1979 (44*FR*41806).

- The second amendment, 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 optimum yield (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. In addition, the fifth amendment included changes to a variety of other management measures. Two or more alternative actions were considered in each of seven general categories; (1) OY and harvest quotas; (2) season closures; (3) area closures; (4) quota allocation between areas; (5) the reduction quota reserve; (6) minimum fish size or mesh size; and (7) foreign fishing and joint venture regulations. The alternatives for the fifth amendment were reviewed by the Council during 1983. The final rule 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, Southwest Region, 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 CPSPDT to amend the FMP for Northern anchovy to conform to the recently revised Magnuson-Stevens Fishery Conservation and Management Act and to expand the scope of the FMP to include the entire CPS fishery. Amendment 8 was partially approved by the U.S. Secretary of Commerce 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 Coastal Pelagic Species Management Team (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 Coastal Pelagic Species Advisory Subpanel 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 Scientific and Statistical Committee (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 will prepare a separate amendment that addresses OY and MSY for squid.

- The Secretary of Commerce approved Amendment 9 on March 22, 2001.

- In April 2001, the Council adopted the capacity goal and transferability provisions recommended by the CPSMT for inclusion in Amendment 10. The Council directed the CPSMT to develop an amendment to the CPS FMP that will include 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 will also address determination of OY and MSY for market squid.

- In November 2001, the Council reviewed the findings of the market squid stock assessment review (STAR) workshop and endorsed the egg escapement approach as a proxy for squid MSY, as recommended by the market squid STAR Panel and CPSMT.

- In March 2002, the Council adopted draft Amendment 10 to the CPS FMP for public review.

- In June 2002, the Council adopted Amendment 10 to the CPS FMP.

- December 30, 2002, the Secretary of Commerce 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 harvest guideline 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 harvest guideline 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 problems.

- 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 coast wide. 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 harvest guideline were at least 90% of the 2003 harvest guideline.

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

Table 2. Regulatory Actions

January 25, 2000. NMFS published harvest guidelines for Pacific sardine and Pacific mackerel for the fishing year beginning January 1, 2000. A harvest guideline of 186,791 mt was established for Pacific sardine, based on a biomass estimate of 1,581,346 mt. The harvest guideline was allocated for Subarea A, which is north of 35° 40' N latitude (Point Piedras Blancas) to the Canadian border, and for Subarea B, which is 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 harvest guideline was in effect until December 31, 2000, or until it was reached and the fishery closed. A harvest guideline of 42,819 mt was established for Pacific mackerel based on a biomass estimate of 239,286 mt. The harvest guideline 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 harvest guideline for Pacific mackerel in the exclusive economic zone (EEZ) off the Pacific Coast. Based on the estimated biomass of 116,967 mt and the formula in the FMP, a harvest guideline of 20,740 mt was calculated for the fishery beginning on July 1, 2000. This harvest guideline 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 harvest guideline for Pacific mackerel based on a formula in the FMP and to close the fishery when the harvest guideline is reached. The harvest guideline of 20,740 mt is projected to be reached before the end of the fishing season on June 30, 2001, which requires closing the directed fishery and setting an incidental harvest limit for Pacific mackerel so that the harvest of other coastal pelagic species will not be further restricted. The intended effect of this action is 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 will be closed October 27, 2000, after which time no more than 20% by weight of any landing of Pacific sardine may 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, make the following correction: 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% 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 harvest guideline for Pacific sardine in the EEZ off the Pacific Coast for the January 1, 2001, through December 31, 2001, fishing season. This harvest guideline has been calculated according to the regulations implementing the FMP. The intended effect of this action is 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 harvest guideline of 134,737 mt was calculated for the fishery beginning January 1, 2001. The harvest guideline 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. Any unused resource in either area will be reallocated between areas to help ensure that the optimum yield will be achieved. The northern allocation is 44,912 mt; the southern allocation is 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% by weight of Pacific mackerel in landings of Pacific sardine, northern anchovy, jack mackerel, and market squid remains in effect; however, CPS fishermen may land up to 1 mt of Pacific mackerel even if they land no other species from the trip. Non-CPS fisherman may land no more than 1 mt of Pacific mackerel per trip. After the harvest guideline of 20,740 mt is reached, all landings of Pacific mackerel will be restricted to 1 mt per trip. This action is authorized by the FMP and is intended to ensure that the fishery achieves, but does not exceed, the harvest guideline while minimizing the economic impact on small businesses. For the reasons stated here, no fishing vessel may land more than 1 mt of Pacific mackerel per fishing trip, except that fishing vessels with other CPS on board may land more than 1 mt of Pacific mackerel in a fishing trip if the total amount of Pacific mackerel on board the vessel does not exceed 20% 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 harvest guideline for Pacific mackerel based on a formula in the FMP and to close the fishery when the harvest guideline is reached. The harvest guideline of 20,740 mt has been reached. Following this date no more than 1 mt of Pacific mackerel may be landed from any fishing trip. The effect of this action is to ensure conservation of the Pacific mackerel resource. (66*FR*17373)

July 25, 2001. NMFS announced a harvest guideline 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% of Pacific mackerel in a landing of any coastal pelagic species. If a significant amount of the harvest guideline 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 harvest guideline'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 harvest guideline 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% 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 harvest guideline 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 harvest guideline for Pacific sardine for the fishing season beginning January 1, 2002. A harvest guideline of 118,442 mt was established for Pacific sardine based on a biomass estimate of 1,057,599 mt. The harvest guideline is allocated for Subarea A, which is north of 35° 40' N latitude (Point Piedras Blancas) to the Canadian border, and for Subarea B, which is 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 harvest guideline 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 harvest guideline remains unharvested (6,585 mt). Therefore, the incidental catch allowance that has been in effect since November 21, 2001 is removed, and any landing of Pacific mackerel may consist of 100% Pacific mackerel. This action was taken to help ensure that the harvest guideline is attained. If the harvest guideline is projected to be reached before June 30, 2002, the directed fishery will be closed and an appropriate incidental landing restriction imposed. (67*FR*16322)

July 11, 2002. NMFS proposed a regulation to implement the annual harvest guideline for Pacific mackerel in the EEZ off the Pacific Coast. The CPS FMP and its implementing regulations require NMFS to set an annual harvest guideline 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 harvest guideline of 12,456 is proposed for the fishery beginning on July 1, 2002, and continue through June 30, 2003, unless the harvest guideline is 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 will remain in effect until the reallocation of the remaining portion of the coast wide harvest guideline is required by the CPS FMP. That reallocation is expected to occur on or about October 1, 2002. The purpose of this action is 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 harvest guideline in the U.S. EEZ off the Pacific Coast. The CPS FMP requires 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 harvest guideline, with 50% 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 reallocates the remainder of the harvest guideline 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, that would result from delaying the reallocation. (67*FR*60601)

October 3, 2002. NMFS issued a regulation to implement the annual harvest guideline for Pacific mackerel in the EEZ off the Pacific Coast. The CPS FMP and its implementing regulations require NMFS to set an annual harvest guideline for Pacific mackerel based on the formula in the FMP. This action is to conserve Pacific mackerel off the Pacific Coast. Based on the estimated biomass of 77,516 mt and the formula in the FMP, a harvest guideline of 12,456 is proposed for the fishery

beginning on July 1, 2002, and continue through June 30, 2003, unless the harvest guideline is attained and the fishery closed before June 30. There will be a directed fishery of at least 9,500 mt, and 3,035 mt of the harvest guideline will be utilized for incidental landings following the closure of the directed fishery. After closure of the directed fishery, no more than 40% by weight of a landing of Pacific sardine, northern anchovy, jack mackerel, or market squid may consist of Pacific mackerel, except that up to 1 mt of Pacific mackerel may be landed without landing any other CPS. The fishery will be monitored, and if a sufficient amount of the harvest guideline remains before June 30, 2003, the directed fishery will be reopened. The goal is to achieve the harvest guideline 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 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 purpose of this proposed rule is to establish the procedures by which limited entry permits can 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 are achieved. (67*FR*66103)

November 25, 2002. NMFS proposed a regulation to implement the annual harvest guideline for Pacific sardine in the U.S. EEZ off the Pacific Coast for the fishing season January 1, 2003, through December 31, 2003. This harvest guideline 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 harvest guideline of 110,908 mt was determined for the fishery beginning January 1, 2003. The harvest guideline 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 harvest guideline for Pacific sardine in the U.S. EEZ off the Pacific Coast for the fishing season January 1, 2003, through December 31, 2003. This harvest guideline 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 harvest guideline of 110,908 mt was determined for the fishery beginning January 1, 2003. The harvest guideline is allocated one-third for Subarea A, which is north of 35° 40' N latitude (Point Piedras Blancas, California) to the Canadian border, and two-thirds for Subarea B, which is south of 35° 40' North latitude to the Mexican border. The northern allocation is 36,969 mt; the southern allocation is 73,939 mt. If an allocation or the harvest guideline is reached, up to 45% by weight of Pacific sardine may 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 of Commerce. 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 is to establish the procedures by which

limited entry permits can 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 are 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 is 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 harvest guideline for Pacific mackerel in the EEZ off the Pacific coast. The CPS FMP and its implementing regulations require NMFS to set an annual harvest guideline 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 harvest guideline in the EEZ off the Pacific Coast. On September 1, 2003, 59,508 mt of the 110,908 mt harvest guideline is expected to remain unharvested. The CPS FMP requires that a review of the fishery be conducted and any uncaught portion of the harvest guideline 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 is allocated to Subarea A and 47,600 mt is allocated to Subarea B. The intended effect of this action is to ensure that a sufficient amount of the resource is 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 harvest guideline 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 harvest guideline for Pacific mackerel based on the formula in the FMP. Based on this approach, the biomass for July 1, 2003, is 68,924 mt. Applying the formula in the FMP results in a harvest guideline of 10,652 mt, which is lower than last year but similar to low harvest guidelines 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 is 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 harvest guideline for Pacific sardine in the U.S. EEZ off the Pacific coast for the fishing season January 1, 2004, through December 31, 2004. This harvest guideline 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 harvest guideline 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 adopts a harvest guideline and initial subarea allocations for Pacific sardine off the Pacific coast that have been 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 harvest guideline for Pacific sardine in U.S. waters for January 1, 2004, through December 31, 2004 is 122,747 mt. The biomass estimate is slightly higher than last year's estimate; however, the difference between this year's biomass is not statistically significant from the biomass estimates of recent years. Under the FMP, the harvest guideline is allocated one-third for Subarea A, which is north of 39° N latitude (Pt. Arena, California) to the Canadian border, and two-thirds for Subarea B, which is 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)

Table 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. (2 Pages)

Vessel Name	CG Number	Year Built	Vessel Age	Registered Measurements (ft.)[1] Length	Breadth	Depth	Calculated Vessel GT[2]	Permit Specifications Number	GT Endorsement	GT Transfer Allowance[3]
Misty Moon	D578511	1976	28	49.60	19.00	10.10	63.8	1	63.8	70.2
Paloma	D280452	1960	44	47.40	16.50	8.30	43.5	2	43.5	47.9
St. George II	D238969	1939	65	71.40	21.20	9.70	98.4	3	98.4	108.2
Barbara H	D643518	1981	23	64.90	24.00	11.60	121.1	4	121.1	133.2
San Antonio	D236947	1937	67	72.10	19.50	8.70	82.0	5	82.0	90.2
Permit No Longer Exists	---	---	---	---	---	---	---	6	---	---
San Pedro Pride	D549506	1973	31	79.60	24.50	12.30	160.7	7	160.7	176.8
Ferrigno Boy	D602455	1978	26	69.60	23.70	12.60	139.3	8	139.3	153.2
King Philip	D1061827	1997	7	79.00	26.00	11.40	156.9	9	156.9	172.6
Sea Wave	D951443	1989	15	78.00	22.00	18.00	206.9	10	206.9	227.6
Mary Louise	D247128	1944	60	58.30	18.00	8.00	56.2	11	56.2	61.8
Bainbridge	D236505	1937	67	78.60	22.70	9.60	114.8	12	114.8	126.3
Pioneer	D246212	1944	60	77.80	24.30	11.20	141.9	13	141.9	156.1
Maria	D236760	1937	67	70.70	20.50	9.2	89.3	14	89.3	98.2
St. Joseph	D633570	1981	23	62.90	22.00	9.1	84.4	15	84.4	92.8
Permit No Longer Exists	---	---	---	---	---	---	---	16	---	---
Retriever	D582022	1977	27	54.20	19.6	8.70	61.9	17	61.9	68.1
Atlantis	D649333	1982	22	49.60	19.00	10.10	63.8	18	63.8	70.2
G. Nazzareno	D246518	1944	60	78.00	22.70	10.50	124.6	19	124.6	137.1
Sea Queen	D582167	1974	30	68.40	22.00	11.10	111.9	20	111.9	123.1
Pacific Leader	D643138	1981	23	59.50	21.00	9.20	77.0	21	77.0	84.7
Chovie Clipper	D524626	1970	34	51.10	18.00	10.30	63.5	22	63.5	69.9
Pacific Journey [4]	OR 661 ZK	2001	3	64.30	22.01	10.3	97.7	23	97.7	107.5
Ocean Angel I	D584336	1977	27	49.60	19.00	10.1	63.8	24	63.8	70.2
Maria T	D509632	1967	37	57.30	18.10	9.8	68.1	25	68.1	74.9
Manana	D253321	1947	57	40.10	13.20	6.70	23.8	26	23.8	26.2
Miss Juli [5]	---	---	---	---	---	---	---	27	55.5	61.1
Mineo Bros.	D939449	1989	15	58.00	21.00	9	73.4	28	73.4	80.7
Sea Queen	D583781	1977	27	49.00	16.00	8.00	42.0	29	42.0	46.2
Little Joe II	D531019	1971	33	50.10	16.00	7.60	40.8	30	40.8	44.9
Caitlin Ann	D960836	1990	14	98.00	33.00	15.70	340.2	31	340.2	374.2
Eldorado	D690849	1985	19	56.00	17.00	8.60	54.9	32	54.9	60.4
Kristen Gail	D618791	1980	24	87.00	26.00	12.80	194.0	33	194.0	213.4
Fiore D'Mare	D550564	1973	31	71.50	23.00	11.40	125.6	34	125.6	138.2
Endurance	D613302	1979	25	49.00	16.00	8.00	42.0	35	42.0	46.2
New Sunbeam	D284470	1961	43	50.30	20.00	4.00	27.0	36	27.0	29.7
Calogera A	D984694	1992	12	57.75	21.00	10.50	85.3	37	85.3	93.8
Eileen	D252749	1947	57	79.40	22.10	10.20	119.9	38	119.9	131.9
Pamela Rose	D693271	1985	19	54.00	19.00	9.00	61.9	39	61.9	68.1
New Stella	D598813	1978	26	58.00	22.00	8.40	71.8	40	71.8	79.0
Traveler	D661936	1983	21	56.00	17.00	6.90	44.0	41	44.0	48.4
Lucky Star	D295673	1964	40	49.90	17.00	7.30	41.5	42	41.5	45.7
Ocean Angel II	D622522	1980	24	74.50	28.00	10.70	149.5	43	149.5	164.5
Mello Boy	D1061917	1997	7	66.00	26.00	12.00	138.0	44	138.0	151.8
Trionfo	D625449	1980	24	63.80	19.30	9.60	79.2	45	79.2	87.1
Corva May [6]	D615795	1979	25	49.60	19.00	10.10	63.8	46	85.0	93.5
Heavy Duty	D655523	1983	21	58.00	21.30	10.20	84.4	47	84.4	92.8
Aliotti Bros	D685870	1985	19	67.60	26.00	9.10	107.2	48	107.2	117.9
Lady J	D647528	1982	22	50.30	17.00	7.10	40.7	49	40.7	44.8
Anna S	D253402	1947	57	50.80	16.20	9.1	50.2	50	50.2	55.2
Endeavor	D971540	1990	14	57.40	19.00	9.9	72.3	51	72.3	79.5
Antoinette W	D606156	1978	26	45.40	16	7.6	37.0	52	37	40.7
Donna B	D648720	1982	22	73.20	25.00	12.9	158.2	53	158.2	174.0
Papa George	D549243	1973	31	72	22.8	11.5	126.5	54	126.5	139.2

Vessel Name	CG Number	Year Built	Vessel Age	Registered Measurements (ft.)[1] Length	Breadth	Depth	Calculated Vessel GT[2]	Permit Specifications Number	GT Endorsement	Transfer Allowance[3]
Mercurio Bros	D650376	1982	22	42.00	16.70	8.60	40.4	55	40.4	44.4
Kathy Jeanne	D507798	1967	37	65.90	22.20	8.80	86.3	56	86.3	94.9
Merva W	D532023	1971	33	56.70	17.90	8.00	54.4	57	54.4	59.8
Santa Maria	D236806	1937	67	79.20	19.50	8.80	91.1	58	91.1	100.2
Buccaneer	D592177	1978	26	62.10	19.90	9.00	74.5	59	74.5	82.0
Midnight Hour	D276920	1958	46	61.10	18.00	8.60	63.4	60	63.4	69.7
Nancy B II	D542513	1972	32	56.40	18.00	8.80	59.9	61	59.9	65.9
Miss Kristina	D580843	1977	27	50.00	16.00	7.40	39.7	62	39.7	43.7
Emerald Sea	D626289	1980	24	62.70	26.00	7.90	86.3	63	86.3	94.9
Connie Marie	D624240	1980	24	49.90	17.90	9.10	54.5	64	54.5	60.0
Theresa Marie	D629721	1980	24	40.60	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 Pacific Journey was built in Canada and is not currently registered with the U.S. Coast Guard. Measurements by marine surveyor Det Norske Veritas.

/5 Miss Juli sank in 2001 and is pending replacement.

/6 Permit #46 was transferred to Corva May after the Jenny Lynn sank in 2003.

Table 4. Vessel age and calculated GT for the initial and current limited entry fleet.

	Initial Fleet	Current Fleet
Number of Vessels	65	62
Average Vessel Age	35 yrs	32 yrs
Range of Ages	12 - 66 yrs	3 - 67 yrs
Average GT	71.3	88.1
Range of GT	12.8 - 206.9	23.8 - 340.2
Sum of Fleet GT	4635.9	5462.9
Capacity Goal (GT)/1	—	5650.9
Transferability Trigger	—	5933.5

/1 Established in Amendment 10 to the CPS FMP.

Table 5. Number of comm. landings sampled by CDFG port sampling program, 1985-2003.

Year	Sardine Landings	Mackerel Landings	Total Landings
2003	151	74	225
2002	137	94	231
2001	172	89	261
2000	110	85	195
1999	157	70	227
1998	97	97	194
1997	113	116	229
1996	96	85	181
1995	254	215	469
1994	119	167	286
1993	85	183	268
1992	231	113	344
1991	169	42	211
1990	99	233	332
1989	149	451	600
1988	190	385	575
1987	128	510	638
1986	105	440	545
1985	40	333	373

Table 6. Incidental catch from landings sampled by the CDFG port sampling program, 1992-1999. (Information represents occurrence of incidental catch, not numbers or weights of fish.)

Yr	Anchovy	Jacksmelt	Herring	White Croaker	M. Squid	Lingcod	Pac Mack	Y-tail	Jack Mackerel	Y-fin Tuna	Skipjack Tuna	Total
99	5	1	1									7
98	3		2	1	4							10
97	1		1		44							46
96	8			1	22	1						32
95	5		1		71		1	1	1			80
94			1									1
93												--
92					1					1	1	3

Table 7a. Incidental catch recorded by CDFG samplers in Los Angeles County, California, 2001.

Fishes	Incidents	Elasmobranchs	Incidents	Invertebrates,	Incidents
Halibut	8	P. electric ray	2	Kelp	50
Bonito	1	"Sand shark"	1	Crab	7
Sablefish	3	Spiny dogfish	1	Sea cucumber	2
Cusk eel	4	Smoothhound	1	"Debris"	1
Kelp bass	1	"Shark"	1	Kelp fronds	1
Sand bass	2	Sevengill shark	1	Lobster	3
Flyingfish	1	Bat ray	22	Plastic bottle	1
Lizardfish	6	"Skates"	4	Sea star	2
Tonguefish	3	Thornback	4	"Sea weed"	4
Sardine	13	Horn shark	4	Snail	1
"Flatfish"	33	Swell shark	1	Squid	16
Butterfish	5	Stingray	2	Squid eggs	1
Pompano	1				
Barracuda	5				
Midshipman	13				
Senorita	1				
"Bass"	1				
Anchovy	10				
Jacksmelt	4				
White croaker	19				
Pacific mackerel	21				
Jack mackerel	29				
California	26				
Total	210	Total	44	Total	89

Table 7b. Incidental catch recorded by CDFG samplers in Los Angeles County, California, 2002.

Fishes	Incidents	Elasmobranchs	Incidents	Invertebrates, Vegetation and Garbage	Incidents
Anchovy, northern	13	Guitarfish, shovelnose	1	Crab, pelagic red	6
Barracuda, California	2	Ray, bat	20	Crab, shells	1
Bass, barred sand	5	Ray, CA butterfly	1	Crab, unsp. Rock	3
Bass, kelp	2	Ray, Pacific electric	3	Cucumber, sea	3
Bonito, Pacific	1	Ray, round stingray	1	Eelgrass	3
Butterfish	11	Shark, brown smoothhound	1	Gorgonians	1
Corbina, California	5	Shark, gray smoothhound	1	Jellyfish	1
Croaker, white	24	Shark, Pacific angel	1	Kelp	67
Croaker, yellowfin	1	Shark, unspecified	1	Lobster, California spiny	3
Cusk-eel	9	Skate, thornback	5	Octopus, unspecified	3
Eel, Yellow Snake	1	Skate, unspecified	2	Pleurobranch	1
Flatfish, unspecified	29			Prawn, spot	1
Flyingfish	2			Salps	19
Halibut, California	6			Sea stars	2
Herring, round	1			Squid egg cases	1
Jacksmelt	3			Squid, market	35
Lizardfish, California	9				
Midshipman, plainfin	13				
Sanddab	1				
Scorpionfish, California	26				
Seabass, giant (black)	1				
Senorita	1				
Sole, bigmouth	1				
Sole, fantail	1				
Surfperch, pink	2				
Surfperch, unspecified	1				
Tonguefish	3				
Topsmelt	1				
Turbot, curlfin	1				
Turbot, diamond	1				
Turbot, hornyhead	3				
Whitefish, ocean	1				
Total incidents	181	Total incidents	37	Total incidents	150

Table 7c. Incidental catch recorded by CDFG samplers in Los Angeles County, California, 2003.

Fishes	Incidents	Elasmobranchs	Incidents	Invertebrates, Vegetation and Garbage	Incidents
Anchovy, northern	15	Guitarfish,	9	Crab, shells	1
Barracuda, California	0	Ray, bat	34	Crab, unsp. Rock	3
Bass, barred sand	5	Ray, round stingray	5	Cucumber, sea	4
Bass, kelp	5	Skate, thornback	13	Eelgrass	4
Bonito, Pacific	0			Jellyfish	2
Butterfish	10			Crab, shells	1
Corbina, California	0			Crab, elbow	1
Croaker, white	27				
Combfish, longspine	1				
Cusk-eel	5				
Eel, Yellow Snake	1				
Flatfish, unspecified	10				
Flyingfish	2				
Halibut, California	26				
Herring, round	0				
Jacksmelt	1				
Lizardfish, California	4				
Midshipman, plainfin	16				
Midshipman,	2				
Sanddab	8				
Scorpionfish, California	36				
Tonguefish	4				
Turbot, curlfin	1				
Turbot, diamond	1				
Turbot, hornyhead	16				
Total incidents	196		61		16

Table 7d. Incidental catch recorded by CDFG port samplers in Monterey, California, 2003.

Finfish	Incidents	Elasmobranchs	Incidents	Invertebrates and Vegetation	Incidents
Mackerel, Pacific	8	Shark, shortfin mako	2	Squid	3
Jack mackerel	2	Bat Ray	2	Sea Star	3
Butterfish	3	Ray, Pacific electric	2	Crab, Dungeness	5
Anchovy, northern	2	Skate, unspecified	2	Rock Crab, unsp.	1
Herring, Pacific	2	Skate, Big	2	Kelp	2
Jacksmelt	4	Skate, California	1	Jellyfish	3
Smelt, whitebait	3	Thornback Skate	4	Squid Egg Cases	1
Sole, unsp	1	Shark, gray smoothhound	1	Crab, slender	2
Sole, Sand	10			Crab, Decorator	1
CA Halibut	6				
Sanddab	6				
Sanddab, Pacific	1				
Flounder, starry	2				
Turbot	2				
CA Scorpionfish	1				
Sculpin, staghorn	2				
Shad, American	1				
White Croaker	9				
Eel, wolf	1				
Sturgeon, unsp.	1				
Surfperch, unsp.	2				
Total Incidents	69		16		21

Table 8a. Market squid incidental catch for 2002. Incidental catch includes species landed with market squid and recorded on landing receipts (round haul gear).

Species name	Number of Landings	Tons
Pacific sardine	107	1601.6
Northern anchovy	16	342.6
Pacific mackerel	15	71.2
Jack Mackerel	15	16.5

Table 8b. Market squid incidental catch for 2003. Incidental catch includes species landed with market squid and recorded on landing receipts (round haul gear).

Species name	Number of Landings	Tons
Pacific sardine	109	1447.9
Northern anchovy	8	91.9
Pacific mackerel	16	163.2
Jack Mackerel	14	33.6
Jacksmelt	1	1.9
Surfperch	1	0.1

Table 8c. 2002 - Percent frequency of bycatch in observed loads of California market squid.

Common Name	Total All Ports	Monterey/ Moss Landing	Santa Barbara/San Pedro/ Ventura	Terminal Island
Algae, marine	0.2			0.7
Anchovy, northern	4.8	3.8	0	5.9
Barnacle	0.2	0		0.7
Butterfish (Pacific pompano)	4.1	5.1	0	3.9
Cabezon	0.4	0.6		0.7
Crab, Dungeness	2.2	6.4		0
Crab, pelagic red	0.2	0		0.7
Crab, rock unspecified	0.4	0		1.3
Croaker, white	0.7	0		2
Fish, unspecified	0.9	0		2.6
Guitarfish, shovelnose	0.2	0		0.7
Herring, Pacific	0.4	1.3		0
Invertebrates, colonial	15.2	44.2		0.7
Jacksmelt	2.6	7.7		0
Kelp	15.2	14.1	0.1	20.3
Mackerel, jack	5.2	6.4	0	5.9
Mackerel, Pacific	8.9	1.3	0.1	13.1
Midshipman, plainfin	0.2	0		0.7
Mussel	0.2	0		0.7
Ray, bat	1.5	1.9	0	2
Ray, Pacific electric	1.7	5.1		0
Ray, unspecified	0.2	0.6		0
Rockfish, bocaccio	0.4	1.3		0
Rockfish, unspecified	0.2	0.6		0
Salmon, chinook	1.3	3.8		0
Sanddab	2.2	0.6	0.1	0.7
Sanddab, Pacific	0.2	0.6		0
Sardine, Pacific	26	12.2	0.3	32.7
Saury, Pacific	0.4	1.3		0
Sea Anemone	0.2	0.6		0
Scorpionfish, California	0.9	0		2.6
Sea stars	0.9	0	0	2
Shark, horn	0.4	0	0	0.7
Sole, bigmouth	0.2	0		0.7
Sole, English	0.2	0.6		0
Sole, unspecified	0.4	0	0	0.7
Squid, mrkt (egg capsules)	8	18.6	0	3.3
Stingray, round	0.2	0	0	0
Stingray, unspecified	0.2	0		0.7
Surfperch, pink	0.2	0		0.7
Surfperch, unspecified	0.2	0.6		0
Triggerfish	0.2	0		0.7
Turbot, curlfin	0.2	0		0.7
Turbot, diamond	0.2	0		0.7
Turbot, hornyhead	0.2	0		0.7
Turbot, unspecified	0.2	0.6		
Total number of samples	394	85	117	192

Table 8d. 2003 - Percent freq. of bycatch in observed loads of CA market squid. (2 pages)

Common Name	Total All Ports	Monterey/ Moss Landing	Santa Barbara/ Ventura	San Pedro/ Terminal Island
Anchovy, northern	8.1	8.2	6	9.4
Barracuda, California	0.3			0.5
Bass, barred sand	0.3			0.5
Blacksmith	0.5			1
Bonito, Pacific	0.3			0.5
Butterfish (Pacific pompano)	5.3	10.6	4.3	3.6
Cabezon	0.3			0.5
Crab, Dungeness	2.8	12.9		
Crab (purple globe)	0.5			1
Crab (sheep)	0.8			1.6
Crab Shells	0.8			1.6
Crab, box	0.3			0.5
Crab, rock unspecified	0.5			1
Croaker, white	0.5			1
Decorator crab	0.3			0.5
Eel Grass	1.5			3.1
Flyingfish	0.8			1.6
greenling,painted	0.3			0.5
Halibut, California	1.5	2.4		2.1
Hermit crab	0.3			0.5
Herring, Pacific	0.5	2.4		
Herring, round	0.3			0.5
Invertebrates, colonial	3.6	14.1		1
Jacksmelt	4.8	18.8		1.6
Jellyfish	8.1	35.3		1
Kelp	23.4	10.6	14.5	34.4
Kelp Surfperch	0.3			0.5
Lizardfish, California	0.5			1
Mackerel, jack	19	24.7	4.3	25.5
Mackerel, Pacific	18.5	9.4	16.2	24
Medusa fish	0.3	1.2		
Midshipman, plainfin	1.3	2.4		1.6
Octopus, unspecified	0.8			1.6
Poacher, unsp.	0.3			0.5
Queenfish	0.5			1
Ray, bat	2.5	3.5	0.9	3.1
Ray, Pacific electric	3.3	15.3		
Ray, unspecified	0.3			0.5
Rockfish, blue	0.3	1.2		
Rockfish, bocaccio	1.3	2.4		1.6
Rockfish, olive	0.3			0.5
Rockfish, shortbelly	0.3	1.2		
Rockfish, unspecified	0.5	1.2		0.5
Salema	0.8	3.5		
Salmon	0.3	1.2		
Salmon, chinook	0.3	1.2		
Salps	0.3			0.5
Sanddab	7.9	7.1	6.8	8.9
Sanddab, longfin	0.8			1.6

Common Name	Total All Ports	Monterey/ Moss Landing	Santa Barbara/ Ventura	San Pedro/ Terminal Island
Sanddab, Pacific	2.3	2.4		3.6
Sanddab, speckled	0.5	1.2		0.5
Sardine, Pacific	42.1	30.6	43.6	46.4
Saury, Pacific	1	3.5		0.5
Scorpionfish, California	3.3			6.8
Sculpin (unidentified)	0.8	3.5		
Sea cucumber, unspecified	1.5			3.1
Sea stars	2	3.5	0.9	2.1
Shark, horn	0.8		0.9	1
Shark, Pacific angel	0.3			0.5
Skate, big	0.3	1.2		
Skate, thornback	0.5			1
Smelt, night	0.3	1.2		
Smelt (unidentified)	0.3			0.5
Smelts, true	0.3			0.5
Sole, unspecified	0.3		0.9	
Sole (curlfin)	0.3			0.5
Sole, bigmouth	0.3			0.5
Sole, English	0.8	2.4		0.5
Sole, fantail	0.5			1
Sole, sand	0.5	2.4		
Squid, jumbo	0.3			0.5
Squid, market (egg capsules)	10.9	17.6	2.6	13
Sunfish, ocean	0.3	1.2		
Stingray	0.8		0.9	1
Surfperch, pink	0.3			0.5
Surfperch, unspecified	0.5	1.2		0.5
Thornyheads	0.3			0.5
Tunicates	0.5			1
Turbot, curlfin	0.8	2.4		0.5
Turbot, unspecified	2	9.4		
Turbot, diamond	0.3			0.5
Turbot, hornyhead	1			2.1
Urchin, purple sea	0.8			1.6
Total number of samples	394	85	117	192

Table 9. Expanded salmonid bycatch in P. sardine fisheries in OR and WA, 2000- 2003.

	Chinook (live)	Chinook (dead)	Coho (live)	Coho (dead)	Pink (live)	Unid Sal (live)	Unid Sal (dead)	Total (live)	Total (dead)	Grand Total
2003										
Oregon								315	185	500
Washington	92	262	81	231	0	32	119	205	612	817
2002										
Oregon								199	81	280
Washington	150	356	61	765	0	200	0	411	1121	1532
2001										
Oregon	45	45	201	134	22	45	0	313	179	492
Washington	449	170	571	504	0	80	0	1100	674	1774
2000										
Oregon	43	72	159	43	0	303	43	505	158	663
Washington	38	3	276	116	0	7	0	321	119	440

Table 10. Observed and reported catches of non-target species caught in the Pacific sardine fishery off of Oregon, 2003. Oregon did not employ at-sea observers during the 2003 fishery.

	Logbook Data	Observer Data
Species	# Caught	# Caught
Blue shark	1	
Thresher shark	5	
Dogfish shark	75 lb	
Unknown shark	3	
Salmon (unknown)	460	4
	(63% alive; 37% dead)	(75% alive; 25% dead)
Mackerel	225,007 lb	750 lb
Anchovy	500 lb	

Table 11. Observed and expanded total number of salmon caught in the Pacific sardine fishery off of Oregon, 2000 - 2003. (Expanded total is based on salmon per trip).

Year	Chinook		Coho		Pink	Unknown		Total		Grand Total
	alive	dead	alive	dead	alive	alive	dead	alive	dead	
2003– exp total								315	185	500
2002 – exp total								199	81	280
2001 – exp total	45	45	201	134	22	45	0	313	179	492
2000 – exp total	43	72	159	43	0	303	43	504	159	663

Table 12a. Expanded observed bycatch data for the 2000 - 2003 Washington trial sardine fisheries. Expanded data based upon salmon and shark per mt sardines landed.

Year	Chinook (live)	Chinook (dead)	Coho (live)	Coho (dead)	Unkn. Salmon (live)	Shark (live)	Shark (dead)
2003	92	262	81	231	151	43	23
2002	150	356	61	765	200	37	22
2001	449	170	571	504	80	150	50
2000	38	3	276	116	7	169	31

Table 12b. List of the observed and reported logbook catches of non-targeted species caught in the 2003 Washington sardine fishery (non-expanded numbers of individuals, unless otherwise noted).

	Observer Data		Logbook Data	
Species	# Released Alive	# Dead	# Released Alive	# Dead
Anchovy	0	210 lbs	0	0
Blue Shark	18	5	0	0
Chinook salmon	24	68	78	83
Coho salmon	21	60	54	60
Dogfish	44	279	30	83
Dungeness crab	5	5	0	0
Hake	3	545	0	0
Herring	1	52 mt	0	0
Jack Mackerel	59	4 mt	0	0
Pacific Mackerel	500	47 mt	0	0
Pink salmon	0	1	0	0
Salmon species	16	31	0	0
Sanddab	0	1	0	0
Shad	0	1	0	0
Soupfin shark	2	2	0	0
Thresher shark	1	1	0	0

Table 13. Species noted as encountered on CDFG Live Bait Logs, 1996-2003.

Year	Days Fished	Grunion	Smelts	Barracuda	Herring	Stickle-back	Shiner Surfperch	Sea Star	Queenfish
2003	1151			32					
2002	1073			1					1
2001	1052	1		56					
2000	488	1		34					
1999	449		1	7	1				
1998	809			69	1		1		
1997	773			104			3	1	
1996	522		5	27	3	1			

Table 14. Estimates of Pacific sardine and Northern anchovy live bait harvest in California (mt). Data for 1939-1992 from Thomson et al. (1994), and 1993-2003 from CDFG logs.

Year	Anchovy	Sardine	Year	Anchovy	Sardine
1939	1,364	0	1972	5,307	0
1940	1,820	0	1973	5,639	0
1941	1,435	0	1974	5,126	0
1942	234	0	1975	5,577	0
1943	World War II	World War II	1976	6,202	0
1944	World War II	World War II	1977	6,410	0
1945	World War II	World War II	1978	6,013	107
1946	2,493	0	1979	5,364	0
1947	2,589	0	1980	4,921	12
1948	3,379	0	1981	4,698	6
1949	2,542	0	1982	6,978	38
1950	3,469	0	1983	4,187	193
1951	4,665	0	1984	4,397	53
1952	6,178	0	1985	3,775	11
1953	5,798	0	1986	3,956	17
1954	6,066	0	1987	3,572	216
1955	5,557	0	1988	4,189	50
1956	5,744	0	1989	4,594	100
1957	3,729	0	1990	4,842	543
1958	3,843	0	1991	5,039	272
1959	4,297	0	1992	2,572	1,807
1960	4,225	0	1993	669	176
1961	5,364	0	1994	2,076	1,506
1962	5,595	0	1995	1,278	2,055
1963	4,030	0	1996	703	1,801
1964	4,709	0	1997	1,077	2,344
1965	5,645	0	1998	304	2,037
1966	6,144	0	1999	453	2411
1967	4,898	0	2000	834	1270
1968	6,644	0	2001	1,238	1245
1969	4,891	0	2002	965	1701
1970	5,543	0	2003	1,085	3028
1971	5,794	0			

Table 15. Ratio of anchovy to sardine in reported live bait catch in California, 1994-2003.

Year	Anchovy	Sardine	Total	% Anchovy	% Sardine
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	0.5	0.5
2000	834	1,270	2,104	0.4	0.6
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 16. Commercial harvest (mt) of CPS finfish in Ensenada, Baja California, Mexico, 1978-2003[1/]. 2003 landings do not include December. Market squid are not commercially fished off Ensenada.

Year	Sardine	Anchovy	Pacific mackerel	Jack mackerel
1978	0	135,036	0	n/a
1979	0	192,476	0	n/a
1980	0	242,907	0	n/a
1981	0	258,745	0	n/a
1982	0	174,634	0	n/a
1983	274	87,429	135	n/a
1984	0	102,931	128	n/a
1985	3,722	117,192	2,582	n/a
1986	243	93,547	4,883	n/a
1987	2,432	124,482	2,082	n/a
1988	2,035	79,495	4,484	902
1989	6,224	81,811	13,687	0
1990	11,375	99	35,767	25
1991	31,392	831	17,500	30
1992	34,568	2,324	24,345	n/a
1993	32,045	284	7,741	n/a
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	43,436	0	7,962	0
2003	30,537	1,287	2,678	0

1/ Source: Data provided by Dr. Celia Eva-Cotero, CRIP Instituto Nacional de la Pesca, Ensenada.

Table 17. Pacific sardine time series of stock biomass (age-1 fish in mt) and recruitment (age-0 fish in 1,000s) estimated at the beginning of semester 2 of each year, 1983-2003. Stock biomass estimates are presented for Area 1 (Inside) and the Total Area of the stock. The 95% confidence intervals (CI) for Total Area biomass and recruitment estimates are also presented. See Conser *et al.* (2003) for details regarding methods used to derive estimates.

	Stock Biomass				Recruitment		
Year	Area 1	Total Area	Lower CI	Upper CI	Total Area	Lower CI	Upper CI
1983	4,721	4,721	2,716	9,937	146,767	89,767	274,267
1984	12,848	12,909	8,917	22,888	222,886	140,886	392,886
1985	21,212	21,703	15,534	35,991	214,411	145,411	368,911
1986	29,752	31,372	23,751	49,516	859,821	606,321	1,355,821
1987	73,047	76,635	59,716	114,284	842,804	602,804	1,257,804
1988	106,233	115,909	94,590	160,815	1,476,516	1,026,516	2,326,516
1989	162,390	181,563	149,812	252,778	1,173,843	809,343	1,973,843
1990	177,666	211,270	173,169	296,546	4,872,561	3,227,561	8,432,561
1991	228,789	266,211	202,708	414,083	5,924,857	3,754,857	10,474,857
1992	356,801	425,957	325,258	657,290	4,064,304	2,594,304	7,459,304
1993	334,681	447,278	350,663	684,962	9,205,937	6,225,937	15,365,937
1994	491,775	652,113	532,364	955,568	10,277,379	7,227,379	16,477,379
1995	504,856	722,777	586,245	1,026,232	6,512,311	4,652,311	10,662,311
1996	525,105	783,985	659,246	1,081,543	5,664,403	4,164,403	8,899,403
1997	479,680	766,702	657,839	1,025,251	10,089,643	7,324,643	15,619,643
1998	479,942	802,487	678,202	1,075,551	12,123,733	8,853,733	18,523,733
1999	553,811	919,974	782,081	1,233,861	8,634,180	6,134,180	14,014,180
2000	554,554	945,892	798,927	1,275,202	8,578,695	5,338,695	15,448,695
2001	474,799	864,672	708,635	1,227,548	14,792,684	8,887,684	27,542,684
2002	604,893	1,034,764	785,740	1,618,994	9,275,313	4,690,313	20,365,313
2003	633,102	1,090,587	777,606	1,810,895	12,586,415	5,036,415	36,886,415

Table 18. Annual U.S. West Coast Pacific sardine landings and harvest guidelines (mt) by state and management subarea, 1981-2004. As of 2003, the "Southern Subarea" comprises fisheries and landings from Pt. Arena (39° N latitude) to the Mexican border.

						Management Area Landings			Harvest Guidelines		
Year	So. Calif.	No. Calif.	Calif. Total	Oregon	Washington	Southern Subarea	Northern Subarea	WOC Total	Southern Subarea	Northern Subarea	Total HG
1981	34.4	0.0	34.4	0.0	0.0	34.4	0.0	34.4	n/a	n/a	n/a
1982	1.8	0.0	1.8	0.0	0.0	1.8	0.0	1.8	n/a	n/a	n/a
1983	0.6	0.0	0.6	0.0	0.0	0.6	0.0	0.6	n/a	n/a	n/a
1984	0.9	0.3	1.2	0.0	0.0	0.9	0.3	1.2	n/a	n/a	n/a
1985	3.7	2.2	5.8	0.0	0.0	3.7	2.2	5.8	n/a	n/a	n/a
1986	304.0	84.4	388.5	0.0	0.0	304.0	84.4	388.5	n/a	n/a	n/a
1987	391.6	47.8	439.4	0.0	0.0	391.6	47.8	439.4	n/a	n/a	n/a
1988	1,185.4	3.0	1,188.4	0.0	0.0	1,185.4	3.0	1,188.4	n/a	n/a	n/a
1989	598.7	238.0	836.7	0.0	0.0	598.7	238.0	836.7	n/a	n/a	n/a
1990	1,537.1	127.1	1,664.2	0.0	0.0	1,537.1	127.1	1,664.2	n/a	n/a	n/a
1991	6,601.4	985.9	7,587.3	0.0	0.0	6,601.4	985.9	7,587.3	n/a	n/a	n/a
1992	14,821.9	3,127.6	17,949.5	0.0	0.0	14,821.9	3,127.6	17,949.5	n/a	n/a	n/a
1993	14,669.6	675.6	15,345.2	0.2	0.0	14,669.6	675.8	15,345.4	n/a	n/a	n/a
1994	9,348.5	2,295.0	11,643.5	0.0	0.0	9,348.5	2,295.0	11,643.5	n/a	n/a	n/a
1995	34,645.7	5,681.2	40,326.9	0.0	0.0	34,645.7	5,681.2	40,326.9	n/a	n/a	n/a
1996	24,565.0	7,988.1	32,553.1	0.0	0.0	24,565.0	7,988.1	32,553.1	n/a	n/a	n/a
1997	29,885.4	13,359.7	43,245.1	0.0	0.0	29,885.4	13,359.7	43,245.1	n/a	n/a	n/a
1998	32,462.1	10,493.3	42,955.4	1.0	0.0	32,462.1	10,494.3	42,956.4	n/a	n/a	n/a
1999	42,017.2	17,246.3	59,263.5	775.5	0.0	42,017.2	18,021.8	60,039.0	n/a	n/a	n/a
2000	42,296.9	11,367.4	53,664.2	9,527.9	0.0	42,296.9	25,686.7	67,983.6	124,527.3	62,263.7	186,791.0
2001	44,708.9	7,102.5	51,811.4	12,780.3	11,127.1	44,708.9	31,009.9	75,718.8	89,824.7	44,912.3	134,737.0
2002	49,366.7	14,078.1	63,444.8	23,125.8	15,832.4	49,366.7	53,036.3	102,403.0	78,961.3	39,480.7	118,442.0
2003	30,289.6	7,427.3	37,716.9	25,257.6	11,920.1	37,716.9	37,177.7	74,894.6	73,938.7	36,969.3	110,908.0
2004	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	81,831.3	40,915.7	122,747.0

Table 19. West Coast Pacific sardine landings by country. Mexican landings are for Ensenada, Baja California, 1981-2003.

Year	Mexico	United States	Canada	Total
1981	0.0	34.4	0.0	34.4
1982	0.0	1.8	0.0	1.8
1983	273.6	0.6	0.0	274.2
1984	0.2	1.2	0.0	1.4
1985	3,722.3	5.9	0.0	3,728.2
1986	242.6	388.5	0.0	631.1
1987	2,431.6	439.4	0.0	2,871.0
1988	2,034.9	1,188.4	0.0	3,223.3
1989	6,224.2	836.7	0.0	7,060.9
1990	11,375.3	1,664.2	0.0	13,039.5
1991	31,391.8	7,587.3	0.0	38,979.1
1992	34,568.2	17,949.5	0.0	52,517.7
1993	32,045.0	15,345.4	0.0	47,390.4
1994	20,876.9	11,643.5	0.0	32,520.4
1995	35,396.2	40,326.9	25.0	75,748.1
1996	39,064.7	32,553.1	88.0	71,705.8
1997	68,439.1	43,245.1	34.0	111,718.2
1998	47,812.2	42,965.4	745.0	91,513.6
1999	58,569.4	60,039.0	1,250.0	119,858.4
2000	51,172.9	67,983.6	1,718.0	120,874.5
2001	22,246.0	75,718.8	1,600.0	99,564.8
2002	43,436.4	102,403.0	703.0	146,542.4
2003	30,537.0	74,894.6	954.0	106,385.6

Table 20. RecFIN estimated recreational harvest of Pacific (chub) mackerel in California by fishing mode (metric tons), 1980-2003.

Year	Man Made Structures	Beach/Bank	Shore Modes	Party/Charter	Private/Rental	Calif Total
1980	349.9	74.9	-	1,320.5	1,009.2	2,754.4
1981	224.6	63.4	-	590.7	515.7	1,394.5
1982	271.5	3.2	-	865.1	527.6	1,667.5
1983	358.5	3.4	-	702.6	404.3	1,468.9
1984	257.9	24.0	-	577.9	585.5	1,445.4
1985	141.4	0.6	-	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
1993	88.3	0.5	-	172.2	362.1	623.0
1994	200.9	5.0	-	245.1	496.3	947.3
1995	119.4	1.8	-	373.4	531.8	1,026.3
1996	92.5	0.9	-	319.4	281.1	693.9
1997	145.0	3.3	-	169.0	650.5	967.8
1998	96.4	0.4	-	131.3	221.4	449.4
1999	57.3	5.1	-	60.7	73.3	196.4
2000	34.4	16.9	-	76.9	121.9	250.1
2001	138.3	208.8	-	52.2	162.2	561.4
2002	72.0	20.0		26.0	161.0	279.0
2003	177.0	31.0	-	25.0	108.0	341.0

Notes from RecFIN query:

1. No data in from 1990 to 1992.
2. No data in wave 1 1995.
3. Data in 2003 are preliminary and may be incomplete.
4. Northern California charter boats were not fully sampled due to refusals.
5. Northern California charter boat tuna trips were not fully sampled.
6. Year 2002 California Party Charter (PC) estimates from PC Phone Survey.

Table 21. RecFIN estimated recreational harvest of Pacific (chub) mackerel by subarea (metric tons), 1980-2003.

Year	Southern California	Northern California	Oregon	Washington	Total
1980	2,745.3	9.1	-	-	2,754.4
1981	1,225.6	168.8	-	-	1,394.5
1982	1,554.7	112.8	-	-	1,667.5
1983	1,341.3	126.0	1.5	-	1,468.9
1984	1,257.4	187.7	0.2	-	1,445.4
1985	1,028.0	48.6	0.0	-	1,076.6
1986	968.2	34.3	-	-	1,002.6
1987	1,257.7	13.5	-	-	1,271.2
1988	778.9	21.2	-	-	800.1
1989	605.6	5.0	-	-	610.6
1990	N/A	N/A	N/A	N/A	N/A
1991	N/A	N/A	N/A	N/A	N/A
1992	N/A	N/A	N/A	N/A	N/A
1993	591.0	30.9	1.1	-	623.0
1994	933.4	13.8	0.2	-	947.3
1995	1,022.9	3.4	0.0	-	1,026.3
1996	664.0	29.8	0.1	-	693.9
1997	568.6	398.4	0.8	-	967.8
1998	425.6	22.6	0.1	1.0	449.4
1999	193.0	3.0	-	0.3	196.4
2000	248.6	1.4	0.1	-	250.1
2001	557.5	3.9	-	-	561.4
2002	279.0	0.0	-	-	279.0
2003	340.0	1.0	0.0	-	341.0

Notes from RecFIN query:
1. No data in from 1990 to 1992.
2. No data in wave 1 1995.
3. Data in 2003 are preliminary and may be incomplete.
4. Northern California charter boats were not fully sampled due to refusals.

Table 22. West coast landings (mt) and real[1] exvessel revenues ($ 2003) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid, 1981-2003.

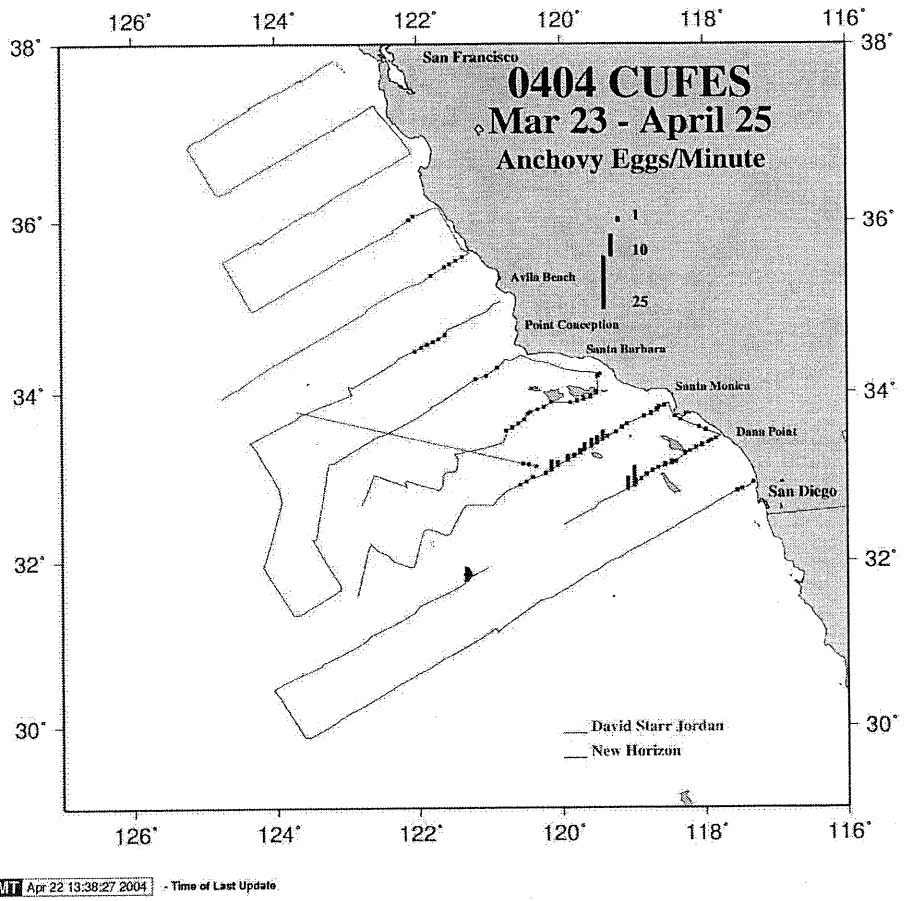
Year	Pacific Sardine mt	Pacific Sardine Rev	Pacific Mackerel mt	Pacific Mackerel Rev	Jack Mackerel mt	Jack Mackerel Rev	Anchovy mt	Anchovy Rev	Squid mt	Squid Rev
1981	15	$5,395	35,388	$13,016,195	17,778	$6,528,745	52,309	$5,850,654	23,510	$9,075,683
1982	2	$906	36,065	$12,236,739	19,617	$6,712,519	42,155	$3,647,029	16,308	$6,084,640
1983	1	$283	41,479	$13,016,386	9,829	$2,905,572	4,430	$676,282	1,824	$1,226,442
1984	1	$1,357	44,084	$12,939,446	9,149	$2,136,541	2,899	$647,970	564	$473,621
1985	6	$2,143	37,772	$9,980,814	6,876	$1,958,514	1,638	$357,427	10,276	$6,020,545
1986	388	$121,281	48,089	$11,817,385	4,777	$1,254,652	1,557	$489,050	21,278	$6,710,609
1987	439	$90,265	46,725	$9,660,866	8,020	$1,709,174	1,467	$447,362	19,984	$5,715,930
1988	1,188	$222,335	50,864	$11,829,092	5,068	$1,110,853	1,518	$559,460	37,232	$10,983,628
1989	837	$262,526	47,713	$9,510,027	10,745	$2,253,850	2,511	$899,105	40,893	$10,123,066
1990	1,664	$257,400	40,092	$6,928,388	3,223	$563,627	3,259	$822,646	28,447	$6,149,700
1991	7,587	$1,117,451	32,019	$6,676,171	1,712	$311,167	4,068	$812,876	37,389	$7,600,105
1992	17,954	$2,269,565	19,045	$4,901,239	1,526	$292,270	1,166	$273,577	13,110	$2,994,827
1993	15,347	$1,847,660	12,129	$1,801,986	1,950	$329,247	2,003	$571,390	42,830	$12,278,163
1994	11,644	$1,774,130	10,293	$1,682,335	2,906	$446,246	1,859	$645,375	55,892	$16,780,963
1995	40,256	$4,081,042	8,823	$1,319,722	1,877	$334,801	2,016	$422,968	70,252	$25,584,904
1996	32,553	$3,548,824	9,729	$1,483,201	2,438	$343,709	4,505	$788,685	80,561	$24,616,695
1997	43,290	$4,918,275	20,168	$3,080,489	1,534	$273,744	5,778	$898,394	70,329	$22,872,068
1998	43,312	$3,968,419	21,560	$2,781,391	1,777	$419,192	1,584	$268,520	2,895	$1,778,660
1999	60,368	$5,591,933	9,094	$1,180,624	1,579	$217,238	5,311	$1,035,954	92,014	$36,038,267
2000	68,034	$7,699,478	22,042	$3,092,829	1,451	$289,738	11,831	$1,527,046	118,903	$28,788,400
2001	75,801	$9,414,502	7,618	$1,284,681	3,839	$631,356	19,345	$1,479,723	86,203	$17,479,536
2002	96,897	$10,783,321	3,744	$533,868	1,026	$210,145	4,882	$633,760	72,878	$18,563,174
2003	71,478	$7,354,248	4,213	$661,840	231	$72,748	1,800	$329,363	41,078	$23,943,030

Source: PacFIN data extracted April, 2004

[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 2003.

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

Figure 1. Distribution of northern anchovy and jack mackerel eggs collected during CalCOFI cruise 0404 (April 2004) using the Continuous Underway Fish Egg Sampler (CUFES). Maps provided by SWFSC: http://swfsc.nmfs.noaa.gov/frd/CalCOFI/CurrentCruise/currentcruise.htm.



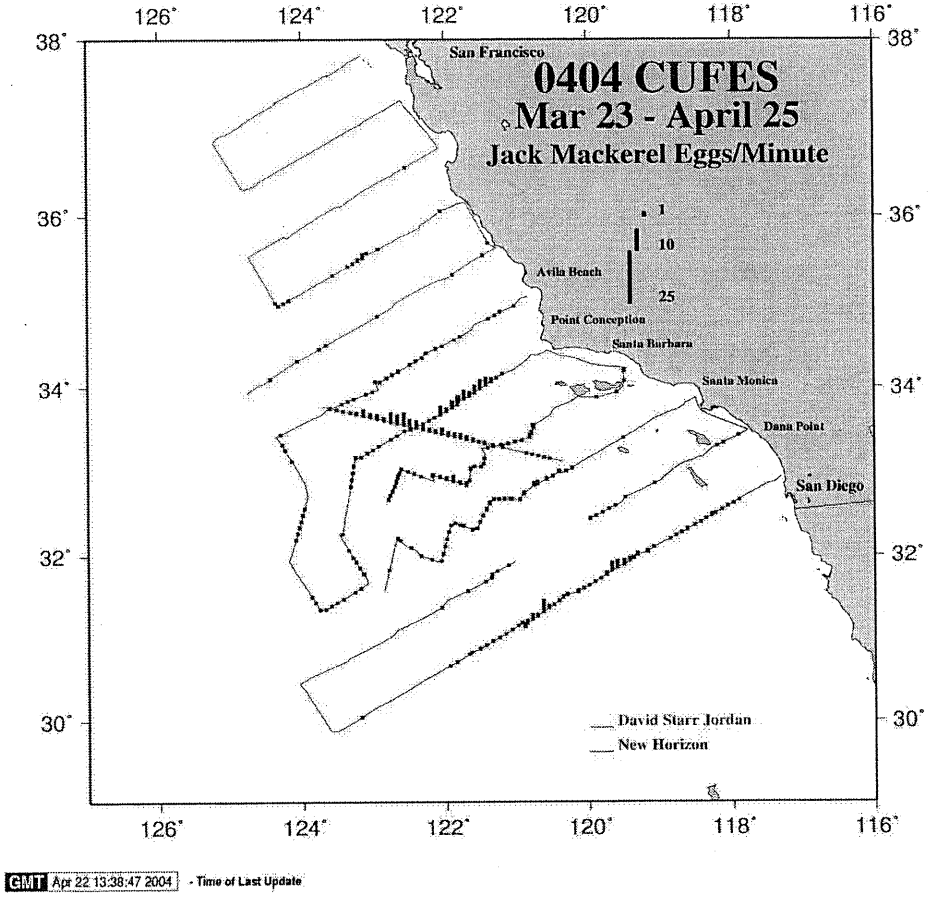
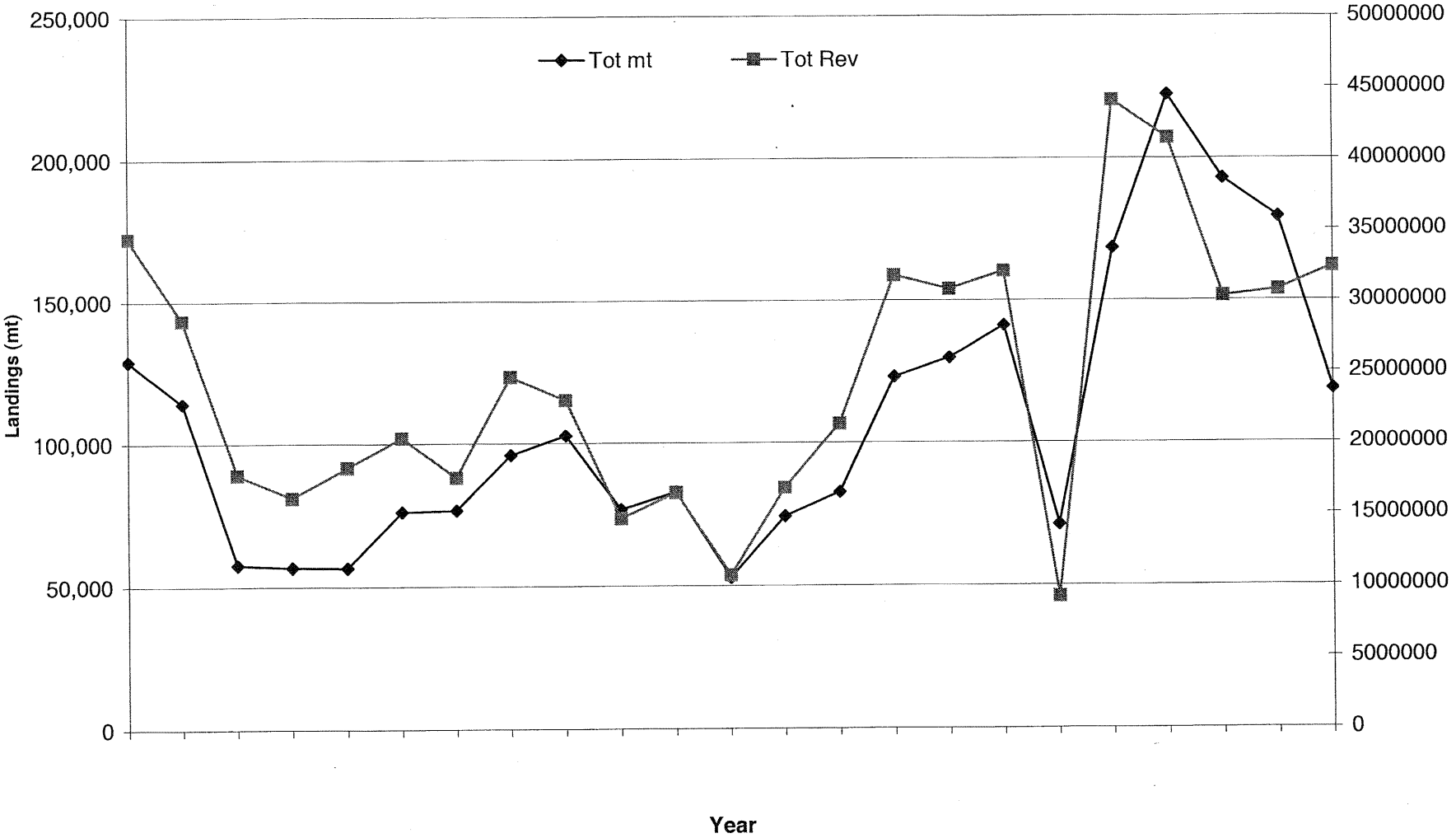


Figure 2. Annual Pacific coast landings and real exvessel revenues for all CPS species, 1981-2003.



APPENDIX 1

ECONOMIC STATUS

OF

WASHINGTON, OREGON, AND CALIFORNIA

CPS FISHERIES

IN 2003

Dr. Sam Herrick – National Marine Fisheries Service, Southwest Fisheries Science Center

June 2004

Table 1. Pacific coast landings (mt) and real[1] exvessel revenues ($ 2003) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by landing area, 1981-2003.

	Landings (mt)					Exvessel Revenues (2002 $)				
Year	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
	San Diego									
1981		11	12	2	4		$13,520	$7,262	$1,169	$3,222
1982		9	<1		<1		$7,032	$219		$36
1983		4	<1	2	1		$4,415	$863	$1,112	$1,162
1984	<1	2	<1		<1	$411	$2,491	$642		$39
1985		1	<1		<1		$1,362	$132		$218
1986		2	<1		<1		$1,985	$310		$18
1987	<1	7	<1	<1	3	$48	$7,347	$1,396	$16	$2,072
1988	<1	6	<1	6	19	$77	$6,738	$1	$4,509	$9,866
1989	<1	6	<1	94	2	$211	$6,690	$19	$276,147	$2,980
1990	<1	6	<1	18	1	$251	$5,864	$80	$52,005	$1,401
1991		11	<1	400			$8,971	$99	$128,242	
1992	<1	17	1	121	16	$216	$17,090	$1,169	$25,887	$4,418
1993	<1	16	3	4	<1	$634	$15,829	$3,131	$1,241	$46
1994	2	21	5	28	<1	$1,023	$15,926	$2,999	$11,334	$253
1995	5	31	<1	38	<1	$4,704	$19,947	$503	$23,353	$665
1996	1	26		145	2	$1,254	$17,474		$75,971	$516
1997	3	16	<1	12	3	$3,280	$10,838	$2	$6,108	$797
1998	215	52		2	2	$22,042	$9,507		$1,117	$1,675
1999	592	15	<1	2	4	$64,634	$4,928	$135	$718	$4,859
2000	19	1	<1	4	35	$7,749	$1,387	$240	$1,832	$11,161
2001	<1	3	<1	2	11	$102	$2,621	$114	$766	$4,772
2002	91	<1	<1	5		$60,486	$866	$115	$3,150	
2003	28	<1	3	14		$21,635	$974	$3,195	$8,103	
	Orange/LA									
1981	15	28,963	14,700	38,216	8,291	$5,380	$10,727,651	$5,393,046	$4,169,186	$1,719,804
1982	2	14,900	18,131	32,515	4,293	$834	$4,951,606	$6,219,222	$2,567,297	$972,741
1983	<1	14,641	6,786	900	854	$262	$4,583,836	$2,234,947	$165,469	$527,977
1984	<1	21,668	3,566	205	66	$530	$7,032,781	$1,099,703	$127,573	$57,426
1985	3	16,395	5,860	43	3,096	$1,235	$4,603,524	$1,658,607	$26,596	$1,544,813
1986	287	19,865	4,289	141	8,122	$89,650	$4,857,468	$1,090,995	$31,848	$2,731,200
1987	317	25,227	7,801	109	5,422	$66,637	$5,334,119	$1,657,371	$28,996	$1,605,356
1988	1,172	29,495	4,939	93	15,090	$217,056	$6,946,421	$1,067,520	$24,365	$4,329,913
1989	505	20,789	10,704	479	16,353	$78,426	$4,457,111	$2,209,960	$68,695	$3,824,242
1990	1,179	28,617	2,936	193	9,798	$188,666	$4,962,423	$503,293	$40,850	$1,786,590
1991	6,415	31,387	1,640	414	12,305	$955,021	$6,520,268	$286,327	$60,942	$2,019,410
1992	13,849	18,071	1,096	137	1,701	$1,676,735	$4,759,308	$266,258	$32,711	$318,194
1993	13,978	11,715	1,269	119	12,890	$1,680,418	$1,750,562	$211,275	$20,420	$3,227,729
1994	9,032	9,842	2,460	137	11,231	$1,102,456	$1,596,729	$318,225	$19,313	$2,796,437
1995	34,137	7,864	1,596	298	18,413	$3,439,110	$1,181,432	$222,704	$32,576	$5,915,846
1996	23,923	8,765	2,054	239	14,994	$2,452,848	$1,277,616	$309,736	$27,832	$4,940,245
1997	26,534	14,002	823	1,121	17,779	$2,812,647	$2,446,898	$199,666	$105,732	$6,463,550
1998	31,702	18,150	1,012	338	228	$3,135,886	$2,519,498	$349,996	$40,605	$143,307
1999	39,084	8,551	927	1,418	27,597	$3,790,819	$1,119,465	$200,020	$235,488	$9,845,361
2000	39,181	21,631	1,210	1,279	44,840	$4,431,189	$3,051,816	$238,718	$154,619	$12,003,720
2001	40,764	6,676	3,624	3,658	39,171	$4,621,746	$1,099,933	$579,666	$332,547	$8,765,047
2002	39,308	3,366	1,004	1,206	28,137	$3,893,610	$494,240	$205,599	$103,315	$6,533,616
2003	22,824	3,941	133	206	7,693	$1,932,650	$621,363	$50,997	$30,645	$4,501,337

	Landings (mt)					Exvessel Revenues (2002 $)				
Year	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
	Ventura/Santa Barbara									
1981	<1	4,870	2,847	9,035	2,390	$13	$1,792,539	$1,042,171	$998,504	$383,826
1982		845	1,195	6,441	1,403		$322,840	$393,658	$587,102	$250,461
1983	<1	473	559	2,727	3	$2	$138,676	$148,556	$253,730	$3,363
1984		1,136	52	141	7		$320,982	$15,758	$70,388	$13,174
1985		1,302	787	110	2,959		$335,920	$210,266	$46,572	$1,151,552
1986	18	1,280	297	161	6,412	$4,457	$310,453	$77,387	$62,856	$1,584,412
1987	74	1,382	8	140	8,407	$15,865	$308,395	$2,372	$53,775	$2,194,007
1988	13	599	7	154	16,334	$4,100	$164,690	$1,565	$65,378	$4,762,411
1989	93	253		161	16,862	$14,382	$33,834		$69,400	$4,056,820
1990	236	290	76	141	10,601	$27,554	$35,652	$8,932	$58,264	$2,504,498
1991	186	136	9	190	16,905	$26,788	$18,500	$1,192	$73,869	$3,098,365
1992	973	92	<1	90	2,807	$85,078	$9,346	$3	$35,002	$545,787
1993	692	35	<1	298	17,367	$61,668	$4,327	$10	$100,354	$4,373,568
1994	315	40	48	341	21,794	$27,004	$9,362	$3,770	$164,427	$5,996,777
1995	355	249	<1	346	41,184	$45,966	$27,269	$216	$163,651	$16,008,825
1996	461	67	11	375	46,435	$43,538	$33,778	$1,775	$168,212	$13,712,366
1997	3,357	1,160	7	510	34,611	$260,119	$114,440	$2,832	$100,156	$10,304,529
1998	899	1,306		239	2,176	$99,704	$75,153		$86,597	$1,360,565
1999	2,545	215	<1	2,233	52,719	$262,718	$38,883	$9	$348,550	$21,706,205
2000	3,048	230	9	3,548	48,747	$312,833	$22,726	$922	$413,912	$10,562,500
2001	3,957	72	<1	3,909	31,876	$381,164	$6,854	$31	$465,182	$5,465,051
2002	5,065	<1	<1	732	11,814	$633,933	$1	$2	$184,716	$3,177,191
2003	1,980	39	<1	496	11,479	$183,381	$4,314	$25	$127,884	$6,768,282
	San Luis Obispo									
1981		<1	<1	17	<1		$356	$15	$11,484	$136
1982		<1	<1		<1		$849	$9		$404
1983					<1					$211
1984					<1					$120
1985	<1	<1	<1	48	<1	$95	$19	$53	$23,654	$404
1986		<1	<1	11	<1		$30	$17	$4,605	$125
1987				2	<1				$905	$375
1988	<1	<1			<1	$1	$27			$82
1989		<1	<1	<1	19		$120	$1	$40	$5,823
1990	121	<1	17		<1	$14,109	$172	$1,910		$71
1991		<1	<1		<1		$124	$10		$21
1992		<1	<1		<1		$299	$66		$122
1993		<1	<1	1	2,036		$52	$15	$598	$962,622
1994	<1	<1	<1	<1	1,344	$29	$111	$5	$421	$681,239
1995		<1	<1		183		$18	$3		$45,882
1996		<1			217		$5			$69,507
1997	<1			23	<1	$21			$10,360	$13
1998	<1	<1	<1		<1	$35	$163	$44		$1
1999		<1		2	17		$30		$963	$5,015
2000		<1	<1		<1		$2	$1		$7
2001		<1		4	79		$17		$1,577	$16,096
2002	102				356	$6,853				$77,283
2003		<1	<1	3	650		$16	$17	$1,402	$357,252

Year	Landings (mt)					Exvessel Revenues (2002 $)				
	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
	Monterey/Santa Cruz									
1981		1,356	212	4,617	12,823		$395,908	$80,763	$483,713	$6,966,811
1982	<1	1,870	280	2,609	10,607	$72	$567,570	$94,270	$236,882	$4,857,701
1983	<1	2,689	2,457	321	500	$20	$520,215	$497,820	$69,332	$358,759
1984	<1	3,221	5,481	1,895	391	$417	$535,640	$1,006,674	$176,963	$315,923
1985	2	449	228	1,138	3,813	$814	$101,460	$89,239	$133,316	$2,985,516
1986	85	946	191	808	5,488	$27,174	$170,080	$85,852	$216,799	$1,974,768
1987	48	321	210	676	5,611	$7,603	$55,240	$47,431	$112,509	$1,754,579
1988	3	23	122	696	4,897	$1,068	$5,617	$41,304	$235,369	$1,607,865
1989	238	14	37	929	7,146	$169,241	$4,215	$39,707	$180,254	$2,117,549
1990	127	2,115	192	2,132	7,918	$26,654	$356,872	$48,461	$414,505	$1,816,802
1991	986	134	44	2,527	6,703	$135,642	$19,065	$20,307	$360,011	$2,046,910
1992	3,093	374	110	608	6,111	$500,083	$92,896	$22,591	$95,730	$1,545,424
1993	676	38	345	1,285	6,040	$104,173	$15,554	$102,137	$283,125	$2,384,251
1994	2,289	38	191	986	13,648	$641,245	$20,640	$111,768	$289,673	$5,267,416
1995	5,678	461	109	1,111	2,449	$579,366	$72,251	$88,916	$104,837	$939,971
1996	7,988	703	91	3,554	4,672	$999,609	$103,382	$14,840	$416,472	$1,549,304
1997	13,357	3,208	327	3,895	8,283	$1,763,460	$477,161	$68,579	$617,267	$3,237,138
1998	10,009	1,457	33	901		$670,975	$155,476	$12,098	$73,889	
1999	16,417	3	24	1,511	301	$1,291,057	$10,796	$1,887	$362,814	$86,033
2000	11,367	39	50	6,804	7,125	$1,024,074	$6,730	$28,479	$838,797	$2,026,535
2001	7,103	172		11,660	7,747	$1,480,314	$19,474		$587,469	$1,830,793
2002	13,607		2	2,690	25,067	$1,319,366		$394	$259,370	$6,906,053
2003	7,907	1	20	706	13,901	$667,134	$4,217	$2,467	$81,964	$7,908,783
	San Francisco									
1981	<1	<1	2	204	<1	$1	$12	$1,522	$84,107	$13
1982			<1	395	2			$270	$179,033	$894
1983		2	1	332	462		$871	$338	$122,208	$330,836
1984		<1	<1	538	97		$430	$146	$214,671	$84,481
1985		1	<1	259	77		$4,571	$39	$99,165	$51,514
1986		<1		393	832		$400		$136,275	$323,329
1987	<1	<1	<1	424	343	$93	$61	$601	$152,208	$114,877
1988	<1	<1	<1	492	299	$5	$40	$403	$170,995	$94,920
1989	<1		4	755	3	$16		$4,107	$218,620	$1,958
1990	<1	<1	2	714	129	$37	$572	$945	$198,452	$39,881
1991		<1	<1	459	1,471		$95	$87	$135,259	$433,501
1992	35	11	1	164	2,448	$7,437	$11,041	$422	$42,085	$573,803
1993		1	<1	244	1,018		$1,187	$247	$130,277	$449,655
1994	<1	2	<1	280	2,236	$672	$1,818	$329	$97,294	$749,615
1995	2	<1	<1	93	747	$553	$613	$271	$10,039	$249,281
1996		4	<1	105	333		$2,194	$638	$27,976	$121,639
1997	3	1	<1	156	205	$1,432	$834	$395	$11,784	$76,672
1998	464	4	1	<1	14	$34,084	$3,838	$892	$22	$16,978
1999	949	<1	<1	47	5	$87,867	$539	$31	$15,825	$1,911
2000	<1	<1	<1	117	<1	$221	$21	$717	$67,035	$4
2001	<1	<1		42	280	$98	$1,689		$13,864	$76,436
2002	172			17	865	$32,485			$9,623	$218,315
2003	<1	<1	<1		2,808	$504	$144	$2		$1,547,389

Year	Landings (mt)					Exvessel Revenues (2002 $)				
	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
	Northern California									
1981		<1	<1		2		$238	$15		$1,783
1982			1		2			$487		$1,532
1983		<1	<1		<1		$28	$27		$53
1984			<1	<1	<1			$2	$937	$131
1985					<1					$18
1986					<1					$19
1987			<1		<1			$3		$58
1988			<1		1			$3		$890
1989			<1		<1			$1		$492
1990					<1					$187
1991					1					$535
1992		<1	1	<1	<1		$385	$554	$116	$1,354
1993		<1	55	<1	<1		$135	$9,213	$30	$7
1994	5	<1	<1	8	38	$1,702	$185	$78	$3,356	$12,263
1995	2	<1	<1		2	$975	$34	$37		$532
1996	<1	<1				$131	$214			
1997		<1	2		3		$207	$1,350		$2,185
1998	21	9	6		<1	$4,769	$3,614	$4,392		$46
1999		3	<1		<1		$685	$15		$6
2000		2	<1		<1		$354	$95		$613
2001	<1			2	<1	$41			$6,548	$86
2002			<1		4			$36		$1,315
2003	14		<1			$5,943		$14		
	Other California									
1981		<1					$13			
1982										
1983										
1984										
1985										
1986										
1987										
1988										
1989										
1990										
1991										
1992										
1993										
1994		4		4	33		$10,843		$285	$8,430
1995										
1996										
1997										
1998										
1999										
2000										
2001										
2002										
2003										

Year	Landings (mt)					Exvessel Revenues (2002 $)				
	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid	Sardine	P. Mackerel	J. Mackerel	Anchovy	Squid
	Oregon									
1981		<1					$2			
1982		<1		<1			$70		$168	
1983		8					$12,647			
1984		3					$1,262			
1985		<1	<1	<1			$3	$2	$59	
1986		<1					$1			
1987		2					$751			
1988		<1		<1			$480		$18	
1989		5		<1			$1,508		$20	
1990		10					$4,663			
1991		<1	19				$194	$3,035		
1992	4	462	317				$189	$976		
1993	<1	280	277				$1,025	$3,180		
1994		252	202	<1			$11,250	$9,067	$234	
1995		189	149	<1			$4,087	$8,249	$556	
1996		61	259				$4,306	$8,633		
1997		1,611	373				$2,534	$831		
1998	1	536	686			$849	$9,460	$47,924		
1999	776	259	518			$92,742	$1,089	$6,431		
2000	9,528	119	161	<1		$1,214,567	$6,653	$18,212	$317	
2001	12,780	322	183			$1,644,576	$73,367	$45,821		
2002	22,711	127	9	3		$2,866,295	$6,575	$2,164	$1,807	
2003	25,258	160	74	39		$2,944,988	$18,636	$15,912	$3,111	
	Washington									
1981				1					$528	
1982				5					$15,969	
1983				3					$8,709	
1984				10					$15,631	
1985				12					$17,932	
1986				22					$29,403	
1987				78					$84,791	
1988				40					$45,535	
1989				62					$72,765	
1990				50					$54,134	
1991				55					$46,655	
1992				42					$40,328	
1993				20					$12,980	
1994				39					$31,827	
1995				118					$75,010	
1996			3	86				$771	$71,378	
1997			<1	59				$88	$46,090	
1998			39	103				$3,847	$66,291	
1999	1		108	98		$1,782		$8,206	$71,588	
2000	4,842		20	79		$701,167		$2,352	$50,457	
2001	11,127		32	68		$1,279,274		$5,626	$71,770	
2002	15,833		12	229		$1,969,194		$1,829	$71,779	
2003	11,920		2	214		$1,469,888		$119	$65,941	

Source: PacFIN data extracted Appril, 2004.

[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 2003.

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

Table 2. Average annual real[1] exvessel prices ($ 2003) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid, 1981-2003.

Year	Pacific Sardine $/lb	Pacific Mackerel $/lb	Jack Mackerel $/lb	Anchovy $/lb	Squid $/lb
1981	$0.16	$0.17	$0.17	$0.05	$0.17
1982	$0.21	$0.15	$0.16	$0.04	$0.17
1983	$0.13	$0.14	$0.13	$0.07	$0.30
1984	$0.62	$0.13	$0.11	$0.10	$0.38
1985	$0.16	$0.12	$0.13	$0.10	$0.27
1986	$0.14	$0.11	$0.12	$0.14	$0.14
1987	$0.09	$0.09	$0.10	$0.14	$0.13
1988	$0.08	$0.11	$0.10	$0.17	$0.13
1989	$0.14	$0.09	$0.10	$0.16	$0.11
1990	$0.07	$0.08	$0.08	$0.11	$0.10
1991	$0.07	$0.09	$0.08	$0.09	$0.09
1992	$0.06	$0.12	$0.09	$0.11	$0.10
1993	$0.05	$0.07	$0.08	$0.13	$0.13
1994	$0.07	$0.07	$0.07	$0.16	$0.14
1995	$0.05	$0.07	$0.08	$0.10	$0.17
1996	$0.05	$0.07	$0.06	$0.08	$0.14
1997	$0.05	$0.07	$0.08	$0.07	$0.15
1998	$0.04	$0.06	$0.11	$0.08	$0.28
1999	$0.04	$0.06	$0.06	$0.09	$0.18
2000	$0.05	$0.06	$0.09	$0.06	$0.11
2001	$0.06	$0.08	$0.07	$0.03	$0.09
2002	$0.05	$0.06	$0.09	$0.06	$0.12
2003	$0.05	$0.07	$0.14	$0.08	$0.26

Source: PacFIN data extracted April, 2004.

Table 3. West coast landings (mt) and real[1] exvessel revenues ($ 2003) for Pacific sardine, Pacific mackerel[2], jack mackerel, anchovy and market squid by state, 1981-2003.

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	$5,395	35,388	$13,016,193	17,778	$6,528,745	52308	$5,850,126	23,510	$9,075,683
1982	2	$906	36,065	$12,236,669	19,617	$6,712,519	42150	$3,630,892	16,308	$6,084,640
1983	1	$283	41,471	$13,003,739	9,829	$2,905,572	4427	$667,572	1,824	$1,226,442
1984	1	$1,357	44,081	$12,938,051	9,149	$2,136,541	2889	$632,340	564	$473,621
1985	6	$2,143	37,772	$9,980,811	6,876	$1,958,513	1626	$339,436	10,276	$6,020,545
1986	388	$121,281	48,089	$11,817,383	4,777	$1,254,652	1535	$459,647	21,278	$6,710,609
1987	439	$90,265	46,724	$9,660,114	8,020	$1,709,174	1390	$362,572	19,984	$5,715,930
1988	1,188	$222,335	50,863	$11,828,613	5,068	$1,110,853	1478	$513,907	37,232	$10,983,628
1989	837	$262,526	47,708	$9,508,452	10,745	$2,253,850	2449	$826,319	40,893	$10,123,066
1990	1,664	$257,400	40,081	$6,923,510	3,223	$563,627	3208	$768,512	28,447	$6,149,700
1991	7,587	$1,117,451	32,018	$6,675,928	1,693	$308,133	4014	$766,221	37,389	$7,600,105
1992	17,950	$2,269,565	18,577	$4,897,663	1,209	$291,293	1124	$233,250	13,110	$2,994,827
1993	15,346	$1,847,660	11,819	$1,795,987	1,673	$326,067	1959	$539,024	42,830	$12,278,163
1994	11,644	$1,774,130	10,008	$1,667,643	2,704	$437,179	1789	$588,803	55,892	$16,780,963
1995	40,256	$4,081,042	8,626	$1,314,697	1,728	$326,552	1886	$334,528	70,252	$25,584,904
1996	32,553	$3,548,824	9,604	$1,456,493	2,177	$334,305	4419	$717,308	80,561	$24,616,695
1997	43,290	$4,918,275	18,401	$3,058,749	1,160	$272,825	5719	$852,305	70,329	$22,872,068
1998	43,311	$3,967,570	20,978	$2,767,424	1,052	$367,422	1481	$202,230	2,895	$1,778,660
1999	59,591	$5,497,408	8,788	$1,175,581	952	$202,601	5214	$964,366	92,014	$36,038,267
2000	53,664	$5,783,744	21,904	$3,084,113	1,269	$269,173	11752	$1,476,272	118,903	$28,788,400
2001	51,893	$6,490,652	6,925	$1,131,555	3,624	$579,910	19277	$1,407,953	86,203	$17,479,536
2002	58,353	$5,947,832	3,369	$497,373	1,005	$206,153	4650	$560,174	72,878	$18,563,174
2003	34,300	$2,939,372	3,999	$632,877	155	$56,718	1547	$260,310	41,078	$23,943,030
	Oregon									
1981			<1	$2						
1982			<1	$70			<1	$168		
1983			8	$12,647						
1984			3	$1,262						
1985			<1	$3	<1	$2	<1	$59		
1986			<1	$1						
1987			1	$751						
1988			1	$480			<1	$18		
1989			5	$1,508			<1	$20		
1990			10	$4,677						
1991			<1	$194	19	$3,035				
1992	4	$0	462	$189	317	$977				
1993			280	$1,025	277	$3,180				
1994			252	$11,250	202	$9,067	1	$234		
1995			189	$4,087	149	$8,249	<1	$556		
1996			61	$4,306	259	$8,633				
1997			1,611	$2,534	373	$831				
1998	1	$849	536	$9,460	686	$47,924				
1999	776	$92,742	259	$1,089	518	$6,431				
2000	9,528	$1,214,567	119	$6,653	161	$18,212	<1	$317		
2001	12,780	$1,644,576	322	$73,367	183	$45,821				
2002	22,711	$2,866,295	127	$6,575	9	$2,164	3	$1,807		
2003	25,258	$2,944,988	160	$18,636	74	$15,912	39	$3,111		

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							1	$528		
1982							5	$15,969		
1983							3	$8,709		
1984			<1	$134			10	$15,631		
1985							12	$17,932		
1986							22	$29,403		
1987							78	$84,791		
1988							40	$45,535		
1989			<1	$67			62	$72,765		
1990			<1	$202			50	$54,134		
1991			<1	$50			54	$46,655		
1992			6	$3,387			42	$40,328		
1993			30	$4,974			44	$32,366		
1994			33	$3,442			70	$56,338		
1995			7	$938			130	$87,883		
1996			65	$22,402	3	$771	86	$71,378		
1997			156	$19,207	1	$88	59	$46,090		
1998			46	$4,507	39	$3,847	103	$66,291		
1999	1	$1,782	47	$3,955	108	$8,206	98	$71,588		
2000	4,842	$701,167	19	$2,063	20	$2,352	79	$50,457		
2001	11,127	$1,279,274	371	$79,759	32	$5,626	68	$71,770		
2002	15,833	$1,969,194	248	$29,920	12	$1,829	229	$71,779		
2003	11,920	$1,469,888	54	$10,327	2	$119	214	$65,941		

Source: PacFIN data extracted April, 2004.

[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 2003.

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

Table 4. Pacific coast CPS landings (mt) and real[1] exvessel revenues ($ 2003) by gear group, 1981-2003.

Year	Roundhaul or Lampara	Dip Net	Pot or Trap	Trawl	Hook and Line	Gillnet	Other or Unknown
	Landings (metric tons)						
1981	120,510	8,231	<1	11	9	75	74
1982	108,952	3,668	1	13	27	71	1,339
1983	41,397	490	<1	8	2	27	15,611
1984	48,057	64	<1	3	1	144	8,281
1985	50,312	494	<1	20	9	374	5,246
1986	65,595	88	4	2	<1	107	10,221
1987	64,607	213	1	6	7	1,296	10,459
1988	86,612	138	1	39	1	1,377	7,515
1989	94,757	248	<1	132	3	96	7,193
1990	70,263	489	2	15	34	64	5,725
1991	58,327	724	37	127	4	56	23,451
1992	45,788	4,322	3	802	15	28	1,779
1993	68,233	5,171	2	592	3	43	114
1994	77,694	2,988	59	510	49	9	1,084
1995	119,406	1,341	4	386	153	8	1,600
1996	128,277	850	1	401	64	23	84
1997	138,523	247	<1	2,157	90	14	9
1998	69,654	37	<1	1,333	44	5	7
1999	166,644	528	72	983	12	10	93
2000	219,871	1,552	45	275	420	4	17
2001	190,193	1,791	1	621	156	3	
2002	178,638	761	<1	10	10	2	
2003	118,481	133	26	81	29	<1	<1
	Revenues (2002 $)						
1981	$32,838,302	$1,496,631	$344	$6,909	$8,554	$48,900	$25,094
1982	$27,430,475	$758,077	$3,608	$7,002	$14,812	$36,630	$393,561
1983	$13,213,912	$311,037	$1,471	$4,391	$2,134	$13,984	$4,257,342
1984	$13,934,696	$54,232	$2,582	$2,922	$1,515	$50,081	$2,086,459
1985	$15,056,803	$471,154	$403	$13,841	$5,900	$177,101	$2,549,537
1986	$17,129,603	$39,270	$1,545	$1,926	$194	$48,789	$3,119,647
1987	$14,631,716	$58,639	$1,906	$3,398	$2,553	$345,692	$2,533,208
1988	$21,992,369	$44,895	$1,229	$40,587	$691	$345,214	$2,211,282
1989	$20,991,052	$57,649	$187	$40,312	$1,171	$31,407	$1,664,605
1990	$13,409,488	$59,220	$1,129	$8,501	$37,383	$34,409	$1,120,916
1991	$12,321,938	$67,283	$8,612	$29,378	$5,807	$19,599	$4,016,597
1992	$9,682,223	$584,007	$2,409	$8,667	$23,943	$12,370	$373,692
1993	$15,735,867	$937,956	$2,124	$10,913	$4,274	$22,378	$28,111
1994	$20,399,439	$537,801	$20,446	$32,658	$48,253	$5,384	$205,728
1995	$30,806,043	$397,157	$2,279	$19,983	$63,774	$4,876	$351,280
1996	$30,365,904	$212,489	$557	$45,403	$70,353	$12,142	$21,825
1997	$31,764,223	$94,727	$111	$33,566	$100,988	$7,449	$3,435
1998	$9,017,584	$27,013	$148	$84,644	$63,421	$3,225	$4,958
1999	$43,755,147	$203,072	$17,214	$37,768	$27,444	$6,397	$7,531
2000	$40,818,056	$409,904	$10,660	$28,611	$93,485	$2,105	$1,003
2001	$29,635,534	$395,715	$411	$182,174	$41,228	$1,680	
2002	$30,501,238	$189,364	$128	$3,934	$24,514	$1,333	
2003	$32,179,784	$74,102	$15,534	$23,045	$38,229	$121	$23

Source: PacFIN data extracted April, 2004.

[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 2003.

Table . Number of vessels with Pacific coast landings of CPS finfish and/or market squid by landing area, 1981-2003.

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	52	128	67	29	60	7	5	1	5	4	19
1982	28	94	17	5	57	6	4		4	1	14
1983	29	74	15		48	10	3		64	1	12
1984	14	69	10		71	8	2		3	1	15
1985	13	68	13	7	77	25			4	2	10
1986	15	79	14	5	52	15			1	2	9
1987	30	105	35	1	43	18	1		92	2	19
1988	35	98	33	3	44	23	2		79	3	20
1989	44	91	22	8	24	13	1		152	2	18
1990	41	85	30	15	81	24			162	2	22
1991	52	89	31	11	30	5			39	2	17
1992	53	85	12	27	150	135	6		38	3	26
1993	46	103	14	16	73	41	5		28	3	23
1994	49	94	17	7	52	53	8	4	38	2	14
1995	40	96	32	3	35	38	2		43	1	18
1996	35	99	29	1	41	38	2		41	9	30
1997	26	102	20	2	49	36	2		50	9	11
1998	21	77	15	10	35	56	11		46	8	9
1999	18	80	17	2	23	18	4		44	10	7
2000	16	83	18	2	41	35	7		43	18	10
2001	18	73	17	2	26	13	4		43	27	5
2002	8	79	9	2	19	6	3		42	23	7
2003	8	57	13	2	22	6	2		43	17	9
	Market Squid										
1981	6	61	26	9	53	1	10				3
1982	1	51	25	7	53	2	7				3
1983	4	44	12	4	32	22	3				7
1984	1	9	17	6	31	8	2				4
1985	1	44	32	5	59	10	1				23
1986	2	43	27	7	41	4	1				8
1987	7	41	30	3	33	17	1				7
1988	10	51	32	4	30	7	1				11
1989	3	48	31	7	28	3	2				5
1990	7	42	26	3	36	9	2				3
1991		36	24	2	30	7	1				3
1992	1	18	14	4	36	16	4				1
1993	1	43	25	13	33	13	1				9
1994	3	42	31	11	34	6	3	1			9
1995	2	59	44	8	28	4	2				27
1996	4	62	66	8	28	2					39
1997	3	55	50	3	28	4	11				22
1998	3	19	45	1		3	2				18
1999	1	76	81	3	13	1	2				44
2000	2	86	65	1	23	1	2				42
2001	4	62	50	2	18	3	3				27
2002		72	61	5	33	3	1				32
2003		43	53	9	36	17					29

Source: PacFIN data extracted April, 2004.

Table 6. Number of vessels with CPS finfish or market squid as principle species[1] by principle landing area[2], 1981-2003.

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	3	52	6	1	3	2				1	4
1982	2	41	5	1	2	1				1	3
1983	4	16	3		4					1	3
1984		21	4		17	1				1	4
1985	1	22	4	2	1	1				2	1
1986		17	3	1	2	1				2	
1987	1	31	4		1	2				2	
1988	2	19	3		1	2			1	2	
1989	6	22	3		4	1				2	1
1990	4	22	3		2					2	2
1991	6	35	4		4					2	1
1992	5	37	4		3	2	1			1	1
1993	2	23	3	1	1	1					1
1994	2	27	6	1	2			1			
1995	2	18	5		2				1		
1996	2	19	7		9						
1997	1	26	3	1	5						
1998	3	37	4		8		1				
1999	1	19	2		6	1			2	1	
2000		26	3		4				6	1	
2001		24	3		3				11	6	
2002	2	23	4		1				10	8	
2003	2	12	2		2		1		10	5	
					Market Squid						
1981	2	14	3		33					1	
1982		16	2		35					2	
1983		6			4	1			1	7	1
1984					3				4	7	
1985		7	7		28				3		2
1986		10	4		17	1					1
1987	3	7	8		14						
1988	4	19	18		15						1
1989	2	18	12		15						1
1990	1	8	13		12						
1991		5	15		12	1					
1992			4		16	2					
1993		15	13	3	16						2
1994		8	18		19	2					4
1995		24	31		3	2				2	6
1996		30	41		7					1	15
1997		28	33		8						9
1998		3	22								6
1999		31	48		1						20
2000	1	44	32		8						9
2001	1	32	22		8	1					5
2002		33	11		17	1					6
2003		20	19		15	1					14

Source: PacFIN data extracted April, 2004.

[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 accross all areas in which it had landings.

Table 7. 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 exvessel expenditures, 1981-2003.

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	1	5	4	2	1	1					2
1982		3	5							1	5
1983	1	2	3		1	1				1	3
1984		1	3		2	2				1	3
1985		2	2	1	1	1				1	1
1986		2	1		1	1				1	2
1987		2	2		1	2				2	1
1988		3	3		1	1				2	1
1989	3	2	1		1	1				2	1
1990	5	2	2		1	2				2	1
1991	2	7	3		2	1				2	1
1992	1	7	4		1	1				1	
1993		4	5		2	1				1	
1994	2	6	4		2	1		1		1	
1995	1	7	4			1			1		2
1996	2	4	6		1	1				1	1
1997	1	9	6		1	1				1	
1998	1		6		3	1	1			1	2
1999	2	5	4		2	2	1			1	
2000		9	4		3				2	1	1
2001		6	6	1		1	1		4	1	
2002	2	5	5		1	1			3	1	
2003	2	7	4		1		1		3	2	
					Market Squid						
1981		1	2		5	4					
1982		1			7	1	1			2	
1983						2				3	
1984					1					2	
1985			3		6						1
1986		1	5		6	1					1
1987		1	5		4	1					
1988		2	3	2	2	2					
1989		2	11		3	2					
1990		2	5		4						
1991		1	6			1					
1992			4			3					
1993	1		8	1	1	1					
1994		2	16	1	2			1			1
1995		1	16								1
1996		4	10		2					1	3
1997		6	10		1						1
1998	1		3								
1999		5	19								5
2000	1	9	20	1	1						5
2001	1	3	14	1	1		1				2
2002		4	11								3
2003		4	11	1	2						1

Source: PacFIN data extracted April, 2004.

Figure 1. Percentage contribution of Pacific coast CPS finfish and market squid landings to the total exvessel value of all Pacific coast landings, 1981-2003.

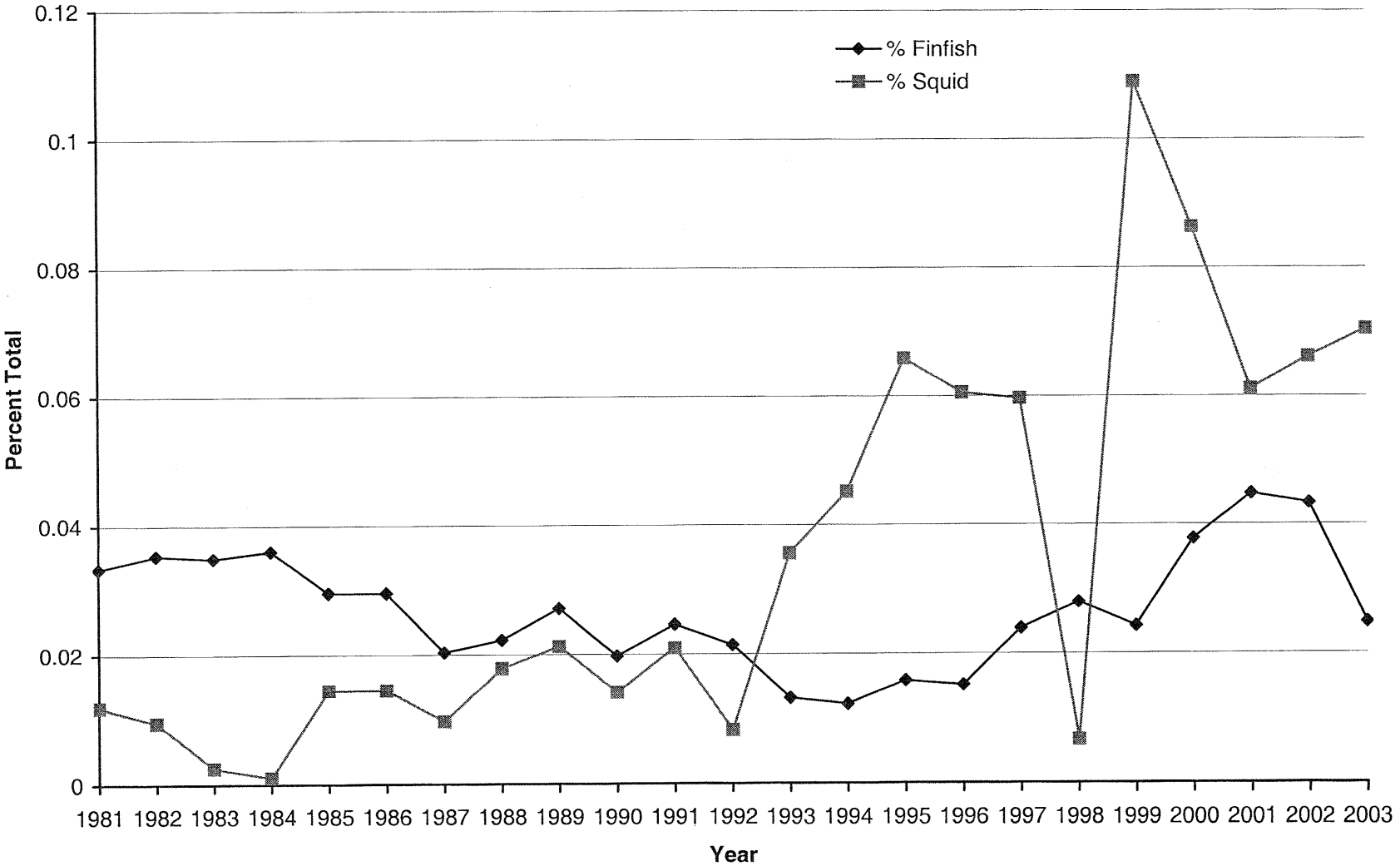


Figure 2. Pacific coast CPS finfish landings and real exvessel price ($/lb, 2003 $), 1981-2003.

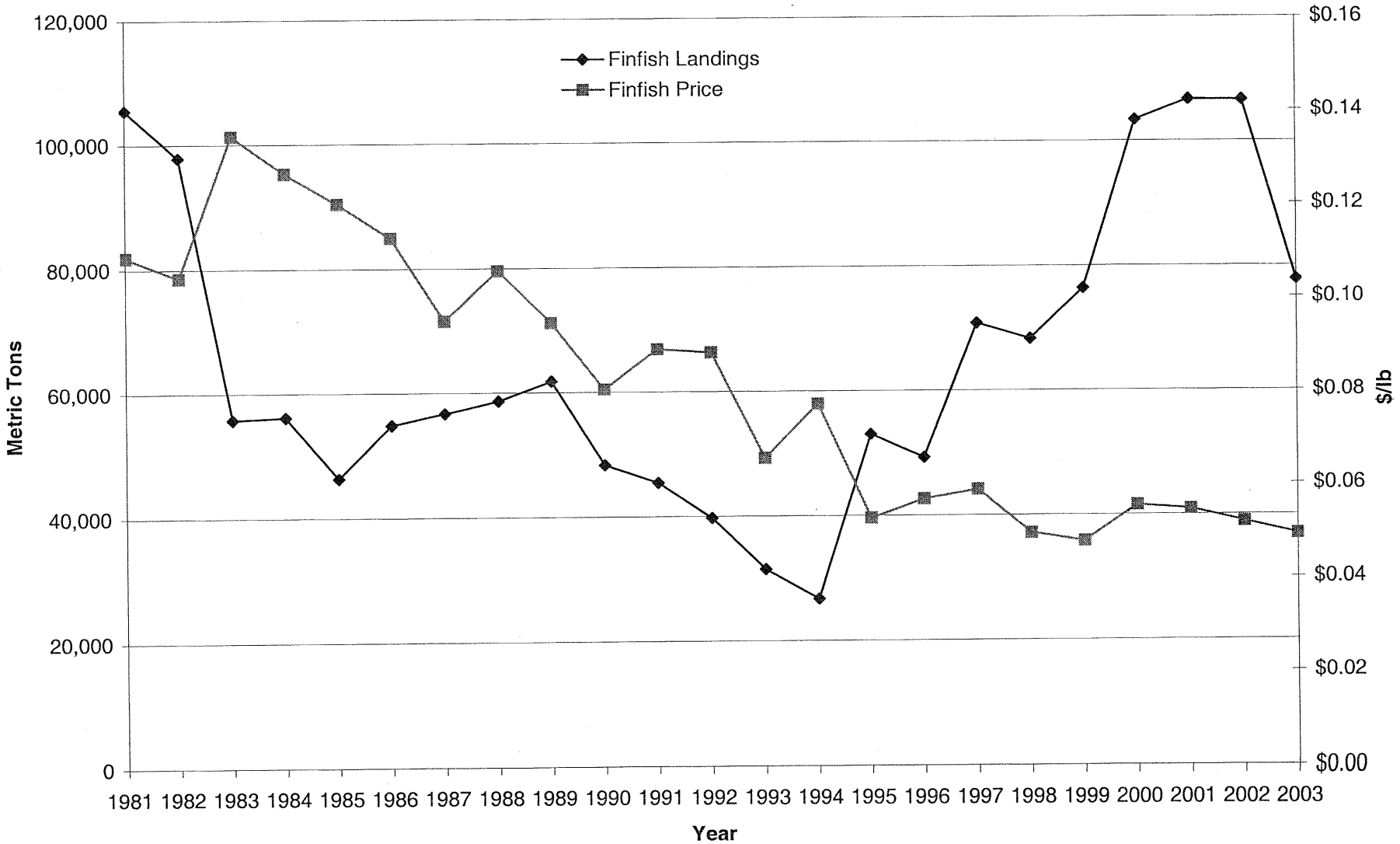


Figure 3. Pacific coast market squid landings and real exvessel price ($/lb, 2003 $), 1981-2003.

Figure 4. Number of vessels with Pacific coast landings of CPS finfish, and number for which CPS finfish was the principle species, 1981-2003.

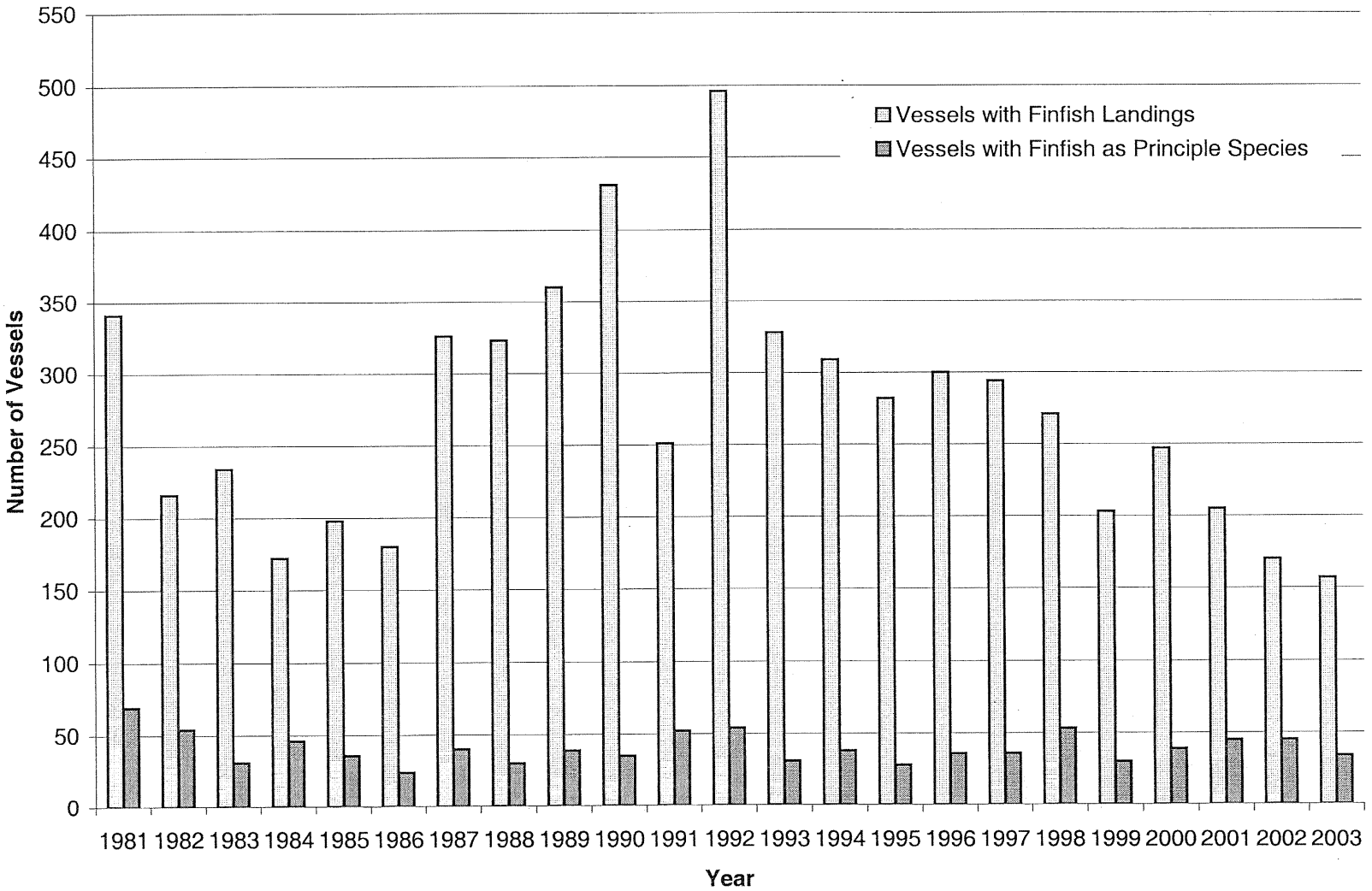


Figure 5. Number of vessels with Pacific coast landings of market squid, and number for which market squid was the principle species, 1981-2003.

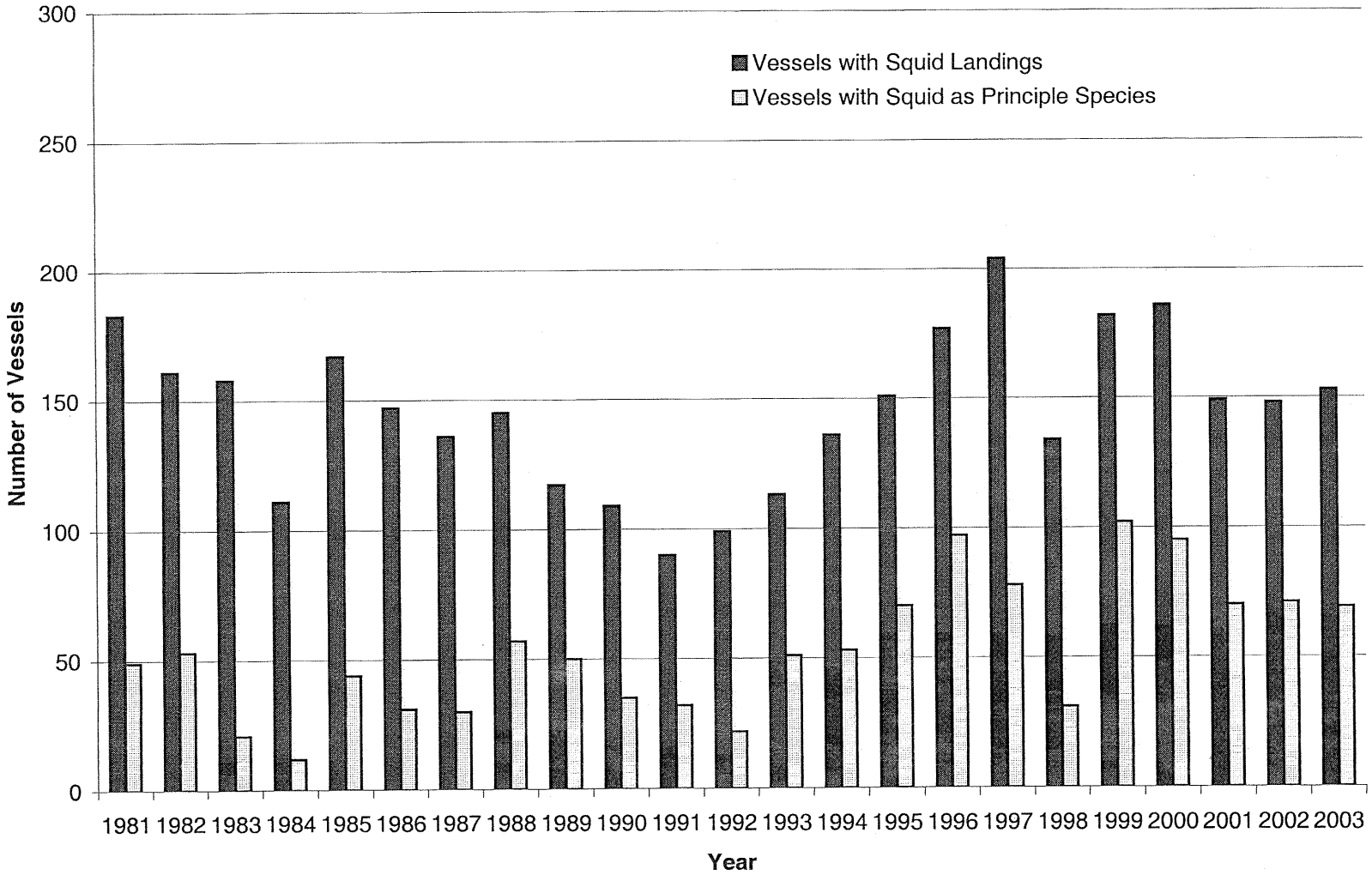
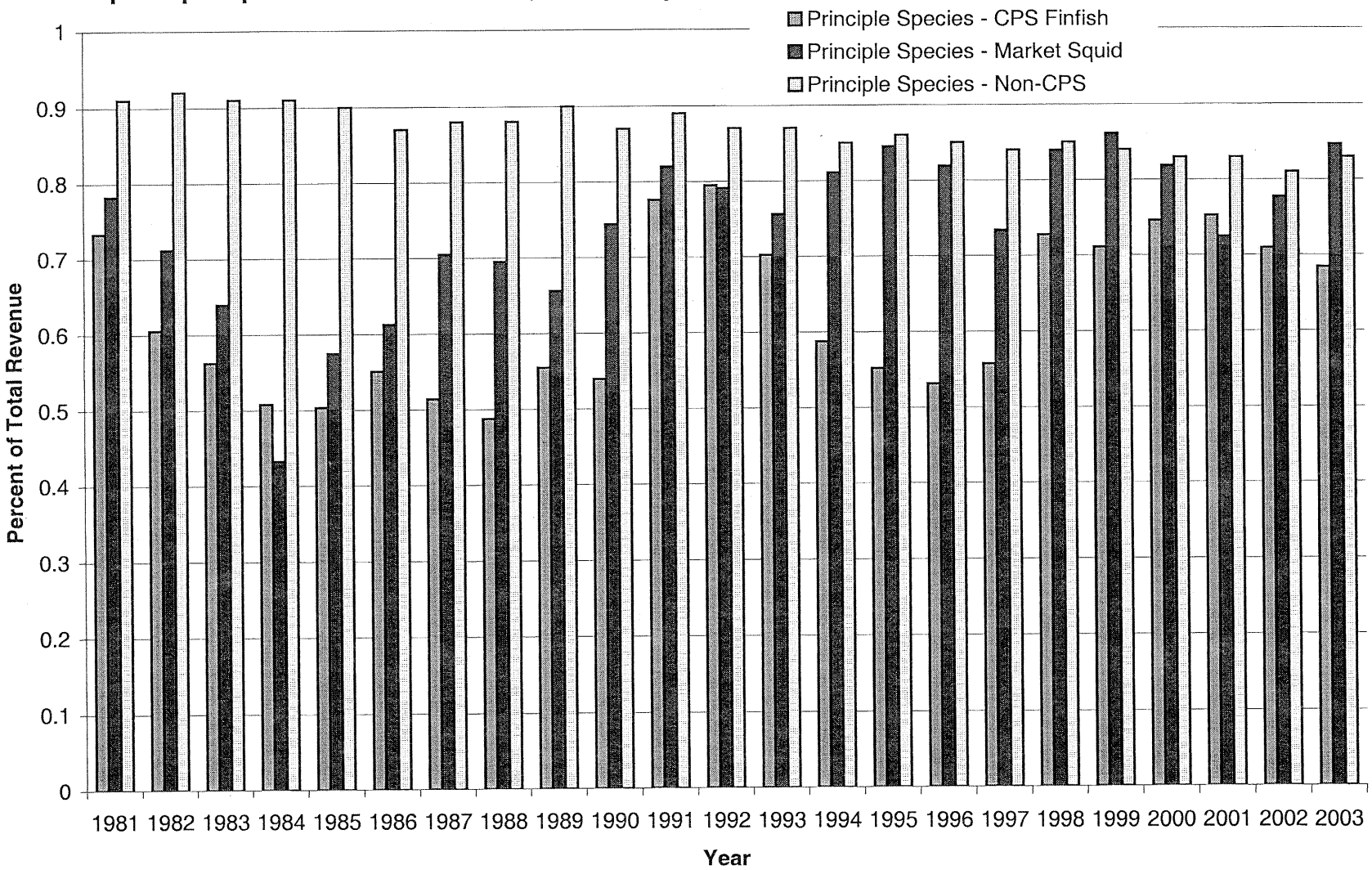


Figure 6. Average share principle species revenues of total revenues for vessels whose principle species was CPS finfish, market squid or non-CPS, 1981-2003.



APPENDIX 2

STOCK ASSESSMENTS FOR ACTIVELY MANAGED SPECIES

PACIFIC MACKEREL

AND

PACIFIC SARDINE

STOCK ASSESSMENT OF PACIFIC MACKEREL (*Scomber japonicus*) WITH RECOMMENDATIONS FOR THE 2004-2005 MANAGEMENT SEASON

EXECUTIVE SUMMARY

by

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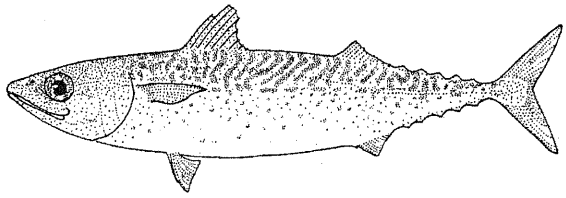

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INTRODUCTION

The following summarizes stock assessment results and harvest guideline (HG) recommendations for Pacific mackerel (*Scomber japonicus*) developed for the Pacific Fishery Management Council's (PFMC) management season of July 1, 2004 to June 30, 2005. This summary will also be included in the PFMC's Stock Assessment and Fishery Evaluation (SAFE) report for coastal pelagic species (CPS), and will be distributed prior to the June 2004 PFMC meeting. A comprehensive stock assessment report is concurrently being developed for the PFMC's first formal stock assessment review (STAR) scheduled for June 21-25, 2004.

SUMMARY OF THE 2003-2004 FISHING SEASON

The coast-wide harvest of Pacific mackerel decreased 35% in calendar year 2003 (Table 1, Figure 1). The directed fisheries off California and northern Baja California (Ensenada, Mexico) had a combined yield of 8,341 mt, compared to 12,778 mt in 2002. California's directed fishery for calendar year 2003 landed 5,185 mt – an increase of about 14% from the 2002 yield. The Ensenada fishery experienced a 65% decrease in yield, from 7,963 mt in 2002 to 2,815 mt in 2003 (Celia Eva Cotero, INP-Ensenada, pers. comm.). The RecFIN estimate of recreational harvest was 341 mt in 2003, up from 279 mt in 2002.

The U.S. commercial fishery was provided a 10,652 mt HG for the 2003-2004 (July-June) season, based on a July 1, 2003 biomass forecast of 68,924 mt (Hill et al. 2003). Through the PFMC management process, it was determined that in order to stay within the HG, there would be an initial directed fishery of 7,500 mt, with 3,152 mt set aside for incidental catch in other CPS fisheries. The 2003-2004 season has progressed slowly, with only 5,545 mt of the directed HG allocation being landed from July 2003 through March 2004. The fishery is projected to land a total of 5,735 mt through the end of June 2004, so will likely remain open through June 30, 2004.

Anecdotal observations from the field have attributed the reduced harvest from 2003-2004 to limited availability, rather than due to market conditions and/or redirected effort. Similar reasons have been postulated for the Ensenada fishery as well (Celia Eva Cotero, INP Ensenada, personal communication), which typically harvests larger yields when the fish are available. However, given the diversity of the species targeted by the CPS fleet at large over the years, it has been problematic objectively determining the influential factors that lead to reductions in harvest in the Pacific mackerel fishery. Finally, management-related information regarding this species' stock structure generally supported by the scientific community follow: (1) historically, mackerel spawning activity has been centered off the central and northern Baja California coast; (2) only limited data exist regarding mackerel abundance south of Ensenada; (3) mackerel have been present as incidental catch in whiting and salmon fisheries off Oregon and Washington since 1992; (4) during El Niño events, mackerel catches have been observed to increase in more northern (off Oregon and Washington) waters; and (5) the presence of older (say ages ≥ 3) and larger mackerel in this northern region, coupled with the relative paucity of these older age groups in the southern California landings, does generally support the expanding/contracting 'single-stock' hypothesis currently in place.

ASSESSMENT METHODS

Model

A modified virtual population analysis (VPA) model ('ADEPT,' Jacobson 1993), based on Gavaris' (1988) ADAPT procedure, was used to estimate biomass of Pacific mackerel. The ADEPT model has been used to assess Pacific mackerel for the past eleven years and is described in detail in Jacobson (1993), Jacobson et al. (1994), and Hill et al. (1999a,b). Conventional VPAs back-calculate age-structured abundance utilizing catch-at-age and weight-at-age data, as well as assumptions regarding both age-specific natural mortality in each year of the time series and fishing mortality (F) estimates for the most recent year (referred to as 'terminal F'). The ADEPT model improves upon a conventional VPA by evaluating terminal F and other parameters to obtain the best statistical fit between VPA output and survey indices of relative abundance. The crux of the statistical procedure lies in the model's ability to estimate terminal F based upon the survey indices, using them to adjust the conventional VPA output.

The ADEPT model uses a standard suite of subroutines to estimate parameters in a VPA model, based on a slightly modified simplex algorithm and subroutine from Press et al. (1990). The standard program for

parameter estimation is similar to that described by Mittertreiner and Schnute (1985). The ADEPT approach is based on the estimation method of maximum likelihood. Parameters are estimated by minimizing an objective function, which in the case of ADEPT, is the negative log-likelihood of the data, given the model and parameter estimates (rather than the equivalent sums of squares used by Gavaris 1988). Two types of parameters are estimated in the ADEPT model: observation parameters (survey-based q's and exponents) and terminal F parameters. Observation parameters are used to interpret index data, which are used in turn to estimate terminal F values. Terminal F parameters are highly influential for estimating population biomass for recent years. Natural mortality was assumed to be 0.5 yr^{-1} for all ages in all analyses (Parrish and MacCall 1978).

Data

The assessment model uses an annual time step and now incorporates 75 years (1929-2003) of fishery data, including landings (Table 1, Figure 1), age composition (Figure 2), and mean estimates of weight-at-age (Figure 3). Fishery data for the early historical period (1929-1965) were obtained from previously published assessments (Parrish and MacCall 1978; Prager and MacCall 1988). Abundance estimates from the VPA are adjusted by the model to better match trends in the survey data, which includes aerial spotter sightings (Lo et al. 1992; Figure 4), CalCOFI larval data (Figure 5), recreational fishery catch-per-unit-effort information (Figures 6 and 7), triennial shelf survey data (Figure 8), and power plant impingement rates (Figure 9). As in past assessments, component likelihoods for most surveys were weighted equally to a value of 1.0. The power plant impingement index (age-0 mackerel caught in cooling water at San Onofre Nuclear Generating Station) represents a small portion of the coastline and was therefore down-weighted to 0.1. The ADEPT model can also accommodate weighted annual survey observations based on coefficients of variation (CVs) associated with the individual estimates. As per Hill et al. (2003), we calculated CVs for each survey observation and re-scaled them to a median value. Re-scaling CVs to a value of 1.0 had the benefit of maintaining equal weighting among surveys, while down-weighting observations within surveys for poorly-sampled or highly-variable years.

Fishing Mortality in the Terminal Year

The ADEPT model estimate of terminal F largely determines biomass estimates for the most recent years. Terminal F estimates for each age group were calculated using age-specific vulnerability ('selectivity') parameters and a parameter for the overall fishing mortality rate:

$$[1] \quad F_a = V_a \bullet F,$$

where F_a is the fishing mortality rate at age a in the terminal year, V_a is the vulnerability for age a, and F is the fishing mortality rate experienced by fully-recruited age groups (ages with $V_a = 1$). The parameters F_a, V_a, and F were estimated after log transformation to improve numerical estimation. Vulnerability parameters in [1] could, in principle, be estimated individually by ADEPT or set manually to any fixed values based on 'prior' information. It is always desirable to estimate selectivities individually, however, data limitations often cause convergence problems making direct estimation impractical. When specified individually (fixed), the best that can be done is to estimate average vulnerability values by preliminary VPA analysis, then fix terminal selectivities to average values.

For this assessment, we enveloped uncertainty in recent biomass estimates using a method consistent with last year's assessment (Hill et al. 2003). We used fixed age-specific parameters based on vulnerabilities averaged for prior years with catch-at-age similar to 2003 (i.e., large proportion of age 0 and 1 fish in the catch; see Figure 2). After an initial model run using fixed values, ADEPT was configured to estimate selectivities of age 0-3 fish individually (ages 4 and ≥ 5 were necessarily fully-selected, i.e., $V_a = 1$ for all model runs). The model converged, however, the parameter for age 2 fish was the only one estimated with any degree of certainty (CV=27%). Model estimates for age 0, 1, and 3 fish were similar to initial values from the default method, but CVs for the estimates were extremely high. Thus, we used fixed values for 0, 1, and 3 year-old fish. Selectivities for age 0 fish are typically low (<0.2), and age 3 fish are moderately vulnerable to the fishery (roughly, 0.4-0.8).

A major area of uncertainty lies in the vulnerability of age-1 mackerel to the fishery. Age-1 vulnerability in the terminal year has the greatest potential impact on biomass calculations for recent years. In other words, a high proportion of age 1 fish in the 2003 catch may be interpreted in two ways: assumed lower vulnerability equates to relatively higher abundance; or assumed higher vulnerability results in relatively lower abundance. Prior model estimates of age-1 vulnerability range from low (~0.2) to high (1.0), with no consistent pattern over

the past fifteen years. For the final model run, we developed a broad range of 'states of nature' by calculating the frequency of occurrence of vulnerabilities for four general vulnerability categories (V_a=0.2, 0.4, 0.6, and 0.8) and subsequently, calculated an average vulnerability within each category. Ultimately, four model runs were conducted based on the age-1 vulnerabilities above and finally, these model outputs were used to derive a weighted estimate of important management-related stock parameters (e.g., biomass and recruits). A summary of final V_a parameters follows:

Age	Vulnerability Parameter (V_a)	Source
0	0.066	fixed average based on catch-at-age
1	0.209, 0.408, 0.602, 0.990	four values used to calculate weighted average
2	0.035	model estimated (CV=27%)
3	0.722	fixed average based on catch-at-age
4 and ≥5	1.000	fixed at 1

Biomass Projection for July 2004

Biomass was estimated through the beginning of 2003 (calendar year), then a projected estimate of biomass for July 1, 2004 was calculated based on: 1) the number of mackerel estimated to comprise each year class at the beginning of 2003; 2) model estimates of fishing mortality during 2003; 3) assumptions for natural mortality (M=0.5) and F through the first half of 2004; and 4) mean weight-at-age for 2003. Weight-at-age data were used to convert numbers of fish to biomass for each age, which was summed across ages to obtain total (≥1 year-old fish) biomass.

RESULTS and DISCUSSION

The ADEPT model recalculates biomass and recruitment for all years in the 75-year time series. Differences in biomass estimates among assessment years can be caused by changes in landings, shifts in fishery age compositions, trends in fishery-independent surveys, and assumptions regarding terminal year fishing vulnerability. As is true for all age-structured population models, abundance-at-age estimates are the least certain for the most recent years when the youngest year classes have not yet become fully vulnerable to, or utilized by, the fishery. Compounding this uncertainty is the general lack of fishery or survey data for Pacific mackerel outside the Southern California Bight and the lack of fishery-independent information on recruitment. Catch-at-age and weight-at-age data are not yet available from the Ensenada fishery, which is comparable in volume to California's commercial fishery.

Biomass Trend

Pacific mackerel biomass peaked in 1982 at approximately 1.39 million mt, declining steadily to a low of 10,438 mt in 2001 (Table 2, Figure 13). The peak biomass observed twenty years ago was primarily built by exceptional year classes in the late 1970s and early 1980s (Table 2, Figure 10). These recruitment pulses occurred after a decade of extremely low biomass from the mid-1960s to mid-1970s (Figure 13). The decline in biomass since 1982 has resulted from a steady decline in year class strength (Figure 10) and relatively low reproductive success (recruits per spawning stock biomass; Figures 11 and 12) since that time. Model estimates of 2001 and 2003 year class abundance are slightly higher than for the previous few years and recent reproductive success (recruits per spawning stock biomass) is more optimistic relative to the past 18 years.

The recent trend in ≥1year-old biomass for the current assessment was similar to that estimated in the 2003 stock assessment (Hill et al. 2003). A precipitous decline in biomass was observed from 1997 to 2001. This decrease is attributed to relatively weak year classes in 1998 to 2000 (Figure 10), combined with high fishing mortality during the 1998 fishery (i.e., keeping in mind that environmental conditions are also believed to strongly influence abundance associated with coastal pelagic stocks in general). The 1998 fishery was the second largest on record (71,355 mt), with the majority (50,726 mt) of the total harvest being landed in Ensenada, Mexico (Table 1, Figure 1). Despite the lower overall estimates of biomass compared with Hill et al (2003), the current time series indicates a stabilization in biomass in the past two years (Figure 13). This may be attributed to what appears to be a relatively strong 2001 year class that contributes substantially to the exploitable biomass. Finally, this stabilization should be interpreted in the context of the historical estimated abundance levels and thus, the population remains at relatively low levels compared with that realized during the 1980s and early 1990s.

Biomass Projection

The July 1, 2004 biomass projection, used to calculate the 2004-2005 HG, was based on ADEPT outputs and certain assumptions about recruitment and fishing mortality during the first half of 2004. Estimates of year class strength (age-0 abundance) for the terminal year (2003) are included in the forecast. Various approaches may be used to address uncertainty in model estimates of age-0 abundance: 1) use a model-derived estimate; 2) use an average of model-derived estimates; or 3) rely strictly on a stock-recruit relationship. Decisions concerning the best approach necessarily depend on assumptions regarding the accuracy of the hypothesized stock-recruit relationship and in particular, the existence of compensatory responses by the stock, i.e., relatively speaking, increased recruitment at low spawning biomass levels.

Reliance on the stock-recruit relationship seems reasonable when model estimates are considerably higher or lower than recently observed values and when no ancillary information exists to suggest that recruitment is atypically high (e.g., year class failure or a compensatory increase in juvenile production and/or survival). The model estimate of age-0 abundance for January 2003 was 310 million fish, well within the range of recruitments observed for the past eight years. Some evidence exists that suggests relatively strong year classes occurred within the past several years. The fishery contained some of the highest proportions of age-0 fish in recent history (e.g., 45% in 2003; Figure 2). The 2000 year class comprised the largest proportion (63%) of the 2002 catch. Length data from recreational angler surveys indicated increased catches of young mackerel by 'shore mode' anglers in 2000 and 2001. Based on the above evidence for stronger year classes, we applied the model estimate of 2003 age-0 abundance in the forecast. The projected estimate of July 1, 2004 population biomass (≥1 year-old fish) is approximately 81,383 mt.

HARVEST GUIDELINE RECOMMENDATION FOR 2003-2004

In Amendment 8 to the CPS FMP (PFMC 1998), the recommended maximum sustainable yield control rule for Pacific mackerel was:

$$\text{HARVEST} = (\text{BIOMASS-CUTOFF}) \times \text{FRACTION} \times \text{STOCK DISTRIBUTION},$$

where HARVEST is the U.S. HG, CUTOFF (18,200 mt) is the lowest level of estimated biomass at which harvest is allowed, FRACTION (30%) is the fraction of biomass above CUTOFF that can be taken by fisheries, and STOCK DISTRIBUTION (70%) is the average fraction of total BIOMASS in U.S. waters. CUTOFF and FRACTION values applied in the Council's harvest policy for mackerel are based on analyses published by MacCall et al. (1985). BIOMASS (81,383 mt) is the estimated biomass of fish age 1 and older for the whole stock as of July 1, 2004. Based on this formula, the 2004-2005 season HG would be 13,268 mt (Table 3, Figure 14). The recommended HG is 2,616 mt higher (+25%) than the 2003-2004 HG, and comparable to the average yield (~12,000 mt) realized by the fishery since the 1992-1993 season (Table 3).

ACKNOWLEDGMENTS

This annual stock assessment depends in large part on the diligent efforts of many colleagues and the timely receipt of their data products. Landings data from the Ensenada fishery were kindly provided by Dr. Celia Eva Cotero of INP-CRIP, Ensenada, Mexico. Port samples and age data were provided by CDFG Marine Region personnel in Los Alamitos and Monterey, with special thanks to Leeanne Laughlin, Valerie Taylor, Kelly O'Reilly, Travis Tanaka, Dianna Porzio, Tom Mason, Sonia Torres, Melissa Nugent for long dockside and laboratory hours. Wendy Dunlap (CDFG, Los Alamitos) supplied logbook data from California's CPFV logbook program. Ron Dotson, Amy Hays, and Sue Manion (NMFS, La Jolla) provided aerial spotter logbook data. Susan Jacobson (NMFS, La Jolla) extracted CalCOFI larval data. Numerous staff from SIO, NMFS, and CDFG assisted in the ongoing collection and identification of CalCOFI ichthyoplankton samples. Mark Wilkins (NMFS, Alaska Fishery Science Center, Seattle, WA) provided swept area estimates from the triennial trawl survey. Kevin Herbinson (Southern California Edison, Rosemead, CA) provided data on mackerel impingement at San Onofre Nuclear Generating Station.

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Table 1. Commercial and recreational landings (metric tons) of Pacific mackerel in California and northern Baja California (Ensenada, Mexico), for calendar years 1929 to 2003. See Figure 1.

Year	CA Com.	CA Rec.	MX Com.	TOTAL	Year	CA Com.	CA Rec.	MX Com.	TOTAL
1929	26,297	134	0	26,431	1966	2,100	492	5,290	7,882
1930	7,498	134	0	7,633	1967	529	260	948	1,738
1931	6,466	134	0	6,600	1968	1,421	189	107	1,718
1932	5,658	134	0	5,792	1969	1,070	288	201	1,559
1933	31,576	134	0	31,711	1970	282	311	0	594
1934	51,641	134	0	51,775	1971	71	538	0	609
1935	66,418	136	0	66,554	1972	49	590	0	639
1936	45,605	43	0	45,648	1973	25	478	0	503
1937	27,641	85	0	27,725	1974	61	246	0	307
1938	36,218	119	0	36,337	1975	131	312	0	443
1939	36,700	234	0	36,934	1976	298	123	0	421
1940	54,660	196	0	54,856	1977	9,220	1,163	0	10,383
1941	35,456	112	0	35,568	1978	21,520	2,256	0	23,776
1942	23,838	111	0	23,949	1979	35,823	3,053	0	38,876
1943	34,117	111	0	34,228	1980	38,188	2,754	0	40,942
1944	37,946	111	0	38,057	1981	42,450	1,394	0	43,844
1945	24,366	111	0	24,477	1982	35,019	1,667	0	36,686
1946	24,437	111	851	25,400	1983	35,454	1,469	135	37,058
1947	21,082	345	1,262	22,689	1984	45,572	1,445	128	47,144
1948	17,865	479	515	18,859	1985	40,514	1,077	2,581	44,172
1949	22,576	225	1,352	24,153	1986	46,557	1,003	4,882	52,441
1950	14,810	141	2,029	16,980	1987	41,212	1,271	2,081	44,565
1951	15,204	99	1,320	16,623	1988	43,991	800	4,883	49,674
1952	9,346	148	1,052	10,547	1989	38,637	611	13,383	52,631
1953	3,403	118	1,177	4,698	1990	39,850	1,126	35,757	76,732
1954	11,518	701	5,681	17,899	1991	32,162	1,190	17,445	50,798
1955	10,573	339	9,798	20,710	1992	19,699	779	24,338	44,815
1956	22,686	258	10,725	33,668	1993	12,680	624	7,739	21,043
1957	28,143	364	2,034	30,541	1994	10,043	947	13,319	24,308
1958	12,541	328	449	13,317	1995	8,667	1,026	4,821	14,514
1959	17,056	213	495	17,765	1996	10,287	694	5,604	16,584
1960	16,696	191	2,981	19,868	1997	20,615	967	12,477	34,059
1961	20,008	274	5,964	26,246	1998	20,073	449	50,726	71,248
1962	22,035	280	3,231	25,547	1999	9,527	197	10,168	19,892
1963	18,254	352	7,966	26,571	2000	23,206	250	7,182	30,637
1964	12,169	243	8,618	21,030	2001	7,785	561	4,078	12,424
1965	3,198	365	7,615	11,177	2002	4,536	279	7,963	12,778
					2003	5,185	341	2,815	8,341

Figure 1. Pacific mackerel landings by fishery for calendar years 1929-2003 (see Table 1).

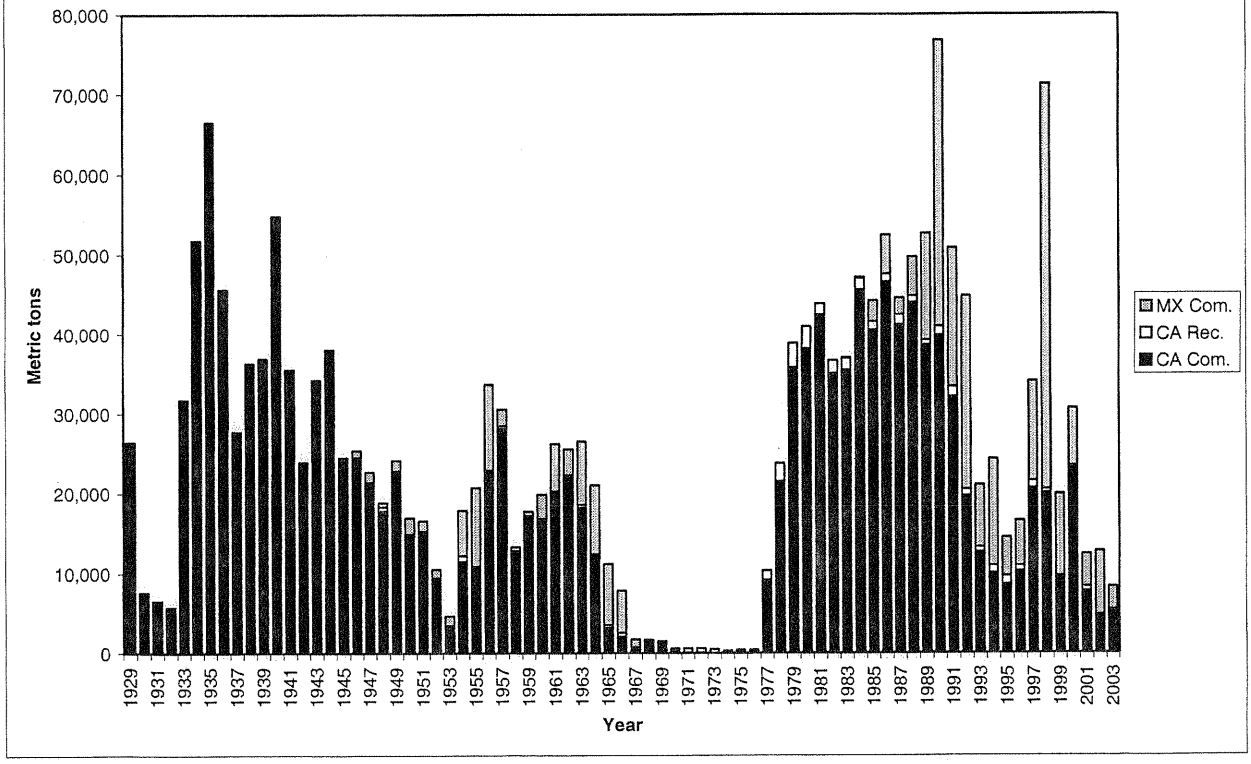


Figure 2. Proportional catch-at-age for California's commercial mackerel fishery, 1984-2003. The assessment model includes data from 1929-2003.

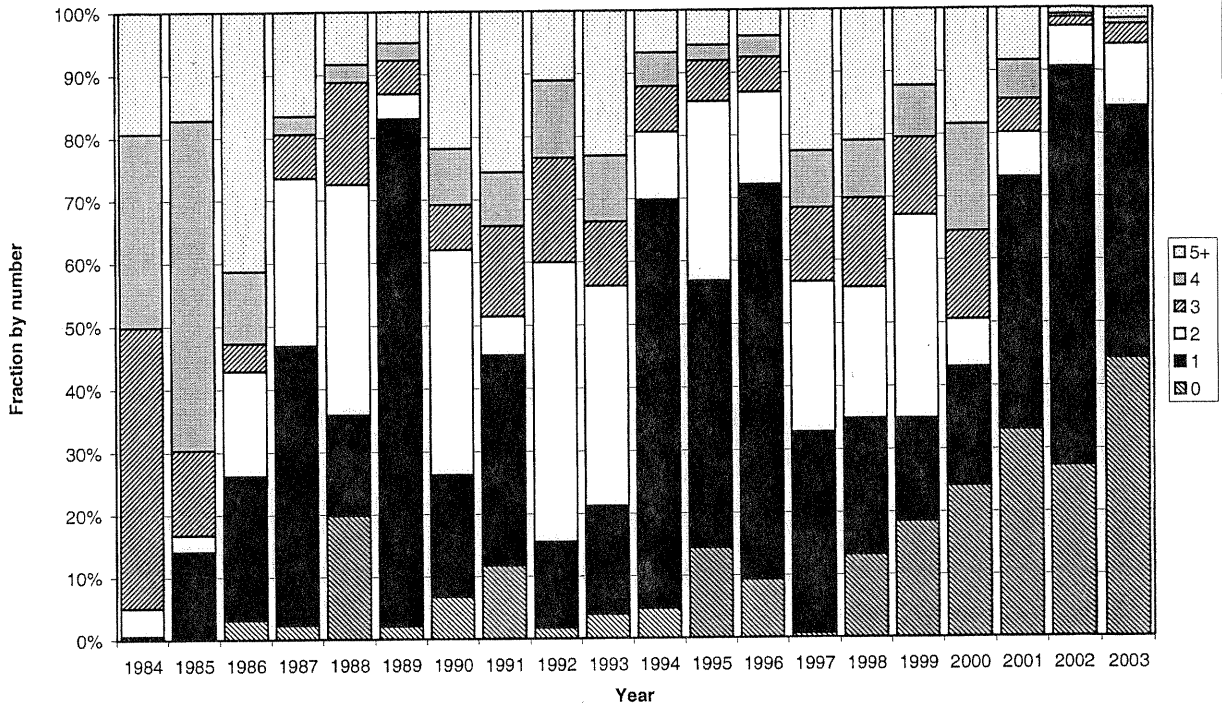


Figure 3. Weight-at-age of Pacific mackerel from California's commercial fishery, 1984-2003. The assessment model includes data from 1929-2003.

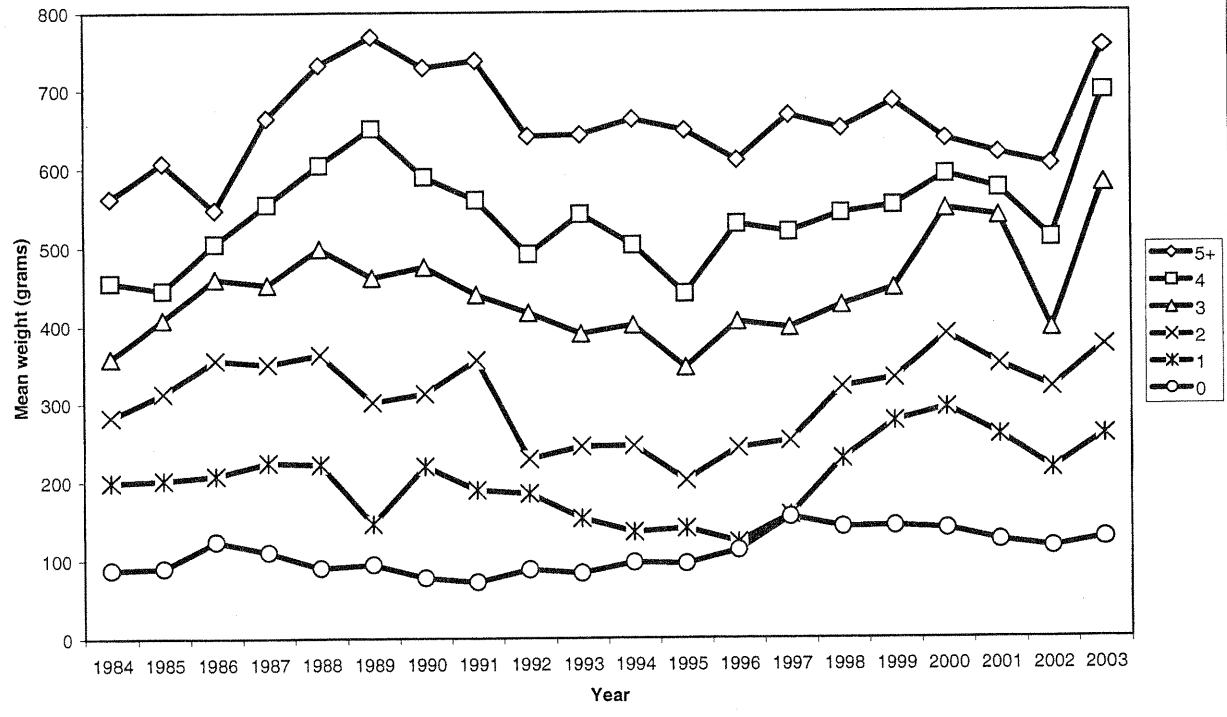


Figure 4. Aerial spotter index of relative abundance.

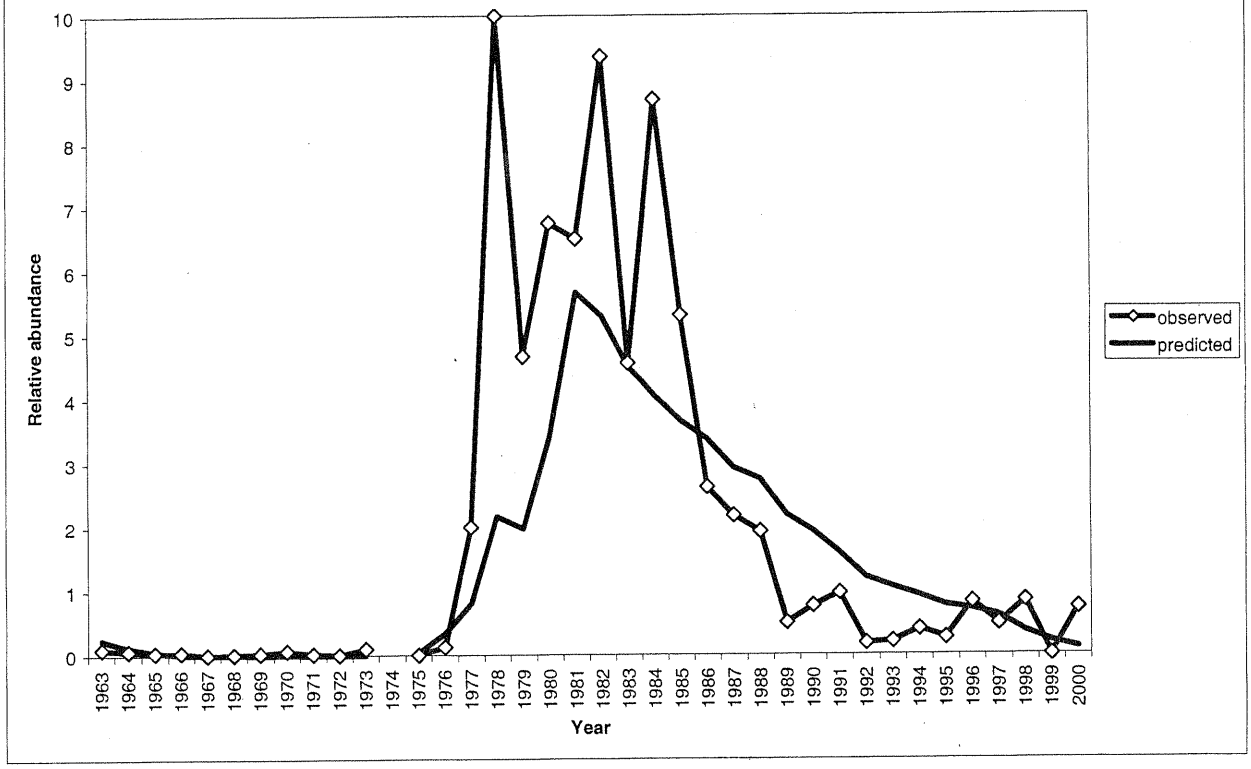


Figure 5. CalCOFI Index - proportion bongo tows positive for Pacific mackerel larvae.

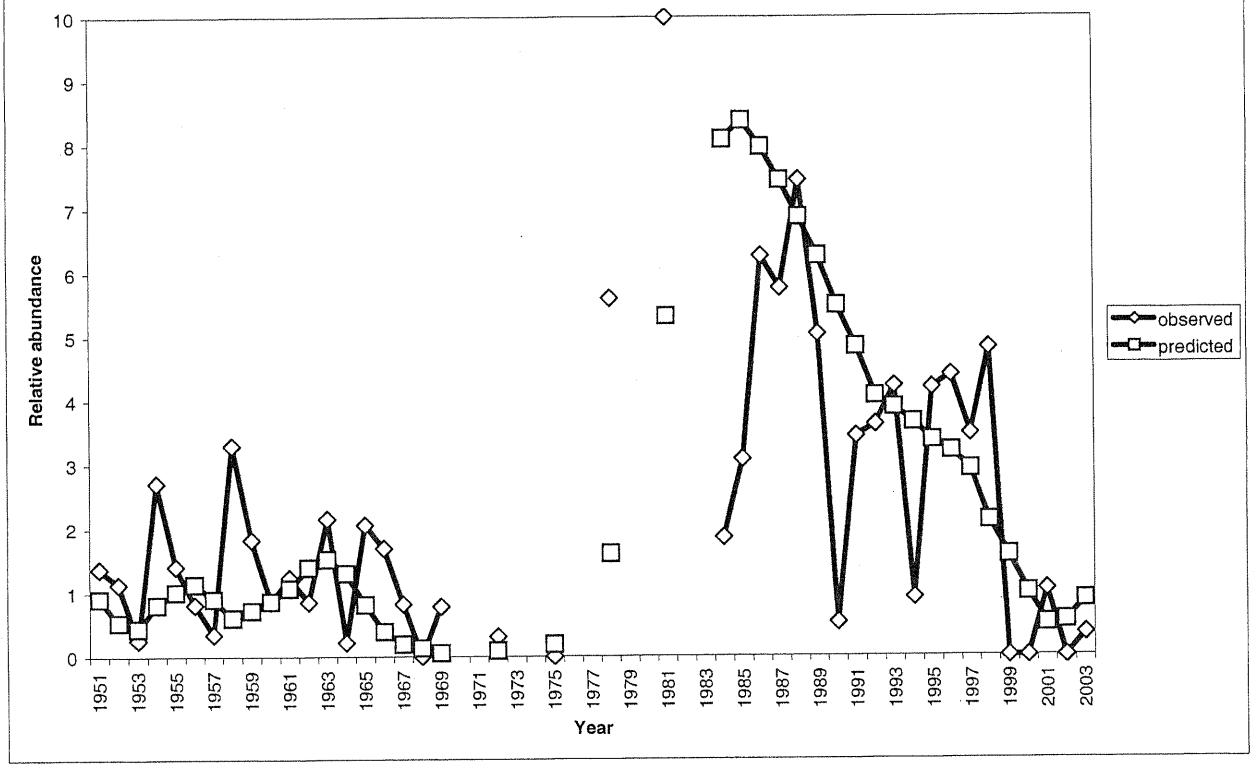


Figure 6. Southern California CPFV CPUE Index.

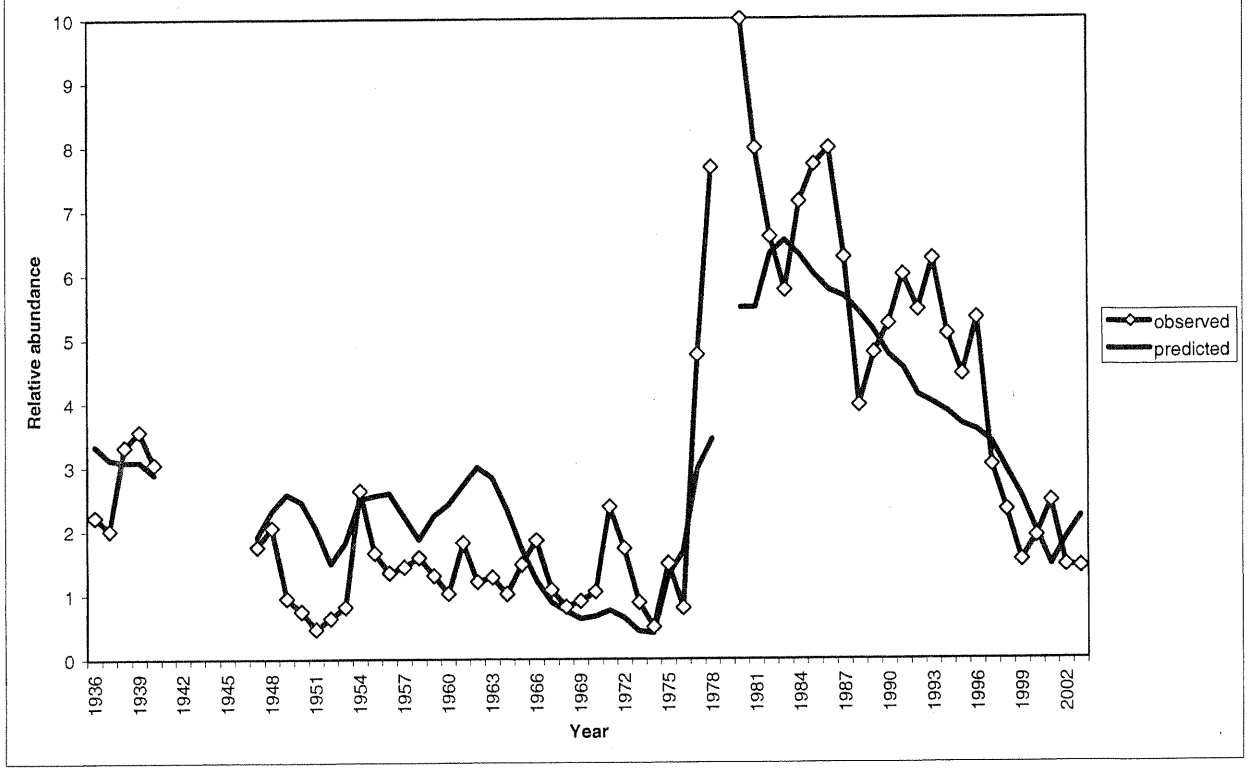


Figure 7. Northern California CPFV CPUE Index.

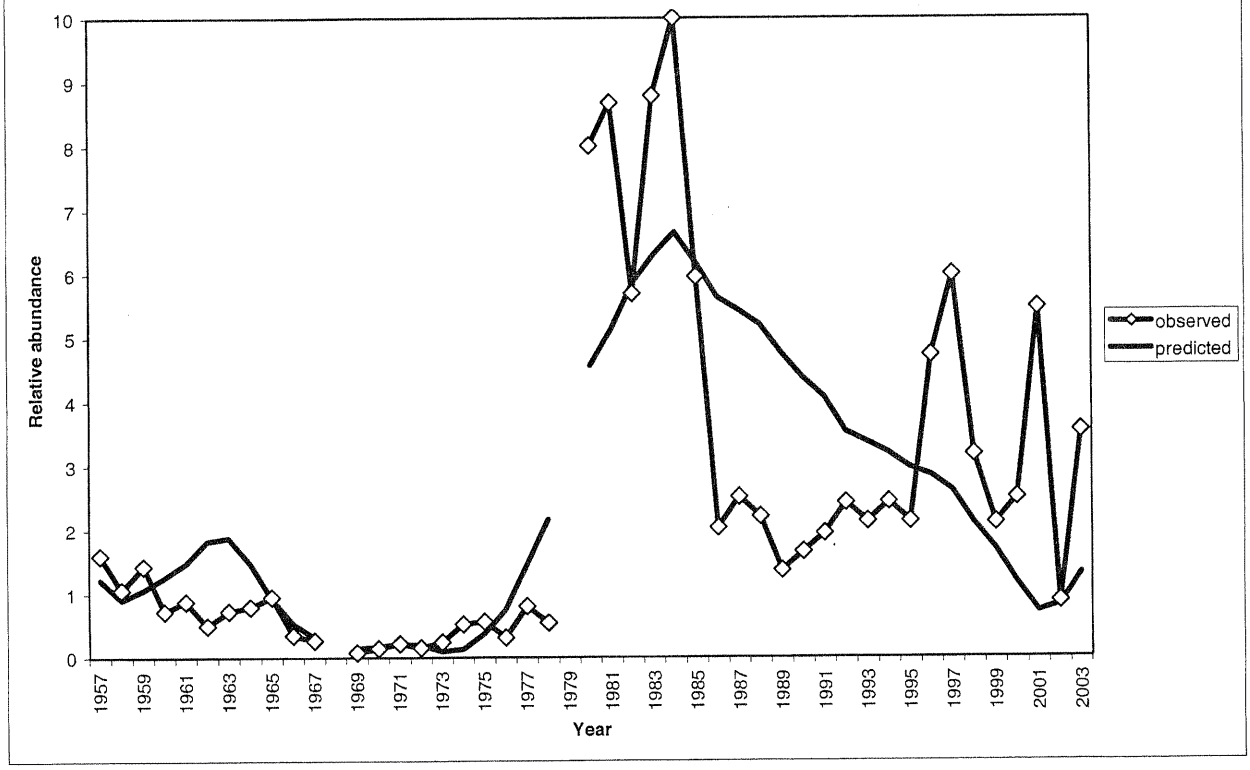


Figure 8. Relative abundance of Pacific mackerel in the trienniel shelf survey, Pt. Conception to the U.S.-Canada border.

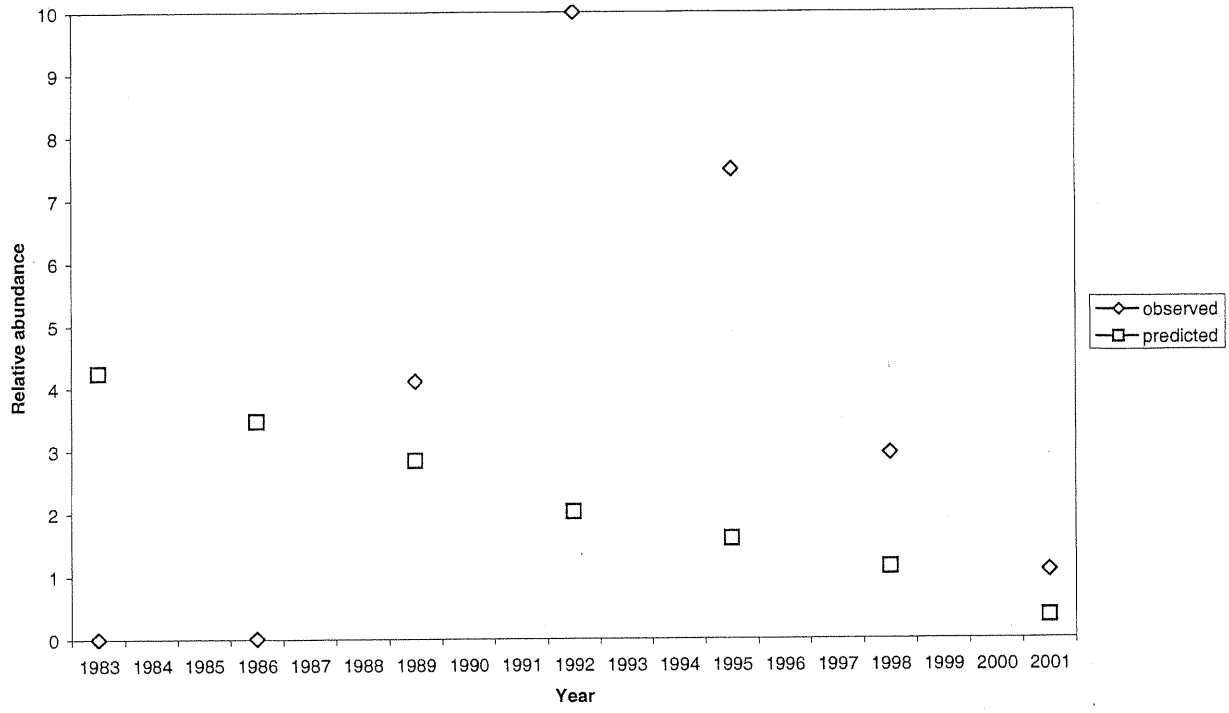


Figure 9. Pacific mackerel impingement at San Onofre Nuclear Generating Station. Index is downweighted to lambda=0.1.

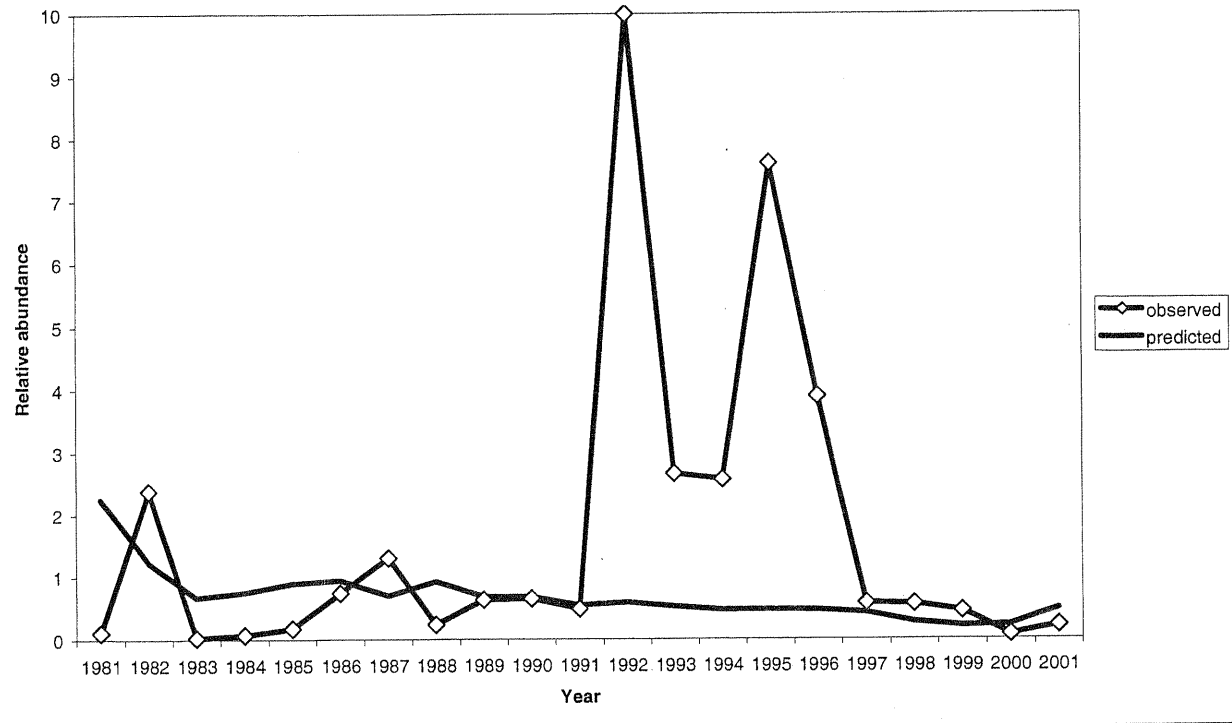


Figure 10. Year class abundance (millions), January 1.

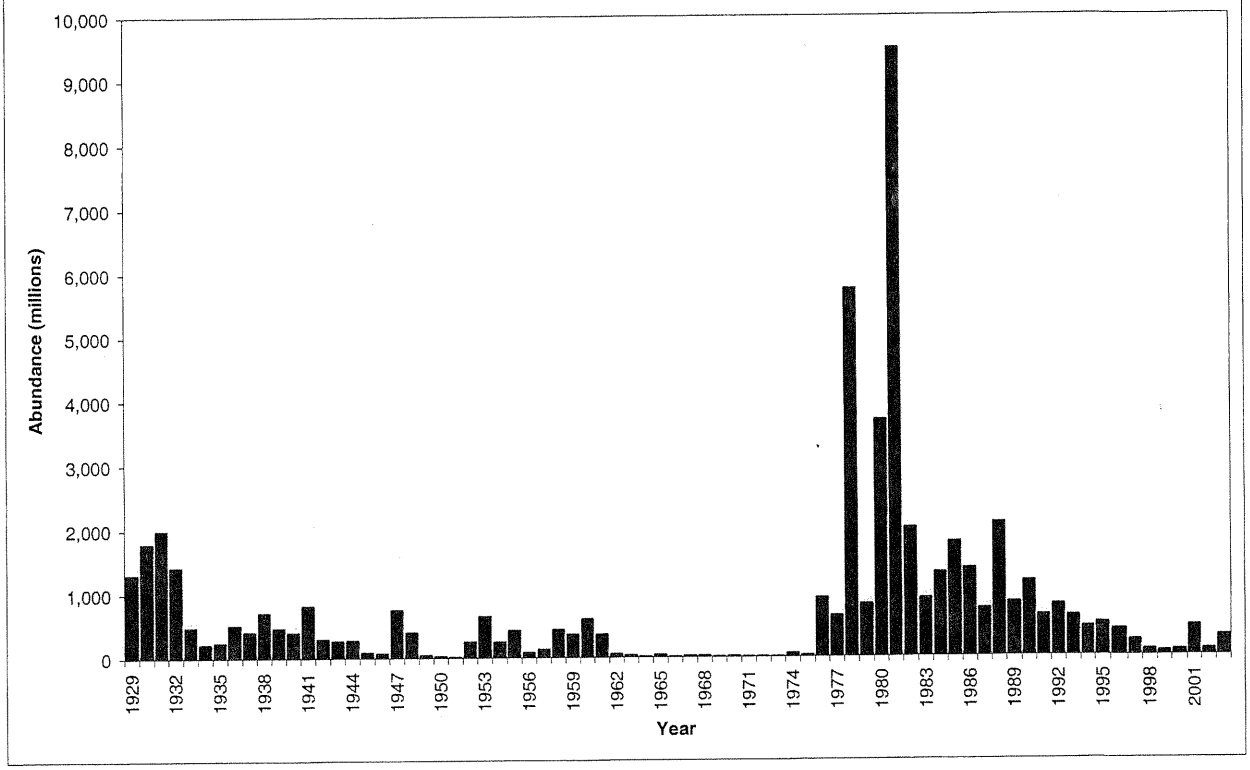


Figure 11. Relative reproductive success of Pacific mackerel, 1930-2003.

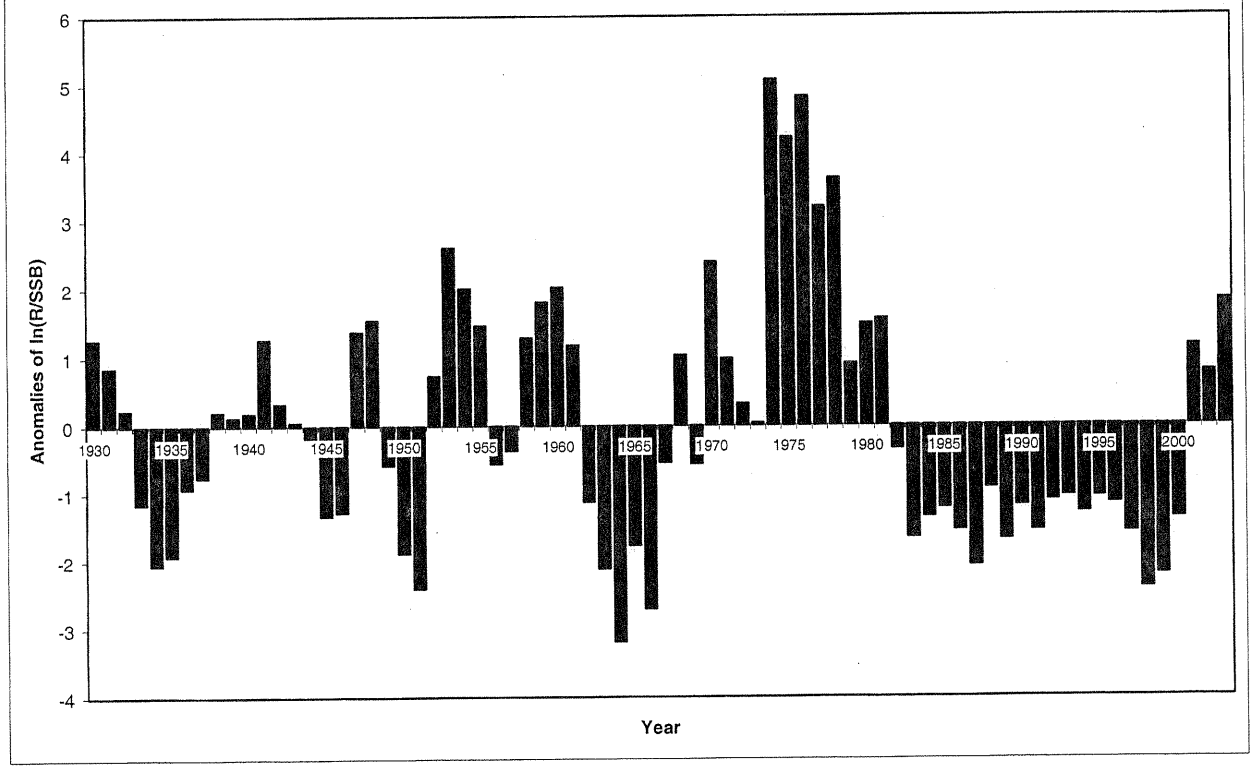


Figure 12. Recruitment Success and Spawning Stock Biomass, 1929/30 to 2002/03.

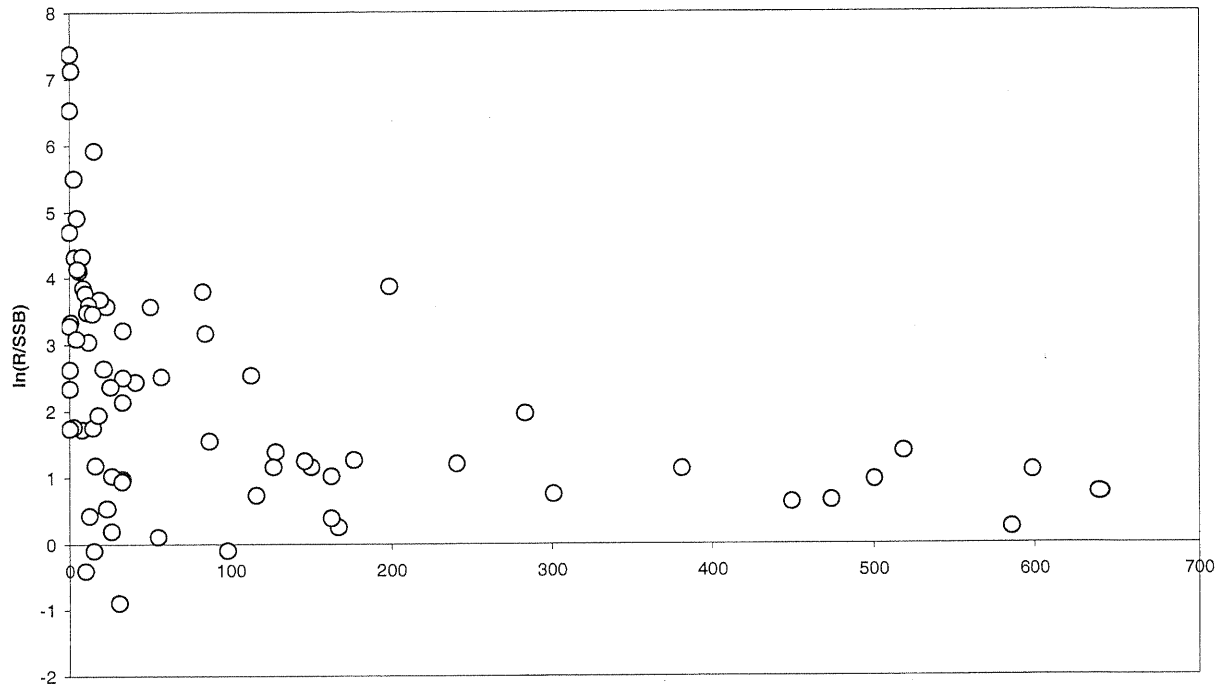


Table 2. Historical July 1 estimates of Pacific mackerel biomass (age 1+, metric tons) and recruitment (age 0, number $1x10^6$) estimated using the ADEPT model. See also Figures 10 and 13.

Year	Age 1+ Biomass (metric tons)	Recruits (millions)	Year	Age 1+ Biomass (metric tons)	Recruits (millions)
1929	155,877	1,020	1967	1,306	6
1930	223,002	1,392	1968	832	12
1931	296,364	1,551	1969	683	2
1932	365,192	1,106	1970	613	6
1933	350,593	373	1971	921	1
1934	289,571	167	1972	433	1
1935	192,391	186	1973	142	1
1936	127,708	399	1974	108	41
1937	114,713	319	1975	9,296	18
1938	105,562	549	1976	13,023	716
1939	116,868	362	1977	146,312	488
1940	91,175	311	1978	160,097	4,474
1941	86,415	635	1979	519,192	641
1942	114,205	233	1980	686,114	2,874
1943	105,781	210	1981	799,251	7,390
1944	84,277	216	1982	1,397,941	1,565
1945	65,374	68	1983	1,257,894	708
1946	41,075	57	1984	1,091,202	1,018
1947	20,862	582	1985	942,444	1,391
1948	57,031	310	1986	851,638	1,066
1949	60,783	35	1987	789,392	578
1950	42,490	15	1988	659,403	1,606
1951	21,921	10	1989	578,228	651
1952	8,133	198	1990	494,960	906
1953	26,276	495	1991	431,022	489
1954	61,752	192	1992	298,738	623
1955	55,043	326	1993	268,740	485
1956	62,478	66	1994	234,638	350
1957	32,664	97	1995	188,211	392
1958	21,300	330	1996	172,344	310
1959	43,937	280	1997	148,508	187
1960	51,512	467	1998	98,564	56
1961	80,677	265	1999	53,798	43
1962	96,241	41	2000	23,888	56
1963	69,787	24	2001	10,438	351
1964	35,922	10	2002	43,881	64
1965	12,602	25	2003	46,121	233
1966	4,198	3	**2004**	**81,383**	---

Figure 13. Pacific mackerel biomass estimates and projection, Ages 1+, July 1.

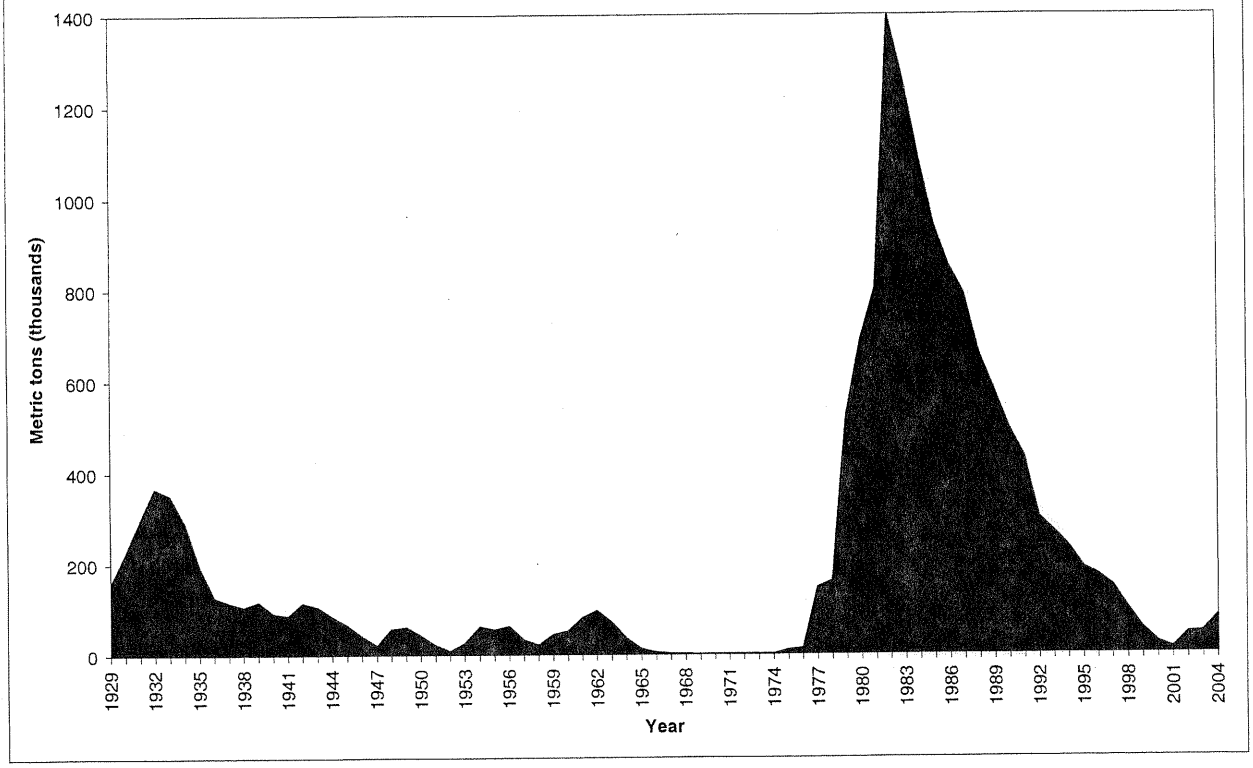


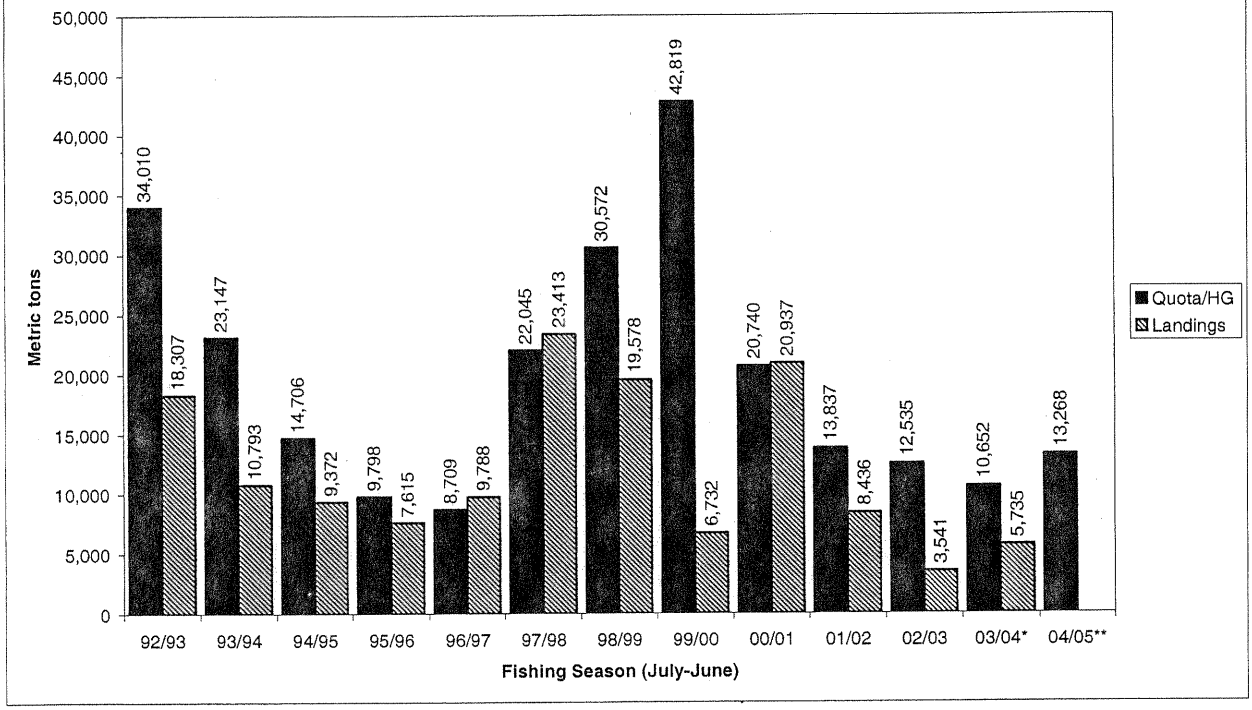
Table 3. Commercial landings (California directed fishery) and quotas (92/93 to 98/99) or harvest guidelines (99/00 to present) for Pacific mackerel. See also Figure 14.

Season	Quota/HG	Landings
92/93	34,010	18,307
93/94	23,147	10,793
94/95	14,706	9,372
95/96	9,798	7,615
96/97	8,709	9,788
97/98	22,045	23,413
98/99	30,572	19,578
99/00	42,819	6,732
00/01	20,740	20,937
01/02	13,837	8,436
02/03	12,535	3,541
03/04*	10,652	5,735
04/05**	**13,268**	---

* projected 03/04 landings.

** proposed harvest guideline for 2004/2005.

Figure 14. Pacific mackerel quotas (CA, pre-99/00) and harvest guidelines (PFMC, 99/00 onward), and resultant landings for each management season (see Table 3). The proposed HG for 2004/05 is 13,268.



Stock Assessment of Pacific Sardine with Management Recommendations for 2004

Executive Summary

by

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http://swfsc.nmfs.noaa.gov/frd/Coastal%20Pelagics/Sardine/sardine1.htm

Introduction

The following summary presents pertinent results and harvest recommendations from a stock assessment conducted on Pacific sardine (*Sardinops sagax*). It is an update to the stock assessment carried out last year (Conser et al. 2002), and is intended for use by the Pacific Fishery Management Council (PFMC) when developing management goals for the upcoming fishing season for sardine beginning January 2004.

The assessment results presented here are applicable to the sardine population off the North America Pacific coast from Baja California, Mexico to British Columbia, Canada. Research surveys (fishery-independent) have been conducted on an annual basis in the spawning areas off central and southern California. For most of the contemporary time series (1983-98), significant fishing for sardine occurred only off northern Mexico and California (Area 1 or *Inside* Area). As the sardine population rebuilt and expanded its range through the mid-1990's, sardine became more available seasonally off Oregon, Washington, and British Columbia. Subsequently, fisheries in these more northerly areas expanded with significant landings beginning in 2000. As in past assessments, research survey data (fishery-independent) are used to index the size of the sardine spawning biomass; and when coupled in a modelling framework with fishery-dependent data and structural information on sardine biology and migration, provide the stock size estimates and demographics needed by the PFMC to establish harvest guidelines for the USA fisheries.

Methods

An age-structured stock assessment model (CANSAR-TAM, **C**atch-at-age **AN**alysis for **SAR**dine - **T**wo **A**rea **M**odel, see Hill et al.1999) was applied to fishery-dependent and fishery-independent data to derive estimates of population abundance and age-specific fishing mortality rates. In 1998, the original CANSAR model (Deriso et al. 1996) was modified to account for the expansion of the population northward to waters off the Pacific northwest. The models are based on a 'forward-simulation' approach, whereby parameters (e.g., population sizes, recruitments, fishing mortality rates, gear selectivities, and catchability coefficients) are estimated after log transformation using the method of nonlinear least squares. The terms in the objective function (to be minimized) included the sum of squared differences in ($\log_e$) observed and ($\log_e$) predicted estimates from the catch-at-age and various sources of auxiliary data used for 'tuning' the model, e.g., indices of abundance from research survey data. Bootstrap procedures were used to calculate variance and bias (95% confidence intervals) of sardine biomass and recruitment estimates generated from the assessment model. The CANSAR-TAM model was based on two fisheries (California, USA and Ensenada, Mexico) and semesters within a year were used as time steps, with ages being incremented between semesters on July 1 and spawning that was assumed to occur on April 1 (middle of the first semester).

Fishery-dependent data from the California and Ensenada fisheries (García and Sánchez 2003) – 1983 to first semester 2003 – were used to develop the following time series: (1) catch (in mt)-

Table 1 and Figure-1; (2) catch-at-age in numbers of fish; and (3) estimates of weight-at-age. Fishery-independent data (time series) from research surveys included the following indices, which were developed from data collected from Area 1 (*Inside Area*, primarily waters off central and southern California) and used as relative abundance measures (Table 2): (1) index (proportion-positive stations) of sardine egg abundance from California Cooperative Oceanic and Fisheries Investigations (CalCOFI) survey data (*CalCOFI Index*)-Figure 2; (2) index of spawning biomass (mt) based on the Daily Egg Production Method (DEPM) survey data (*DEPM Index*)-Figure 3, see Lo et al. (1996); (3) index of spawning area (Nmi^2) from CalCOFI and DEPM survey data (*Spawning Area Index*)-Figure 4, see Barnes et al. (1997); and (4) index of pre-adult biomass (mt) from aerial spotter plane survey data (*Aerial Spotter Index*)-Figure 5, see Lo et al. (1992). Time series of sea-surface temperatures (Figure 6) recorded at Scripps Pier, La Jolla, California were used to determine appropriate harvest guidelines (*Sea-surface Temperature Index*), see Amendment 8 of the Coastal Pelagic Species Fishery Management Plan, Option J, Table 4.2.5-1, PFMC (1998). Further, the CANSAR-TAM model includes a modified Ricker (1975) spawner-recruit function that constrains recruitment estimates in the last few years. Following Jacobson and MacCall (1995), the modified model includes a term for sea-surface temperature, but the remaining spawner-recruit parameters are fixed per Jacobson and MacCall (1995).

Survey indices of relative abundance were re-estimated using generally similar techniques as was done in previous assessments (Hill et al. 1999; Conser et al. 2000; Conser et al. 2001; and Conser et al. 2002). The final model configuration was based on equally 'weighted' indices except for the CalCOFI index, which was downweighted to 0.7 (relative to 1.0 for the other indices). The relative weight used for the CalCOFI index (0.7) was consistent with previous assessments in which the proportion of the total spawning area covered by the CalCOFI surveys (~70%) was used to determine its relative weighting in the model. Further the CalCOFI Index has undergone considerable saturation in recent years due to the higher frequency of positive stations as the sardine stock expanded throughout and beyond the southern California Bight. As in the previous assessment, the CalCOFI index was fit with a non-unity exponent (0.3547) to allow for a nonlinear relationship between the index and sardine spawning biomass. This procedure produced a better fit to these data and a more acceptable residual pattern than assuming the classical linear relationship between the index of abundance and population size. As in the two previous assessments, the Aerial Spotter Index was assumed to primarily track pre-adult fish (ages 0 and 1 plus a portion of age 2 fish). All of the other fishery-independent indices were used as indices of the spawning stock biomass, which can be approximated by the biomass of ages 1+ sardine.

Recognizing that the geographical extent of the sardine population tends to increase as population size increases (inferred largely from tagging data and the expansion of the fishery in the 1930's), the CANSAR-TAM model uses explicit time-varying migration rates to 'move' sardine from the well-sampled Area 1 (roughly Baja California through central California) to the larger, coastwide stock area. Internal consistency checks are done to ensure that reasonable numbers of sardine are present outside Area 1 to account for the catches of the developing fisheries in the Pacific Northwest. In conjunction with the previous assessment (Conser et al.

2002), a sensitivity run was carried out in which (i) the available catch-at-age from Oregon and Washington fisheries (mostly 2000 and 2001) were formally incorporated into the model and (ii) no structural assumptions regarding migration rates were imposed. The 2002 assessment results were fairly robust to the alternative structural assumptions of the sensitivity run. The sensitivity run was not repeated this year. However, as the time series of catch-at-age data from the Pacific Northwest fisheries accumulates and fishery-independent data become available from northern areas, the structure of this sensitivity run is likely to become the template for future sardine stock assessments.

Results

Pacific sardine landings estimate for the directed fisheries off California, USA and Ensenada, Mexico decreased from the relatively high level that was reached during 2002 (107,000 mt), with a total 2003 harvest of roughly 94,000 mt (Table 1, Figure 1); however, note that semester 2 landings in 2003 reflect projected estimates based on landing patterns observed in the fisheries during recent years (Table 1). California landings in 2003 are expected to decrease somewhat from the 2002 level, while the Ensenada landings are projected to remain at the 2002 level or slightly above. Currently, the USA fishery is regulated using a quota (harvest guideline) management scheme and the Mexico fishery (Ensenada landings) is essentially unregulated.

As has been the case in recent years, landings from the USA Pacific sardine fishery (California, Oregon, and Washington) are below the harvest guideline recommended for 2003 (111,000 mt), with roughly 65,000 mt landed through September 2003 and 86,000 mt projected landings for the entire year (the fishing year ends December 31, 2003).

Estimated stock biomass ($\geq$1-year old fish on July 1, 2003) from the assessment conducted this year indicated the sardine population has remained at a relatively high abundance level, with a bias-corrected estimate of nearly 1.1 million mt (Table 3 and Figure 7). Estimated recruitment (age-0 fish on July 1) has increased significantly – with year-to-year fluctuation – since the late 1980's (Table 3 and Figure 8). Recent recruitment levels are an order of magnitude larger than the low levels estimated during the 1980's. However, it should be noted that recent recruitment (5-37 billion recruits) is not well-estimated (Figure 8) – largely due to the lack of a recruitment index in recent years. Another 2-3 years of data may be needed to ascertain whether the sardine population biomass has reached a plateau at approximately the one million mt level (Figure 7).

Estimates of Pacific sardine biomass from the 1930's (Murphy 1966 and MacCall 1979) indicate that the sardine population may have been more than three times its current size prior to the population decline and eventual collapse in the 1960's (Figure 9). Considering the historical perspective, it would appear that the sardine population, under the right conditions, may still have growth potential beyond its present size. However, per capita recruitment estimates show a downward trend in recruits per spawner in recent years that may be indicative of a stock that has reached a plateau under current environmental conditions (Conser et al. 2001).

Harvest Guideline for 2004

The harvest guideline recommended for the USA (California, Oregon, and Washington) Pacific sardine fishery for 2004 is 122,747 mt. Statistics used to determine this harvest guideline are discussed below and presented in Table 4. To calculate the proposed harvest guideline for 2004, we used the maximum sustainable yield (MSY) control rule defined in Amendment 8 of the Coastal Pelagic Species-Fishery Management Plan, Option J, Table 4.2.5-1, PFMC (1998). This formula is intended to prevent Pacific sardine from being overfished and maintain relatively high and consistent catch levels over a long-term horizon. The Amendment 8 harvest formula for sardine is:

$$HG_{2004} = (\text{TOTAL STOCK BIOMASS}_{2003} - \text{CUTOFF}) \bullet \text{FRACTION} \bullet \text{USA DISTRIBUTION}$$

where HG_{2004} is the total USA (California, Oregon, and Washington) harvest guideline recommended for 2004, TOTAL STOCK BIOMASS_{2003} is the estimated stock biomass (ages 1+) from the current assessment conducted in 2003 (see above), CUTOFF is the lowest level of estimated biomass at which harvest is allowed, FRACTION is an environment-based percentage of biomass above the CUTOFF that can be harvested by the fisheries (see below), and USA DISTRIBUTION is the percentage of TOTAL STOCK BIOMASS_{2003} in USA 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-water 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 years. Ultimately, under Option J (PFMC 1998), F_{msy} is constrained and ranges between 5% and 15% (Figure 10).

Based on the T values observed throughout the period covered by this stock assessment (1983-2003), the appropriate F_{msy} exploitation fraction has consistently been 15% (see Figures 6 and 1); and this remains the case under current oceanic conditions (T_{2003} = 17.5 °C). However, it should be noted that the general decline in sea-surface temperature observed in recent years (1998-2003) may contribute to environmentally-based reductions in the exploitation fraction in the future years – with concomitant reductions in future harvest guidelines (see Figure 10).

The 2004 USA harvest guideline (122,747 mt) is 11% greater the 2003 harvest guideline (110,908 mt). Recent fishery practices and market conditions indicate that it may not be constraining with regard to USA fishery landings in 2004 (Figure 11). However, recent

recruitment levels are not well-estimated, resulting in a high degree of uncertainty with respect to recent recruitment. If the actual recruitment in recent years is less than that estimated in the model and/or should the general sea-surface temperature decline continue, it is likely that harvest guidelines in the out years will constrain USA fishery practices and removals.

Further when viewed on a stock-wide basis and considering the landings of Mexico and Canada as well as the USA, adherence to an implied 'stock-wide harvest guideline' may constrain fisheries even without recruitment and sea-surface temperature declines. Figure 12 compares recent international landings with the annual harvest guidelines that would have resulted from applying the PFMC CPS FMP harvest formula (above) absent the "USA Distribution" term. International landings have exceeded such calculated harvest guidelines during the past two years (2002 and 2003). Should Oregon and Washington landings continue to increase (at rates comparable to the past few years) and/or Mexican landings return to the levels reported during 1997-2000 (average landings of 56,500 – see Table 1), the implied stock-wide harvest guideline will be exceeded again in 2004 and perhaps beyond.

Acknowledgments

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Table 1. Pacific sardine time series of landings (mt) by semester (1 is January-June and 2 is July-December) in California and Baja California (Ensenada), 1983-2003. Semester 2 (2003) estimates are projections. Note that estimates in 2002 reflect updated values and differ from projected estimates used in the assessment conducted in 2002, see Conser et al. (2002). Ensenada fisheries data are from García and Sánchez (2003).

	CALIFORNIA			ENSENADA			
Year	Semester 1	Semester 2	Total	Semester 1	Semester 2	Total	Grand Total
83	245	244	489	150	124	274	762
84	188	187	375	<1	<1	0	375
85	330	335	665	3,174	548	3,722	4,388
86	804	483	1,287	99	143	243	1,529
87	1,625	1,296	2,921	975	1,457	2,432	5,352
88	2,516	1,611	4,128	620	1,415	2,035	6,163
89	2,161	1,561	3,722	461	5,763	6,224	9,947
90	2,272	1,033	3,305	5,900	5,475	11,375	14,681
91	5,680	3,354	9,034	9,271	22,121	31,392	40,426
92	8,021	13,216	21,238	3,327	31,242	34,568	55,806
93	12,953	4,889	17,842	18,649	13,396	32,045	49,887
94	9,040	5,010	14,050	5,712	15,165	20,877	34,927
95	29,565	13,925	43,490	18,227	17,169	35,396	78,886
96	17,896	18,161	36,057	15,666	23,399	39,065	75,121
97	11,865	34,331	46,196	13,499	54,941	68,439	114,636
98	21,841	19,215	41,055	20,239	27,573	47,812	88,868
99	31,791	24,956	56,747	34,760	23,810	58,569	115,316
00	35,174	22,761	57,935	25,800	25,373	51,173	109,108
01	30,118	24,785	54,903	9,307	12,939	22,246	77,149
02	28,195	35,248	63,444	16,497	26,940	43,437	106,881
03	25,268	25,114	50,382	15,097	28,596	43,693	94,075

Table 2. Pacific sardine time series of survey indices of relative abundance and sea-surface temperature, 1983-03.

Year	CalCOFI (% positive)	DEPM (mt)	Spawning area (Nmi^2)	Spotter plane (mt)	Sea-surface temperature (C)
83	na	na	40	na	17.25
84	4.9	na	480	na	17.58
85	3.8	na	760	na	17.80
86	1.9	7,659	1,260	22,049	17.87
87	4.0	15,704	2,120	11,498	17.71
88	7.9	13,526	3,120	55,882	17.55
89	7.2	na	3,720	32,929	17.24
90	3.7	na	1,760	21,144	17.19
91	16.7	na	5,550	40,571	17.35
92	8.8	na	9,697	49,065	17.61
93	6.1	na	7,685	84,070	17.84
94	17.8	127,102	24,539	211,293	17.97
95	13.4	na	23,816	188,924	18.04
96	28.0	83,175	25,890	119,731	18.06
97	27.3	409,579	40,591	66,943	18.06
98	24.3	313,985	33,446	118,492	18.44
99	16.7	282,248	55,171	40,506	18.04
00	7.8	1,063,837	32,784	48,373	17.73
01	12.5	790,925	31,663	na	17.24
02	7.1	206,333	61,753	na	17.31
03	14.2	485,121	41,702	na	17.50

Table 3. Pacific sardine time series of stock biomass (>age-1 fish in mt) and recruitment (age-0 fish in 1,000s) estimated at the beginning of semester 2 of each year. Stock biomass estimates are presented for Area 1 (Inside) and the Total Area of the stock. The 95% CIs for Total Area biomass and recruitment estimates are also presented.

	Stock Biomass				Recruitment		
Year	Area 1	Total Area	Lower CI	Upper CI	Total Area	Lower CI	Upper CI
83	4,721	4,721	2,716	9,937	146,767	89,767	274,267
84	12,848	12,909	8,917	22,888	222,886	140,886	392,886
85	21,212	21,703	15,534	35,991	214,411	145,411	368,911
86	29,752	31,372	23,751	49,516	859,821	606,321	1,355,821
87	73,047	76,635	59,716	114,284	842,804	602,804	1,257,804
88	106,233	115,909	94,590	160,815	1,476,516	1,026,516	2,326,516
89	162,390	181,563	149,812	252,778	1,173,843	809,343	1,973,843
90	177,666	211,270	173,169	296,546	4,872,561	3,227,561	8,432,561
91	228,789	266,211	202,708	414,083	5,924,857	3,754,857	10,474,857
92	356,801	425,957	325,258	657,290	4,064,304	2,594,304	7,459,304
93	334,681	447,278	350,663	684,962	9,205,937	6,225,937	15,365,937
94	491,775	652,113	532,364	955,568	10,277,379	7,227,379	16,477,379
95	504,856	722,777	586,245	1,026,232	6,512,311	4,652,311	10,662,311
96	525,105	783,985	659,246	1,081,543	5,664,403	4,164,403	8,899,403
97	479,680	766,702	657,839	1,025,251	10,089,643	7,324,643	15,619,643
98	479,942	802,487	678,202	1,075,551	12,123,733	8,853,733	18,523,733
99	553,811	919,974	782,081	1,233,861	8,634,180	6,134,180	14,014,180
00	554,554	945,892	798,927	1,275,202	8,578,695	5,338,695	15,448,695
01	474,799	864,672	708,635	1,227,548	14,792,684	8,887,684	27,542,684
02	604,893	1,034,764	785,740	1,618,994	9,275,313	4,690,313	20,365,313
03	633,102	1,090,587	777,606	1,810,895	12,586,415	5,036,415	36,886,415

Table 4. Proposed harvest guideline for Pacific sardine for the 2003 fishing season. See Harvest Guideline for 2004 section for methods used to derive harvest guideline.

Total stock biomass (mt)	Cutoff (mt)	Fraction (%)	U.S. Distribution (%)	Harvest guideline (mt)
1,090,587	150,000	15%	87%	**122,747**

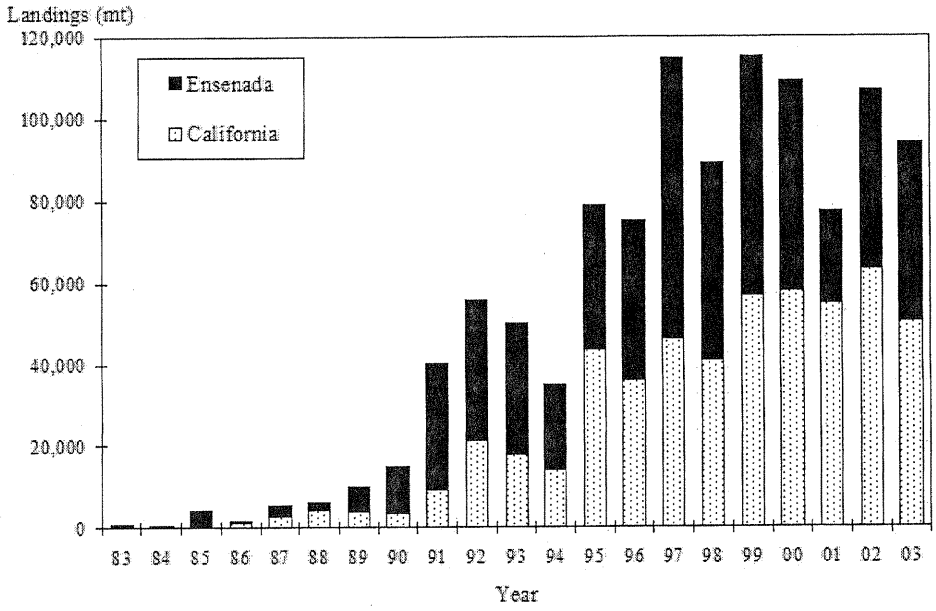

Figure 1. Pacific sardine landings (mt) in California and Baja California (Ensenada), 1983-03.

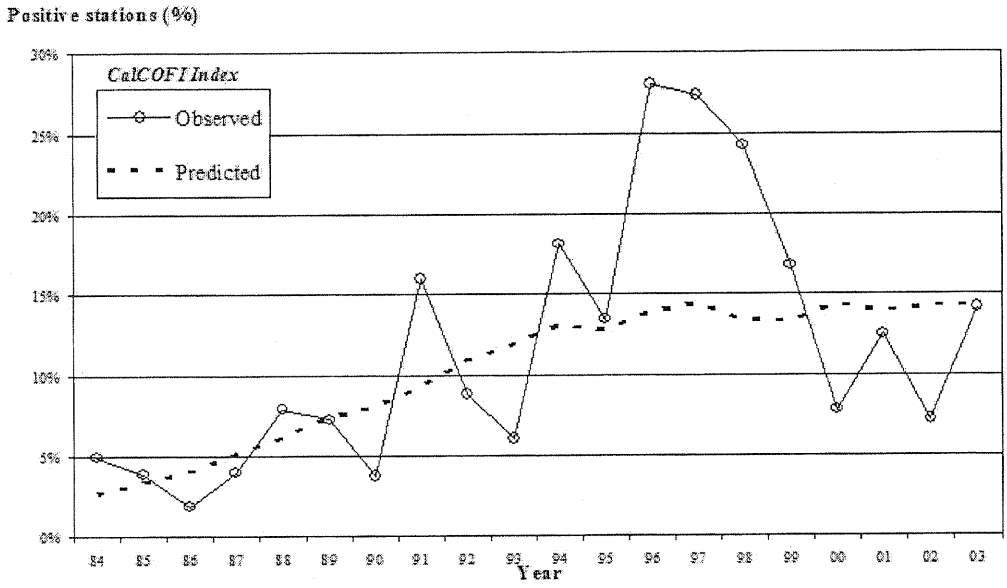

Figure 2. Index of relative abundance of Pacific sardine eggs (proportion-positive stations) off southern California based on CalCOFI bongo-net survey (1984-03).

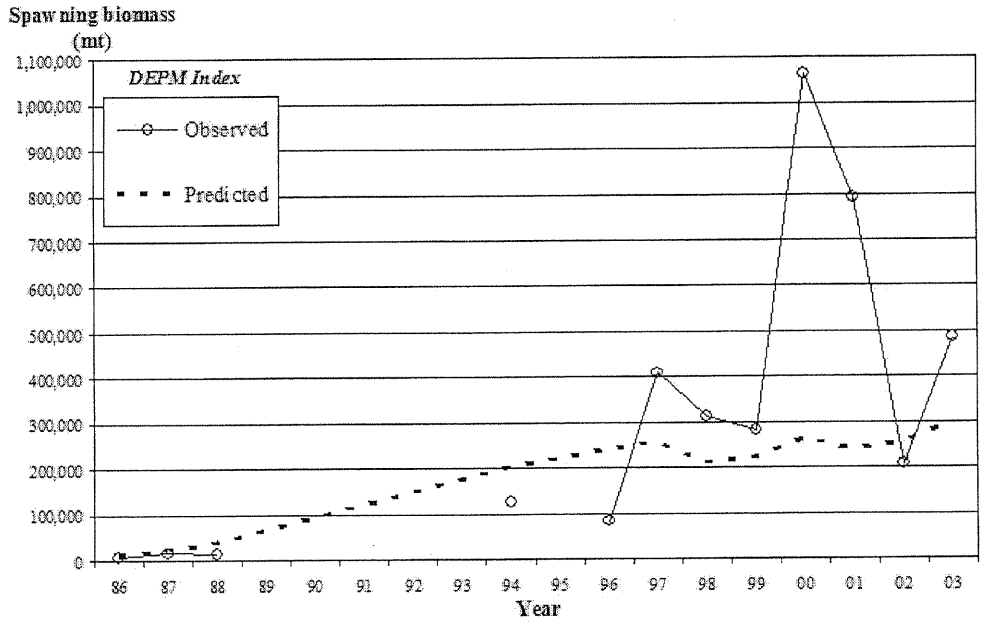

Figure 3. Index of relative abundance of Pacific sardine spawning biomass (mt) off California based on daily egg production method (DEPM) estimates from ichthyoplankton survey data (1986-03). Note that no sample data (Observed estimates) were available for years 1989-93 and 1995.

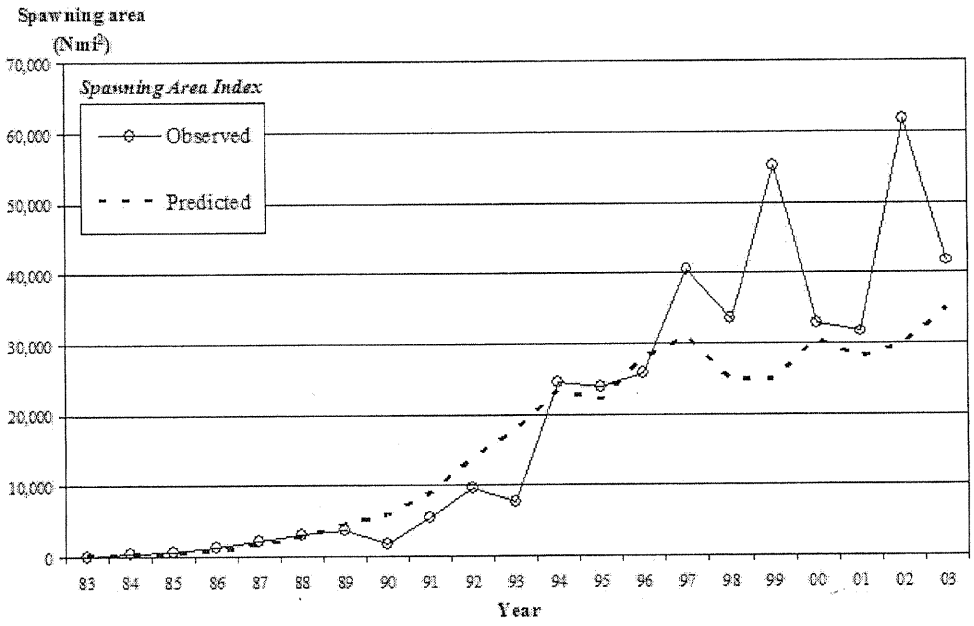

Figure 4. Index of relative abundance of Pacific sardine spawning stock size based on estimates of spawning area (Nmi2) calculated from CalCOFI and DEPM survey data (1983-03).

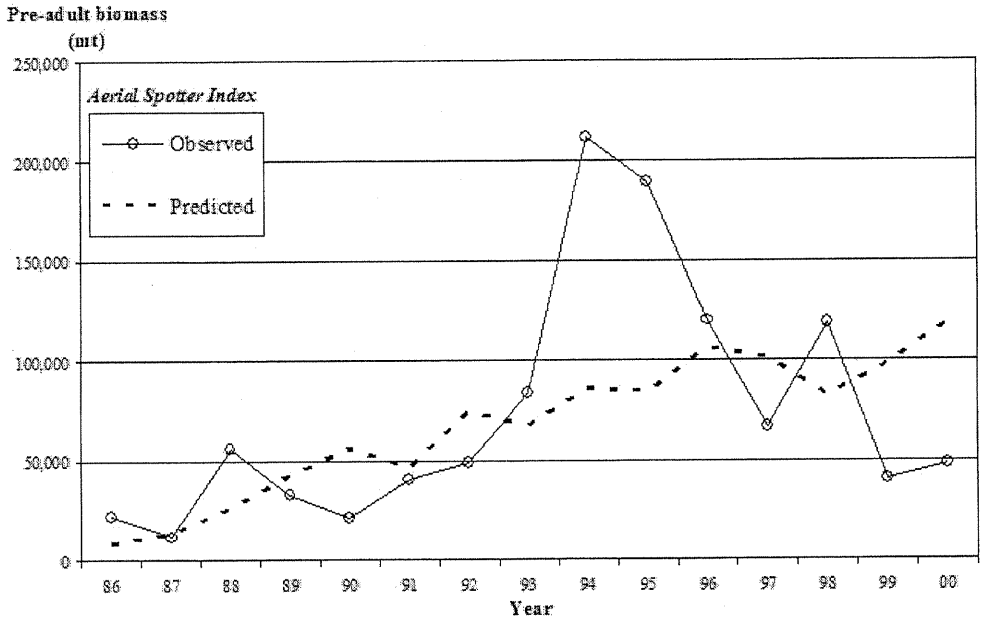

Figure 5. Index of relative abundance of Pacific sardine pre-adult biomass (primarily age 0-2 fish in mt) off California based on aerial spotter plane survey data (1986-00). Note that no sample data were available for 2001-03.

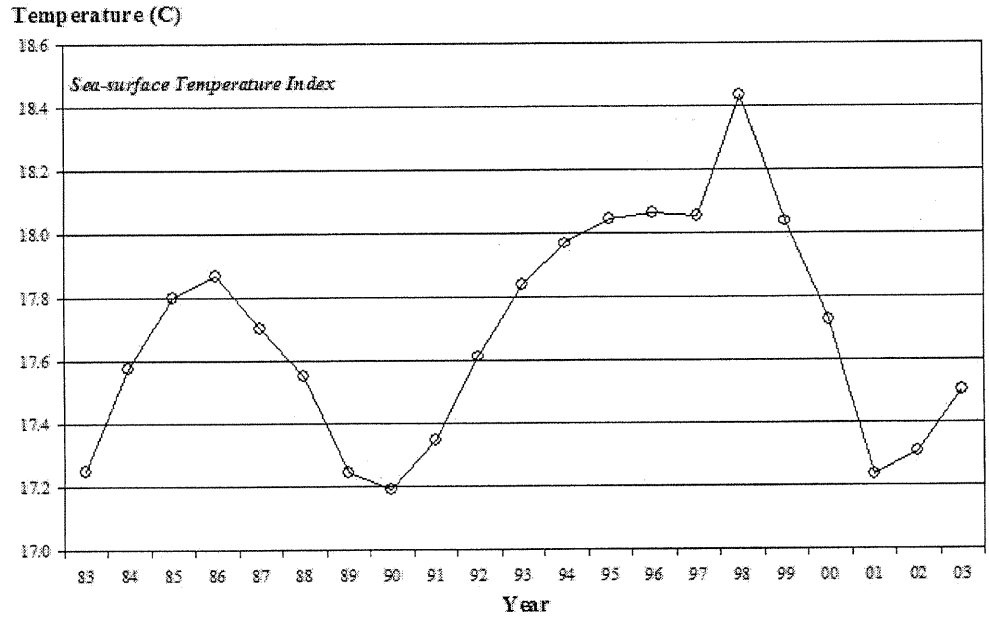

Figure 6. Time series of sea-surface temperature (C) recorded at Scripps Pier, La Jolla, CA (1983-03). Annual estimates reflect 3-year 'running' averages, see Jacobson and MacCall (1995).

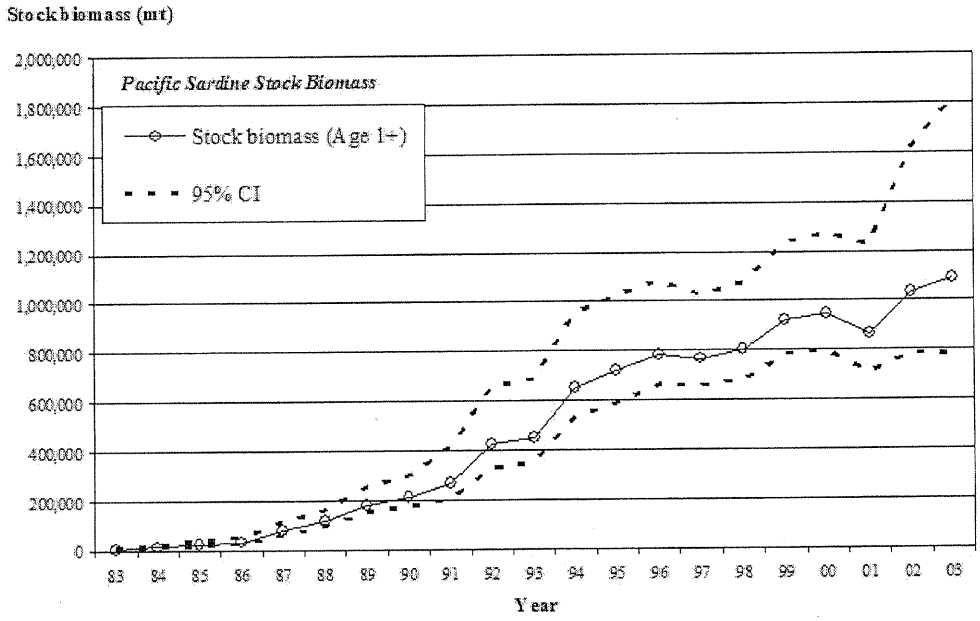

Figure 7. Time series (1983-03) of Pacific sardine stock biomass (>1-yr old fish on July 1 of each year in mt) estimated from an age-structured stock assessment model (CANSAR-TAM, see Hill et al. 1999).

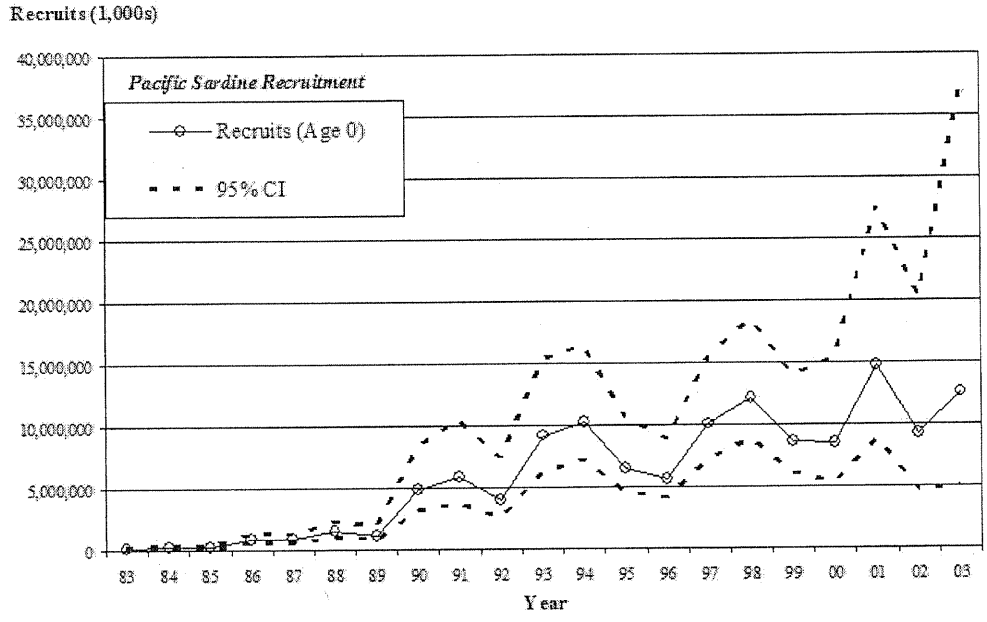

Figure 8. Time series (1983-03) of Pacific sardine recruitment (0-yr old fish on July 1 of each year in 1,000s) estimated from an age-structured stock assessment model (CANSAR-TAM, see Hill et al. 1999).

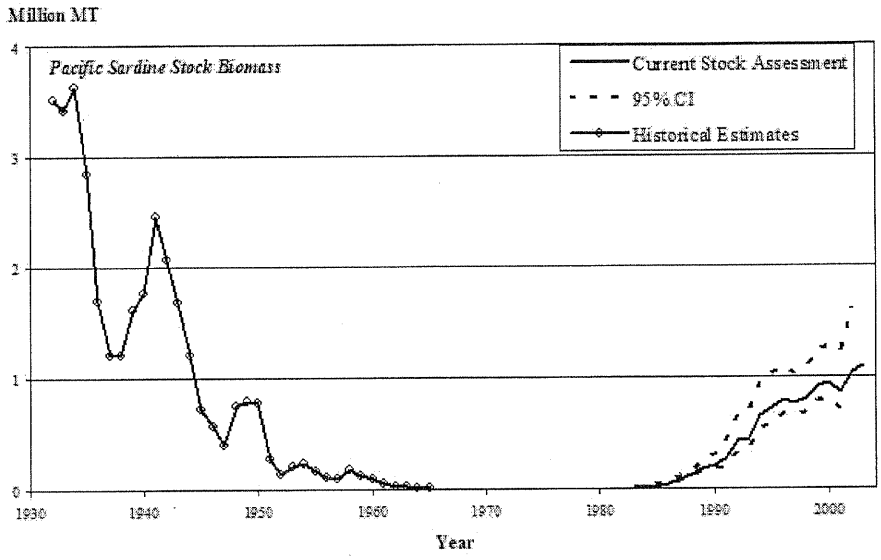

Figure 9. Time series (1983-2003) of Pacific sardine stock biomass (>age 1+ fish on July 1 of each year in million mt) and associated 95% confidence intervals estimated in the current stock assessment (cf. Figure 7); and historical stock biomass estimates (1932-65) from Murphy (1966). Confidence intervals or other measures of precision are not available for the historical estimates. No stock assessment-based estimates are available for the period 1966-82. The sardine fishery was closed during much of this period and biomass was at very low levels.

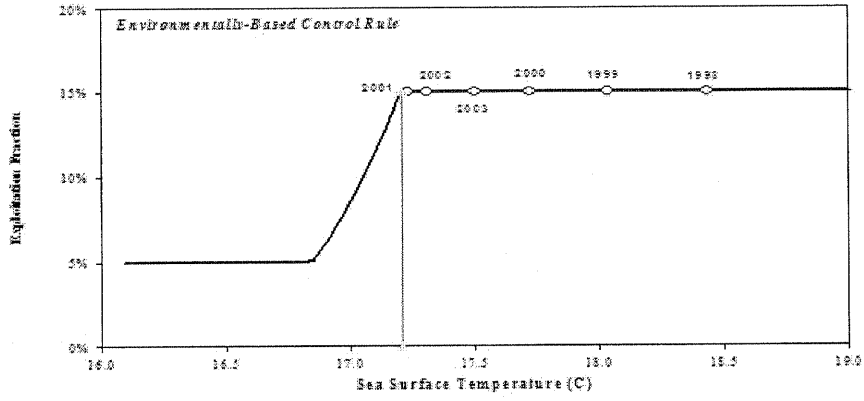

Figure 10. Environmentally-based harvest rate control rule for Pacific sardine as specified in the Coastal Pelagic Species Fishery Management Plan (PFMC 1998). For any given year, sea surface temperature (X-axis) is the running average sea surface temperature at Scripps Pier (La Jolla, CA) during the three preceding years. The exploitation fraction (Y-axis), which can range between 5-15%, is an explicit part of the algorithm used to determine the annual harvest guideline (quota) for the coastwide U.S. fishery – see Table 4. Open circles illustrate the sea surface temperature and exploitation fraction for recent years (1998-2003).

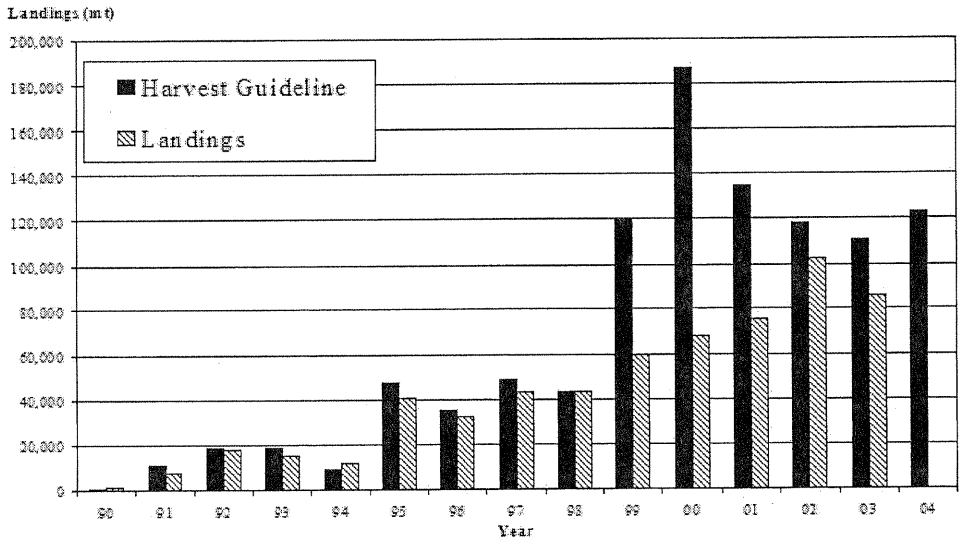

Figure 11. Time series (1990-03) of Pacific sardine harvest guidelines ('quotas') and actual landings (mt). State-based (California) regulations were in place for 1990-99, with federal-based (California, Oregon, and Washington) regulations beginning in 2000. Note that landings in 2003 represent a projected estimate and no landings thus far in 2004.

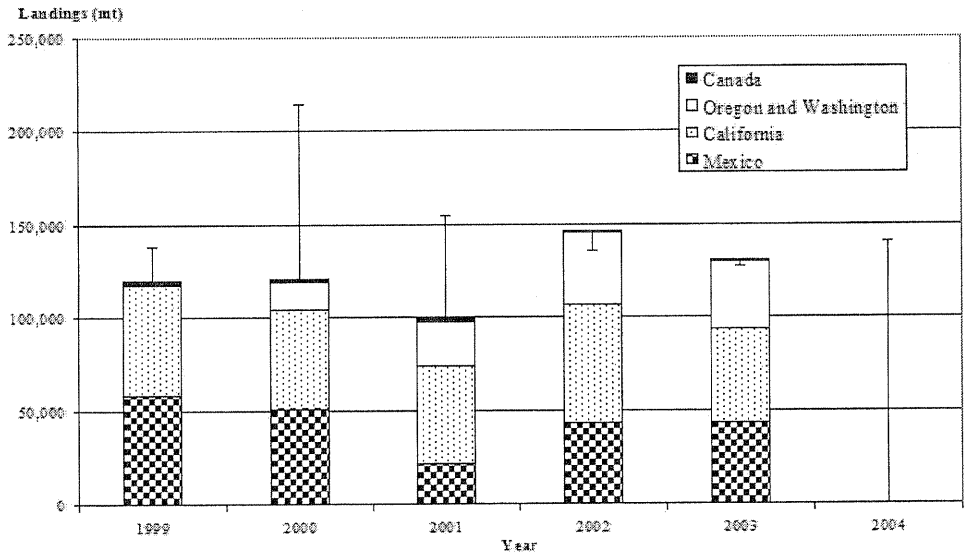

Figure 12. Pacific sardine landings (mt) from Mexico (Ensenda), California, Oregon and Washington, and Canada (1999-03). Landings shown for 2003 are estimates projected through the end of the calendar year. The thin bars illustrate the annual harvest guidelines that would have resulted from applying the PFMC CPS FMP harvest formula (see Table 4 and related text) on a stock-wide basis, i.e., applying the harvest guideline formula absent the 'U.S. Distribution' term.

APPENDIX 3

TERMS OF REFERENCE FOR A CPS STOCK ASSESSMENT REVIEW PROCESS

TERMS OF REFERENCE FOR A COASTAL PELAGIC SPECIES
STOCK ASSESSMENT REVIEW PROCESS
APRIL 2003

Introduction

The purpose of this document is to help the Council family and others understand the coastal pelagic stock assessment review process (STAR). Parties involved are the National Marine Fisheries Service (NMFS); state agencies; the Council and its advisors, including the Scientific and Statistical Committee (SSC), Coastal Pelagic Species Management Team (CPSMT), Coastal Pelagic Species Advisory Subpanel (CPSAS), Council staff; and interested persons. The STAR process is a key element in an overall process designed to make timely use of new fishery and survey data, to analyze and understand these data as completely as possible, to provide opportunity for public comment, and to assure the results are as accurate and error-free as possible. The STAR process is designed to assist in balancing these somewhat conflicting goals of timeliness, completeness and openness.

Stock assessments for Pacific sardine and Pacific mackerel are conducted annually to assess the abundance, trends and appropriate harvest levels for these species.[1/] Assessments use statistical population models to analyze and integrate a combination of survey, fishery, and biological data. At its November 2001 meeting, the SSC reported that

> *The Coastal Pelagic Species Management Team (CPSMT) has recommended a peer review process for the coastal pelagic species similar to the groundfish STAR process. The CPSMT suggests that full sardine and Pacific mackerel stock assessments and reviews be conducted on a triennial cycle, with a less formal review by the CPSMT and SSC during interim years. Full stock assessment reports would be developed and distributed following each STAR Panel review. Details from interim-year assessments could be documented in executive summaries similar to the one produced for this year's (2001) sardine assessment. As entirely new assessments are developed, a STAR Panel would be convened to review the assessment prior to implementation of results for setting harvest guidelines. The SSC supports the CPSMT's proposal.*

1/ Stock assessments are conducted for species "actively" managed under the Coastal Pelagic Species Fishery Management Plan (FMP). That is, fisheries for Pacific sardine and Pacific mackerel are actively managed via annual harvest guidelines and management specifications, which are based on current stock assessment information. Jack mackerel, Northern anchovy, and market squid are "monitored" species under the FMP. Annual landings of these species are monitored and reported in the annual Stock Assessment and Fishery Evaluation (SAFE) report, but harvest guidelines are not set for them.

At its June 2002 meeting, the SSC further noted that the methodology on which the 2002 Pacific mackerel stock assessment was based...

> *is not fully documented in the Stock Assessment and Fishery Evaluation (SAFE) report precluding a detailed review by the SSC at this time. The SSC recommends the methodology be reviewed in detail by a stock assessment review panel in 2003. The CPS subcommittee of the SSC will develop Terms of Reference for such a review if it is supported and funded. The timing of any review needs to be coordinated with the timing of the groundfish Stock Assessment Review (STAR) Panels for 2003.*

Clearly there is a need to develop and implement a stock assessment and review (STAR) process for coastal pelagic species similar to that for groundfish. The first and most pressing candidates are Pacific sardine and Pacific mackerel.

Pacific sardine is now, along with Pacific whiting, the most abundant fish resource off the West Coast; at one time sardine was the largest single-species fishery in the world, yet the research program for supporting sardine assessment is seriously under funded and under reviewed. The current fishery independent surveys only provide indices of sardine egg abundance and daily egg production. The aerial fish spotter index (used as a measure of sardine recruitment) only covers the nearshore areas of the southern California Bight and, more recently, spotter effort has been at negligible levels as spotter pilots have focused on other non-CPS fisheries. The adult parameters used in recent biomass estimates are computed on the basis of biological data collected in 1994, at a time when the population was one-tenth of the 2002 biomass. The data sources for sardine are limited to geographic areas off Baja California, Mexico, and the State of California (particularly the area from San Diego to Monterey Bay). A migration model parameterized with historical estimates of sardine migration rates is used to extrapolate the stock assessment to the northern areas of the sardine distribution. With the recent expansion of the sardine population off Oregon, Washington, and British Columbia, there is an urgent need to incorporate fishery-dependent data for northern areas into the stock assessment and to initiate resource surveys to establish a fishery-independent time series for those areas.

The same can be said for Pacific mackerel. The 2002 harvest guideline (HG) was based on the same stock assessment methodology and harvest control rule used in 2001, with the addition of one additional year's data. Compared with the 2001 assessment, the biomass time series for the 2002 assessment was 14% lower over the last decade, and the July 1, 2001 biomass, a projection in the 2001 assessment, 30% lower. The methodology on which this (current) assessment is based is not fully documented in the SAFE report precluding a detailed review by the SSC. Therefore, in 2002 the SSC recommended (June 2002 minutes) that the methodology be reviewed in detail by a stock assessment review panel as soon as possible.

STAR Goals and Objectives

The goals and objectives for the CPS assessment and review process[2/] are:

a. Ensure that CPS stock assessments provide the kinds and quality of information required by all members of the Council family.

b. Satisfy the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and other legal requirements.

c. Provide a well-defined, Council oriented process that helps make CPS stock assessments the "best available" scientific information and facilitates use of the information by the Council. In this context, "well-defined" means with a detailed calendar, explicit responsibilities for all participants, and specified outcomes and reports.

d. Emphasize external, independent review of CPS stock assessment work.

e. Increase understanding and acceptance of CPS stock assessment and review work by all members of the Council family.

f. Identify research needed to improve assessments, reviews and fishery management in the future.

g. Use assessment and review resources effectively and efficiently.

Shared Responsibilities

All parties have a stake in assuring adequate technical review of stock assessments. NMFS must determine that the best scientific advice has been used when it approves fishery management recommendations made by the Council. The Council uses advice from the SSC to determine whether the information on which it will base its recommendation is the "best available" scientific advice. Fishery managers and scientists providing technical documents to the Council for use in management need to ensure the work is technically correct. Program reviews, in-depth external reviews, and peer-reviewed scientific publications are used by federal and state agencies to provide quality assurance for the basic scientific methods used to produce stock assessments. However, the time-frame for this sort of review is not suited to the routine examination of assessments that are, generally, the primary basis for a harvest recommendation.

The review of current stock assessments requires a routine, dedicated effort that simultaneously meets the needs of NMFS, the Council, and others. Leadership, in the context of the stock assessment review process for CPS species, means consulting with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables. Coordination means organizing

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2/ In this document, the term "stock assessment" includes activities, analyses, and management recommendations, beginning with data collection and continuing through to the development of management recommendations by the Coastal Pelagic Species Management Team and information presented to the Council as a basis for management decisions.

and carrying out review meetings, distributing documents in a timely fashion, and making sure that assessments and reviews are completed according to plan. Leadership and coordination both involve costs, both monetary and time, which have not been calculated, but are likely substantial.

The Council and NMFS share primary responsibility to a successful STAR process. The Council will sponsor the process and involve its standing advisory committees, especially the SSC. The chair of the SSC CPS subcommittee will coordinate, oversee and facilitate the process. Together they will consult with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables. NMFS and the Council will share fiscal and logistical responsibilities.

The CPS STAR process is sponsored by the Council, because the Federal Advisory Committee Act (FACA) limits the ability of NMFS to establish advisory committees. FACA specifies a procedure for convening advisory committees that provide consensus recommendations to the federal government. The intent of FACA was to limit the number of advisory committees; ensure that advisory committees fairly represent affected parties; and insure that advisory committee meetings, discussions, and reports are carried out and prepared in full public view. Under FACA, advisory committees must be chartered by the Department of Commerce through a rather cumbersome process. However, the Magnuson-Stevens Act exempts the Council from FACA per se, but requires public notice and open meetings similar to those under FACA.

CPS STAR Coordination

The SSC CPS subcommittee chair will work with the Council, Council staff, other agencies, groups or interested persons that carry out assessment work to coordinate and organize Stock Assessment Team (STAT) Teams and STAR Panels, and make sure that work is carried out in a timely fashion according to the calendar and terms of reference.

The SSC CPS Subcommittee chair, in consultation with the SSC, will select STAR Panel chairs, and will coordinate the selection of external reviewers following criteria for reviewer qualifications, nomination, and selection. The public is welcome to nominate qualified reviewers. Following any modifications to the stock assessments resulting from STAR Panel reviews and prior to distribution of stock assessment documents and STAR Panel reports, the coordinator will review the stock assessments and panel reports for consistency with the terms of reference, especially completeness. Inconsistencies will be identified. Authors will be requested to make appropriate revisions in time to meet the deadline for distributing documents for the CPSMT meeting at which HG recommendations are developed.

Individuals (employed by NMFS, state agencies, or other entities) that conduct assessments or technical work in connection with CPS stock assessments are responsible for ensuring their work is technically sound and complete. The Council's review process is the principal means for review of complete stock assessments, although additional in-depth technical review of methods and data is desirable. Stock assessments conducted by NMFS, state agencies, or other entities must be completed and reviewed in full accordance with the terms of reference, at times specified in the

calendar.

CPSMT Responsibilities

The CPSMT is responsible for identifying and evaluating potential management actions based on the best available scientific information. In particular, the CPSMT makes HG recommendations to the Council based on agreed control rules. The CPSMT will use stock assessments, STAR Panel reports, and other information in making their HG recommendations. Preliminary HG recommendations will be developed by the CPSMT according to the management process defined in Council Operating Procedures (COP-9). A representative of the CPSMT will serve as a liaison to each STAR Panel, but will not serve as a member of the Panel. The CPSMT will not seek revision or additional review of the stock assessments after they have been reviewed by the STAR Panel. The CPSMT chair will communicate any unresolved issues to the SSC for consideration. Successful separation of scientific (i.e., STAT Team and STAR Panels) from management (i.e., CPSMT) work depends on stock assessment documents and STAR reviews being completed by the time the CPSMT meets to discuss preliminary HG levels. However, the CPSMT can request additional model projections, based on reviewed model scenarios, in order to develop a full evaluation of potential management actions.

CPSAS Responsibilities

The chair of the CPSAS will appoint a representative to participate at the STAR Panel meeting. The CPSAS representative will participate in review discussions as an advisor to the STAR Panel, in the same capacity as the CPSMT advisor.

The CPSAS representative will attend the CPSMT meeting at which preliminary HG recommendations are developed. The CPSAS representative will also attend subsequent CPSMT, Council, and other necessary meetings.

The CPSAS representative will provide appropriate data and advice to the STAR Panel and CPSMT and will report to the CPSAS on STAR Panel and CPSMT meeting proceedings.

SSC Responsibilities

The SSC will participate in the stock assessment review process and provide the CPSMT and Council with technical advice related to the stock assessments and the review process. The SSC will assign one member from its CPS Subcommittee to each STAR Panel. This member is expected to attend the assigned STAR Panel meeting, the CPSMT meeting at which HG recommendations are made, and the Council meetings when CPS stock assessment agenda items are discussed. The SSC representative on the STAR Panel will present the STAR Panel report at CPSMT, SSC and Council meetings. The SSC representative will communicate SSC comments or questions to the CPSMT and STAR Panel chair. The SSC will review any additional analytical work on any of the stock assessments required or carried out by the CPSMT after the stock assessments have been reviewed by the STAR Panels. In addition,

the SSC will review and advise the CPSMT and Council on harvest guideline recommendations.

The SSC, during their normally scheduled meetings, will serve as arbitrator to resolve disagreements between the STAT Team, STAR Panel, or CPSMT. The STAT Team and the STAR Panel may disagree on technical issues regarding an assessment. In this case, a complete stock assessment must include a point-by-point response by the STAT Team to each of the STAR Panel recommendations. Estimates and projections representing all sides of the disagreement need to be presented, reviewed, and commented on by the SSC.

Council Staff Responsibilities

Council staff will prepare meeting notices and distribute stock assessment documents, stock summaries, meeting minutes, and other appropriate documents. Council staff will assist in coordination of the STAR process. Staff will also publish or maintain file copies of reports from each STAR Panel (containing items specified in the STAR Panel's term of reference), the outline for CPS stock assessment documents, comments from external reviewers, SSC, CPSMT, and CPSAS, letters from the public, and any other relevant information. At a minimum, the stock assessments (STAT Team reports, STAR Panel reports, and stock summaries) should be published and distributed in the Council's annual CPS SAFE document.

Terms of Reference for STAR Panels and Their Meetings

The principal responsibility of the STAR Panel is to carry out the following terms of reference. The STAR Panel's work includes:

1. reviewing draft stock assessment documents and any other pertinent information (e.g.; previous assessments and STAR Panel reports, if available);
2. working with STAT Teams to ensure assessments are reviewed as needed;
3. documenting meeting discussions; and
4. reviewing summaries of stock status (prepared by STAT Teams) for inclusion in the SAFE document.

STAR Panels normally include a chair, at least one "external" member (i.e., outside the Council family and not involved in management or assessment of West Coast CPS), and one SSC member. The total number of STAR members should be at least "n+2" where n is the number of stock assessments and "2" counts the chair and external reviewer. In addition to Panel members, STAR meetings will include CPSMT and CPSAS advisory representatives with responsibilities laid out in their terms of reference.

STAR Panels normally meet for one week.

The number of assessments reviewed per Panel should not exceed two.

The STAR Panel is responsible for determining if a stock assessment document is sufficiently complete.

It is the Panel's responsibility to identify assessments that cannot be reviewed or completed for any reason. The Panel's decision that an assessment is complete should be made by consensus. If a Panel cannot reach agreement, then the nature of the disagreement must be described in the Panel's report.

The STAR Panel's terms of reference concern technical aspects of stock assessment work. The STAR Panel should strive for a risk neutral approach in its reports and deliberations. Confidence intervals of indices and model outputs, as well as other measures of uncertainty that could affect management decisions, should be provided in completed stock assessments and the reports prepared by STAR Panels. The STAR Panel should identify scenarios that are unlikely or have a flawed technical basis.

Recommendations and requests to the STAT Team for additional or revised analyses must be clear, explicit and in writing. A written summary of discussion on significant technical points and lists of all STAR Panel recommendations and requests to the STAT Team are required in the STAR Panel's report. This should be completed (at least in draft form) prior to the end of the meeting. It is the chair and Panel's responsibility to carry out any follow-up review work that is required.

Additional analyses required in the stock assessment should be completed during the STAR Panel meeting. If follow-up work by the STAT Team is required after the review meeting, then it is the Panel's responsibility to track STAT Team progress. In particular, the chair is responsible for communicating with all Panel members (by phone, email, or any convenient means) to determine if the revised stock assessment and documents are complete and ready to be used by managers in the Council family. If stock assessments and reviews are not complete at the end of the STAR Panel meeting, then the work must be completed prior to the CPSMT meeting where the assessments and preliminary HG levels are discussed.

The STAR Panel, STAT Team, and all interested parties are legitimate meeting participants that must be accommodated in discussions. It is the STAR Panel chair's responsibility to manage discussions and public comment so that work can be completed.

STAT Teams and STAR Panels may disagree on technical issues. If the STAR Panel and STAT Team disagree, the STAR Panel must document the areas of disagreement in its report. The STAR Panel may request additional analysis based on alternative approaches. Estimates and projections representing all sides of the disagreement need to be presented in the assessment document, reviewed, and commented on by the SSC. It is expected that the STAT Team will make a good faith effort to complete these analyses.

The SSC representative on the STAR Panel is expected to attend CPSMT and Council meetings where stock assessments and harvest projections are discussed to explain the reviews and provide other technical information and advice.

The chair is responsible for providing Council staff with a camera ready and suitable electronic version

of the Panel's report for inclusion in the annual SAFE report.

Suggested Template for STAR Panel Report

- Minutes of the STAR Panel meeting, including name and affiliation of STAR Panel members.
- List of analyses requested by the STAR Panel.
- Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies.
- Explanation of areas of disagreement regarding STAR Panel recommendations:
  - among STAR Panel members (majority and minority reports), and
  - between the STAR Panel and STAT Team.
- Unresolved problems and major uncertainties, (e.g., any special issues that complicate scientific assessment, questions about the best model scenario).
- Prioritized recommendations for future research and data collection.

Terms of Reference for CPS STAT Teams

The STAT Team will carry out its work according to these terms of reference.

Each STAT Team will appoint a representative to coordinate work with the STAR Panel and attend the STAR Panel meeting.

Each STAT Team will appoint a representative who will attend the CPSMT, CPSAS, and Council meetings where preliminary harvest levels are discussed. In addition, a representative of the STAT Team should attend the CPSMT and Council meeting where final HG recommendations are developed, if requested or necessary. At these meetings, the STAT Team member shall be available to answer questions about the STAT Team report.

The STAT Team is responsible for preparing three versions of the stock assessment document, (1) a "draft" for discussion at the stock assessment review meeting; (2) a revised "complete draft" for distribution to the CPSMT, CPSAS, SSC, and Council for discussions about preliminary harvest levels; (3) a "final" version published in the SAFE report. Other than authorized changes, only editorial and other minor changes should be made between the "complete draft" and "final" versions. The STAT Team will distribute "draft" assessment documents to the STAR Panel, Council, and CPSMT and CPSAS representatives at least two weeks prior to the STAR Panel meeting.

The STAT Team is responsible for bringing computerized data and working assessment models to the review meeting in a form that can be analyzed on site. STAT Teams should take the initiative in building and selecting candidate models. If possible, the STAT Team should have several complete models and be prepared to justify model recommendations.

The STAT Team is responsible for producing the complete draft by the end of the STAR Panel meeting. In the event that the complete draft is not completed, the Team is responsible for completing

the work as soon as possible and to the satisfaction of the STAR Panel at least one week before the CPSMT meeting.

The STAT Team and the STAR Panel may disagree on technical issues regarding an assessment, but a complete stock assessment must include a point-by-point response by the STAT Team to each of the STAR Panel recommendations. Estimates and projections representing all sides of the disagreement need to be presented, reviewed, and commented on by the SSC.

Electronic versions of final assessment documents, parameter files, data files, and key output files will be provided to Council staff.

Appendix A: Outline for CPS Stock Assessment Documents

This is an outline of items that should be included in stock assessment reports for CPS managed by the Pacific Fishery Management Council. The outline is a working document meant to provide assessment authors with flexible guidelines about how to organize and communicate their work. All items listed in the outline may not be appropriate or available for each assessment. In the interest of clarity and uniformity of presentation, stock assessment authors and reviewers are encouraged (but not required) to use the same organization and section names as in the outline. It is important that time trends of catch, abundance, harvest rates, recruitment and other key quantities be presented in tabular form to facilitate full understanding and followup work.

1. Title page and list of preparers (the names and affiliations of the stock assessment team (STAT) either alphabetically or as first and secondary authors)

2. Executive Summary (this also serves as the STAT summary included in the SAFE)

3. Introduction
   a. Scientific name, distribution, stock structure, management units
   b. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography)
   c. Important features of current fishery and relevant history of fishery
   d. Management history (e.g., changes in management measures, harvest guidelines)
   e. Management performance – a table or tables comparing annual biomass, harvest guidelines, and landings for each management subarea and year

4. Assessment
   a. Data
      i. Landings by year and fishery, catch-at-age, weight-at-age, survey and CPUE data, data used to estimate biological parameters (e.g., growth rates, maturity schedules, and natural mortality) with coefficients of variances (CVs) or variances if available. Include complete tables and figures if practical
      ii. Sample size information for length and age composition data by area, year, etc.

   b. History of modeling approaches used for this stock – changes between current and previous assessment models

   c. Model description
      i. Complete description of any new modeling approaches
      ii. Assessment program with last revision date (i.e., date executable program file was compiled)
      iii. List and description of all likelihood components in the model
      iv. Constraints on parameters, selectivity assumptions, natural mortality, assumed level of

age reader agreement or assumed ageing error (if applicable), and other assumed parameters
v. Description of stock-recruitment constraint or components
vi. Critical assumptions and consequences of assumption failures
vii. Convergence criteria

d. Model selection and evaluation
   i. Evidence of search for balance between realistic (but possibly over-parameterized) and simpler (but not realistic) models
   ii. Use hierarchical approach where possible (e.g., asymptotic vs. domed selectivities, constant vs. time varying selectivities)
   iii. Do parameter estimates make sense, are they credible?
   iv. Residual analysis (e.g., residual plots, time series plots of observed and predicted values, or other approach)
   v. Convergence status and convergence criteria for "base-run(s)"
   vi. Randomization run results or other evidence of search for global best estimates

e. Base-run(s) results
   i. Table listing all parameters in the stock assessment model used for base runs, their purpose (e.g., recruitment parameter, selectivity parameter) and whether or not the parameter was actually estimated in the stock assessment model
   ii. Time-series of total and spawning biomass, recruitment and fishing mortality or exploitation rate estimates (table and figures)
   iii. Selectivity estimates (if not included elsewhere)
   iv. Stock-recruitment relationship

f. Uncertainty and sensitivity analyses
   i. The best approach for describing uncertainty and range of probable biomass estimates in CPS assessments may depend on the situation. Possible approaches include:
      A. Sensitivity analyses (tables or figures) that show ending biomass levels or likelihood component values obtained while systematically varying emphasis factors for each type of data in the model
      B. Likelihood profiles for parameters or biomass levels may also be used
      C. CVs for biomass estimated by bootstrap, implicit autodifferentiation, or the delta method
      D. Subjective appraisal of magnitude and sources of uncertainty
      E. Comparison of alternate models
      F. Comparison of alternate assumptions about recent recruitment
   ii. If a range of model runs (e.g., based on CV's or alternate assumptions about model structure or recruitment) is used to depict uncertainty, then it is important that some qualitative or quantitative information about relative probability be included. If no statements about relative probability can be made, then it is important to state that all scenarios (or all scenarios between the bounds depicted by the runs) are equally likely

iii. If possible, ranges depicting uncertainty should include at least three runs: (a) one judged most probable; (b) at least one that depicts the range of uncertainty in the direction of lower current biomass levels; and (c) one that depicts the range of uncertainty in the direction of higher current biomass levels. The entire range of uncertainty should be carried through stock projections and decision table analyses
iv. Retrospective analysis (retrospective bias in base model or models for each area)
v. Historic analysis (plot of actual estimates from current and previous assessments for each area)
vi Simulation results (if available)

5. Harvest Control Rules

Pacific Sardine

The CPS FMP defines the maximum sustainable yield (MSY) control rule for Pacific sardine. This formula is intended to prevent Pacific sardine from being overfished and maintain relatively high and consistent catch levels over a long-term. The harvest formula for sardine is:

HG = (TOTAL STOCK BIOMASS - CUTOFF) • FRACTION • U.S. DISTRIBUTION,

where harvest guideline (HG) is the total U.S. (California, Oregon, and Washington) harvest recommended for the next fishing year, TOTAL STOCK BIOMASS is the estimated stock biomass (ages 1+) from the current assessment, CUTOFF is the lowest level of estimated biomass at which harvest is allowed, FRACTION is an environment-based percentage of biomass above the CUTOFF that can be harvested by the fisheries, and U.S. DISTRIBUTION is the percentage of TOTAL STOCK BIOMASS 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 during relatively warm-water ocean conditions, 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 years. Under the harvest control rule, F_{MSY} is constrained and ranges between 5% and 15% depending on the value of T. Based on the T values observed throughout the period covered by this stock assessment (1983-2002), the appropriate F_{MSY} exploitation fraction has consistently been 15%; and this remains the case under current oceanic conditions (T_{2002} = 17.3 °C). However, it should be noted that the decline in sea-surface temperature observed in recent years (1998-2002) may invoke environmentally-based reductions in the exploitation fraction in the near future and could substantially reduce the harvest guideline.

The harvest guideline recommended for the U.S. (California, Oregon, and Washington) Pacific sardine

fishery for 2003 was 110,908 mt.

Pacific Mackerel

The CPS FMP defines the MSY control rule for Pacific mackerel as:

HG = (BIOMASS-CUTOFF) x FRACTION x STOCK DISTRIBUTION,

where HG is the U.S. harvest guideline, CUTOFF (18,200 mt) is the lowest level of estimated biomass at which harvest is allowed, FRACTION (30%) is the fraction of biomass above CUTOFF that can be taken by fisheries, and STOCK DISTRIBUTION (70%) is the average fraction of total BIOMASS in U.S. waters.

CUTOFF and FRACTION values applied in the Council's harvest policy for mackerel are based on simulations published by MacCall et al. in 1985. BIOMASS is the estimated biomass of fish age 1 and older for the whole stock as of July 1. As for Pacific sardine, FRACTION is a proxy for F_{MSY}.

Based on this formula and current BIOMASS of 77, 516 mt, the HG for the July 1, 2002 - June 30, 2003 season was 12,456 mt. The recommended harvest guideline was 1,381 mt lower (-10%) than the 2001-2002 HG, but similar to the average yield (14,053 mt) realized by the fishery since the 1992-1993 season.

6. Target Fishing Mortality Rates (if changes are proposed)

7. Harvest Projections and Decision Tables

    a. Harvest projections and decision tables should cover the plausible range of uncertainty about current biomass and the full range of candidate fishing mortality targets used for the stock or requested by the CPSMT. Ideally, the alternatives described in the decision table will be drawn from a probability distribution which describes the pattern of uncertainty regarding the status of the stock and the consequences of alternative future management actions. Where alternatives are not formally associated with a probability distribution, the document needs to present sufficient information to guide assignment of approximate probabilities to each alternative

    b. Information presented should include biomass and yield projections for at least three years into the future, beginning with the first year for which management action could be based upon the assessment

8. Management Recommendations

9. Research Needs (prioritized)

10. Acknowledgments (include STAR Panel members and affiliations as well as names and affiliations of persons who contributed data, advice or information but were not part of the assessment team)

11. Literature Cited

12. Complete Parameter Files and Results for Base Runs

Exhibit F.2.b
CPSAS Report
June 2004

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL STATEMENT ON PACIFIC MACKEREL HARVEST GUIDELINE FOR THE 2004/2005 SEASON

The Coastal Pelagic Species Advisory Subpanel (CPSAS) heard a report from Dr. Kevin Hill of the Coastal Pelagic Species Management Team (CPSMT) regarding the Pacific mackerel stock assessment and proposed harvest guideline for the 2004-2005 season.

Based on the most recent information, the CPSMT is recommending a harvest guideline of 13,268 mt for the 2004-2005 season.

Based on this harvest guideline, the CPSAS is recommending a directed fishery for 9,100 mt to begin on July 1, 2004. After the directed fishery quota is reached, the fishery would revert to an incidental-catch-only fishery. There will be 4,168 mt as a set aside for the incidental fishery. The CPSAS recommends a 40% incidental catch rate 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.

The CPSAS recommends an inseason review of the mackerel season for the March 2005 Council meeting, with the possibility of re-opening the directed fishery as an automatic action if a sufficient amount of the harvest guideline remains.

PFMC
05/26/04

COASTAL PELAGIC SPECIES MANAGEMENT TEAM STATEMENT ON PACIFIC MACKEREL HARVEST GUIDELINE FOR THE 2004/2005 SEASON

For the 2004 Pacific mackerel assessment, the Coastal Pelagic Species Management Team (CPSMT) agreed that the mackerel biomass estimate from the ADEPT model was appropriate, because it is consistent with the approach used in recent years, and the resulting biomass estimate is reasonable relative to what is known about recent recruitment. Based on a biomass estimate of 81,383 mt and the Pacific mackerel harvest control rule, the CPSMT recommends a harvest guideline of 13,268 mt for the July 1, 2004-June 30, 2005 mackerel season.

The CPSMT notes that several improvements for future assessments are anticipated in the near future. These include pooling of the southern and northern California party boat logbook information into a single index, increased and enhanced fishery dependent data from aerial surveys, and new research surveys. These anticipated changes are scheduled for review at the CPS stock assessment review (STAR) meeting in June 2004 and incorporation into the 2005-2006 fishery.

As the Pacific mackerel abundance estimate has decreased over the past several years, the CPSMT discussed overfishing concerns related to this fishery. Based on the current modeling approach and the harvest control rules in the fishery management plan (FMP), there is, currently, not a concern related to overfishing of Pacific mackerel. Historically, intermittent periods of high recruitment have supported relatively high amounts of fishing pressure. However, more recently, protracted periods of generally lower recruitment have contributed to lower levels of spawning stock and total biomass. Fishing pressure is largely influenced by availability of the resource to the fishery, as well as market factors. The U.S. West Coast Pacific mackerel fishery targets mackerel in the northern parts of its overall range and in inshore waters. It is possible that mackerel abundance could be strong south of the U.S. border and/or in offshore waters beyond the range of the U.S. West Coast CPS fleet. Also, as in other CPS fisheries, market dynamics greatly influence total harvest. While mackerel is desirable it is not as important to the CPS fishery as Pacific sardine and market squid. In addition, most commercial harvest of Pacific mackerel occurs within the area under limited entry as defined by the CPS FMP. Thus, given these reasons, the level of fishing effort relative to mackerel abundance should not give rise to immediate concern. However, model estimates of the spawning stock and recruitment relationship indicate little to no reproductive-related compensation at low levels of spawning stock biomass. Thus, issues surrounding recruitment-based overfishing should be monitored closely.

Overfishing for Pacific mackerel is defined in the CPS FMP as harvest exceeding acceptable biological catch (ABC) for two concurrent years. Recent landings have been well below ABC. Also, the cutoff value in the harvest control rule serves as a proxy for determining if mackerel is overfished. The cutoff value equates to a biomass estimate of 18,200 mt. The current biomass estimate, 81,383 mt is well above the cut off value.

PFMC
05/26/04

Exhibit F.2.b
Supplemental SSC Report
June 2004

SCIENTIFIC AND STATISICAL COMMITTEE REPORT ON PACIFIC MACKEREL HARVEST GUIDELINE FOR THE 2004/2005 SEASON

Dr Kevin Hill discussed the 2004-2005 Pacific mackerel harvest guideline (HG) with the SSC. The recommended HG is 13,268 mt based on the maximum sustainable yield control rule in Amendment 8 to the Coastal Pelagic Species (CPS) fishery management plan. The SSC notes that the HG is based on the same stock assessment methodology and harvest control rule used in several previous years, with the addition of one additional year of catch data, and new or revised data for four of the six indices of abundance. Over-estimation of biomass for the last year of the assessment period is a chronic feature of the Pacific mackerel assessment. For example, the biomass estimate for 2003 based on the 2004 assessment (46,121 mt) is lower than the estimate of this biomass based on the 2003 assessment (68,924 mt). The estimate of biomass for 2003 is higher than that for 2002 due primarily to the large 2001 recruitment.

The bulk of Pacific mackerel spawning occurs off Baja California while larval surveys are conducted in the California Bight. Therefore, data used to develop abundance indices for use in the stock assessment cover only a small proportion of the area of spawning. Data from the Investigaciones Mexicanas de la Corriente de California (IMECOCAL) program could provide information that covers a larger proportion of the spawning area, which could then be used in future assessments of Pacific mackerel as well as Pacific sardine and bocaccio.

The methodology on which this assessment is based is not fully documented in the Stock Assessment and Fishery Evaluation (SAFE) report, precluding a detailed review by the SSC. This assessment will, however, be reviewed, along with that of Pacific sardine, during a CPS STAR Panel meeting in 21-25 June 2004. The control rule used to set Harvest Guidelines for Pacific mackerel was established over 20 years ago. The SSC highlights that there may be value in reviewing the basis for this control rule during a future CPS STAR Panel.

PFMC
06/15/04

FISHERY MANAGEMENT PLAN (FMP) AMENDMENT–SARDINE ALLOCATION

Situation: The Pacific Fishery Management Council (Council) is scheduled to consider initiation of an amendment to the Coastal Pelagic Species (CPS) Fishery Management Plan (FMP) to address annual allocation of the Pacific sardine harvest guideline.

In April 2003, the Council adopted an interim framework for allocating sardine. The revised 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) to 39° N latitude (Point Arena), (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) reallocates all unharvested sardine that remains on December 1 coast wide.

The Council requested this allocation framework be in place for the 2003 and 2004 fishing seasons, and also in 2005 if the 2005 harvest guideline is at least 90% of the 2003 harvest guideline. National Marine Fisheries Service (NMFS) implemented the revised allocation framework on September 4, 2003 (Exhibit F.3.a, Attachment 1).

The Council took this action in response to concern that the previous allocation framework did not provide optimal harvest opportunity to the various fishing sectors. Concern was also expressed that the previous allocation hindered optimal use of the available harvest. For example:

Year	Harvest Guideline (mt)	Coastwide Landings (mt)
2000	186,791	67,984
2001	134,737	75,719
2002	118,442	102,403
Post revised allocation		
2003	110,908	74,895

To address these concerns in the short-term, the interim allocation framework was rapidly developed using the best available information, with the understanding that more information and time would be needed to develop a more comprehensive, longer-term allocation framework. However, as shown above, in 2003, under the revised allocation framework, the harvest guideline was not achieved. Hence, some industry participants continue to express concern about the need for developing a long-term allocation framework, specifically to help ensure the annual harvest guideline is achieved.

More recently, NMFS has informed the Council of several other FMP-related issues that might need to be addressed through amendment of the CPS FMP (Exhibit F.1.a, Attachment 1). These issues include FMP harvest control rules, compatibility between California's proposed market squid FMP and the Council's CPS FMP, market squid overfishing definitions, CPS FMP bycatch provisions and pilot at-sea observer program, CPS essential fish habitat, and five-year review of the CPS FMP.

The CPS Management Team and CPS Advisory Subpanel have been briefed on the letter from NMFS and the scheduled Council action. These committees will report their recommendations to the Council, which are provided in Exhibit F.3.b, CPSMT Report and CPSAS Report.

Based on this advice and guidance from NMFS, the Council should consider if and how to proceed with developing an amendment to the CPS FMP.

Council Task:

1. Council Guidance on Initiation of an FMP Amendment.

Reference Materials:

1. Exhibit F.3.a, Attachment 1: Sardine Allocation Final Rule, September 4, 2003.
2. Exhibit F.3.b, CPSMT Report.
3. Exhibit F.3.b, CPSAS Report.
4. Exhibit F.3.c, Public Comment.

Agenda Order:

a. Agendum Overview — Dan Waldeck
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Guidance on Initiation of an FMP Amendment

PFMC
05/25/04

§ 660.324 Pacific Coast treaty Indian fisheries.

* * * * *

(d) *Procedures.* The rights referred to in paragraph (a) of this section will be implemented by the Secretary, after consideration of the tribal request, the recommendation of the Council, and the comments of the public. The rights will be implemented either through an allocation of fish that will be managed by the tribes, or through regulations in this section that will apply specifically to the tribal fisheries. 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 Regional Administrator, prior to the first Council meeting in which biennial harvest specifications and management measures are discussed for an upcoming biennial management period. The Secretary generally will announce the annual tribal allocations at the same time as the announcement of the harvest specifications. The Secretary recognizes the sovereign status and co-manager role of Indian tribes over shared Federal and tribal fishery resources. Accordingly, the Secretary will develop tribal allocations and regulations under this paragraph in consultation with the affected tribe(s) and, insofar as possible, with tribal consensus.

* * * * *

(j) *Black rockfish.* Harvest guidelines for commercial harvests of black rockfish by members of the Pacific Coast Indian tribes using hook and line gear will be established biennially for two subsequent one year periods for the areas between the U.S.-Canadian border and Cape Alava (48°.09′30″ N. lat.) and between Destruction Island (47°40′00″ N. lat.) and Leadbetter Point (46°38′10″ N. lat.), in accordance with the procedures for implementing harvest specifications and management measures. Pacific Coast treaty Indians fishing for black rockfish in these areas under these harvest guidelines are subject to the provisions in this section, and not to the restrictions in other sections of this part.

* * * * *

■ 6. In § 660.332, paragraphs (a) introductory text, (b)(3), and (e) are revised to read as follows:

§ 660.332 Allocations.

(a) *General.* The commercial portion of the Pacific Coast groundfish fishery, excluding the treaty Indian fishery, is divided into limited entry and open access fisheries. Separate allocations for the limited entry and open access fisheries will be established biennially or annually for certain species and/or areas using the procedures described in this subpart or the PCGFMP.

* * * * *

(b) * * *

(3) The guidelines in this paragraph (b)(3) apply to recalculation of the open access allocation percentage. Any recalculated allocation percentage will be used in calculating the following biennial fishing period's open access allocation.

* * * * *

(e) *Treaty Indian fisheries.* Certain amounts of groundfish may be set aside biennially or annually for tribal fisheries prior to dividing the balance of the allowable catch between the limited entry and open access fisheries. Tribal fisheries conducted under a set-aside are not subject to the regulations governing limited entry and open access fisheries.

* * * * *

■ 7. In § 660.333, paragraph (c)(2) is revised to read as follows:

§ 660.333 Limited entry fishery eligibility and registration.

* * * * *

(c) * * *

(2) The major limited entry cumulative limit periods will be announced in the **Federal Register** with the harvest specifications and management measures, and with routine management measures when the cumulative limit periods are changed.

* * * * *

■ 8. In § 660.350, paragraph (a)(6) is revised to read as follows:

§ 660.350 Compensation with fish for collecting resource information—exempted fishing permits off Washington, Oregon, and California.

(a) * * *

(6) *Accounting for the compensation catch.* As part of the harvest specifications process (§ 660.321), NMFS will advise the Council of the amount of fish authorized to be retained under a compensation EFP, which then will be deducted from the next harvest specifications (ABCs) set by the Council. Fish authorized in an EFP too late in the year to be deducted from the following year's ABCs will be accounted for in the next management cycle where it is practicable to do so.

* * * * *

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 660

[Docket No. 030612150–3214–02; I.D. 051503B]

RIN 0648–AQ94

Fisheries Off West Coast States and in the Western Pacific; Coastal Pelagic Species Fishery; Regulatory Amendment

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule.

SUMMARY: NMFS issues a final rule to implement a regulatory amendment to the Coastal Pelagic Species (CPS) Fishery Management Plan (FMP) that changes the management subareas and the allocation process for Pacific sardine. The purpose of this final rule is to establish a more effective and efficient allocation process for Pacific sardine and increase the possibility of achieving optimum yield (OY).

DATES: Effective August 29, 2003.

ADDRESSES: Copies of the environmental assessment/regulatory impact review/final regulatory flexibility analysis (EA/RIR/FRFA) may be obtained from Donald O. McIssac, Executive Director, Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220.

FOR FURTHER INFORMATION CONTACT: James Morgan, Sustainable Fisheries Division, NMFS, at 562–980–4036.

SUPPLEMENTARY INFORMATION: On April 28, 2003, the Pacific Fishery Management Council (Council) submitted a regulatory amendment to the FMP that proposed changing the management subareas and the allocation process for Pacific sardine. A range of options were analyzed in the Council's regulatory amendment, which included an environmental assessment, a regulatory impact review, and an initial regulatory flexibility analysis (IRFA). A proposed rule was published in the **Federal Register** on June 26, 2003 (68 FR 37995). The public comment period ended on July 28, 2003. The background on development of the amendment was explained in the proposed rule and is not repeated here.

The Council recommended a preferred option that: (1) Changes the definition of subarea A and subarea B by moving the geographic boundary between the two areas from Pt. Piedras

Blancas, CA at 35° 40′ 00″ N. lat. to Pt. Arena, CA at 39° 00′ 00″ N. lat., (2) moves the date when Pacific sardine that remain unharvested are reallocated to Subarea A and Subarea B from October 1 to September 1, (3) changes 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) reallocates all unharvested sardine that remain on December 1 coast wide. This procedure will be in effect for 2003 and 2004, and for 2005 if the 2005 harvest guideline is at least 90 percent of the 2003 harvest guideline. Currently, Subarea A includes the area from Monterey, CA, north to the U.S.-Canada border. Subarea B includes the area south of Monterey, CA to the U.S.-Mexico border. Changing the boundary between the two subareas will move Monterey, CA to Subarea B, and the new geographic boundary will coincide with the boundary for the limited access and open access fisheries.

The change in the allocation system is viewed by the Council as an interim approach. The sardine resource has recovered after decades of low abundance and there is a more detailed process for allocating the resource among the fishing communities along the Pacific coast. The change will most likely avoid the need for an emergency rule to reallocate unharvested portions of the OY, which was necessary in 2002, and will have a greater possibility of achieving OY than the current allocation process. Information from resource surveys scheduled for the Pacific Northwest in 2003 and 2004 plus accumulated data on size and age of sardine from all areas of the fishery will improve the assessment model and provide better data for measuring the impacts of various allocation options for the longer-term.

Comments and Responses

Six letters were received from the fishing industry and one from the city of Monterey, CA. Two electronic mail messages were received. Most respondents opposed the proposed action. One comment was received on the IRFA and is addressed in the Response to Comment 10. Following is a summary of the comments received:

Comment 1: The proposed regulations do not comply with the Magnuson-Steven Fishery Conservation and Management Act (Magnuson-Stevens Act) because the proposed action overcapitalizes the fishery by allowing more vessels in the fishery than are Federally licensed.

Response: The final regulations comply with the Magnuson-Stevens Act. Amendment 8 to the FMP gives the reasons for having an open access area in the Pacific Northwest. Sardine will be available in the Pacific Northwest only when the biomass is around 750,000 mt or more. A high biomass allows benefits to be obtained by a larger number of harvesters. Amendment 8 cautions against investing heavily in harvesting sardine in this area because sardine exhibit wide fluctuations in abundance. The fishing season in the Pacific Northwest is also restricted by deteriorating sea conditions in the fall. The new allocation procedure is only valid through 2005. Resource surveys are being conducted in the Pacific Northwest to obtain better information on the status of Pacific sardine. At this time, there is no indication that there is overcapitalization in the Pacific northwest; however, fishing capacity in this area will be an issue when the Council begins review of alternatives for a longer term allocation procedure.

Comment 2: The Council did not take a precautionary approach when selecting its proposed action. Cooler sea surface temperatures indicate a potential shift in the ocean environment that will likely lead to a decline in sardine abundance. Action was taken without knowing the impact of harvesting the larger fish in the Pacific Northwest.

Response: Recognizing the role of temperature in sardine abundance is one of the risk averse measures utilized in the FMP. If the average sea surface temperature declines, the harvest rate will be reduced, which will yield a smaller harvest guideline, thereby protecting the resource. The size of the fish harvested involves two issues. One is that a disproportional harvest of larger fish in the Pacific Northwest may have a detrimental effect on the resource. Size and age data are collected all along the Pacific coast and, to date, there is no indication of a detrimental impact on the resource from harvesting relatively large fish in the north or relatively small fish in the south. The second issue is that the migration patterns of the resource are poorly understood; therefore, the relationship between fish harvested in the south and fish harvested in the north at any particular time is not known. Although uncertainty does exist, the model used to estimate the current biomass includes a factor to account for migration, which is based on information obtained from the historical fishery. Given the overall conservative harvest formula adopted by the Council, there does not appear to be any risk to the resource from implementing the proposed action.

Comment 3: Including Monterey in the southern California subarea risks preempting Monterey's fall harvest due to the much larger fishing industry in southern California.

Response: Monterey may be at some risk of preemption from southern California and the Pacific Northwest, but preemption is not likely at current harvest guideline levels. Under the current system, Monterey is at risk of early closure if there is strong participation from the northern fisheries, as in 2002. There is less risk to Monterey fisheries under the proposed new system because Monterey often has a strong fall fishery, which might be preempted by the summer fishery in the Pacific Northwest. The Council may address this issue when it considers a more permanent allocation process.

Comment 4: The net result of the proposed action will be to shift economic hardship from the open access area in the Pacific Northwest to the limited access area in California.

Response: Under the proposed alternative, the net gain in producer surplus above the status quo in the open access area would be $1,567,441. The net gain in the limited access area would be $288,712. Of all options considered, the proposed alternative has the largest net gain above the status quo for the limited access while still providing a net gain for the open access area. No economic hardships are anticipated from taking this action.

Comment 5: The proposed action perpetuates the coast wide overfishing of the sardine resource that has occurred from the recent expansion of the Mexican and Canadian harvest, which is not adequately accounted for in setting the harvest guideline.

Response: The Council determined that the proposed alternative is more likely to achieve OY than the status quo, and the analysis in the analytical documents supporting the conclusion. From current figures on the 2002 fishery, the total harvest by Mexico, Canada, and the United States was about 145,000 mt, close to 9,000 mt above the total allowable biological catch. There is no agreement between the United States and any other country on management; however, the harvest formula deals with this uncertainty in two ways. First, a percentage of the biomass is subtracted from the total biomass to account for harvest beyond the jurisdiction of the United States. Second, total removals from the resource in all sectors of the fishery are included in the calculation of the next

year's biomass estimate. A better way to manage the resource would be to have a management agreement with Mexico and Canada. Nevertheless, the formula in the FMP uses the best information available to account for harvests beyond U.S. jurisdiction and is designed to minimize the potential for overfishing. In 2002, the U.S. fishery left about 18,000 mt of the harvest guideline unharvested.

Comment 6: The proposed option encourages further expansion of the open access fishery, which includes more than 40 additional vessels, even though veteran California fishermen were denied limited entry permits.

Response: In 2002, 26 vessels landed sardine in the open access fishery off Oregon and Washington, of which six vessels held limited entry permits for the southern fishery. By the end of July 2003, however, sardine landings in the Pacific Northwest were about 3,000 mt below the landings through July 2002, about 75 percent of the 2002 landings. Only 18 vessels had participated. At this time, there is no indication that this regulation will lead to a substantial increase in the number of participating vessels in the Northwest. Amendment 8 assumes that since high biomass levels of Pacific sardine are transitory, the limited availability of sardine in the Pacific Northwest will tend to limit the number of participating vessels, while offering an opportunity for more northern fisheries to gain benefits when the sardine biomass is large. To date, neither the Council nor any other source of information has indicated a need to change this approach.

Comment 7: The economics of the fishery were not well addressed in California with regard to the impact of shifting the quotas to Oregon and Washington.

Response: Under the proposed option, an additional 2,200 mt is anticipated to be harvested off California. The proposed option provides the greatest increase in producer surplus for California in relation to the benefits that accrue to California from the nine options analyzed. The increase in the estimated Pacific Northwest harvest is not great enough to invite significant increases in vessels and processors in the Pacific Northwest. If the biomass and the harvest guideline increase substantially in the future, there would be pressure to increase capital investment, but larger harvest guidelines would produce this pressure even under the status quo.

Comment 8: If there is a cold water regime shift and the sardine biomass declines, this is a good reason for precaution and to avoid locking up a fixed 33 percent of the sardine quota in the open access fishery. A reduced quota will cause economic hardship on the traditional limited entry fishery.

Response: The harvest formula in the FMP is a risk averse approach to fishing mortality, and the proposed option does not allocate a fixed amount to any fishery. One-third of the harvest guideline would be initially allocated to Subarea A (Pacific Northwest); however, the unharvested portions of the harvest guideline in Subarea A and Subarea B (California) are added together and reallocated on September 1, 20 percent to Subarea A and 80 percent to Subarea B. The amount received in either area depends on performance of the individual fisheries and the limit set by the harvest guideline. The Council also intends to revisit this allocation issue in the near future. With regard to the economic impact on California fisheries, if the biomass declines, there would be economic consequences to all sardine fisheries under all options.

Comment 9: The proposed rule incorrectly assumes that southern California vessels can offset economic impact by fishing in Monterey, California, when such long distance travel is not possible for much of this fleet.

Response: The summary of the initial regulatory flexibility analysis states only that some vessels may be able to participate in more northern fisheries. However, there could be mitigation to a certain extent for some vessels by changing fishing locations to land larger, higher-priced sardines.

Comment 10: The regulatory amendment and the proposed rule do not include impacts on processors, many of which are small businesses.

Response: The impact on processors was addressed in the regulatory impact review, which included calculations of producer surplus based on data supplied by cooperating sardine processors. Some processors may be small businesses, but data are not available on processors in the way that ex-vessel revenue is available for individual vessels. In this regard, the best available data were used. No information on profitability of individual vessels was available, so ex-vessel revenue was used as a proxy for vessel profitability. The producer surplus figures are assumed to reflect profitability for processors in general, and the economic effect of the proposed action on processors is assumed to be related to ex-vessel revenue.

In considering the above comments, NMFS did not change the proposed rule.

Classification

The Administrator, Southwest Region, NMFS, determined that the FMP regulatory amendment is necessary for the conservation and management of the coastal pelagic species fishery and that it is consistent with the Magnuson-Stevens Act and other applicable laws.

The Assistant Administrator for Fisheries, NOAA (AA), finds that this final rule relieves a restriction under 5 U.S.C. 553 (c)(1), and thus is exempt from the 30 delay in the effective date requirement of 5 U.S.C. 553(d). This rule relieves a restriction because the allocation to Subarea A is likely to be reached before October 1. If the allocation is reached before October 1, the Subarea A fishery will be closed and the fishery will not be able to resume until the reallocation is completed on October 1 under the existing rule. In 2002, the Pacific Northwest fisheries landed more than 36,500 mt before October 1, and the fishery in northern California, which was included in Subarea A in 2002, landed more than 5,000 mt by October 1. The initial allocation to Subarea A in 2003 is 36,969 mt, lower than the allocation in 2002, when an emergency rule was necessary to keep the fishery open following a temporary closure. Keeping the fishery operating will increase landings by about 1,500 mt per week. At an ex-vessel price of $100/mt, this would generate $150,000 per week to fishermen and $300,000 to processors (based on 50 percent recovery rate and a sales price of $400/mt).

The final rule has been determined to be not significant for the purposes of Executive Order 12866.

The Council prepared an IRFA which was summarized in the proposed rule published on June 26, 2003 (68 FR 37995). The Council prepared an FRFA that describes the economic impact of this action on small entities. Two specific comments were received on the IRFA, one regarding the possibility of some vessels minimizing impacts by fishing in more northern fisheries and one regarding the treatment of processors in the IRFA. Responses to these comments are contained in comments 9 and 10 in the preamble to the final rule. The following is the summary of the FRFA. The need for and objectives of this final rule are contained in the **SUPPLEMENTARY INFORMATION** of the preamble and in the proposed rule. Comments and responses regarding the economic impacts of this rule are contained in the preamble.

Approximately 140 vessels are permitted in the sardine fisheries off the U.S. West Coast; 65 vessels are

permitted in the Federal CPS limited entry fishery off California, while approximately 55 vessels are permitted in the sardine fisheries of the States. An additional 18 live bait vessels are permitted in southern California and 2 live bait vessels are permitted in Oregon and Washington. All of these vessels would be considered small businesses by the Small Business Administration. Therefore, there would be no disproportionate economic impacts resulting between small and large vessels under the proposed action. Because cost data are lacking for the harvesting operations of CPS finfish vessels, it was not possible to evaluate the economic impacts from estimated changes in sardine landings in terms of vessel profitability. Instead, economic impacts were evaluated based only on changes in sardine ex-vessel revenues compared to sardine landings under the status quo. Therefore, the difference between vessel revenues generated by 2003 proposed quotas and those generated by 2003 projected landings were used as a proxy for vessel profitability among the three regions evaluated. All projections utilized 2001 data because this was the best available data. CPS finfish vessels typically harvest a number of other species, including anchovy, mackerel, squid, and tuna. However, since data on individual vessel operations were not readily available, it was not possible to evaluate potential changes in fishing strategies by these vessels in response to different opportunities to harvest sardines under each of the allocation alternatives and what this would mean in terms of total ex-vessel revenues from all species.

Under the proposed action, sardine landings for CPS vessels for the entire West Coast are estimated to increase 9,846 metric tons (mt) from the status quo, with a corresponding increase in ex-vessel value of $1,077,540. As used by the Council, the ''status quo'' harvest levels reflect an increase of 10 percent from 2002 harvest levels. All of the coastwide harvest guideline OY would be caught by the end of the season under the proposed action. Sardine landings by vessels participating in the Oregon/Washington fishery were estimated to be 7,622 mt greater than the status quo (and more than 11,000 mt above the 2002 level), with ex-vessel revenues increasing by $873,526 relative to the status quo. Landings by CPS vessels that historically would have participated in the northern California sardine fishery would increase 2,449 mt above the status quo (and 4000 mt above the 2002 harvest level) with a corresponding rise in ex-vessel revenues of $228,035. Under the proposed action, a loss of 225 mt in landings relative to the status quo was estimated for vessels that historically fished out of southern California ports, which equates to foregone ex-vessel revenues amounting to $24,021, or approximately $370 per vessel, in lost ex-vessel revenue relative to the status quo. However, landing would still be about 4,900 mt greater than in 2002, and revenue would be almost 10 percent higher than in 2002. Twenty live bait vessels landed approximately 2,000 mt per year of mixed species from 1993 through 1997. Those landings were comprised mostly of Pacific sardine and northern anchovy. The estimated 18 live bait vessels fishing in southern California are expected to be only minimally impacted by this action similar to results for the CPS limited entry vessels fishing in that area. The two live bait vessels fishing in Oregon and Washington are not expected to be impacted by this action.

For the 65 CPS limited entry vessels that could participate in either the southern California or northern California sardine fisheries, the 225 mt reduction in harvest relative to the status quo represents a potential loss in ex-vessel revenues for the CPS vessels choosing to operate in southern California. If the 65 CPS limited entry vessels choose to fish in the traditional northern California sardine fishery, the potential gain in ex-vessel revenue for that fishery is estimated to be approximately $3,508 per vessel per year. However, this amount could be underestimated since data from the 2001 SAFE report show that only 27 CPS vessels landed in Monterey/Santa Cruz and only 13 CPS vessels landed in San Francisco.

Even though limited entry vessels based in southern California are not restricted from participating in the northern California or the open access Oregon/Washington sardine fisheries, it is unlikely that it would be profitable for all southern California vessels to do so due to additional travel time and fuel costs. However, any loss in profitability by the CPS vessels choosing to fish in southern California could be mitigated to a certain extent by moving northward to land larger, higher-priced sardines in northern California ports.

Vessels that participate in the Oregon/Washington sector of the fishery are estimated to increase ex-vessel revenues by $15,882 per vessel based on the estimated 55 state sardine permits issued. However, this figure may be underestimated since data show that, of the 35 Washington permitted vessels, only 19 vessels participated in these fisheries in 2002 with the majority of the catch accomplished by only 13 vessels.

The Council considered 3 alternatives to the proposed action in addition to the no-action alternative. All alternatives resulted in ex-vessel revenue gains of various magnitudes for the fishery as a whole. However, the proposed alternative yielded the greatest overall gain, with the least negative impacts to individual vessels from any one region while also providing the fishery with a high likelihood of achieving OY as required under the Magnuson-Stevens Act.

Alternative 1 (status quo)—With a 10-percent increase in harvest from 2002, total landings would be 101,061 mt and total ex-vessel revenues would amount to $10,587,481. Southern California vessels would realize ex-vessel revenues of $5,749,562, northern California vessels $1,039,424, and Oregon/Washington vessels $3,798,405.

Alternative 2 (start year with 66–33 allocation, subarea line to 39° N lat., September (50–50) reallocation, and December (coastwide) reallocation). Relative to 10 percent overall increase in the status quo, southern California vessels would lose 3,618 mt or $386,201 in ex-vessel revenues. Northern California vessels would gain 35 mt or $3,306, and Oregon/Washington would gain 10,108 mt or $1,158,314, for a net increase in coastwide ex-vessel revenues of $775,420.

Alternative 4 (start year with 66–33 allocation, subarea line not changed, September (50–50) reallocation, and December (coastwide) reallocation). Compared to the status quo, southern California vessels would realize no change in landings, northern California vessels would gain 274 mt or $25,518 in ex-vessel revenues, and Oregon/Washington vessels would gain 8,091 mt or $927,167. This results in an overall net increase of $952,685 in ex-vessel revenues.

Alternative 5 (start year with 66–33 allocation, subarea line to 39° N lat., September coastwide reallocation). Relative to the status quo, southern California vessels would lose 2,500 mt or $266,924 in ex-vessel revenues. Northern California vessels would gain 2,239 mt or $208,547, and Oregon/Washington vessels would gain 10,108 mt or $1,099,937, for a net increase in overall ex-vessel revenues of $1,099,937.

There are no new compliance requirements resulting from this rule. Two management subareas and the amount of the harvest guideline allocated to the subareas have been redefined, and the date unharvested

amounts of the resource are reallocated to the subareas has been changed. This action changes how the annual harvest is monitored, but imposes no compliance requirements on the fishing industry beyond those already in effect and well understood by those affected.

List of Subjects in 50 CFR Part 660

Administrative practice and procedure, American Samoa, Fisheries, Fishing, Guam, Hawaiian Natives, Indians, Northern Mariana Islands, Reporting and recordkeeping requirements.

Dated: August 29, 2003.

John Oliver,

Deputy Assistant Administrator for Operations, National Marine Fisheries Service.

■ For the reasons set out in the preamble, 50 CFR part 660 is amended to read as follows:

PART 660—FISHERIES OFF WEST COAST STATES AND IN THE WESTERN PACIFIC

■ 1. The authority citation for part 660 continues to read as follows:

Authority: 16 U.S.C. 1801 *et seq.*

■ 2. In § 660.503, paragraphs (b)(2) and (c)(1) are revised to read as follows:

§ 660.503 Management subareas.

* * * * *

(b) * * *

(2) Southern boundary—at 39°00′00″ N. lat. (Pt. Arena).

(c) * * *

(1) Northern boundary—at 39°00′00″ N. lat. (Pt. Arena); and

* * * * *

■ 3. Section 660.509 is revised to read as follows:

§ 660.509 Closure of directed fishery.

(a) The date when Pacific sardine that remains unharvested will be reallocated to Subarea A and Subarea B is September 1 for 2003 and 2004, and for 2005 if the 2005 harvest guideline is at least 90 percent of the 2003 harvest guideline.

(b) All unharvested sardine that remains on December 1 will be available for harvest coast wide.

■ 4. In § 660.511 new paragraph (f) is added to read as follows:

§ 660.511 Catch restrictions.

* * * * *

(f) The percentages of the unharvested sardine that are reallocated to Subarea A and Subarea B are 20 percent to Subarea A and 80 percent to Subarea B.

[FR Doc. 03–22548 Filed 8–29–03; 3:46 pm]

BILLING CODE 3510–22–P

Exhibit F.3.b
CPSAS Report
June 2004

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL STATEMENT ON FISHERY MANAGEMENT PLAN AMENDMENT–SARDINE ALLOCATION

The Coastal Pelagic Species Advisory Subpanel (CPSAS) received information from Council staff about scheduled Council action related to sardine allocation. The CPSAS also received a report from NMFS about several CPS fishery management plan (FMP)-related issues that could be addressed through amendment of the CPS FMP (May 18, 2004 -- McInnis Letter). The NMFS letter notes that sardine allocation is the "top priority." However, the letter also urges the Council to "consider the full range of possible alternatives." Thus, it is unclear to the CPSAS if NMFS considers the issues raised in the letter more urgent than sardine allocation.

The CPSAS considers development of a long-term allocation framework for the sardine fishery to be the highest priority CPS FMP issue. Therefore, the CPSAS recommends the Council move forward with developing an FMP amendment to address sardine allocation. Final Council action on sardine allocation should occur no later than June 2005 to enable implementation in time for the 2006 sardine fishery.

However, if NMFS considers the issues raised in the May 18 letter more urgent than allocation, and that a more comprehensive FMP amendment is warranted, NMFS should clarify for the Council this urgency and work with the Council, CPSMT, and CPSAS to plan and schedule a more comprehensive FMP amendment. If this path is taken, the Council should prepare for the high likelihood that implementation of a revised sardine allocation would not occur in time for the 2006 sardine fishery.

To reiterate, the CPSAS believes allocation is the highest priority and, if directed by the Council, commits to cooperatively develop a practicable range of sardine allocation alternatives. The CPSAS acknowledges that issues raised by NMFS should be reviewed to see if more comprehensive changes to the FMP are needed. However, this review should not jeopardize final Council action on the sardine allocation FMP amendment by June 2005. If issues raised by NMFS could be addressed concurrent to sardine allocation without jeopardizing the schedule, the Council should consider including these issues in the sardine allocation FMP amendment.

PFMC
05/25/04

Exhibit F.3.b
CPSMT Report
June 2004

COASTAL PELAGIC SPECIES MANAGEMENT TEAM STATEMENT ON FISHERY MANAGEMENT PLAN AMENDMENT--SARDINE ALLOCATION

The Coastal Pelagic Species Management Team (CPSMT) was briefed by National Marine Fisheries Service (NMFS) about issues raised in the May 18, 2004 letter to Chairman Donald Hansen. In addition to allocation of Pacific sardine, these issues include fishery management plan (FMP) harvest control rules, compatibility between California's proposed market squid FMP and the Council's CPS FMP, market squid overfishing definitions, CPS FMP bycatch provisions and pilot at-sea observer program, CPS essential fish habitat, and five-year review of the CPS FMP. NMFS notes that allocation is a high priority, but urges the Council to consider the full range of potential issues.

The CPSMT understands the Council is presently scheduled to decide on moving forward with an FMP amendment to develop a long-term sardine allocation framework. The CPSMT discussed the tradeoffs of moving forward with an FMP amendment for sardine allocation versus developing a more comprehensive FMP amendment to address allocation and the issues raised by NMFS. The consensus of the CPSMT was to move forward with an FMP amendment to develop a long-term sardine allocation framework.

Information currently available is sufficient to proceed with development of an FMP amendment for sardine allocation. General knowledge of annual migration patterns and economic data from vessels and processors can be used to develop and analyze alternative allocation frameworks. The CPSMT, if directed by the Council, is willing to work with the CPSAS in analysis of alternatives. The CPSMT suggests that scoping and development of allocation alternatives is more appropriately within the purview of the CPSAS.

Thus, if the Council determines that principal development of allocation alternatives is to be performed by the CPSAS, the CPSMT could devote time to fully reviewing the issues raised by NMFS to identify those that need to be addressed through FMP amendment, and if they could be addressed in the short-term or would require more extensive time to complete. This information could be reported to the Council at the September 2004 meeting.

PFMC
05/25/04

Exhibit F.3.c
Public Comment
June 2004

Fishermen's Union of America

Pacific and Caribbean Area

Affiliated with
Seafarers International Union of N.A.
AFL-CIO

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March 7, 2004

Chairman Donald K. Hansen
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Dear Chairman Hansen:

I am in receipt of the March Council Meeting material, which also includes the Informational Report on Coastal Pegalic Species and the 2004 CPS Sehedule.

The report clearly shows that the Council "may" formally initiate an amendment to the CPS fishery management plan for a more comprehensive revision of the Pacific sardine allocation framework. In speaking with other interested "fishery" people and also some of the individuals involved in the FMP process, it is our belief that any introductions to the FMP at this time is much too premature and unwarranted.

Certainly, with the provisions currently in place as an interim measure and in light of the fact that new data on sardine stocks generated from expanded research cruises is not yet available but likely will be by fall, postponing initiation of an FMP amendment process to coincide with discussion of biomass estimates will give the Council, the CPS Management Team and the Advisory Panel plenty of time to meet and discuss this issue. The public will also have tremendous time to voice their opinions and the Council to complete this process well before 2006.

Your reconsideration of the potential timetable set at this time would be most appreciative. With every good wish for a successful 2004.

Very truly yours,

Terry R Hoinsky
President & Member CPSAS

Cc: Executive Director Donald O. McIsaac:
Members of the CPSAS
Dan Waldeck, Staff Officer

Exhibit F.3.c
Supplemental Public Comment 2
June 2004

Heather Munro Mann
Munro Consulting, Inc
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Donald K. Hansen, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220-1384

June 16, 2004

RE: June Council Agenda Item F.3.c.

Dear Chairman Hansen & Council Members:

These comments are respectfully submitted on behalf of the West Coast Seafood Processors Association (WCSPA). WCSPA represents shore-based seafood processors in Washington, Oregon and California. WCSPA members process a major portion of the sardine landed on the west coast.

WCSPA strongly urges the Council to move forward with the FMP amendment to develop a long-term sardine allocation framework. It is critical that this amendment process begin as soon as possible in order to have a process in place for the 2006 sardine season. As you know the interim agreement expires following the 2005 season. The harvest guideline continues to be underutilized on an annual basis so consideration of a long-term allocation amendment is appropriate to replace the existing interim allocation.

The timing of the NMFS request of May 18th requesting a host of additional issues to be addressed through the FMP process is troubling. While the additional issues outlined in Dr. McInnis's letter are important, they should not impede resolving the crucial allocation issues plaguing the fishery. The obvious importance is to address the allocation issue without delay. WCSPA suggests that the Council immediately take up the allocation issue through an FMP amendment and the longer-term issues be addressed through a subsequent FMP amendment. Planning for multiple FMP amendments is not precedent setting and with commitments from the agencies as well as the CPSMT and CPSAS to work on these issues there is sufficient flexibility to proceed in this manner.

Thank you for your consideration.

Sincerely,

Heather Munro Mann
Munro Consulting, Inc for WCSPA