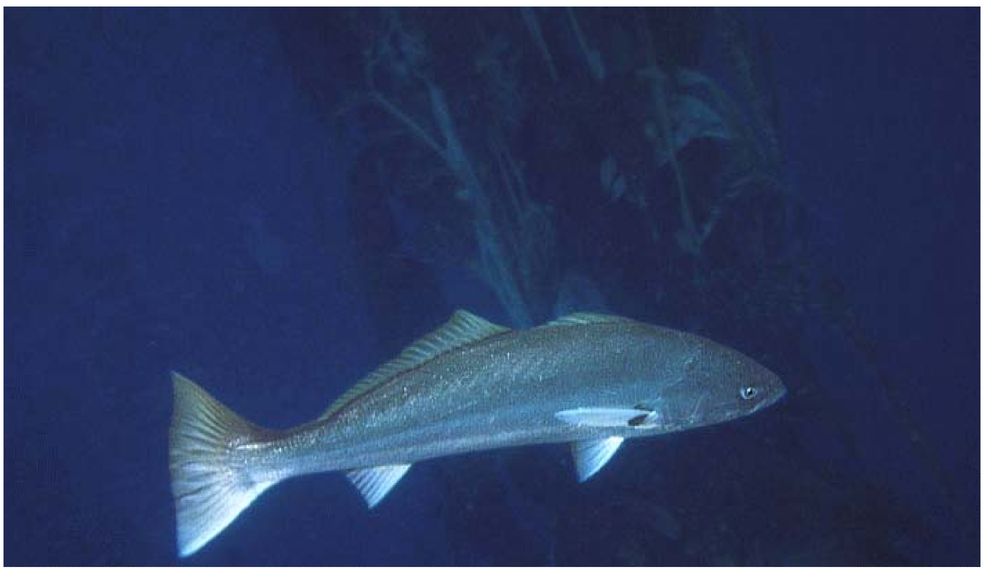
FINAL
WHITE SEABASS FISHERY
MANAGEMENT PLAN



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STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF FISH AND GAME
MARINE REGION

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White Seabass Fishery Management Plan

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Cover photo courtesy of Terry Maas

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Conversion Table

Metric to U.S. Customary

Multiply	By	To Obtain
distance		
millimeters (mm)	0.03937	inches (in.)
centimeters (cm)	0.3937	inches
meters (m)	3.281	feet (ft)
meters	0.5468	fathoms (fm)
kilometers (km)	0.6214	miles (mi)
area		
square meters (m^2)	10.76	square feet (ft^2)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.471	acres
weight		
milligrams (mg)	0.00003527	ounces (oz)
grams (g)	0.03527	ounces
kilograms (kg)	2.205	pounds (lb)
metric tons (t)	2205.0	pounds
metric tons	1.102	short tons (ton)
temperature and heat		
Celsius degrees (°C)	1.8(°C) + 32	Fahrenheit degrees (°F)
kilocalories (kcal)	3.968	British thermal units (BTU)

U.S. Customary to Metric

distance		
inches	25.40	millimeters
inches	2.54	centimeters
feet	0.3048	meters
fathoms	1.829	meters
miles	1.609	kilometers
nautical miles (nmi)	1.852	kilometers
area		
square feet	0.0929	square meters
square miles	2.590	square kilometers
acres	0.4047	hectares
weight		
ounces	28.35	grams
pounds	0.4536	kilograms
short tons	0.9072	metric tons
temperature and heat		
British thermal units (BTU)	0.2520	kilocalories
Fahrenheit degrees	0.5556(°F - 32)	Celsius degrees

Executive Summary

White seabass are large, highly prized members of the croaker family, found in waters off the west coasts of California and Mexico. White seabass are recovering off California from low population levels in the mid to late 1900s. The current recovery is occurring under management designed to provide for moderate harvests while protecting young white seabass and spawning adults through seasonal closures, gear provisions, and size and bag limits.

Concern over the decline in white seabass landings and conflict between recreational and commercial fishermen over this resource resulted in legislation requiring the development of a white seabass fisheries management plan (WSFMP). The plan was developed in 1995 through the cooperative efforts of academic and federal fishery scientists, consultants, and fishery constituents. The plan was adopted by the Fish and Game Commission (Commission) in 1996; however, regulations to implement the WSFMP were not adopted at that time.

California enacted the Marine Life Management Act (MLMA) in 1998, granting broader regulatory authority to the Commission for specified commercial fisheries, including white seabass. The MLMA declared that the WSFMP shall remain in effect until amended, but it must be brought into conformance with the MLMA on or before 01 January 2002. This deadline was later extended in order to incorporate the recommendations of the peer review panel.

The MLMA further directs that all fisheries be managed on a sustainable basis using fishery management plans (FMPs). The MLMA specifies the content of FMPs, encourages management to use the best available information, supports research to obtain essential fisheries information, and promotes cooperation and collaboration with fisheries participants and other constituents. This document amends the WSFMP to reflect these goals and others of the MLMA and to otherwise achieve conformance with the MLMA.

The WSFMP uses a framework plan approach for managing the white seabass fishery. This enables the adjustment of management measures, within the scope and criteria established by this WSFMP and implementing regulations, without the need for amending the FMP. Framework adjustments can be implemented quickly, enabling more responsive adaptive management of white seabass. In addition to annual management changes, the Commission may make in-season adjustments to address resource conservation or socioeconomic issues. A Department white seabass management team along with an advisory panel consisting of representatives from the scientific community, recreational and commercial fishing industries, and environmental groups will continually monitor the effectiveness of management measures, and recommend changes to the Commission if needed.

In addition to the framework procedures, initial management alternatives are proposed for implementation upon approval of the WSFMP. These alternatives represent different determinations of a maximum sustainable yield (MSY) and optimum yield (OY) to be used in setting upper harvest limits for white seabass. The OYs range from 212,985 pounds to 1.3 million pounds. The preferred alternative is an OY of 1.2 million pounds. This OY was derived by making a precautionary adjustment to an MSY proxy that was calculated from a previously determined pre-exploitation biomass of white seabass.

The preferred alternative, along with a framework plan approach, will allow continued recovery of the white seabass resource while important data are collected to yield a better defined MSY/OY control rule. The WSFMP also includes several trigger mechanisms aimed at identifying and minimizing overfishing of the white seabass stock. Socioeconomic and bycatch impacts are not expected to be significant under the preferred alternative.

The WSFMP identifies specific short-term operational and long-term strategic research goals as part of research protocols that address needed essential fisheries information for white seabass. The overall goal is to bring our knowledge of white seabass stocks up from data-poor to data-rich; data-poor management of white seabass using an MSY/OY approach should be considered an interim solution. A stock assessment for white seabass using existing and ongoing datasets, along with new fishery independent information, is of paramount importance for the successful management of white seabass. Other short-term research goals include determinations of the size at sexual maturity, hooking mortality of released fish, amount of bycatch, and validation of age/growth studies.

Long-term research goals include development of more sophisticated stock assessments and models, expansion of hatchery-reared white seabass studies, collection and analyses of more socioeconomic data, cooperative research with Mexico and implementation of an ecosystem-based management approach.

The costs of implementing the WSFMP are estimated to be high. Most of the costs are associated with ongoing and future research (data collection and analysis), enforcement of regulations, and document preparation and review; the costs of research alone are estimated to be over $700,000 annually.

Chapter 1. Background and Description

White seabass, which are targeted by both recreational and commercial fisheries, have great economic and intrinsic value to the people of California. White seabass are migratory fish that are common in Mexican waters and in the Southern California Bight. The fisheries for white seabass have existed since the late 1800s, but increased fishing pressure, oceanographic fluctuations, and habitat degradation have resulted in reductions of white seabass populations. Currently, our monitoring and assessment of white seabass stocks is inadequate for effective management of this important resource.

1.1 Purpose and Need for Action

The overall trend in commercial and recreational landings of white seabass from 1960 to 1997 was one of decline. During the late 1980s and early 1990s, concern over the decline in white seabass landings and conflict between recreational and commercial fishermen over this resource lead concerned citizens to ask the Legislature for management improvements. The resulting legislation required the development of a white seabass fisheries management plan (WSFMP) which was developed in 1995 through the cooperative efforts of academic and federal fishery scientists, consultants, and fishery constituents. The plan was adopted by the Fish and Game Commission (Commission) in 1996; however, no regulations were adopted at that time, so the plan was not implemented.

In 1998, the Marine Life Management Act (MLMA) was enacted and changed the way in which recreational and commercial fisheries are managed in the State of California [Fish and Game Code (FGC) section §7050]. Under MLMA, the Commission was granted authority to regulate specific commercial fisheries, including the white seabass fishery (it already had authority over the recreational fishery). Also, MLMA specified that the previously adopted WSFMP should remain in effect until such time as the existing plan could be amended to comply with MLMA. The amended WSFMP was to be presented to the Commission no later than 01 January 2002; however, the deadline was extended in order to incorporate the recommendations of the peer review panel.

1.1.1 Location and General Characteristics of the Project Area

The sport and commercial harvest of white seabass is proposed statewide in all areas defined as ocean waters (§27.00 Title 14 CCR) except where prohibited or restricted, as specified, in state refuges, reserves or national parks, and as regulated by provision of this WSFMP.

The shoreline of California is one of the longest in the nation. There are approximately 1,072 miles of shoreline along the mainland coast, and 300 miles around the offshore islands. The mainland shore consists of about 354 miles of rocky headlands and cliffs; 602 miles of sandy beaches; and 110 miles of rocky beach. Major embayments are:

Humboldt (17,000 surface acres, or 6,880 hectares); Tomales (7,760 surface acres, or 3,140 hectares); San Francisco (320,000 surface acres, or 129,504 hectares); Morro (2,101 surface acres, or 8,540 hectares) and San Diego (11,500 surface acres, or 4,654 hectares).

The marine environment is composed of numerous micro-habitats which support a distinct assemblage of species uniquely adapted to their environment. A detailed description of the oceanographic and geological conditions that make California's marine environment so complex can be found in the Final Program Environmental Document Ocean Sport Fishing Regulations. An in-depth description of the habitat preferences and life history of white seabass is found in Chapter 2, Section 9 of this document.

1.1.2 Problem Statement

Our knowledge of white seabass population dynamics and the role this species plays in the nearshore ecosystem is limited. Further, there is an urgent need to acquire essential fisheries information which can only be obtained gradually, over a period of several years, and at a considerable cost. As a result, management decisions have lagged behind the development of the fishery and it is difficult to determine whether or not current fishing is at sustainable levels.

The potential effects of changes in fishing effort, oceanographic conditions, and many other factors affecting white seabass stocks need to be assessed in order to manage this resource effectively. Since the ban on gill and trammel nets went into effect in 1994, the recreational seabass catch has surpassed commercial landings. In addition, white seabass range into Mexican waters and may be heavily impacted by Mexican harvests. Thus, an essential step to ensure the long term maintenance of a healthy white seabass resource in California waters is to develop a management plan for this species.

1.2 The Marine Life Management Act

The MLMA was signed into law and incorporated into the FGC (§7050-7090) 01 January 1999. The act created state policies, goals, and objectives to govern the conservation, sustainable use and restoration of California's marine living resources. The MLMA opened a new chapter in the conservation of California's marine wildlife and the management of our marine fisheries (Weber and Heneman 2000). The MLMA gives the Fish and Game Commission and the Department specific guidance for managing marine resources through a comprehensive set of goals and objectives outlined below. The WSFMP is being amended under this direction to better facilitate conservation and stewardship of this important resource.

1.2.1 Goals and Objectives

Goal: To ensure the conservation, sustainable use, and, where feasible, restoration of

California's marine living resources for the benefit of all the citizens of the State.

<u>Objectives</u>:

- Conserve the health and diversity of marine ecosystems and marine living resources;
- Allow and encourage only those activities and uses that are sustainable;
- Recognize the importance of activities and uses that do not involve take;
- Recognize the importance to the economy and culture of California of sustainable sport and commercial fisheries and the development of commercial aquaculture;
- Support and promote scientific research on marine ecosystems;
- Manage on the basis of the best available scientific and other relevant information;
- Involve all interested parties;
- Promote the dissemination of accurate information through the management process;
- Coordinate and cooperate with adjacent states, as well as with Mexico and Canada, and encourage regional approaches to management.

<u>Goal</u>: To achieve the management goal of sustainability, every fishery shall be managed under a system whose objectives include:

<u>Objectives</u>:

- Long-term health of the resource is not sacrificed in favor of short-term benefits. A fishery managed on the basis of maximum sustainable yield shall have optimum yield as its objective.
- Health of a habitat is maintained, and to the extent feasible, the habitat is restored and, where appropriate, enhanced.
- Depressed fisheries are rebuilt to highest sustainable yields consistent with environmental and habitat conditions.
- Bycatch is limited to acceptable types and amounts.
- Fishery participants are allowed to propose methods to prevent or reduce excess effort in marine fisheries.
- Management is closely coordinated when a species is the target of both sport and commercial fisheries or of a fishery that employs different gears.
- Fishery management is adaptive and based on best available scientific or other relevant information.
- The management decision-making process is open and seeks advice and assistance of interested parties.
- Adverse impacts of fishery management on small-scale fisheries, coastal communities, and local economies are minimized.
- Collaborative and cooperative approaches to management are encouraged and mechanisms are in place to resolve disputes such as access, allocation, and gear conflicts.

- Management is proactive and responds to changing environmental conditions and market or other socioeconomic factors and concerns of fishery participants.
- The management system is periodically reviewed for effectiveness.

1.2.2 Process of Plan Review

The MLMA requires public and peer review for all FMPs (FGC §7075-7078). For public review, the Department solicits input and/or assistance from the various user groups who may be affected by the FMP or other interested parties prior to development of an FMP. The Department can also approach the National Marine Fisheries Service, Sea Grant, the Pacific Fishery Management Council or advisory committees established by the Department for advice. Once the FMP or amendment has been developed, the plan must be submitted to the Commission for a 30-day public comment period prior to any public hearings. Additionally, the Commission must hold at least two public hearings on the FMP. Any comments or proposals made to the Commission relative to the FMP may be considered by the Commission and forwarded to the Department for inclusion into the FMP.

For external peer review, the Department is required to set up a formalized procedure for examining the science that is used as the basis for any management recommendation. The peer review panel must be given all pertinent comments received by the Department from fishery participants or other interested parties. Any suggestions made through external peer review may be used in whole or part; however, if the Department disagrees with the findings and chooses not to use the recommendations, an explanation of why the peer review recommendations were not used must accompany the FMP or amendment.

More information on the review processes for FMPs can be found in *The Master Plan: A Guide for the Development of Fishery Management Plans* (California Department of Fish and Game 2001).

1.2.3 Process for Plan Amendment

The MLMA also requires a plan amendment process for all FMPs (§7087 FGC). The amendment process must identify the types of regulations that the Department may adopt without amending the plan. In addition, any amendment to an FMP must undergo the review process, as outlined above in section 1.2.2. More information on the FMP amendment process can be found in *The Master Plan: A Guide for the Development of Fishery Management Plans* (California Department of Fish and Game 2001).

1.3 Specific Goals and Objectives of the White Seabass Fishery Management Plan

<u>Goals</u>:

1. To manage the white seabass resource for the optimum long-term benefits of

present and future generations of Californians.

2. To bring the management of this valuable commercial and recreational species under one authority.
3. To develop a framework for management that will be responsive to environmental and socioeconomic changes.

Objectives (not listed in order of priority):

- Provide for the sustainable use of the white seabass resource and provide for stock growth for commercial and sport fisheries;
- Use adaptive management to provide for necessary changes and modifications of management measures in a timely and efficient manner;
- Minimize bycatch and waste of white seabass and other species;
- Support and promote increased understanding of white seabass natural history, population dynamics, and its ecosystem's role to improve management;
- Ensure effective monitoring of the white seabass population and its fisheries;
- Ensure effective enforcement of regulations and improved compliance;
- Identify, protect, and restore critical white seabass habitat; and
- Minimize the adverse impacts of management on small-scale fisheries, coastal communities, and local economies.

1.3.1 Constituent Involvement

The MLMA requires, and the Department is committed to, a collaborative approach to resource management. One of the over-riding objectives of MLMA is constituent involvement. The Department believes that broad participation in the development of an FMP will improve the effectiveness of management and the ability to implement the plan. Constituent involvement also ensures that decision makers are better informed when making management decisions by:

- Exploring issues, concerns, and management measures from various perspectives;
- Providing increased understanding of a resource and its fishery from participants' and nonparticipants' perspectives through consensus building; and
- Sharing responsibility of sustainable fisheries management with all interested constituents.

In addition to the requirements of the MLMA, the California Environmental Quality Act (CEQA) requires public consultation on all environmental projects. The Department accomplishes this through either a 30-day public comment period, scoping sessions within the communities involved, or at least two Commission meetings.

1.3.1.1 Public Consultation for Definition of Plan Goals and Objectives

In 1994 when the initial WSFMP was developed, one of the first actions taken was the creation of two committees: 1) The White Seabass Subcommittee of the Director's Marine Resources Advisory Committee, composed of representatives from the recreational and commercial fishing communities; and 2) The White Seabass Scientific Advisory Committee, composed of fisheries scientists from academia and the federal government (Appendix F). These two bodies met repeatedly in 1995, each time bringing relevant comments from their constituent groups. It was through these actions that the goals and objectives identified above were generated. In January 2001, the remaining members of the Scientific Advisory Committee and several members of the former White Seabass Subcommittee of the Director's Marine Resources Advisory Committee joined to form the White Seabass Scientific and Constituent Advisory Panel (WSSCAP). The WSSCAP determined that the goals and objectives outlined in the previous WSFMP were still valid.

1.3.1.2 Public Consultation for Selection of Preferred Management Alternative

Prior to preparing the initial draft environmental document in 1995, the Department developed a Notice of Preparation (NOP). The notice was provided to individuals and organizations that had expressed prior interest in Commission regulatory actions. The NOP was also submitted to the State Clearinghouse for distribution to appropriate responsible and trustee agencies for their input and comments. No comments were received in response to the initial NOP in 1995.

The Department also conducted three public meetings with a subpanel of the Director's Marine Resources Advisory Committee (11 October 1994; 31 January 1995; and 31 March 1995) and three public meetings with the Scientific Advisory Committee (24 October 1995; 06 February 1995; and 09 March 1995) (Appendix F).

In addition to the NOP and six public meetings, discussion of the WSFMP was held at two Commission meetings (04 August 1995 and 03 November 1995). The result of these meetings was the selection of a management framework for the WSFMP.

As with the WSFMP's goals and objectives, discussions of the preferred alternative and other possible management alternatives were held with members of the WSSCAP and other interested parties on 30 January 2001, 04 June 2001, 18 December 2001, and 22 January 2001. Additionally, a presentation of the status of the WSFMP was given to the MLMA Evaluation Advisory Committee on 09 February 2001.

1.4 Authority and Responsibility

The California Constitution gives authority to the State Legislature which may, by statute, provide for the seasons and the conditions under which different species of fish may be taken. California law consists of 29 codes including the FGC. Laws in the FGC consist of statutes and propositions passed by the voters of the state. Statutes, such as MLMA, are chaptered bills that have passed through both houses of the

Legislature and ultimately signed by the Governor and recorded by the Secretary of State. The FGC is administered and enforced through regulations.

General policies for the conduct of the Department are formulated by the Commission, a body created by the Constitution and appointed by the Governor. The rulemaking powers of the Commission are delegated to it by the Legislature.

The Department is the state agency charged with carrying out policies adopted by the State Legislature and the Commission. The Department enforces statutes and regulations governing recreational and commercial fishing activities, conducts biological research, monitors fisheries, and collects fishery statistics necessary to protect, conserve, and manage the living marine resources of California.

Other state agencies have functions and responsibilities that directly or indirectly affect the management of ocean and coastal resources (California Department of Fish and Game, December 1993). In addition, marine resources are also managed by federal laws governing the take of seabirds, marine mammals, fish, and shellfish (Weber and Heneman 2000).

1.4.1 California Environmental Quality Act (CEQA)

The basic goal of CEQA [Public Resources Code (PRC) §21000-21006] is to develop and maintain a high-quality environment now and in the future. Projects carried out by public agencies are subject to the same level of review and consideration as those of the private sector. Most state agencies satisfy this requirement by preparing a Negative Declaration (ND) if it finds no significant impacts, a Mitigated Negative Declaration (MND) if it finds significant impacts but revises the project to avoid or mitigate those impacts, or an Environmental Impact Report (EIR) if it finds significant impacts.

1.4.1.1 Functional Equivalent

The CEQA requires all public agencies in the State to evaluate the environmental impacts of projects that they approve or carry out. If there are potentially significant environmental impacts, most agencies satisfy this requirement by preparing an Environmental Impact Report (EIR). If no potentially significant impacts exist, a Negative Declaration (ND) is prepared. However, an alternative to the EIR/ND requirement exists for State agencies with activities that include protection of the environment as part of their regulatory program. Under this alternative, an agency may request certification of its regulatory program from the Secretary for Resources. With certification, an agency may prepare functional equivalent environmental documents in lieu of EIRs or NDs. The regulatory program of the Fish and Game Commission has been certified by the Secretary for Resources. Therefore, the Commission is eligible to submit an environmental document in lieu of an EIR (§15252 CEQA Guidelines).

The Department and the Commission hold the public trust for managing the State's fish and wildlife populations. That responsibility is fulfilled by a staff of experts, including those with expertise in marine resources management and enforcement issues related to the harvesting of white seabass. The knowledge and training represented by that expertise qualifies them to perform the review and analysis of the proposed project contained in this document.

1.4.1.2 Use of the Environmental Document

This environmental document contains a description of the proposed management action, potential effects of the proposed action, reasonable alternatives to the proposal, cumulative effects, and a discussion of mitigation of adverse environmental effects related to the proposal and alternatives. In addition, it considers relevant policies of the Legislature and Commission. These standards are contained in §781.5 Title 14 California Code of Regulations (CCR). This environmental document presents information to allow a comparison of the potential effects of various alternatives to adoption of sport and commercial fishing regulations for white seabass as they are currently written and enforced.

1.4.2 Federal Law

The Federal government manages the marine resources and fishing activities of the United States (US) through the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The purpose of the MSFCMA is to provide conservation and management of US fishery resources, develop domestic fisheries, and phase out foreign fishing activity within the Exclusive Economic Zone (EEZ) consisting of ocean waters from the edge of State waters three mi (5 km) to 200 mi (322 km) offshore.

Eight Regional Fishery Management Councils implement the goals of the MSFCMA in coordination with the National Marine Fisheries Service. The Pacific Fishery Management Council manages the fisheries resources off Washington, Oregon, and California by developing fishery management plans for the EEZ. Although white seabass are a trans-boundary stock occurring in Mexican and U.S. waters, the fishery in both countries has primarily been a coastal fishery (within three miles of shore). As such, the fishery in California is not subject to federal management. Even with the removal of gill nets from state waters along much of the California coast, and subsequent move to federal waters, the fishery continues to be managed by the state because vessels taking white seabass are registered by the State and land their catch in California ports.

1.5 Current Management of White Seabass

Management of the white seabass fishery has been divided between the Legislature and the Commission. In the past two decades, the Legislature and the Commission have adopted statutes and regulations specific to the management of various components of the white seabass fishery (Appendix B). The most recent and far reaching management change occurred with the enactment of the MLMA.

1.5.1 Legislative Responsibilities

Statues passed by the State Legislature regulating commercial fishing are contained in the Fish and Game Code of California. Some provisions of law apply specifically to white seabass, while others apply generally to the take of all fish such as some area closures and gear restrictions. Statutes pertaining specifically to the commercial take of white seabass are listed in Appendix B.

As mentioned earlier, The MLMA identifies a number of policies, goals, objectives, requirements, and processes for managing California's marine resources. These resources are to be managed to assure long-term economic, recreational, ecological, cultural, and social benefits.

The MLMA requires that fishery management plans (FMPs) form the primary basis for managing the State's marine fisheries. An FMP is a planning document that contains comprehensive review of the fishery along with clear objectives and measures to insure sustainability of that fishery. An FMP is based on the best available scientific or other relevant information.

1.5.2 Fish and Game Commission Responsibilities

The authority and responsibility of the Commission and the Department to make and enforce regulations governing recreational and commercial fishing are provided by the Legislature. General policies for the conduct of the Department are formulated by the Commission (FGC §704). General policy for conservation of aquatic resources is provided by FGC §1700, and specific policy for the management of marine resources (MLMA) is provided in FGC §7500- §7090.

1.5.2.1 Recreational Fisheries

Recreational fishing regulations are adopted by the Commission following procedures listed in the FGC. General provisions applying to the taking and possession of fish by recreational fishermen are provided in FGC §7100-7400. Specific sportfishing regulations are found in California Code of Regulations (CCR), Title 14, Chapter 4. Regulations specific to the recreational take of white seabass are listed in Appendix B.

1.5.2.2 Commercial Fisheries

Commercial fishing regulations are created by the Legislature and the Commission. Provisions relating to the taking and possession of fish for commercial purposes is provided in FGC §7600-9101 and CCR, Title 14, Chapter 6. With the passage of the MLMA, the Commission has been granted broad authority to regulate commercial fisheries, including white seabass.

1.5.2.3 Rulemaking Process under the Administrative Procedures Act (APA)

The California Constitution and Legislative statutes create state agencies and can grant them certain powers including the ability to make rules and regulations in order to carry out their duties. The California APA (§11340-11359) of the Government Code provides guidance on the rulemaking process.

The Commission's rulemaking process is provided in FGC §200-221. Basic minimum procedural requirements for the adoption, amendment or repeal of regulations are provided in the California Government Code §11346. Emergency rulemaking considerations are provided in California Government Code §11346.1 and in FGC §240.

Chapter 2. Description of Stocks

2.1 Species Description

The croakers (Family Sciaenidae) are among the most important fishes caught by marine recreational anglers in California. Most croakers emit sounds, which have been variously described as 'drumming', 'croaking', 'grunting', 'snoring', 'bellowing', purring', 'buzzing', and 'whistling' (Welsh and Breder 1923). These sounds are produced by vibrations of the air bladder.

The white seabass, *Atractoscion nobilis*, is the largest croaker species in California waters (Thomas 1968). Adults are bluish to gray dorsally with dark speckling, and silver to white colored ventrally. Juveniles have several dark vertical bars. White seabass are relatively large fish which have been recorded to 5 ft (1.5 m) and 90 lbs (41 kg) (Miller and Lea 1972); however, individuals larger than 60 lbs (27 kg) are rarely observed (Thomas 1968).

Fossil records of white seabass have been found in several southern California Pleistocene deposits and in a Pliocene site at San Diego. Some deposits are probably 10 to 12 million years old (Fitch and Lavenberg 1971).

2.2 Distribution, Genetic Stock Structure, and Migration

White seabass range over the continental shelf of the Eastern North Pacific ocean from Juneau, Alaska, to Magdalena Bay, Baja California, Mexico. This species also inhabits the upper Gulf of California, Mexico; a subpopulation that appears to be isolated from the coastal mainland megapopulation (or stock) (Thomas 1968).

California Cooperative Oceanic Fisheries Investigations (CalCOFI) data collected between 1950 and 1978 indicate that white seabass larvae appear to settle out into coastal areas extending from Santa Rosa Island, California to Bahia Santa Maria, half way down the Baja California, Mexico peninsula (Moser et al. 1983). Fifteen percent of these occurrences were in California waters. Most of the larvae occurred from May to August and peaked in July. White seabass larvae were collected within San Francisco Bay (Richardson Bay) during a 1972 to 1973 study (Eldridge 1977). However, to date, no adults have been found within the bay. That event was correlated with upwelling, implying that the larvae were transported into the bay with warm water currents.

In the past, it was assumed that white seabass off California consisted of non-resident fish that migrated into the Southern California Bight from Baja California, Mexico. However, white seabass off the coasts of California and Baja California, Mexico are currently considered to be part of the same breeding population, and the center of this population appears to be off central Baja California, Mexico (Moser et al. 1983; Vojkovich and Reed 1983; Franklin 1997). Franklin (1997) examined white seabass

DNA from fish collected between 1990 and 1995 in Californian and Mexican waters, and he found that there are local spawning groups within the Southern California Bight that contribute to the genetic make-up of the population. Based on this research, Franklin (1997) concluded that the white seabass stock in the Eastern Pacific is composed of three components: northern, southern and Sea of Cortez. The northern component of the white seabass stock ranges from Point Conception, California to Magdalena Bay, Baja California, Mexico (Franklin 1997).

Recruitment of young white seabass to coastal habitats in southern California is probably related to the strength and persistence of northward flowing warm water currents (Allen and Franklin 1988). However, the exact relationship is still unknown. Although previous white seabass tagging studies for migration have been unsuccessful (Maxwell 1977b), hatchery-produced white seabass have been recaptured as far as 85 nautical miles from the point of release (CDFG 1999). Catch data indicate that white seabass move northward with seasonally warming ocean temperatures (Skogsberg 1939; Radovich 1961; Karpov et al. 1995). For example, there were substantial commercial catches of white seabass near San Francisco Bay, Tomales Bay, and Monterey Bay during the early 1900s when ocean waters were warmer, followed by a long period in which landings from the central California coast were rare. Since 1999, commercial and recreational catches of white seabass have increased north of Point Conception; possibly indicating a recent northward shift in the stock due to warmer waters brought up during the El-Niño/Southern Oscillation (ENSO) of 1997-1998.

2.3 Age and Growth

The age and growth of white seabass has been determined by reading scales and otoliths. Thomas (1968) used scales, but found them difficult to read for individuals older than 13 years. A 711 mm (28 in.) white seabass (the minimum legal size) was determined to be five years old and weigh about 3 kg (7 lb).

The white seabass length-weight relationship can be described by the equation:

$$W = 0.000015491^{*L2.9216},$$

where length is in millimeters and weight is in grams (Thomas 1968). However, this may not be an accurate estimator of over all lengths since only mature fish of both sexes were used in Thomas' calculations.

Data from otoliths indicate that white seabass can grow very quickly, especially during the first four years (Table 2-1). A recent study using sectioned otoliths found that white seabass grow much faster than previously thought, indicating that larger individuals are considerably younger than previous estimates (CDFG unpubl. data). The von Bertalanffy growth equation for juvenile and adult fishes of both sexes was calculated to be:

$$L_t = 1391\ [1-e^{-0.0156(t+1.297)}]$$

Growth rates for males and females were not evaluated separately. The oldest fish aged was 27 years and measured 1365 mm total length (TL). These otolith data indicate that a 711 mm (28 in.) white seabass is approximately three years old. In contrast, the same fish would be five years old according to Thomas's (1968) scale data.

The age estimates based on otolith data were closer to those proposed by Clark (1930), who investigated white seabass gross gonadal development. She estimated fish less than 35 cm (13.7 in.) were one year old; fish between 35 to 65 cm (13.7 to 25.6 in.) were two years old; and, fish larger than 75 cm (29.5 in.) were three years old or older.

The discrepancies between Thomas's (1968) study and the more recent Department study may be partly due to the following reasons: First, different ageing structures were used in each study; and second, the Department's study was conducted during a period of oceanic warming which may have influenced (increased) white seabass growth rates.

Table 2-1. Mean total length and weight at age for white seabass

Age class (years)	Mean length in mm (inches) using scales	Mean length in mm (inches) using otoliths	Weight in kg (pounds)
0	-	274 (10.8)	0.2 (0.5)
1	231 (9.1)	411 (16.2)	0.7 (1.5)
2	336 (13.2)	542 (21.3)	1.5 (3.3)
3	467 (18.4)	685 (27.0)	3.0 (6.6)
4	571 (22.5)	808 (31.8)	4.8 (10.7)
5	723 (28.5)	867 (34.1)	5.9 (13.1)
6	866 (34.1)	985 (38.8)	8.6 (19.0)
7	929 (36.6)	1004 (39.5)	9.1 (20.1)
8	981 (38.6)	1063 (41.8)	10.8 (23.8)
9	1033(40.7)	1130 (44.5)	12.9 (28.4)
10	1072(42.2)	1072 (42.2)	11.0 (24.4)
11	1144(45.0)	1269 (50.0)	18.1 (39.9)
12	1194(47.0)	1183 (46.6)	14.7 (32.5)
13	1217(47.9)	1131 (44.5)	12.9 (28.5)
14	-	1229 (48.4)	16.5 (36.3)
17	-	1245 (49.0)	17.1 (37.7)
27	-	1365 (53.7)	22.4 (49.3)

Note:Data using scales from Thomas (1968)
Data using otoliths from CDFG unpubl. data (2000); small sample size for age classes seven and older.

2.4 Reproduction, Fecundity and Seasonality

Precise spawning areas have not been determined, but data indicate that peak spawning occurs in southern California from April through August (Skogsberg 1925). During this period, mature fish appear to congregate near shore, over rocky habitat, and near kelp beds (Thomas 1968).

A study of white seabass maturity in the late 1920s indicated that females begin maturing when they are near 24 inches (607 mm) in length or three years old and males may reach sexual maturity at about 20 inches (508 mm) or two years old (ages based on otolith data above). All white seabass have probably spawned at least once by the time they reach 31.5 inches (800 mm) total length (Clark 1930) or four years old.

White seabass have the largest eggs of the West Coast sciaenids. These eggs are buoyant and drift with the ocean currents. The dark colored larvae appear to settle out in coastal areas (Moser et al. 1983). Fecundity has been determined from artificial propagation attempts (CDFG 1994). Batch fecundity, the number of eggs released by one female at a single time, has ranged from 0.76 million to 1.5 million eggs, and has varied as a function of mean female body weight.

Although it has been reported that white seabass spawn more than once per season, spawning intervals for individual females are unknown. However, it has been estimated that females spawn about four to five times during each season.

2.5 Natural Mortality

Thomas (1968) calculated a natural mortality rate of 0.303 for fish caught in commercial gill nets. These fish represented the majority of commercially-caught white seabass and tend to be larger than recreationally-caught fish. Recently, natural mortality rates were determined for juvenile white seabass based on OREHP data. Kent and Ford (1990) found that natural mortality rates ranged from 0.258 (one and two year old fish) to 0.117 (three and four year old fish). Likewise, MacCall et al. (1976) and Dayton and MacCall (1992) calculated natural mortality rates for white seabass from the recreational and commercial fisheries, which were significantly less than Thomas’ (1968) estimate (Table 2-2) . In light of these values, it would seem that Thomas' estimate was high since natural mortality rates usually decline and level off as fish age.

Table 2-2. Estimates of white seabass natural mortality (M)

Source	M
Thomas 1968	0.303

MacCall et al. 1976	0.13
Kent and Ford 1990	0.258 (1 to 2 yr old); 0.117 (3 to 4 yr old)
Dayton and MacCall 1992	0.08

In comparison, natural mortality rates for another sciaenid, the red drum (*Sciaenops ocellatus*), were similar. Red drum are found in the Gulf of Mexico and the Atlantic ocean, and have a life history similar to white seabass. The natural mortality rates for them are 0.20 to 0.23 for subadults (1 to 5 yr old) and 0.12 to 0.13 for adults (6+ yr old) (SAFMC 2000). These rates are consistent with those calculated for white seabass by Kent and Ford (1990).

2.6 Parasites and Disease

Love and Moser (1976) provided a review of parasites commonly associated with marine fishes, including those common to white seabass taken from Mexican and Californian waters. External parasites consisted of three species of copepod (*Lepeophtheirus abdominis*, *L. thompsoni*, and *Neobrachiella gracilis*) and an unidentified monogenetic trematode, which were found attached to the body, fins, and mouth. Internally, three species of cestode worms (*Callitetrarhynchus gracilis*, *Grillotia smarisgora*, and *Lacistorhyncus tenuis*) have been found in the viscera and mesentery of white seabass. In addition, two species of digenera trematodes (*Pleorchis magniporus*, *P. californiensis*) have been found in the intestines, along with one species of nematode worm (*Anisakis* sp.). Two protozoans (*Ceratomyxa venusta* and *Kudoa clupeidae*) have been discovered in the gallbladder and muscle tissue of white seabass.

Little is known about disease in wild white seabass stocks. Chen et al. (1995) identified the marine gliding bacteria, *Flexibacter maritimus*, as the cause of lesions on white seabass, Northern anchovy (*Engralis mordax*) and Pacific sardine (*Sardinops sagax*) being held in close proximity. They also identified the presence of a second pathogenic bacteria, *Vibrio* species on white seabass. The cause of the infections was attributed to physical trauma such as net abrasions from capture and transfer, aggressive feeding behavior of captive white seabass, and wounds resulting from fish-eating birds (Chen et al. 1995). A third bacteria found to affect hatchery-reared white seabass is a Rickettsiales-like bacteria (CDFG 1998), which appeared to be similar to Rickettsia bacteria found on net pen-reared salmon in Chile. Whether these and other bacteria are present on wild fish is currently unknown.

Worldover, scientific information on the diseases of marine fishes is poorly developed compared to information on the diseases of livestock and avian species. Investigation of disease in aquatic animals is more difficult due to the extensive and variable nature of the marine environment and the large number of species involved. Disease events are more likely to be recognized in aquaculture facilities than in wild stocks. Thus, information on the health status of commonly cultured species, such as salmonids, tends to be more comprehensive (AQIS 1999).

The effect of external and internal parasites and pathogens on healthy fish are often minor, being manifested as inflamation, lesions or increased mucus secretions (Smith 1975). However, conditions which stress fish can induce pathogenogenic infections that may result in death.

2.7 Predator/Prey Relationships

Knowledge of the food preferences and habits of white seabass are primarily anecdotal. However, mysid shrimp (Mysidae) made up a major portion of the diet of juvenile white seabass taken in and just outside of San Diego Bay (Crooke 1989a). Adults are known to feed on northern anchovy (*Engraulis mordax*); market squid (*Loligo opalescens*); Pacific sardine (*Sardinops sagax*); blacksmith (*Chromis punctipinnis*); silversides (Atherinopsidae species); and pelagic red crab (*Pleuroncodes planipes*) (Thomas 1968). Large white seabass have been found to have eaten only Pacific mackerel (*Scomber japonicus*) (Fitch 1958).

Commercial fishermen have recorded numerous instances of sea lion and shark predation on adult white seabass caught in nets (Fitch and Lavenberg 1971). Studies to identify the predators of white seabass eggs, larvae, and juveniles have not been done. Hypothetically, predators would include all piscivorous fishes such as kelp and sand bass (*Paralabrax clathratus* and *P. nebulifer*). In laboratory tanks, white seabass larvae are cannibalistic and must be graded by size (Crooke 1989a). This behavior probably takes place in the wild.

2.8 Competition

White seabass are often taken in conjunction with other migratory or seasonally available species such as bonito (*Sarda chiliensis*), California barracuda (*Sphyraena argentea*), and yellowtail (*Seriola lalandi*). Juveniles have been found mixed with bait fish caught by round haul nets. However, no specific data exist concerning white seabass competition with other species.

2.9 Critical Habitat

Young-of-the-year (age 0) white seabass ranging in length from 6 to 57 mm (0.25 to 2.25 in.) inhabit the open coast at depths of from 4 to 9 m (12 to 30 ft). These young fish are closely associated with small drifting debris and algae in shallow areas just outside the surf zone (Allen and Franklin 1988; 1992). Anecdotal information indicate that they are occasionally caught mixed with bait fish (anchovy) schools. By the time white seabass are two years old, some have moved into protected bays and are found in association with eelgrass beds (Crooke 1989b). Larger juveniles (three and four years old) are caught off piers and jetties and in kelp beds. Large white seabass school over rocky substrate in or near the large kelp beds that fringe the beaches and offshore islands. They are also found several miles offshore in schools swimming at or near the surface (Skogsberg 1939; Squire 1972).

2.10 Status of the Stocks

Historically, the white seabass resource extended as far north as San Francisco Bay, but as oceanographic conditions changed and the various segments of the fishery grew, there was a steady decline in availability and subsequently catch. In essence, the resource contracted geographically, so that the bulk of the resource was situated off of southern California and northern Baja California, Mexico. Only during ENSOs were white seabass caught in quantity north of Point Conception. However, recent increase of catches by recreational and commercial fishermen in the Monterey Bay area during the past two years may indicate expansion of the stock (Department unpubl. data). There are few data available concerning the status of white seabass populations in Mexican waters, so it is difficult to determine if this is a geographic expansion of the stock due to increasing numbers or a shifting of the stock northward.

Although a current stock assessment has not been done for white seabass there are indications that the white seabass population in California is recovering from low levels seen in the 1970s, 1980s, and most of the 1990s. It appears that white seabass may be entering a pattern similar to the 1940s, where abundance increased following a shift from a period of warmer to colder ocean waters. Warmer waters have occurred in the Southern California Bight from the late 1970s to mid 1990s, but have become colder the last few years. During this time, there has also been a steady increase in white seabass take in California waters, approaching catch levels of the late 1940s and early 1950s. A similar pattern also occurred in the late 1890s and early 1900s when white seabass catches were high following a much warmer period that ended in the 1880s (MacCall pers. comm.).

In addition to increased catches of white seabass, there has been a steady increase in the size of fish taken. For example, the weight of white seabass caught by the recreational fishery averaged about 2.4 kilograms (5 lbs) in the 1980s but increased to 6.2 kilograms (14 lbs) in the 1990s (RecFIN 2001). It is difficult to determine if a similar change has occurred in the commercial fishery since most white seabass taken are well above the legal size limit of 28 inches (711 mm). However, anecdotal information from the commercial fishery suggests that a similar trend is occurring.

White seabass recruitment in the Southern California Bight has also increased steadily since 1982, with large increases occurring in recent years (Crooke pers. comm.; Allen et al. 2001). Fishery-independent data from gill net surveys indicate a significant increase in 0 to 4 year old white seabass from 1995-2001 (Allen et al. 2001). The largest recruitment during this period occurred in 1999 when a large number of one and two year old fish were caught. This was probably a result of a strong year class associated with the ENSO of 1997-1998.

Chapter 3. Description of the Fishery

3.1 Areas and Stocks Involved

White seabass occur in or near large kelp beds which fringe beaches and rocky headlands in southern California and the offshore islands (Skogsberg 1939; Thomas 1968). They are also found several miles offshore in schools of various sizes. During some months of the year, white seabass tend to occur close to the seafloor in deeper water (Skogsberg 1939). These same patterns have been reported for white seabass taken north of Point Conception (Thomas 1968). Some of the typical areas inhabited by white seabass are Long Point, Palos Verdes Peninsula; Point Loma; Dana Point; the west end of Santa Catalina Island; San Clemente Island; Santa Barbara Island; and Santa Cruz Island.

Historically, recreational and commercial white seabass fishing activity occurred along the coast between San Pedro and San Diego. Over time, as more recreational fishermen became interested in white seabass, fishing activity expanded northward along the coast to Santa Barbara and out to the northern Channel Islands. Since these areas had been used by commercial fishermen, user conflicts increased. In the mid-1990's, implementation of the southern California nearshore gill net ban caused a shift in commercial fishing activity. The San Pedro/Huntington Flats area became less important as effort was focused at San Miguel, Santa Rosa, and Santa Cruz islands and along the mainland from Goleta northward (Department unpubl. data). Increased regulation on the use of various commercial gear has created large areas along the mainland coast and offshore islands that have become defacto commercial fishing closures. As a consequence, recreational fishermen have had better access to white seabass than ever before over the past two decades and the partitioning of the white seabass resource has shifted to the recreational fishery.

3.2 History of Exploitation

The white seabass resource of the Eastern Pacific has been shared by the recreational and commercial components of the fishery since at least the late 1890's. Documentation of this common usage can be found in the Avalon Tuna Club’s weight records for white seabass from the early 1900's (Dayton and MacCall 1992) and in Department data (Young 1973; Table 3-1).

Another component of the historical catch is the contribution of white seabass landings by U.S. boats fishing off Mexico. Until the 1960s, that portion of California landings averaged between 35% and 40% of total catches and increased to 75% between 1963 and 1980. However, in January 1982, Mexico began denying fishing permits to U.S. commercial fishermen (Vojkovich and Reed 1983). The result was a substantial reduction in total U.S. commercial seabass landings (Table 3-1).

Table 3-1. Total white seabass take in U.S. and Mexico by U.S. commercial and recreational industries from 1936 to 2000[1]										
	U.S. commercial (lbs)	Mexico[4] commercial (lbs)	U.S.[2] recreational (lbs)	Mexico[2] recreational (lbs)	U.S.[3] Commercial (# of fish)	Mexico[3] commercial (# of fish)	U.S. recreational (# of fish)	Mexico recreational (# of fish)	Total catch (lbs)	Total catch (# of fish)
1936	564,956	242,823	105,516		22,598	9,713	8,793		913,295	41,104
1937	263,195	336,224	90,192		10,528	13,449	7,516		689,611	31,493
1938	269,987	356,660	102,108		10,799	14,266	8,509		728,755	33,575
1939	806,604	187,792	221,784		32,264	7,512	18,482		1,216,180	58,258
1940	809,231	104,080	132,504		32,369	4,163	11,042		1,045,815	47,574
1941	832,454	75,842			33,298	3,034			908,296	36,332
1942	356,526	197,200	No recreational records		14,261	7,888	No recreational records		553,726	22,149
1943	379,178	121,005	available during		15,167	4,840	available during		500,183	20,007
1944	254,050	139,918	WWII		10,162	5,597	WWII		393,968	15,759
1945	380,093	147,262			15,204	5,890			527,355	21,094
1946	471,649	144,272			18,866	5,771			615,921	24,637
1947	692,314	390,709	207,972	9,252	27,693	15,628	17,331	771	1,300,247	61,423
1948	789,691	324,599	259,044	16,812	31,588	12,984	21,587	1,401	1,390,146	67,560
1949	945,502	466,736	750,036	16,464	37,820	18,669	62,503	1,372	2,178,738	120,365
1950	1,123,429	409,301	524,280	24,636	44,937	16,372	43,690	2,053	2,081,646	107,052
1951	955,145	591,410	488,928	5,484	38,206	23,656	40,744	457	2,040,967	103,063
1952	692,232	456,474	421,056	5,772	27,689	18,259	35,088	481	1,575,534	81,517
1953	471,206	437,868	292,716	3,636	18,848	17,515	24,393	303	1,205,426	61,059
1954	434,354	772,198	488,052	1,548	17,374	30,888	40,671	129	1,696,152	89,062
1955	544,953	370,173	334,140	4,104	21,798	14,807	27,845	342	1,253,370	64,792
1956	413,956	676,754	230,640	3,576	16,558	27,070	19,220	298	1,324,926	63,146
1957	1,261,755	245,140	226,428	1,932	50,470	9,806	18,869	161	1,735,255	79,306
1958	2,750,652	99,111	332,916	74,220	110,026	3,964	27,743	6,185	3,256,899	147,919
1959	3,385,791	37,562	119,364	7,752	135,432	1,502	9,947	646	3,550,469	147,527
1960	1,086,895	149,303	181,236	7,128	43,476	5,972	15,103	594	1,424,562	65,145
1961	458,491	238,509	164,160	4,824	18,340	9,540	13,680	402	865,984	41,962
1962	208,867	365,541	162,780	11,964	8,355	14,622	13,565	997	749,152	37,538
1963	372,479	518,741	232,452	5,124	14,899	20,750	19,371	427	1,128,796	55,447
1964	550,817	841,061	173,892	4,920	22,033	33,642	14,491	410	1,570,690	70,576
1965	577,607	851,000	115,512	1,788	23,104	34,040	9,626	149	1,545,907	66,919
1966	674,545	663,000	40,572	7,092	26,982	26,520	3,381	591	1,385,209	57,474
1967	507,588	715,000	31,668	8,952	20,304	28,600	2,639	746	1,263,208	52,289
1968	210,050	652,000	41,232	8,424	8,402	26,080	3,436	702	911,706	38,620
1969	250,906	848,000	34,824	13,848	10,036	33,920	2,902	1,154	1,147,578	48,012
1970	426,299	675,000	24,060	28,248	17,052	27,000	2,005	2,354	1,153,607	48,411
1971	551,552	272,000	36,648	26,532	22,062	10,880	3,054	2,211	886,732	38,207
1972	548,015	227,000	25,620	20,592	21,921	9,080	2,135	1,716	821,227	34,852

Table 3-1. Total white seabass take in U.S. and Mexico by U.S. commercial and recreational industries from 1936 to 2000[1]										
	U.S. commercial (lbs)	Mexico[4] commercial (lbs)	U.S.[2] recreational (lbs)	Mexico[2] recreational (lbs)	U.S.[3] Commercial (# of fish)	Mexico[3] commercial (# of fish)	U.S. recreational (# of fish)	Mexico recreational (# of fish)	Total catch (lbs)	Total catch (# of fish)
1973	581,267	228,000	61,284	23,712	23,251	9,120	5,107	1,976	894,263	39,454
1974	286,935	104,409	40,896	7,128	11,477	4,176	3,408	594	439,368	19,656
1975	201,702	980,708	33,120	4,776	8,068	39,228	2,760	398	1,220,306	50,454
1976	198,140	860,533	22,836	9,204	7,926	34,421	1,903	767	1,090,713	45,017
1977	369,712	829,932	23,340	1,812	14,788	33,197	1,945	151	1,224,796	50,082
1978	294,691	866,064	3,408	1,788	11,788	34,643	284	149	1,165,951	46,863
1979	137,907	1,067,759	7,032	9,192	5,516	42,710	586	766	1,221,890	49,579
1980	133,741	836,671	55,190	3,888	5,350	33,467	16,300	324	1,029,490	55,440
1981	84,772	691,232	32,622	3,432	3,391	27,649	8,291	286	812,058	39,167
1982	69,898		76,940	4,128	2,796		15,514	344	150,966	18,654
1983	77,552		34,584	4,416	3,102		7,415	368	116,552	10,885
1984	117,801		67,478	4,176	4,712		8,365	348	189,455	13,425
1985	125,316		114,232	2,028	5,013		11,527	169	241,576	16,709
1986	105,690		96,141	2,664	4,228		13,132	222	204,495	17,582
1987	116,074		102,126	1,464	4,643		14,714	122	219,664	19,479
1988	106,898		88,214	4,812	4,276		18,475	401	199,924	23,152
1989	116,022		14,227	4,104	4,641		3,353	342	134,353	8,336
1990	133,661		29,928	852	5,346		2,494	71	164,441	7,911
1991	163,784		19,836	1,080	6,551		1,653	90	184,700	8,294
1992	125,104		7,248	1,152	5,004		604	96	133,504	5,704
1993	99,481		101,324	3,960	3,979		6,993	330	204,765	11,302
1994	78,896		157,048	1,476	3,156		14,721	123	237,420	18,000
1995	73,380		202,042	912	2,935		17,336	76	276,334	20,347
1996	94,769		71,904	1,884	3,791		8,530	157	168,557	12,478
1997	58,155		108,339	1,356	2,326		7,479	113	167,850	9,918
1998	156,633		164,093	4,248	6,265		8,810	354	324,974	15,429
1999	247,050		435,271	1,896	9,882		28,544	158	684,217	38,584
2000	212,652		716,298	1,236	8,506		37,410	103	930,186	46,019

All take in Mexico denotes catches by U.S. fishermen in Mexican waters.

[1] 1936-1964 commercial catches from Collyer (1949) and Thomas (1968); 1965-2000 commercial values from DFG landing data; 1936-1979 recreational catches from CPFV logbook database; 1980-2000 recreational values from CPFV logbook data plus PSMFC RecFIN.

[2] Computed value used 12 pounds per fish for CPFV and private/rental boats, and 5 pounds per fish for shore-based fishing (Collyer 1949; Thomas 1968). For 1980-1989 and 1993-2000, computed value used average weight of fish caught by fishing mode (from RecFIN database).

[3] Computed value used 25 pounds per fish (Collyer 1949; Thomas 1968).

[4] Catch by U. S. commercial fishermen in Mexican waters; Mexico closed territorial waters to U.S. commercial fleet in 1982.

3.2.1 Description of User Groups

Recreational Fishery

White seabass are most often fished with hook and line gear using live bait in relatively shallow water but are also taken with a fast trolled spoon, artificial squid, or bone jig. Live squid appear to be the best and most commonly used white seabass bait, but large anchovies and medium-sized sardines are also effective as live bait. At times, large white seabass will bite only on fairly large, live Pacific mackerel (Fitch 1958). Frozen squid can also be effective when white seabass are feeding aggressively. When live squid are available, relatively large catches of seabass can be made around the full moon in the spring and early summer. The fish can be brought to the surface, or just under the boat, by heavy chumming.

Hook and line anglers can fish for white seabass from shore, including beaches and man-made structures, such as jetties and piers; private or rental boats; and charter or party boats, known as Commercial Passenger Fishing Vessels (CPFV). In 2000, nearly five percent of surveyed angler trips in southern California reported targeting white seabass (RecFIN 2000); thus, an estimated 63,000 anglers targeted white seabass that year in southern California marine waters.

In addition to hook and line anglers, scuba and free divers contribute to the recreational take of white seabass. However, an exact number of active divers who spearfish in California is unknown. Free diving is a more effective method of targeting and spearing white seabass than scuba. Three southern California clubs from Los Angeles and San Diego Counties (Neptune Free Divers, the Fathomiers, and the San Diego Free Divers) are dedicated to free diving and spearfishing. These clubs have a combined membership of approximately 145 free divers; only about 55 are estimated to efficiently target and spear white seabass (Romanowski pers. comm.). In addition, approximately 165 free divers not affiliated with any clubs in Los Angeles and San Diego Counties effectively target and spear white seabass (Lum pers. comm.). An estimated 45 free divers in the Ventura County and Santa Barbara Counties target and successfully spear white seabass (Lum pers. comm.). The number of non-spearfishing free-divers in California that may have some impact on white seabass is unknown. For example, activities such as under-water photography and under-water filming could potentially disrupt the fish's reproductive behavior.

Commercial Fishery

Historically, commercial fishermen have used gill nets; hook and line; trawl nets; and roundhaul gear such as lampara and purse seine nets to take white seabass. Lampara and purse seine nets were used in the early years of the fishery until it became unprofitable (Whitehead 1930). Descriptions of the commercial fishery and gear types used prior to 1980 have been given in Skogsberg (1925, 1939); Whitehead (1930); Thomas (1968); Young (1973); MacCall et al. (1976); and Vojkovich and Reed (1983).

The commercial fishery for white seabass has largely been composed of a small group of fishermen who target white seabass with set gill nets, drift gill nets, and hook and line gear with the remaining catches landed incidentally in other fisheries (Table 3-2). For the past twenty years, an annual average of 141 vessels (range: 91-199 vessels) have participated in this fishery (Table 3-3); however, about twenty vessels participated in the directed fishery, landing 80% (range: 56 to 94%) of the annual catch. This trend holds true even during years of high white seabass abundance and increased participation. A breakdown of the number of vessels by gear type illustrates that there has been a 64% drop in the number of set and drift gill net vessels since 1985, while the number of hook and line vessels has experienced a five-fold increase. This change can be attributed to fishermen shifting from gill nets to hook and line and other fisheries, and attrition to the fishery.

Table 3-2. Total California landings (pounds) of white seabass by gear type from 1981-2000[1]

Year	Drift gill net	Set gill net	Hook/Line	Trawl	Purse seine	Other/ unknown	Total pounds
1981	5,161	78,203	968	95	0	345	84,772
1982	1,620	66,778	817	101	0	583	69,898
1983	367	72,422	1,626	16	0	3,121	77,552
1984	79	115,199	753	44	549	1,177	117,801
1985	7,215	116,145	1,285	93	18	561	125,316
1986	24,674	77,825	2,425	325	0	441	105,690
1987	21,345	92,169	1,321	394	0	845	116,074
1988	28,242	72,979	1,666	3,716	0	295	106,898
1989	32,071	78,445	2,553	856	0	2,097	116,022
1990	31,313	95,239	5,318	794	0	998	133,661
1991	37,832	121,205	3,745	620	25	357	163,784
1992	24,806	95,765	2,584	1,535	0	415	125,104
1993	35,824	56,288	6,098	864	0	407	99,481
1994	53,244	19,611	5,636	325	0	80	78,896
1995	31,506	20,807	19,542	1,451	0	74	73,380
1996	62,812	16,059	15,300	347	0	250	94,769
1997	27,354	21,633	6,981	2,179	0	8	58,155
1998	26,635	118,972	7,469	3,403	0	154	156,633
1999	81,095	128,242	32,231	5,326	0	156	247,050
2000	33,071	144,354	31,234	3,993	0	175	212,652

[1] Entangling net data added to drift and set data based on the ratio of drift/set net effort taken from logbook data.

Although the fishermen's ability, aided by advances in marine vessel electronic technology (e.g., fathometers, sea surface temperature faxes) to locate white seabass has increased over time, commercial fishing gear used in the white seabass fishery has not changed much since the fishery began in the late 1890's. Gill nets have been the most important gear type in the commercial white seabass fishery, and are still designed the same way except the materials have changed over time from multi-strand twine to multi-filament nylon webbing, and now to monofilament nylon webbing (Thomas 1968; Vojkovich and Reed 1983). The two types of gill nets used are set nets and drift gill nets with 6- to 7-inch (152 to 178 mm) mesh (stretched mesh, knot to knot). The most significant change has been the addition of a mechanized net reel, developed in the 1940s. The net reel greatly aides in setting and retrieving nets (Thomas 1968), and it also permits fishermen to increase the length of their nets and the amount of gear set.

In the late 1970s and 1980s, set nets were the principle gear used to take white seabass in California waters while drift gill nets were used primarily in Mexican waters (Vojkovich and Reed 1983). In the mid-1990s, drift gill nets played a larger role in the California fishery (Table 3-3).

Table 3-3. Number of vessels landing white seabass by principle landing gear from 1981-2000[1]

Year	Hook/ line	Trawl	Drift gill net	Set gill net	Gill nets	Purse seine	Other/ unknown	Total vessels
1981	14	2			130	0	3	129
1982	27	5			113	0	19	142
1983	12	1			112	0	34	156
1984	13	2			141	2	26	173
1985	12	3			171	1	18	199
1986	21	6			166	0	16	197
1987	19	11			146	0	14	181
1988	18	11			114	0	7	145
1989	23	7			115	0	10	148
1990	29	8			102	0	12	145
1991	33	11			97	0	7	136
1992	26	14			87	0	7	121
1993	56	12			68	0	7	136
1994	41	11	24	40	53	0	4	103
1995	42	15	24	45	57	0	4	114
1996	33	10	20	42	50	0	1	91
1997	32	19	20	47	57	0	1	106
1998	40	29	15	53	57	0	2	118
1999	64	32	20	65	66	0	4	150
2000	84	29	24	65	69	0	3	167

[1] Reflects total number of vessels landing white seabass, recognizing that many boats use multiple gears within a year.

The size of gill net vessels has not changed significantly. Most boats range from 29 to 40 feet (9 to 12 m) in length and are crewed by a skipper working alone or with at least one deckhand. The set time nets are in the water depends on the availability of white seabass, weather conditions and presence of marine mammals. Most drift gill nets along the mainland shore are set just prior to sunset and pulled two or three hours later. At the Channel Islands, drift gill nets may be set for up to twelve hours. Set gill nets remain in the water for about sixteen hours.

The other principle gear used to take white seabass is hook and line. In the early years of the fishery, handlines were used to take white seabass (Skogsberg 1925). As technology changed, fishing with rod and reel and live bait became more prevalent (Skogsberg 1939). Over the past ten years, this method of fishing has grown (Table 3-3). Today, rod and reel and longlines are the two types of hook and line gear used. Commercial rod and reel gear is similar to that used by the recreational industry, consisting of monofilament line with two hooks and either live squid or sardine as bait. The boats, ranging in size from 20 to 45 feet (6 to 14 m), will either drift or anchor within or adjacent to kelp beds. Set longlines used in the white seabass fishery are similar to those used in the old east coast cod fishery. The gear consists of a buoy and vertical line attached to an anchor and main line, which can vary in length. Distributed along the mainline are equi-distant, snap-on gangions with hooks. The main line is monofilament and is taken on and off the boat by means of a reel. This gear is typically fished over sandy substrate and the duration of the set is the amount of time it takes to set and retrieve the gear (Athens pers. comm.). It takes at least two people to work longline gear.

Over the last two decades, commercial fishermen have sold their catch to fish businesses distributed along the coast from San Diego to Eureka. The majority of fish businesses that receive white seabass, however, are located in southern California (Table 3-4). Only a small number of these businesses purchase 2.5 tons (2.3 metric tons) or more annually (Table 3-5).

3.2.2 Fishing Catch and Effort

<u>Recreational Fishing</u>
A very active recreational fishery for white seabass has existed since the late 1930s (Skogsberg 1939). This species has a special allure for anglers, probably due to its potential size, eating quality, and elusive nature. Large recreational catches of white seabass take place only occasionally, at irregular intervals, and at scattered localities. At times, excellent catches are made near southern California’s offshore islands. From the 1950s to1970s, higher catches were seen in nearshore coastal areas. In contrast, throughout the 1980s and 1990s, the highest catches were recorded off the Channel Islands (Department unpubl. data).

Annual recreational catches of white seabass have fluctuated considerably over the years (Table 3-1) with much of the catch occurring aboard CPFVs (Figure 3-1). The majority of white seabass are caught in U.S. waters with a small percentage caught in Mexican waters. Historical records show that at the peak of the recreational fishery for white seabass (1947 to 1959), anglers on CPFV’s landed an average of 31,100 fish per year. This was followed by a steady decline in the average annual catch: 10,400 fish during the 1960s, 3,400 fish in the 1970s, and 1,300 fish in the 1980s. In the 1990s, annual catches fluctuated from a low of 700 fish in 1992 to more than 16,000 fish in 1999, with an average of 2,800.

Much higher recreational catches of white seabass occurred in 1999 and 2000 than in previous years (Figure 3-1). This can be attributed to an increase in the availability of white seabass and fishing effort. More anglers have targeted white seabass in recent

Table 3-4. Number of fish businesses receiving white seabass by principle landing area from 1981-2000								
Year	San Diego	Orange/ Los Angeles	Ventura/ Santa Barbara	San Luis Obispo	Monterey/ Santa Cruz	San Francisco Bay Area	Ports north of San Francisco	Total No. of Businesses
1981	23	20	18	5	3	1	0	69
1982	18	28	18	7	2	1	0	69
1983	20	33	15	6	6	13	1	91
1984	22	25	17	8	7	6	0	76
1985	21	26	20	7	7	1	0	74
1986	19	25	17	7	4	4	0	70
1987	22	23	16	8	3	1	0	69
1988	20	17	22	5	3	1	1	66
1989	16	20	25	8	5	0	0	70
1990	16	24	20	7	4	1	0	71
1991	19	25	18	6	5	1	0	67
1992	14	17	20	6	3	2	0	61
1993	13	21	15	6	5	3	0	59
1994	10	15	22	5	4	6	0	60
1995	8	18	30	5	7	3	0	69
1996	7	13	24	5	2	2	0	53
1997	8	11	23	8	11	9	0	68
1998	8	22	29	13	10	9	0	82
1999	12	33	35	8	14	10	0	104
2000	9	30	26	6	10	6	1	86

Table 3-5. Number of fish markets receiving white seabass by pounds received from 1981-2000						
Year	>0 and <1,000 lbs	1,000 and <5,000 lbs	5,000 and <10,000 lbs	10,000 and <20,000 lbs	20,000 lbs	Total No. of Markets
1981	52	14	2	0	1	69
1982	52	14	3	0	0	69
1983	76	11	2	2	0	91
1984	56	10	8	2	0	76
1985	48	19	4	3	0	74
1986	54	9	3	4	0	70
1987	51	10	4	3	1	69
1988	49	11	4	1	1	66
1989	53	10	2	5	0	70
1990	48	17	2	3	1	71
1991	41	15	6	5	0	67
1992	41	12	5	2	1	61
1993	45	9	1	4	0	59
1994	47	8	3	2	0	60
1995	53	13	2	1	0	69
1996	38	10	3	1	1	53
1997	57	7	3	1	0	68
1998	67	6	5	2	2	82
1999	79	14	4	4	3	104
2000	68	8	4	2	4	86

years (Figure 3-2), and the CPUE for trips aboard CPFVs targeting white seabass increased dramatically during 1999 (Figure 3-3).

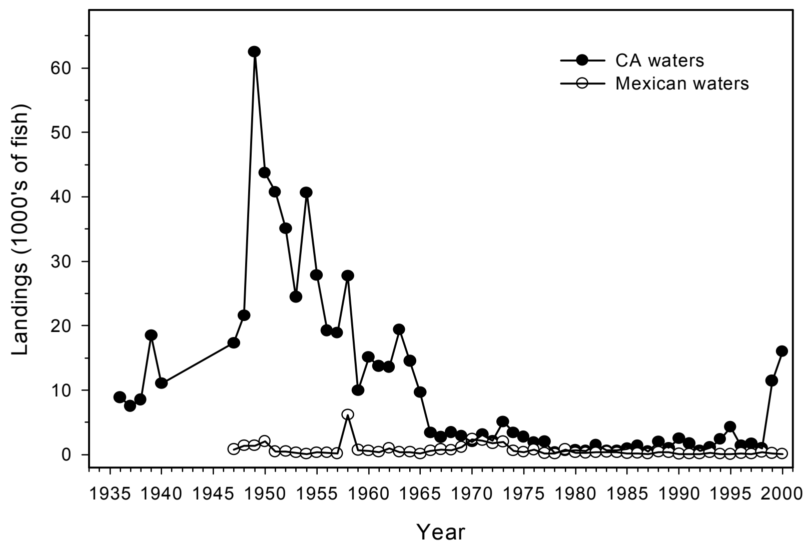

Figure 3-1. Commercial Passenger Fishing Vessel (CPFV) landings of white seabass in U.S. and Mexican waters. Data from Department's historical logbook database.

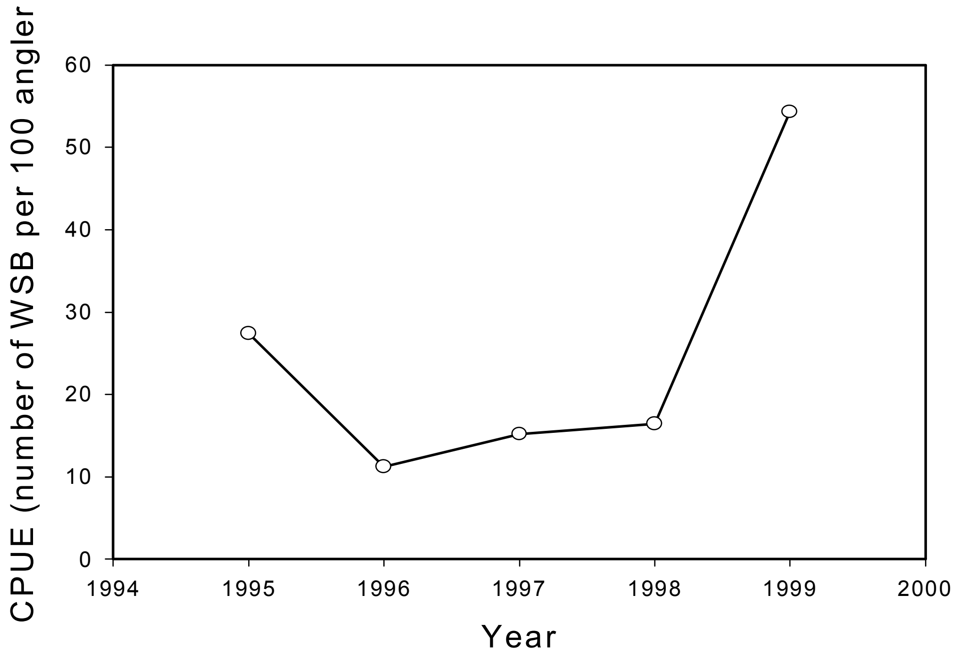

Figure 3-3. Catch-per-unit-effort (CPUE) of white seabass (WSB) aboard California Passenger Fishing Vessels (CPFVs) targeting white seabass from 1995-1999.

The precise number of white seabass caught by fishermen aboard private boats

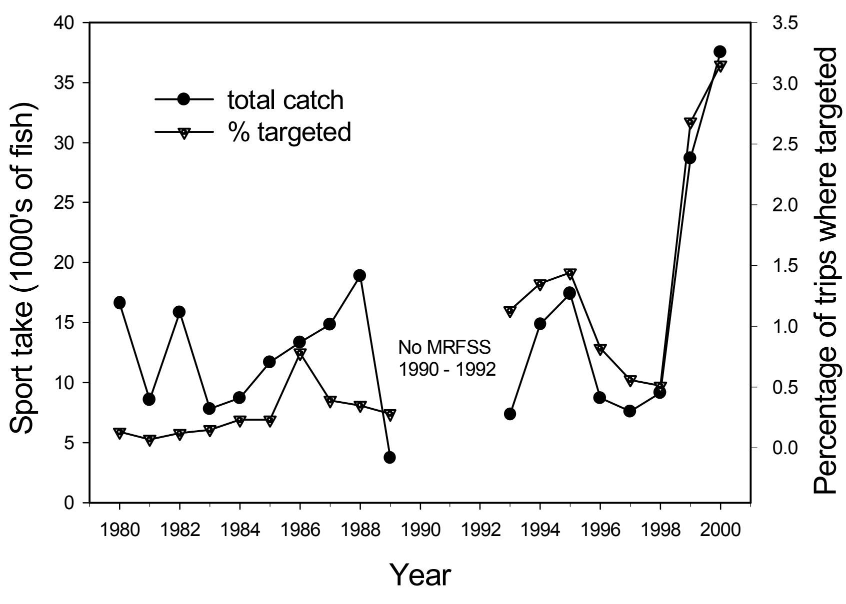

Figure 3-2. Total sport take of white seabass (WSB), in thousands of fish, compared to percentage of trips they are targeted.

(including rental boats) is difficult to determine since few studies have included them in their surveys. However, it is generally believed that private boat fishermen have recently played a larger role in the white seabass fishery. An estimated 3,350 white seabass were caught by private boat fishermen during 1964 (Pinkas et al. 1968); 2,580 during 1976 to 1977; 1,977 during 1977 to 1978; and 1,750 in 1981 (Wine 1978;1979;1982). Data collected by the Marine Recreational Fishery Statistical Survey (MRFSS) from 1980 to 2000 show that private boat catch estimates are consistently higher than CPFV catches (Figure 3-4; RecFIN 2001). Shore-based anglers have also played a large part in the catch of white seabass. Pinkas et al. (1963; 1968) estimated that pier and jetty fishermen caught approximately 8,500 white seabass in 1963 and shoreline anglers caught nearly 700 in 1965 to 1966. These shore-based catches can be higher than CPFV catches, but are generally lower (Figure 3-4; RecFIN 2001).

Much of the earlier catches from 1936 to 1978 contained a number of fish that were under the legal size of 28 inches. For some time, anglers were allowed to take up to fifteen fish per day, five of which could be less than 28 inches. Since white seabass have barely reached sexual maturity at 28 inches, this take of undersized fish may have contributed to today’s lower population sizes.

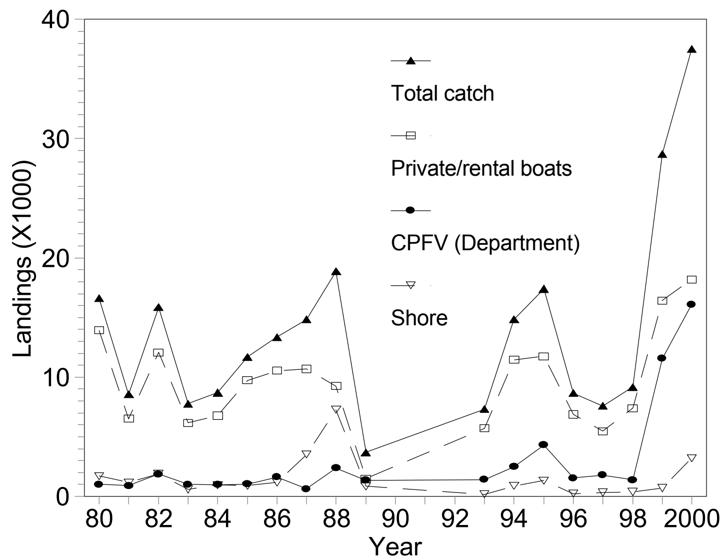

Figure 3-4. Recreational catch of white seabass (thousands of fish) by fishing mode from 1980-2000. Private/rental boats and shore data from RecFIN database; CPFV data from Department logbooks.

Today, anglers have little trouble locating small white seabass throughout the season; however, most have difficulty locating and catching large ones. Anglers fishing from CPFVs typically catch many undersized fish and relatively few large fish, and those fishing from piers and jetties catch undersized fish almost exclusively. Private boat anglers catch fish that are comparable in size to a combination of the CPFV and

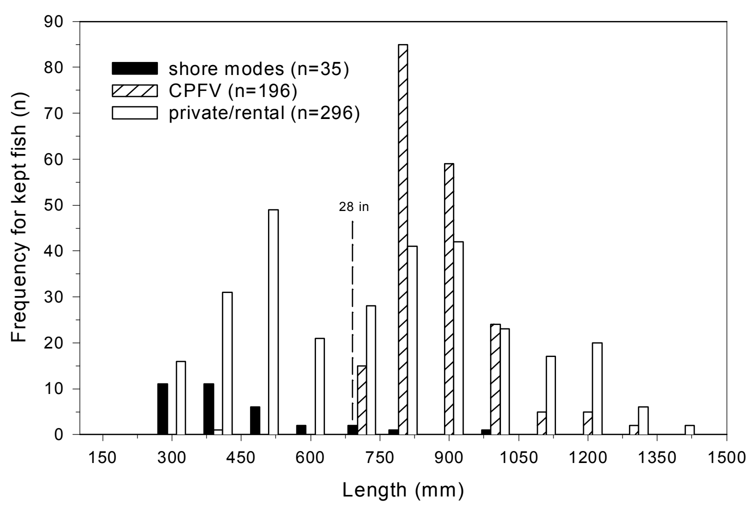

Figure 3-5. Length of white seabass kept by different fishing modes from 1980-2000.

pier/jetty catches (Figure 3-5; MacCall et al. 1976). During a survey of private boat fishermen conducted from 1975 to 1982, only 6% to 16% of the white seabass landed were of legal size (Wine 1978;1979;1982). Another survey showed that from 1985 to 1987, 6% to 40% of the white seabass caught aboard CPFVs were of legal size. Thus, from 60% to 94% of the white seabass caught by recreational anglers have been undersized, and a substantial number were illegally kept (Ally et al. 1992).

The high retention of sub-legal fish occurs because anglers are unaware of the size limit and are unable to correctly identify small white seabass. In a few studies, only 10% of fishermen knew the size limit for white seabass (Wine 1980), and only 23% were able to correctly identify them (Hartmann 1980). This can be a particular problem for pier and private boat fishermen since CPFV anglers can rely on vessel crew for white seabass identification and information on regulations.

Because white seabass are highly sensitive to noise and movement, scuba diving, with its associated bubbles, is a difficult method for effectively spearing these fish. Thus, scuba divers probably do not have a large impact on the total number of white seabass taken. However, some experienced scuba diver/spear fishermen have been known to effectively target white seabass and can spear enough fish to take their full daily bag limits (Lum pers. comm.).

Currently, the average free diver takes about two white seabass per year, and experienced divers take an average of five to ten fish per year (Lum pers. comm.). Compared to the average of 0.5 per year in prior years, this is a 50 to100-fold increase in the number of white seabass taken by free divers. In "good years", when the number of fish are locally plentiful, the take can be much higher. According to Lum, 1994 and 1999 were exceptionally good years when he saw very large schools of white seabass numbering in the thousands and speared at least 40 large fish, each weighing over 40 pounds (18 kg). Given Lum's estimate of five white seabass per year, and an estimated 265 free divers who target white seabass, an average of 1,325 fish per year may be taken by southern California free divers.

Lum (pers. comm.) also stated that all fish which appear to be of legal size are targeted in the early part of the season when there is a bag limit of three white seabass per day. Unfortunately, this may include the take of some fish that are less than the legal size of 28 inches (711 mm). When the bag limit is reduced to one white seabass per day from 15 March to 15 June, free divers may tend to target only larger fish.

Commercial Fishing

Commercial white seabass landings have fluctuated dramatically over the years. Landings were moderate during the late 1800s and grew impressively from 1889 to 1915. By 1904, over one million pounds (0.45 million kg) were landed annually. Catches from central and northern California were substantial (often as high as 50% of the total catch), however, the center of the fishery had shifted to southern California by 1916. This was probably due to decreased fish abundance north of Point Conception and to the increased number of fishermen and increased demand in southern California. The fishery experienced spectacular catches after World War I. Highest total landings in the early years of this fishery occurred in 1919 and 1920 when the landings exceeded two million pounds (0.9 million kg) both years. For the next ten years, the landings fluctuated between 800,000 and 1.4 million pounds (0.6 million kg).

Declining catches in the late 1920s and early 1930s prompted a series of commercial regulations including closed seasons, bag limits, gear restrictions and minimum size limits (Skogsberg 1939). During the 1930s and 1940s, landings ranged from 250,000 to 900,000 pounds (113,400 to 408,240 kg). The greatest peak in California landings occurred during the warm water year of 1959, when more than 3 million pounds (1.4 million kg) were taken. Between 1959 and 1965, landings dropped sharply, falling from over 1 million to 577,607 pounds (262,003 kg). There was a slight increase in 1966 to over 674,000 pounds (305,726 kg). The remainder of the1960s and all of the 1970's show catches below 600,000 pounds (272,160 kg). In the 1980s, catches dropped below 200,000 pounds (90,720 kg) and reached a low of fewer than 70,000 pounds (31,752 kg) in 1982. The large decline (91%) in catch seen between 1981 and 1982 was the result of the loss of catches from Mexican waters. In the 1990s, the commercial fishery experienced wide fluctuations in landings. Beginning in 1994, annual landings dropped below 100,000 pounds (45,360 kg) and reached a record low of 58,554 pounds (26,309 kg) in 1997. This low was followed by three years of large increases with 1999 reaching almost 250,000 pounds (113,400 kg) (Table 3-1; Figure 3-6).

Declining commercial landings of white seabass are partly due to reductions in effort. A decrease in effort for white seabass is reflected in logbook data collected from the commercial set and drift gill net fishery (Figure 3-7). The number of white seabass sets made by fishermen using set gill nets dropped from nearly 2000 in 1982 to less then 50 sets in 1994 (Beeson and Hanan 1994).

Since the commercial fishery began, there have been a number of factors that have affected fishing effort for white seabass. These factors include increased regulation, improvements in technology, market factors (i.e., demand and price), and changes in fish abundance. In the past two decades, there have been two regulatory changes that have greatly affected the commercial catch of white seabass. The first was the closure of Mexican waters to U.S. fishermen in 1982, and the second was passage of the Marine Life Protection Act of 1990, which banned the use of gill nets in State waters south of Point Conception after 1994. Thus, the decline in commercial white seabass landings can, in part, be attributed to decreased effort and participation by commercial fishermen due to the loss of grounds off of Mexico in the 1980s and in the Southern California Bight during the 1990s.

Public demand and fish businesses also influence fishing effort. Because of consumer demand, white seabass has always commanded relatively high prices for whole dressed (gutted) fish, in the range of $1.60 to $2.00 per lb. At the beginning of the season, a premium price is paid for white seabass. However, if availability is high, the price can drop to as low as $0.60 per lb. This results in fishermen reducing the number

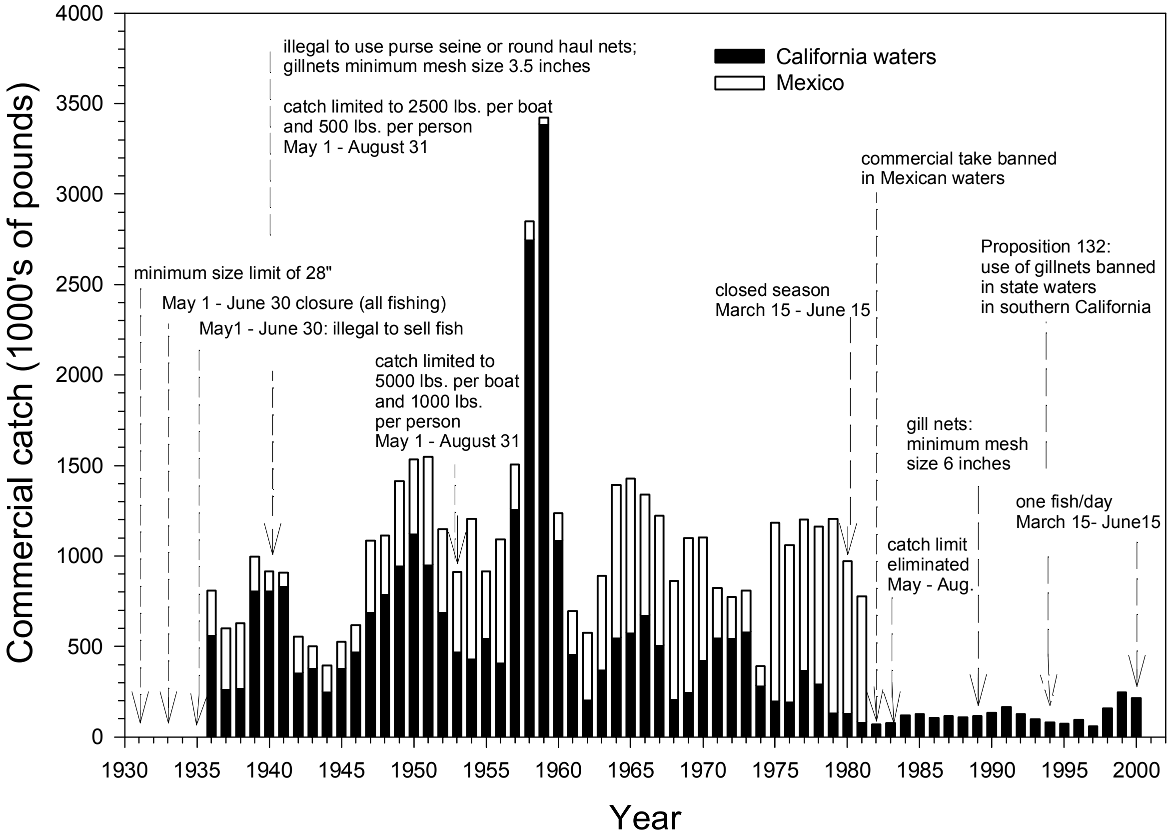

Figure 3-6. Regulation changes and total white seabass commercial catch from U.S. and Mexican waters taken by California fishermen from 1936-2000. Modified from Thomas (1968).

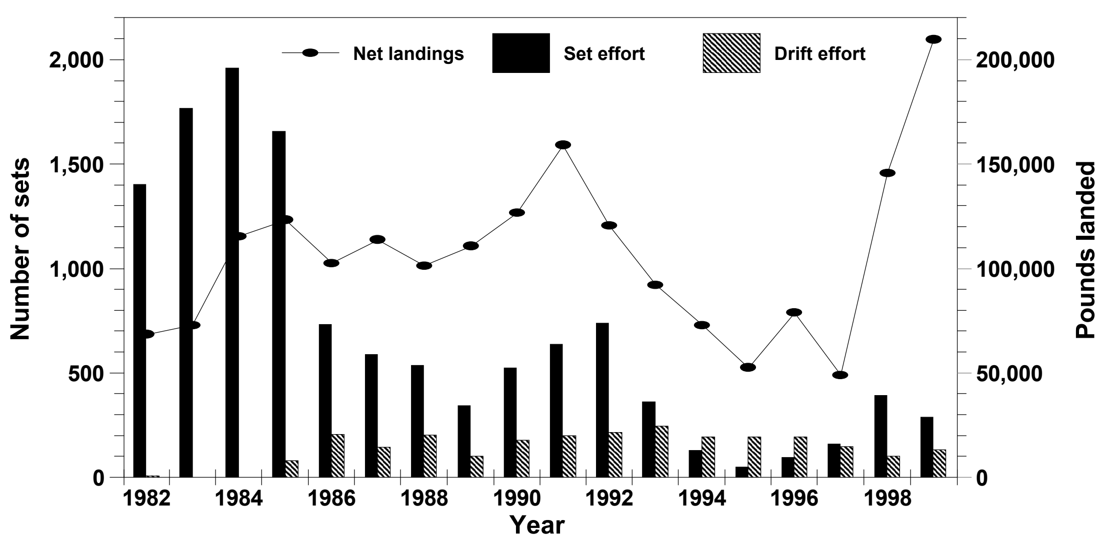

Figure 3-7. Set gill net and drift gill net effort and pounds landed from 1982-2000.

of days they target white seabass or shifting to another species. Another way in which fish businesses influence fishing effort is through the importation of white seabass from Mexico. Imports from Mexico cost about $0.60 to $0.70 per pound, significantly less than the average of over $2.00 per pound paid to California fishermen in 2000. If Mexican seabass is readily available, markets will not buy fish from local fishermen unless there is a special need for local fresh-caught fish.

The commercial CPUE for white seabass has been quite variable. During the period 1950 to1970, the U.S. segment of the fishery had a 50% drop in CPUE while the Mexican fishery remained stable (MacCall et al.1976). Vojkovich and Reed (1983) found a similar decline for California-caught white seabass from 1970 to 1980, indicating that the white seabass resource in California was continuing to decline. Estimates of commercial CPUE for the period 1982 to 2000, however, show an increasing trend (Figure 3-8), and perhaps is evidence that the white seabass stock size is increasing. The amount of fish taken per boat increased almost 3-fold from just

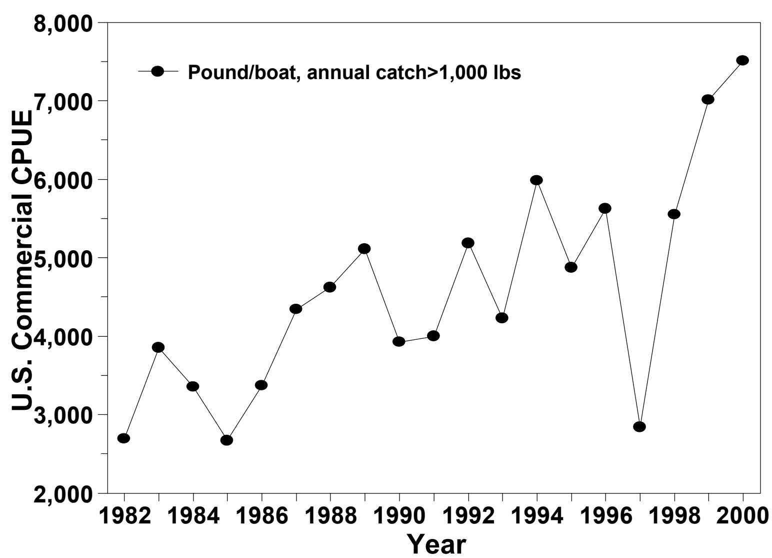

Figure 3-8. Commercial catch-per-unit-effort (CPUE) of white seabass from 1982-2000.

over 2,500 pounds (1,134 kg) in 1982 to over 7,000 pounds (3,175 kg) in 2000.

3.3 Social and Economic Characteristics of the Fishery

The commercial and recreational fisheries for white seabass in California produce a ripple effect in our economy. Money generated in these industries stimulates further economic growth throughout the state of California in the form of jobs, income and output. Available socioeconomic data has been gathered and presented below.

However, current data is limited and the need for improved socioeconomic data are addressed in Chapter 7.

3.3.1 Recreational Sector

White seabass is an important gamefish that, along with other marine sport fish, has become more popular with recreational anglers every year. The amount of money spent in the pursuit of white seabass contributes to the growth of the recreational fishing industry and California's economy. Socioeconomic information on California's saltwater recreational fishery is available from MRFSS data through the National Marine Fisheries Service (NMFS), the Southern California Sportfish Economic Survey (Thomson and Crooke 1991), and the U.S. Fish and Wildlife Service (USFWS), which conducts a socioeconomic survey every five years. With a few exceptions, data collected in these surveys apply to the recreational fishing industry as a whole, and not specifically to the white seabass fishery.

The Southern California Sportfish Economic Survey estimated the percentage of recreational anglers who participated in the white seabass fishery in 1989 and projected future participation levels in the fishery using the contingent valuation method. This method uses survey questions to elicit net benefits received by respondents from a proposed improvement. The survey found that participation in the fishery and angler avidity varied by county of residence. In addition, survey responses indicate that increases in catch rates of white seabass would have a significant effect on angler participation in the white seabass fishery (Table 3-6).

Table 3-6. 1989 participation in white seabass fishing and projected future participation in response to enhancement of catch rates by county of residence (Thomson and Crooke 1991)

Participation	County of residence								
	Los Angeles	Orange	Riverside	San Bernardino	San Diego	San Luis Obispo	Santa Barbara	Ventura	Non-coastal
Anglers targeting white seabass (%)	16.1	15.4	13.9	17.6	16.2	10.8	14.6	15.2	13.3
Average # of white seabass trips/year	1.93	2.97	1.88	2.29	1.78	1.89	2.47	2.21	1.45
Anglers that would increase their white seabass fishing (%)	36.5	39.5	19.7	27.9	36.4	17.1	23.6	32.3	22.0
Average increase in # of white seabass trips/year	3.46	3.31	2.39	3.06	3.03	4.77	3.84	2.88	2.40

In 2000, saltwater recreational anglers spent a total of $2.5 billion on related goods and services in California, with southern California exhibiting the highest recreational fishing expenditures for the Pacific Coast region (Milon 2000). The most recent employment records for the recreational fishing industry are for 1996 and show that

19,113 individuals were employed statewide, with combined salaries totaling $498,369,450 (USFWS 1997). These salaries would be valued at $548,206,395 with inflation adjustments for 2000 (BLS 2000). White seabass angling activity occurs primarily in

southern California, so socioeconomic data pertaining to this region will be the focus of this section.

Saltwater anglers spend substantial amounts of money on fishing related items such as boat maintenance, fishing licenses, and fishing gear, as well as trip related expenditures such as food, gasoline, parking, lodging, and tickets for CPFV (party boat) trips. Expenses related to private boat and CPFV angling activities are especially significant. In 2000, anglers in southern California spent nearly $127 million on CPFV trip related expenses (over 55% of all trip related expenditures), while private and rental boat trip related expenses totaled about $78 million (about 34% of all trip related expenditures) (Table 3-7). Anglers who fished from shore in southern California spent close to $25 million on trip related expenses, which is about 11% of all marine angler trip expenditures for this region.

Table 3-7. Total annual trip expenditures for saltwater anglers in southern California by fishing mode and resident status for 2000 (MRFSS data)

Trip expenditure	Party/charter boat		Private/rental boat		Shore	
	Resident	Non-resident	Resident	Non-resident	Resident	Non-resident
Private transportation	$8,217,000	$7,599,000	$11,914,000	$5,181,000	$6,754,000	$2,321,000
Food	$10,605,000	$4,402,000	$12,712,000	$1,213,000	$5,789,000	$686,000
Lodging	$995,000	$6,897,000	$875,000	$1,614,000	$2,873,000	$1,301,000
Public transportation	$429,000	$29,405,000	$46,000	$4,251,000	$162,000	$504,000
Boat fuel	N/A	N/A	$21,700,000	$1,520,000	N/A	N/A
Party/charter fees	$46,587,000	$4,332,000	N/A	N/A	N/A	N/A
Access/boat launching	$806,000	$342,000	$2,595,000	$164,000	$969,000	$166,000
Equipment rental	$1,525,000	$4,050,000	$1,213,000	$534,000	$150,000	$30,000
Bait and ice	$225,000	$268,000	$11,570,000	$762,000	$2,750,000	$195,000
Totals	$69,388,000	$57,294,000	$62,627,000	$15,241,000	$19,446,000	$5,203,000

The MRFSS data reflect a general decline in recreational fishing activity since 1993, despite increases in activity in 1994 and 2000 (Figure 3-9). Overall, the average annual number of sport fishing trips between 1993 and 2000 was 3,659,870. Participation estimates followed the same general trend. The number of participants declined annually except in 1994 and 2000; however, the number of anglers participating in the fishery has

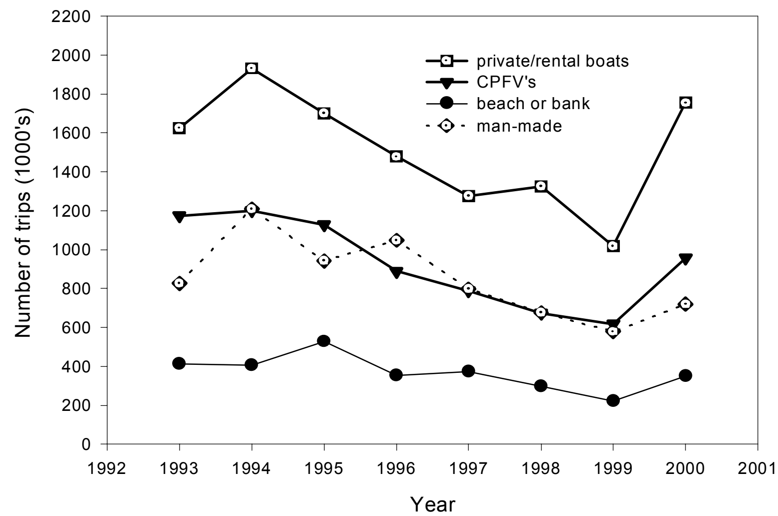

Figure 3-9. Recreational fishing trips (saltwater) taken in southern California from 1993-2000.

been more stable than the annual number of trips taken during the 1993-2000 period (Table 3-8). In addition, participation trends by area of residence has remained fairly constant. Most saltwater anglers fishing in southern California reside in coastal counties (nearly 86% in 2000). Out-of-state anglers comprised about 13%; whereas less than one percent of anglers lived in non-coastal counties in 2000.

Table 3-8. Southern California participation estimates for the saltwater recreational fishery by area of residence, 1993-2000 (MRFSS data)

Year	Coastal county	Non-coastal	Out of state	Total
1993	856,366	6,805	122,604	985,775
1994	1,099,801	11,819	173,727	1,285,347
1995	803,810	8,956	156,189	968,955
1996	Data unavailable for 1996			
1997	776,860	5,818	122,023	904,701
1998	775,281	7,900	139,148	922,330
1999	630,461	4,913	108,012	743,386
2000	1,086,442	10,790	168,823	1,266,055

The MRFSS data enabled estimates to be made on the number of anglers targeting white seabass, and their associated angling expenditures. In 2000, about 3% of surveyed angler trips in the state and nearly 5% of surveyed angler trips in southern California targeted white seabass (Figure 3-7; RecFIN 2001). Five percent of the estimated anglers fishing southern California marine waters in 2000 amounts to over 63,000 anglers specifically targeting white seabass in this region. If it is assumed that these anglers also contributed to about 5% of southern California trip expenditures, then anglers who targeted white seabass spent about $11.5 million on trip related expenses. In addition, annual expenditures on such items as tackle and license fees would amount to nearly $86 million.

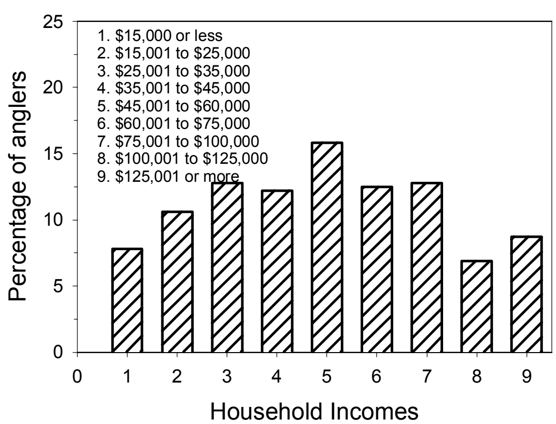

Figure 3-10. Annual household incomes of marine anglers in California in 2000.

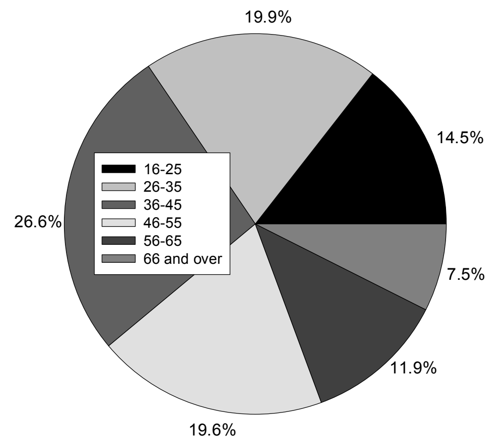

Figure 3-11. Age groups of marine anglers in California in 2000.

Some demographic data from the MRFSS were available for marine anglers fishing in California (Milon 2000). In 2000, 81.1% of surveyed anglers were male and 18.9% were female. Most of these anglers were Caucasian (83.9%), 5.2% were Hispanic, 3.7% were African American, 0.6 % were Asian, and 6.7% were of some other ethnicity. Nearly 60% of California marine anglers had a household income of $60,000 or less (Figure 3-10). About 66% of surveyed anglers were between the ages of 26 and 55 years old (Figure 3-11). Approximately 52% of California anglers surveyed in 2000 were college graduates.

Demographic patterns of characters such as income, gender, ethnicity, and age of surveyed anglers were relatively consistent across the Pacific region, suggesting that these are stable influences on marine angler participation (Milon 2000). Demographic data were not available for anglers specifically targeting white seabass.

3.3.2 Commercial Sector

California's fishing industry ranks among the top five seafood producing states in the nation (CSC 1997), and growth or decline in commercial fishing, including the white seabass industry, affects production, trade, and employment throughout the California economy.

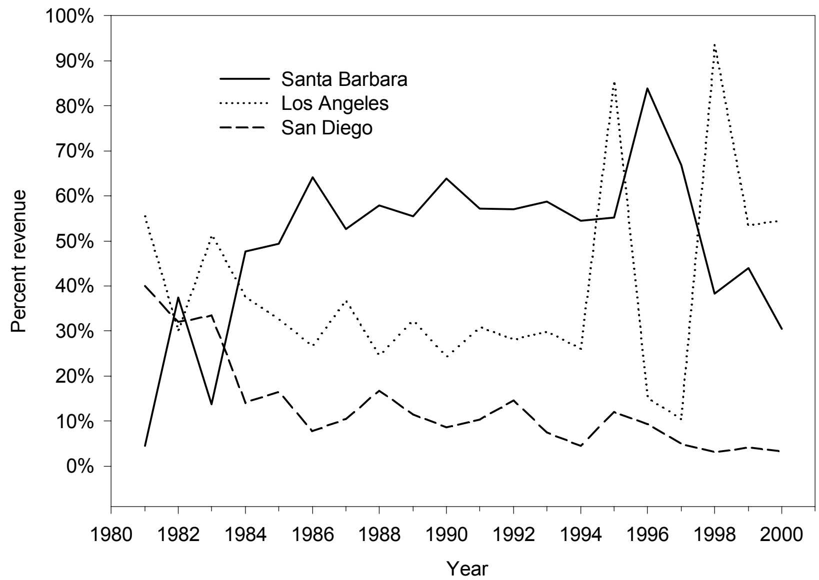

Figure 3-12. Percentage of white seabass revenue by port area from 1981-2000.

There are four major port areas associated with California's commercial white seabass fishing industry: northern California (counties north of San Luis Obispo); Santa Barbara (Ventura, Santa Barbara, and San Luis Obispo Counties); Los Angeles (LA and Orange Counties); and San Diego County. In recent years, the Santa Barbara and Los Angeles port areas have received the bulk of white seabass revenues, with the highest revenues coming into the ports of San Pedro, Los Angeles County, and Santa Barbara Harbor, Santa Barbara County (Figure 3-12).

White seabass landings rank within the top twelve commercially landed finfish for Santa Barbara/Ventura Counties, and Los Angeles/Orange Counties. (McKee-Lewis and Read 1997; Barsky 1998). Historically, San Diego County has been an important area as well, but landings and revenue coming into San Diego ports were significantly diminished following the 1982 ban of U.S. commercial fishermen from Mexican waters. Despite this, white seabass still ranked 12th in commercial finfish landings in San Diego for 1993-1994. Landings north of Point Conception rarely exceed 20% of the catch (Vojkovich 1992), making northern California an area of minor economic importance.

Revenues generated from the white seabass fishery have fluctuated over the years. In general, ex-vessel revenues from white seabass fishing closely parallel landings (Figure 3-13). Market prices are affected by such factors as the availability of white seabass, competition from foreign markets, and consumer demand. For example, the increase in average price per pound from $1.61 in 1981 to $1.80 in 1982 can be attributed to reduced availability brought on by the closure of Mexican waters that occurred that year (Table 3-9). During the period 1981 to 2000, average annual market prices for white seabass ranged from a low of $1.61 per pound to a high of $2.27 per pound. In 1981, the white seabass

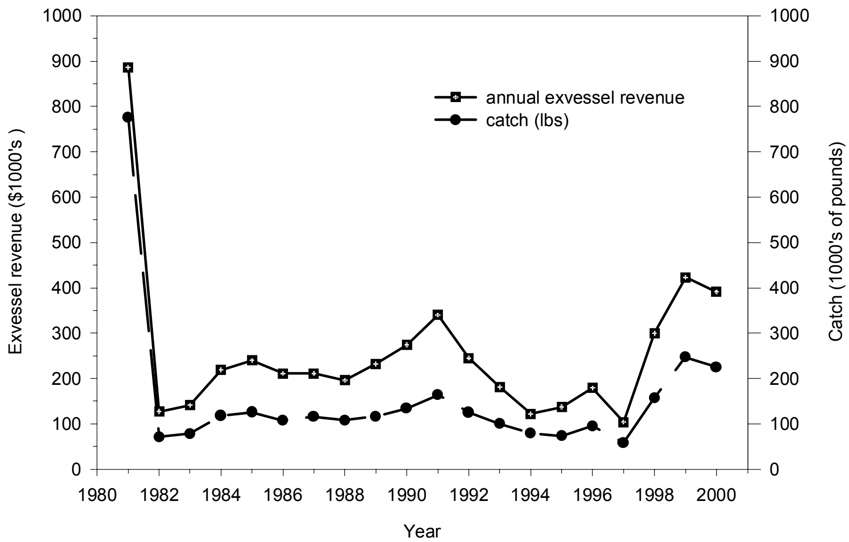

Figure 3-13. Annual white seabass commercial landings and ex-vessel revenue for California from 1981-2000.

catch generated about $886,000 in ex-vessel revenue. Revenues dropped significantly after the 1982 fishing ban in Mexican waters due to lost fishing opportunities and decreased landings. The average annual ex-vessel catch value since 1982 has been about $225,000. The best year for white seabass revenues, since the Mexico ban, occurred in 1999 with the catch valued at $391,339 (Figure 3-13).

Table 3-9. Average annual market price (per pound) for white seabass from 1981-2000

Year	Average	Minimum	Maximum	Std. Dev.	Year	Average	Minimum	Maximum	Std. Dev.
1981	$1.61	$0.50	$3.80	0.28	1991	$2.14	$0.90	$3.85	0.34
1982	$1.80	$0.20	$3.50	0.25	1992	$2.21	$0.50	$3.25	0.32
1983	$1.84	$0.25	$2.75	0.25	1993	$2.19	$1.00	$4.30	0.35
1984	$1.93	$0.20	$3.50	0.22	1994	$2.23	$0.35	$7.50	0.48
1985	$1.98	$0.20	$6.00	0.2	1995	$2.27	$0.45	$4.25	0.55
1986	$2.07	$0.10	$6.88	0.25	1996	$2.32	$0.75	$4.00	0.52
1987	$2.06	$0.22	$4.25	0.27	1997	$2.27	$0.50	$5.50	0.50
1988	$2.07	$0.25	$6.25	0.32	1998	$2.02	$0.50	$3.90	0.63
1989	$2.16	$1.00	$5.50	0.28	1999	$1.96	$0.50	$6.00	0.69
1990	$2.15	$0.45	$4.00	0.29	2000	$2.09	$0.20	$3.75	0.50

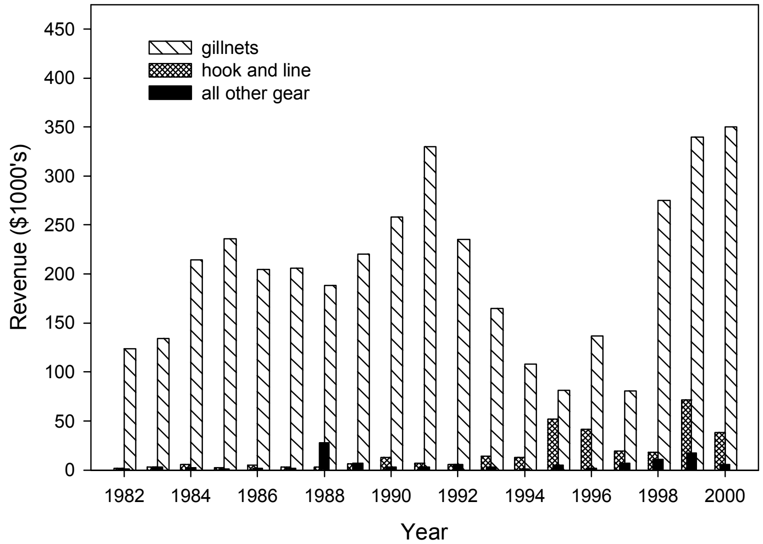

Figure 3-14. White seabass revenue by gear type from 1982-2000.

Most of this revenue is generated by gill net fishermen who dominate the fishery, but hook and line effort in the fishery has been increasing in recent years. From 1996 to 2000, 89% of landings by weight and 83% of revenues were produced by gill net effort, while hook and line effort accounted for close to 13% of landings and about 15% of revenues (Figure 3-14). An annual average of 141 vessels participate in the white seabass fishery, but only 20 of these vessels land 80% of the catch. Assuming that most commercial fishermen employ an average of one crew member, it is estimated that over 280 individuals participate in the fishery annually, with about 40 core individuals.

Representative operating costs were obtained through personal communications with white seabass fishermen (Table 3-10). Although these costs are associated with white seabass fishing, many white seabass fishermen participate in other fisheries, and some of these costs would be shared with other fishing effort.

Table 3-10. Examples of annual operating costs for white seabass fishing by primary gear type

Expense category	Set longline	Set net	Drift net
Days fished	220	90	25
Crew members	1 full time;	1 full time;	No crew
Fuel	$16,000	$10,800	$1,000
Crew wages	30% share ($40,000)	20 to 35% share	N/A
Maintenance and repair	$25,000	$14,000	$5,000

Gear and equipment	$12,000	$6,500	$1,000
Food and provisions	$8,571	$2,250	$375
Insurance	$9,500	$9,000	$9,000
Fishing licences and permits	$315	$445	$445
Property tax (vessel)	$75	$80	$75
Mooring fees	$245/mo	$50/mo	$234/mo

Between 1996 and 2000, 53 to 104 fish businesses received white seabass from commercial fishermen. Santa Barbara and Ventura County businesses made up the highest percentage of these businesses at 23.5%, while Los Angeles and Orange County businesses comprised another 18.7%. All other port areas contained less than 10% of businesses purchasing white seabass. However, 61.8 % of all businesses purchasing white seabass during this period obtained less than 1,000 pounds (454 kg) annually. Only about 3.4% the businesses purchased over 10,000 pounds (4,536 kg) on an annual basis (Table 3-4; Table 3-5).

Demographics

The primary locations for commercial white seabass activity is Los Angeles and Santa Barbara counties. The following demographic information was available for these areas.

Los Angeles County

The population of Los Angeles County increased from 8,863,000 to 9,519,338 between 1990 and 2000. The number of Caucasians declined from 41% to 31% of the population; the Hispanic population increased from 38% to 45%; the percentage of African Americans decreased from 11% to 10%; and the Asian population increased from 10% to 12% (CDF 2001). In the Los Angeles-Long Beach metropolitan area, the unemployment rate dropped from 8.2% in 1991 to 5.9% in 1999 (BLS 2000). In 1998, the average annual wage in Los Angeles County was $36,000, while the average commercial fishing wage was $22,617 (CTTCA 2000).

Community profile - San Pedro

San Pedro, located in southwest Los Angeles on the southeastern slope of the Palos Verdes Peninsula, is the most important port in Los Angeles County with regard to the white seabass fishing industry. The community's roots developed over a century of participation in fishing and related industries and are described in the San Pedro Community Environmental Perspectives (1989). The community is relatively small, with a hometown feeling, enhanced by the fact that many residents are locally employed.

During the 1980s, the commercial fishing industry in Los Angeles continued to decline, directly affecting the local economies of San Pedro and Wilmington. One reason for the decline was price-cutting competition from foreign fisheries, which allegedly operated with lower labor costs and government subsidies. State and local taxes and high insurance costs were blamed as additional burdens on the struggling industry. By 1986, only one fish packing plant remained of the fourteen that operated in 1960 (PFMC 1998).

The population in San Pedro decreased from 85,987 in 1990 to 84,697 in 2001. In 1996, 51.6% of the community was Caucasian, 33.8% was Hispanic, 6.2% was African American, and 7.6% was Asian. The average per capita income in 1996 was $19,413 (Claritas 1996).

Santa Barbara County

The population of Santa Barbara County increased from 369,608 in 1990 to 399,347 in 2000. The unemployment rate for the Santa Barbara-Santa Maria-Lompoc metropolitan area dropped, going from 5.9% in 1991 to 3.9% in 1999 (BLS 2000). The average annual wage in Santa Barbara County in 1998 was $29,277, while the average commercial fishing wage was $27,061 (CTTCA 2000). Community profile information for the Santa Barbara harbor area was not available.

3.4 Non-consumptive Use

Non-consumptive use of the fishery includes activities of scuba and skin divers such as underwater photography and wildlife viewing. Data on the number of divers involved in non-consumptive activities in southern California are unavailable. Some demographic data on divers in general were available from the Professional Association of Diving Instructors (PADI 2000). According to their statistics, the average age of sport divers is 36 years. Most are male (72%), and 28% are female. Half have a college degree, and 62% have an income that exceeds $50,000 per year.

Although data are unavailable for the entire southern California area, socioeconomic data related to diving activities in the Channel Islands Marine Sanctuary (CINMS) and surrounding offshore area from Point Sal to Point Mugu are available (Leeworthy 2000). The Sanctuary and surrounding area is a popular diving location, and contains prime habitat for white seabass. In 1997, an estimated 50,884 to 65,375 diver days occurred in the Sanctuary and surrounding area. Divers spent between $5.1 million and $6.5 million in the local economies. This had an income impact of between $6.8 million and $8.5 million, and an employment impact of between 274 and 467 full and part-time employees (including proprietors) (Table 3-11). Recreational diving only accounts for a fraction of a percent of the income and employment in Santa Barbara and Ventura counties (Leeworthy 2000).

Table 3-11. Estimated socioeconomic impact of recreational diving from boats in CINMS reserve area and surrounding waters during 1997 (Leeworthy 2000)

Activity	Days		Expenditures (millions$)		Total income (millions$)		Employment	
	lower	upper	lower	upper	lower	upper	lower	upper
charter/party	50,884	65,375	4.392	5.647	6.554	7.927	265	453
private /rental	12,984	15,870	0.715	0.873	0.267	0.52	9	14
total	63,868	81,245	5.107	6.52	6.821	8.447	274	467

3.5 Analysis of Impacts

The adverse effects from fishing activities may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem (Bargmann et al. 1998). Fishery management plans must include measures that minimize adverse effects on marine ecosystems from fishing, to the extent practicable, and identify conservation and enhancement measures. They must also contain an assessment of the potential adverse effects of all fishing activities and should consider the relative impacts of all fishing equipment types used in different types of habitat (Bargmann et al. 1998).

The commercial and recreational fisheries for white seabass have exploited different age groups of the stock over the years. In general, the recreational fishery catches mostly smaller, younger individuals, whereas the commercial fishery lands relatively larger, older fish. Immature or undersized white seabass are often caught by recreational and some segments of the commercial fisheries. Taking smaller fish may have a negative effect on the overall abundance of the population by removing individuals that have not yet spawned. If the take of immature fish exceeds the rate at which these fish are being replaced, then the resource can become overfished. Similarly, taking too many larger, older more fecund fish may limit the amount of recruits in the future.

The catching, handling, and release of smaller white seabass may also have substantial impacts. These activities may cause injury, permanent damage, or death. White seabass may be particularly vulnerable due to their weak, soft mouths that are easily torn and their susceptibility to barotrauma. Barotrauma (trauma due to rapid changes in atmospheric pressure) injuries affecting the gas bladders of white seabass have been observed in fish brought up from depths as shallow as 10 feet (3 meters) (Crooke pers. comm.). Fish caught in depths greater than 50-feet, will most likely suffer barotrauma injuries that result in death, regardless of proper gas bladder deflation. It is unknown how often white seabass are released and the level of associated mortality. However, MRFSS data shows an increasing number of white seabass being released by private and rental boat fishermen from 1980-2000 (Figure 3-15; RecFIN 2001).

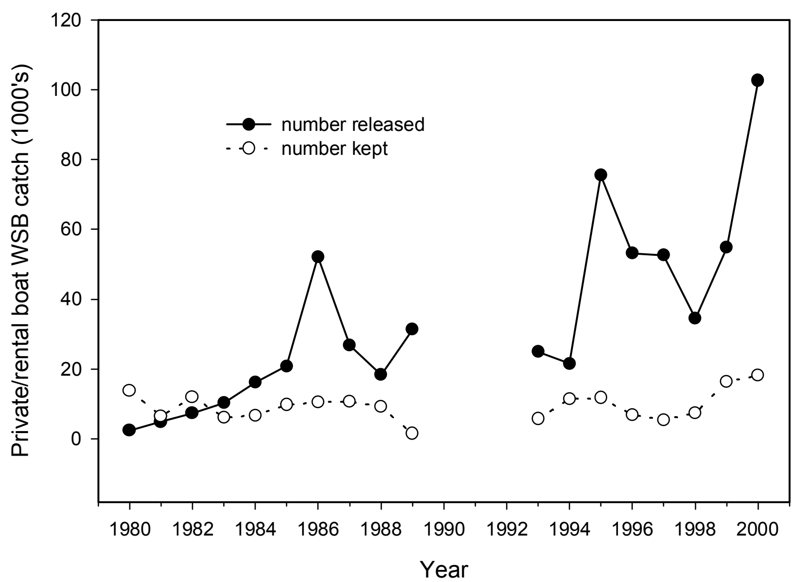

Figure 3-15. Estimated number of white seabass kept and released by anglers who used private/rental boats. No data were collected from 1990-1992.

Chapter 4. History of Conservation and Management Measures

4.1 Regulatory History in California

Fisheries regulation in California began in 1851 when the Legislature enacted its first law dealing specifically with fish and game matters by delineating rights to take oysters and to protect aquatic property. The first closed seasons for trout were established in 1861 when fishing fees were first collected. Nine years later, in 1870, the Legislature established a Board of Fish Commissioners to provide for the restoration and preservation of fish in the State's waters. California had the first wildlife conservation agency in the nation, predating even the U.S. Commission of Fish and Fisheries.

By the end of the 19th century, fish and game laws had been expanded and the administration of these laws had strengthened. In 1871, two wardens were appointed to patrol San Francisco Bay and the Lake Tahoe area. In 1878, the Fish Commission's authority was expanded to include game animals as well as fish. The Commission established a Bureau of Patrol and Law Enforcement in 1883 and published the first compilation of California fish and game laws in 1885.

The first hunting licenses were issued in 1907 and money from license sales and fines were deposited in a new Fish and Game Preservation Fund established by the Legislature. The name of the Board of Fish Commissioners was changed to the Fish and Game Commission in 1909; to more accurately reflect the scope of its interests and activities.

In 1927, the governor approved a Division of Fish and Game within the Department of Natural Resources. The new Division was unique, because it was administered by the Commission. A separate Fish and Game Code was enacted by the Legislature in 1933; replacing portions of the State Penal Code. The Legislature delegated the responsibility for making state recreational fishing and hunting regulations to the Commission through a constitutional amendment in 1945. Six years later, the Reorganization Act of 1951 elevated the Division of Fish and Game to Department status.

4.2 Regulatory History Specific to White Seabass fisheries

4.2.1 Commercial Fishery

Declining white seabass landings in the late 1920's and during most of the 1930's led to a series of regulations designed to stabilize the catch (Young 1973) (Table 4-1). The first of these regulations, instituted in 1931, was aimed primarily at the commercial fishery and imposed a commercial fishing closure during May and June, and a commercial minimum size limit of 28 in. (711 mm). The main purpose of these restrictions was to protect seabass during spawning and to provide the fish the opportunity to spawn at least twice before they were caught (Skogsberg 1939).

By the 1940s, commercial gear restrictions were imposed on the fishery. The use of purse seine and other roundhaul nets to take white seabass in waters off California was prohibited in 1940, however, their use in Mexican waters was still allowed and fishermen could transit through California waters with purse seine-caught fish under a Department-issued permit. A minimum gill net mesh size of 3.5 in. (89 mm) was established in 1941 and later increased to 6 in. (152 mm) in 1988. Four years later, California voted to ban the use of gill and trammel nets in state waters along the mainland shore south of Point Arguello, Santa Barbara County, and one mile offshore or within 70 fathoms around the Channel Islands.

Since the fishery began, California commercial fishermen fished in Mexican waters for white seabass. The catches from Mexico contributed between 30 to 85% of California's white seabass fishery depending on market and fishing conditions. In 1982, the Mexican government enacted a Foreign Fishery Act which closed Mexico's waters to the United States and all other foreign countries. In order to fish in Mexico, a fish business has to have 51% Mexican ownership (Arenas pers. comm.). Currently, there are no specific commercial white seabass regulations in Mexico, however, white seabass are managed under the general Sciaenidae regulations that prohibit increases in fishing effort in the artisanal fishery where white seabass are taken as bycatch (Arenas pers. comm.).

4.2.2 Recreational Fishery

In 1913, the Anglers License Act made it a misdemeanor for any person over 18 years of age to take, catch, or kill any "game fish" for any purpose other than profit, without first purchasing a license. For purposes of the Act, "game fishes" did not include white seabass, but did include tuna; yellowtail; giant sea bass; albacore; barracuda; bonito; rock bass (kelp bass); California whiting (corbina); surf-fish; yellowfin croaker; spotfin croaker; salmon; steelhead; other trout; charr; white-fish (mountain whitefish); striped bass; and black bass. White seabass was added to the list of "game fish" in 1937. The addition of white seabass to the list meant that all persons catching white seabass for sport had to have a sport fishing license (Table 4-1). This change meant that the size limit, season closure and bag limit regulations instituted prior to 1937 also applied to sport take.

In 1949, the sport bag limit for white seabass was set at ten fish per day, with not more than five white seabass less than 28 in. (711mm) in length. In 1957, the allowance for undersized fish was reduced to two fish per day. In 1971, the allowance for undersized fish was abolished, however, it was reestablished in 1973 when the possession of one seabass shorter than 28 in. (711 mm) was allowed. In 1978, it once again became illegal to possess any white seabass less than the minimum size limit, and the daily bag limit was reduced from ten to three fish.

In 1980, a seasonal closure was enacted which prohibited the possession of any white seabass from 15 March through 15 June. However, in 1984, an allowance of one legal-size fish per day during the closed season was enacted.

Table 4-1. Summary of white seabass regulations from 1931 to the present (modified from Vojkovich and Reed 1983)

Date (License required)	Season length	Size limit	Bag limit	Gear and area restrictions	Special conditions
1931-33 (com'l lic. req.)	July 1-April 30	Commercial 28"; no more than 5 fish <28"	None	No nets within 4-mile radius of San Juan Pt., Orange Co.; bait nets only in Santa Monica Bay.	5 fish any size with hook & line, but may not be sold
1933-35 (same)	Hook & line all year	Same	May 1 - Jun 30 (5 per day - hook & line)	Same	After Oct. 25, 1933, no fish may be sold from May 1 - June 30.
1935-37 (same)	No net fishing May 1 - Aug 31	Same	May 1 - Aug 31 500 lbs/person; 2500 lbs/boat	No nets in any Orange Co. waters (later rescinded)	Same
1937-39 (sportfishing lic. req.)	Same	Com'l and Sport: 28" ; no more than 5 fish <28"	Sportfishing: 15/day for anyone on sportfish boat	Same	Sport-caught fish may not be sold
1939-41 (same)	Year round net fishing allowed	Same	Same	No purse seines. Gill net mesh 3 ½"	Same
1941-49 (same)	Same	Same	Same	Same	Same
1949-53 (same)	Same	Same	Sportfish: 10/day	Same	Same
1953-57 (same)	Same	Same	Com'l: 1000 lbs/person/day; 5000 lbs/boat/day.	Same	Same
1957-71 (same)	Same	Sportfish: 2 fish < 28"	Sportfish: 10/day	Same	Same
1971-73 (same)	Same	Sport and comm. No fish <28"	Same	Same	Same
1973-78 (same)	Same	Sport and comm. One fish <28"	Same	Same	Same
1978 (same)	Same	Sport and comm. No fish <28"	Same	Same	Same
1980-81 (same)	Season closed Mar 15-Jun 15	Same	Sportfish: 3/day/person	Same	Logs required Permits required
1982 (same)	Same	Same	Same	Area closures for nets with mesh less than 6"	Permits no longer required
1984 (same)	Same	Same	Sportfish: 1 white seabass during closed season	Same	Same
1994 (same)	Same	Same	Same	No Gill or trammel nets allowed 0-3 miles from shore along the mainland, or within 1 mile or waters less than 70 fathoms deep at the offshore islands from Point Arguello, Santa Barbara Co. to the United States - Mexico Border, and in waters less than 35 fathoms deep from Point Fermin, Los Angeles Co. to the south jetty Newport Harbor, Orange Co.	

Date (License required)	Season length	Size limit	Bag limit	Gear and area restrictions	Special conditions
2000	Same	Same	commercial: 1 seabass during closed season	Same	

Sport fishing regulations for white seabass in Mexico are not specific to this species but apply to all species not covered under separate regulations. In general, fishing can be done with hook and line, and by pole or spear gun while scuba diving. There is a ten fish per day bag limit of which no more than five fish can be white seabass. The bag limit for fish taken using scuba has an additional limitation that no more than 55 lbs (25 kg) of fish may be taken.

For more detail on the statutes and regulations specific to the various components of the white seabass fishery see Appendix B.

4.3 Additional Conservation Measures for White Seabass Stocks

The Ocean Resources Enhancement and Hatchery Program (OREHP) was created by the following legislation: Assembly Bill 1414 (Stirling, Ch. 982, Stats. 1983); and, Fish and Game Code §6599 which was continued through 1992 by Senate Bill 204-Stirling (Ch. 8, Stats. 1989) and extended through 31 December 2002 by Assembly Bill 960-Alpert (Ch. 987, Stats. 1992); further modified by Assembly Bill 3011-Alpert (Ch. 369, Stats. 1994); and extended indefinitely by Senate Bill 58-Alpert (Ch. 89, Stats. 2001). The ultimate goal of this legislation is to enhance populations of marine fin fish species important to California for their sport and commercial fishing value. The OREHP was developed to conduct a program of basic and applied research into the artificial propagation, rearing and stocking of important marine fin fish species that occur in ocean waters off southern California.

The OREHP is funded through the establishment of the Ocean Fishery Research and Hatchery Account (OFRHA) within the Fish and Game Preservation Fund. The program receives most of its revenue from the sales of ocean fishing enhancement stamps. The costs of investigating and developing artificial propagation techniques to enhance marine fish species are high, and the implementation of this program within the Department's existing budget would seriously impact the Department's ongoing research and management functions. Recognizing this, the Legislature established this program as a self-supporting entity. These stamps are required to be purchased by recreational anglers taking fish in ocean waters south of Point Arguello, Santa Barbara County ($2.50 annually or $0.50 for one day licenses); owners of Commercial Passenger Fishing Vessels (CPFV), which operate in waters south of Point Arguello ($25.00 annually); and by commercial fishermen landing white seabass south of Point Arguello ($25.00 annually). The ocean enhancement stamp is required in addition to the basic sport and commercial fishing licenses. Revenues generated from the ocean enhancement stamp have averaged $860,840 annually since 1995, with 98.4% of the revenue coming from recreational fishermen (Table 4-2). From 1983 through 1995, annual OREHP revenues averaged $0.5 million per year based on a $1.00 stamp for all recreational anglers and $10.00 stamp for commercial fishing vessels. OREHP also receives funding through the Sportfish Restoration Act and from mitigation for the San Onofre Nuclear Generating Station. In addition, volunteers provide thousands of hours of assistance at grow-out facilities.

Table 4-2. Revenue generated through the purchase of the ocean enhancement stamp[1], 1992-2000

Fishing segment	1995	1996	1997	1998	1999	2000	2001
Recreational	868,960	859,568	927,444	846,833	827,757	822,697	804,709
CPFV [2]	5,125	5,200	5,875	4,950	6,350	5,675	5,500
Commercial	5,700	4,700	3,875	7,825	9,975	13,150	14,600
Total	879,785	869,468	937,194	846,833	827,757	822,069	824,809

1 Data from California Department of Fish and Game, License and Revenue Branch.
2 Commercial passenger fishing vessel.

The program is administered by the Director of the Department of Fish and Game with the advice and assistance of a ten-member Ocean Resources Enhancement Advisory Panel (OREAP). The panel consists of representatives of various user groups, affiliated marine research organizations, and the aquaculture industry. Members of the panel provide policy direction, review research proposals, and recommend allocation of funds for the OREHP.

During the first six years of the program, research focused on the capture, maintenance, spawning (both natural and captive), and grow-out to release size for white seabass and California halibut. Additionally, work was undertaken to determine juvenile natural mortality and distribution in the wild, post release survivability of hatchery-reared fish, and marking methods to identify hatchery-reared fish in the wild. Finally, a cost/benefit model was developed to evaluate the economic feasibility of the OREHP. Reports to the Legislature by Schultze (1984 and 1985) and Crooke (1986, 1987, 1988, 1989) give detailed accounts of yearly activities.

Beginning in 1990, OREHP research focused on white seabass with only limited effort on California halibut. The reduction in research on halibut was necessary because of limited funding and increased expenses associated with producing 100,000 white seabass annually for release. Raising and releasing a large number of juveniles was undertaken to gain experience with new hatchery protocols associated with increased production and to provide juveniles for release and recapture studies. In addition, the recapture field work provided data on juvenile distribution and natural mortality. To facilitate rearing increased numbers of white seabass, OREHP accepted an offer by

United Anglers of California to equip and run a pen rearing grow-out facility at Oxnard (Channel Islands Harbor). By the end of 2001, additional pen rearing facilities located at San Diego, Mission Bay, Dana Point, Newport Beach, Huntington Harbor, Alamitos Bay, Santa Catalina Island, King (Redondo) Harbor, Marina Del Rey, Port Hueneme, and Santa Barbara had joined the volunteer program and accepted fish. (Crooke 1990, 1991, 1992; Crooke and Domeier 1993, Crooke 1994, Crooke 1995, Crooke 2000, Crooke 2001). Volunteers from the sportfishing community not only raised money to build the grow-out pens, but they also contributed over 20,000 hours a year of their time to raise and care for the hatchery-bred white seabass.

Concurrent with the passage of new OREHP legislation in 1992, the California Coastal Commission authorized use of $1.2 million in mitigation funds for OREHP capital construction and enhanced recovery of fish in the field. The money was part of a mitigation package which Southern California Edison and San Diego Gas and Electric Company agreed to for environmental effects of the San Onofre Nuclear Generating Station (SONGS). Obtaining the funding was essential to OREHP since it provided construction money for an experimental production hatchery. Without increased funding, there would only have been adequate resources to continue work at the 1992 level for hatchery production and field recoveries. Department and Coastal Commission staff spent 1993 developing a Memorandum of Agreement (MOA) to cover financing, construction, and operation of the proposed hatchery. Construction started during July 1994 and the hatchery was dedicated on October 13, 1995.

Soon after initial completion of the hatchery, it became apparent that funding for construction was not adequate to completely build-out the facility, nor was OREHP stamp revenue sufficient to cover the costs of operating a larger facility. In addition, field sampling to recover tagged fish was proving to be more costly than anticipated. Acting on a recommendation developed by the staff in conjunction with the Department, the Coastal Commission authorized an additional $3.6 million in SONGS mitigation at their September 1997 meeting. The funds were used to reduce the debt incurred during initial construction of the hatchery ($428,965), provide funding ($816,800) for equipment to build out the hatchery, and supplement operating funds by $2,189,440 over the next eight years.

During 2000, the operator of the hatchery at Carlsbad, Hubbs-Sea World Research Institute (HSWRI), completed build-out of the hatchery and continued operations to supply juvenile fish to grow-out facilities. Build-out focused on completing the installation of three new sea water recirculating (closed) systems. Poor water quality during the winter of 1998 due to fresh water run-off and dredging of the lagoon supplying hatchery water prompted the recirculating experiments. Preliminary experiments showed that eggs, larval and juvenile fish survival rates were significantly enhanced under closed conditions in which temperature and sterility of the water could be controlled.

The primary function of the hatchery is to provide juvenile white seabass, two to three inches in length, to field-rearing systems operated by volunteer fishermen throughout the Southern California Bight. The hatchery is designed to release 400,000 small fish to the grow-out facilities, which will rear them to eight inches and then release the fish. Unfortunately, the hatchery has not reached anticipated production levels because of water quality and disease problems. The water quality problems appear to be resolved but bacterial and viral diseases contributed to poor production during 1999 and 2000. During 2001, approximately 131,000 juvenile white seabass were released to grow-out facilities and of those, 100,318 were ultimately released into the open ocean; the best year of production in the program's history. Both the Department and HSWRI are continuing to investigate more effective ways to control diseases within the hatchery and grow-out facilities.

Beginning with 1986, direct releases from the hatchery and grow-out facilities have totaled 503,000 white seabass. Since it is possible to back calculate the number of fish remaining in the wild on a yearly basis (1.0 - natural mortality) it is possible to estimate the number of OREHP produced legal size fish (> 28 in.) in the wild population. Using age specific numbers for natural mortality (see section 2.5) for one- to-four-year-old fish from Kent and Ford (1990), and an average of 0.1 for 5+ age fish based on MacCall's papers, there were 43,000 OREHP-produced adult white seabass in the wild at the end of 2001.

The hatchery now possess 230 adult white seabass to act as brood fish. One hundred seventy-five fish are divided among four tanks and kept at different water temperatures and day lengths to assure that the program has continued access to viable eggs. The remaining 55 fish are stored off-site as back-up spawners should something happen to the fish at the hatchery.

California State University, Northridge (CSUN) and the Center for Marine Studies, San Diego State University (SDSU) operate the field studies. Sampling to recover tagged white seabass was redirected in 1997 to emphasize capture of I to IV year-old juvenile fish (12 to 24 in.). A series of variable mesh gill nets were set in nearshore areas for the months of April, June, August and October. Nineteen different stations from San Diego Bay to Santa Barbara were sampled. Thirteen sites were on the open coast, including Santa Catalina Island, and six were in embayments. From April 2000 through June 2001, a total of 560 sets yielded 1,372 white seabass. While the fish ranged in size from 6 to 32 inches, most were in the 9 to 24 inch size range.

All fish were scanned for coded wire tags and 111 (8%) were detected. Approximately 84% of the fish were recovered from embayments while the remainder were taken along the open coast. The ratio of tagged to untagged fish for embayments was 1:1.7 while the open coast ratio was much lower at 1:64.

Eight adult coded wire tagged fish have been recovered since the summer of 1999. These white seabass represent the first recoveries of legal size fish with a known age and release date. Previously, two legal size fish labeled with tetracycline, an antibiotic which places a permanent mark on the bones, were recovered but the mark on the bones is not specific for a release date so the age of the fish was unknown. One of the coded wire tagged fish was recovered over 90 miles to the north and another was recaptured at the point of release. The fish that was recaptured at it's release site grew to legal size in three years (four or five years is normal), possibly by remaining in the warm waters of Mission Bay and living in the vicinity of a live bait receiver (a steady source of food).

Three additional recoveries of juvenile white seabass during 2000 were especially significant since they showed movement from Santa Catalina Island to the mainland. All previous recoveries only showed movement along the coast.

The OREHP has now progressed to a point where it is possible, with the addition of the new hatchery in 1995, to culture white seabass in quantity. With the new facility, the program has determined many of the factors that are limiting greater production, but all the factors necessary to increase production are still not understood. White seabass culture continues to hold promise for enhancement of the resource because of the current reduced size of the wild stock.

In addition to hatchery related programs, OREHP has sponsored other research which related directly to white seabass management. Foremost among the programs is the juvenile white seabass gill net study which is designed to show the relative abundance of small fish as well as the hatchery contribution to juvenile fish in the wild. This represents the only fishery independent data base focusing exclusively on white seabass recruitment. Researchers working under OREHP grants have examined the genetic structure of the wild stock and found it to be homogeneous throughout its range. Finally, age and growth studies using otoliths to age wild fish and recoveries of tagged fish in the field have shown that white seabass growth is faster than previously documented.

Chapter 5. Fishery Management Program

This WSFMP establishes a fisheries management program for white seabass and procedures by which the Commission will manage the white seabass resource and the various fishery components. It also sets the limits of management authority for the Commission when acting under the WSFMP. Management measures implementing the WSFMP, which directly control fishing activities, must be consistent with the goals and objectives of the WSFMP, MLMA, and other applicable laws. These management actions are to be considered annually with an exception that provides for more timely Commission action under certain specific conditions. Procedures in this FMP do not affect the authority of the Director of the Department of Fish and Game to take emergency regulatory action under §7710 FGC.

5.1 Potential Management Measures

This Section of the FMP describes potential management measures and their application for the white seabass fisheries. The Commission, may on the recommendation of the White Seabass Scientific and Constituent Advisory Panel (WSSCAP), implement these management measures or others, as appropriate, on an annual basis. The Commission may also implement any of these measures when action is deemed necessary under authority of the points of concern process (see Section 5.4.1) and the socioeconomic process (see Section 5.4.2). In addition to the following management measures, other types of actions may also be valid and are intended to be available to the Commission providing they are consistent with the criteria and procedures contained in this WSFMP.

<u>Harvest Control</u>
A harvest control rule is a numerical harvest objective which differs from a quota in that closure of a fishery (prohibition of retention, possession or landing) is not automatically required when the guideline is reached. A harvest control rule may be a range or a point estimate. Bycatch may be allowed after a harvest control rule is reached although some allowance for bycatch is usually made when the harvest control rule is set.

<u>Quotas</u>
Quotas are specified harvest limits that, once attained, cause closure of the fishery for that species, gear type or geographic area. Quotas may be established for intentional allocation purposes, to terminate harvest at a specified point, or other purpose. They may be specified for a particular area, gear type, time period, species, or species group.

<u>Bycatch</u>
Regulation of bycatch is often necessary to limit or prohibit the take of a species that occurs incidentally while catching another species. Management measures to regulate bycatch include but are not limited to an incidental allowance or an overall incidental

reserve that is subtracted from the total harvest control rule or quota.

Time (Season)/Area Closures

Time (season or time of day) and area closures have traditionally been used to regulate fisheries. Time/area closures may also be used to reduce conflict between user groups or for other uses. Various seasonal and area closures for fisheries exist in California.

Landing Limits and Trip Frequency Limits

A trip or landing limit is the amount of a managed species that may be taken and retained, possessed, or landed from a single fishing trip or during a specified period of time. A trip frequency limit is a limit on the number of trips during a specified period of time. Trips may be defined in various ways depending on circumstances. Trip landing limits and trip frequency limits are used to delay reaching a quota or harvest control rule and avoid premature closure of a fishery. They can be utilized to minimize targeting on a species while allowing landings of some level of incidental catch. Trip landing and frequency limits may also be used to discourage waste by limiting landings to amounts that can be used by available markets and/or processing capabilities.

Allocation

Allocation is the apportionment of harvest to or among particular individuals or groups. Allocation is commonly a numerical quota or harvest control rule for a specific gear, fishery sector, geographic area, use, or vessel category but may arise from any other type of management measure. Most fishery management measures allocate fishery resources to some degree because they differentially affect access to the resource by different fishery sectors. Allocation impacts that are not intentional are considered to be indirect or unintentional allocations. Direct allocation occurs when numerical quotas, harvest control rules, or other management measures are established with the specific intent of affecting a particular group's access to the fishery resource. Allocation impacts of all proposed management measures should be analyzed and discussed in the Commission's decision making process.

Size Limits

Size limits are used to prevent the harvest of a particular size of fish. Size limits often protect small fish which are immature or have not reached full reproductive capacity, whereas large fish may be protected due to overall importance to reproduction. Size limits can be applied to all fisheries, but are generally used where fish are handled individually or in small groups such as hook and line or recreational-caught fish. Size limits lose their utility when the survival of fish returned to the sea is low.

Mesh Size

Restrictions on the mesh size used in nets or traps are a common management measure. By increasing or decreasing mesh size, it is possible, to a limited degree, to increase or decrease the size of fish retained in the net. Control over the size at entry into the fishery can ensure that sufficient numbers of immature fish pass through the gear to protect the long-term productivity of the resource. Mesh size also can be adjusted to maximize the yield of certain species.

Bag Limits

Methods for controlling recreational fishing include, but are not limited to, bag limits, which limit the catch per individual over a set time period. Bag limits are often set on a daily basis. The intended effect of bag limits is to restrict the overall catch, to spread the available catch over a large number of anglers, and to avoid waste. Punch cards are a type of bag limit whereby cards are issued and punched for catch and possession of one or more fish, usually over a longer period of time. Punch cards can be used as a reporting system to monitor and restrict catch in the recreational fishery.

Effort Controls

Effort limitation includes almost all measures to restrict or reduce fishing activities. Limited entry programs restrict the total number of permitted fishing licenses or vessels; individual transferable quotas limit the catch allowed per license or individual as well as the number of individuals who participate. The total number of participants in the white seabass recreational fishery has never been limited by regulation. However, the Commission may determine that management of the fisheries requires some form of effort limitation in order to achieve the objectives of the WSFMP.

Controls on Fishing Gear

Other forms of control include but are not limited to restrictions on the number of units of gear or restrictions on the type and size of nets, number of hooks, number of poles, size of vessels, or escape panels and ports.

The use of fishing gear for the commercial harvest of white seabass is authorized pursuant to statutes enacted by the Legislature and regulations adopted by the Commission. Implementation and modification of specific management measures regarding gear, such as definitions of legal gear, mesh size restrictions, gear marking, escape panels and ports, and the length of time gear may be left unattended, or other gear restrictions are authorized by this FMP. Gear restrictions specific to white seabass fisheries may be established, modified, or removed under the points of concern process. Any changes in gear regulations should be scheduled so as to minimize costs to the fishing industry.

There are restrictions on legal recreational gear; existing state regulations apply and may be modified under the points of concern process as appropriate to accomplish the WSFMP goals. Gear restrictions may be established, modified, or removed under the points of concern process. Any changes in gear regulations should be scheduled so as to minimize costs to recreational fishermen.

Reporting and Observer Programs

Data reporting and on-board observer programs are used to collect detailed data required in some circumstances. This WSFMP authorizes development of data reporting and observer programs as determined necessary by the Commission. The WSFMP intends that any special requirement be imposed only if it is expected to enhance the ability to accurately monitor the various components of the white seabass fishery, including but not limited to catch, incidental catch of non-target fish, interactions with birds, pinnipeds, or sea turtles, and effectiveness of historical or newly enacted regulations.

Vessel operators may be required to maintain and submit logbooks at specified intervals, which contain accurate information including the following: daily and cumulative catch by species, effort, processing, and transfer information; crew size; time, position, duration, sea depth, and catch by species of each haul or set; gear information; identification of catcher vessels; information on parties receiving fish or fish products; and any other information deemed necessary.

All fishing vessels engaged in the take of white seabass may also be required to accommodate on-board observers for the purposes of collecting scientific data. An observer program will be considered for the circumstances where other data collection methods are deemed ineffective for management of the fishery. Specifications for any observer program shall be developed in cooperation and consultation with the operators of the fishing vessels under consideration.

Fees and Permits
California has laws concerning commercial and recreational licenses, permits, and fees. Nothing in this FMP is intended to exclude the use of additional fees or permits in the future as long as the fee or permit is consistent with applicable law, management measures and the intent of the WSFMP.

Vessel Identification
The WSFMP authorizes the use of vessel identification requirements, which may be modified as necessary to facilitate vessel recognition and enforcement.

5.2 Definition of Maximum Sustainable Yield and Optimum Yield
Maximum sustainable yield (MSY) is defined in §96.5 FGC as follows: "Maximum sustainable yield in a marine fishery means the highest average yield over time that does not result in a continuing reduction in stock abundance, taking into account fluctuations in abundance and environmental variability."

The MSY model determines catch limits, which most often are expressed as a fixed fishing rate such that a constant fraction of the stock may be harvested each year. It is specific for each species or stock of fish, and is calculated from knowledge of abundance, life history, and population dynamics. Environmental factors are also considered since they affect growth, reproduction, and mortality rates. In many cases, providing a range of estimates for MSY may be reasonable since there are different assumptions in the model. In addition, there may be situations where the scientific information is inadequate to directly calculate MSY for a particular species, and a proxy or substitute may be used. For example, recent average catch may be used as a proxy for MSY if a time period is chosen when there is no evidence of a declining abundance.

Optimum yield (OY) is generally defined as the harvest level for a species, such as white seabass, that achieves the greatest overall benefits when considering biological, social and economic factors. Optimum yield differs from MSY because MSY only considers the biology of the species in question (Wallace et al. 1994).

The Marine Life Management Act provides a definition of OY, which is similar to the generalized definition, but which gives specific direction for resource managers:

> "Optimum yield, with regard to a marine fishery, means the amount of fish taken in a fishery that does all of the following: (a) provides the greatest benefit to the people of California, particularly with respect to food production and recreational opportunities, and takes into account the protection of marine ecosystems. (b) is the maximum sustainable yield of the fishery, reduced by relevant economic, social, or ecological factors; (c) In the case of an overfished fishery, provides for rebuilding to a level consistent with producing maximum sustainable yield in the fishery" (§97 FGC).

White seabass management through the use of an OY is consistent with the MLMA and the goals and objectives of the WSFMP. This methodology allows continued utilization of the white seabass resource while the stock is recovering from low abundance and less than optimal oceanic conditions which occurred during the 1960s and 1970s.

It is not uncommon that the status of knowledge for a given stock is limited to the catch history and incomplete life history information. A precautionary approach to calculating OY in data-moderate or data-poor situations is to multiply MSY, or its proxy, by a fraction. A tenet of this principle is that less aggressive (more restrictive) harvest policies are adopted as uncertainty increases concerning the status of stocks and their response to fishing pressure (Restrepo et al. 1998).

5.3 General Fishery Management Plan Framework

An FMP framework is a multi-year management plan that describes the processes by which the fishery will be managed, including when, how, and within what limits regulatory changes will be made, and the ranges of the resulting impacts. Preseason and in-season adjustments to regulations may be made without FMP amendment by implementing the procedures and provisions established in the FMP framework. Instead of providing a fixed set of management measures to implement at one point in time, the FMP framework establishes mechanisms to adjust the management of the fishery to meet changing circumstances over a longer time frame. This may be accomplished through annual adjustments of seasons, quotas, etc., or through in-season adjustments needed in response to factors that cannot be precisely anticipated during a review process. Framework adjustments may be implemented more quickly than FMP amendments, allowing for more timely management response and providing for adaptive management.

Explicit instructions may be built into an FMP framework to lessen the risk that the FMP could be considered capricious. However, guidelines that are too specific could restrict the flexibility and adaptability of fishery management. Included in the FMP framework are limits and controls for how adjustments may be made. The FMP framework must specify fully the processes to be used in making adjustments including the triggering mechanisms, procedures to be followed, and actions to be taken.

5.3.1 Plan Amendment

Framework management for FMPs is designed to be flexible and adaptable to a wide range of future conditions and intended to function without the need for frequent amendment. However, unforseen social, economic, environmental or biological developments may create an unanticipated situation where the existing FMP does not adequately provide for future management of the fishery. Under such circumstances, the FMP would be amended to allow for efficient and responsive management of the fishery. Fishery management plan amendments are required for major changes or controversial actions, which are outside the scope of the original FMP. Examples of actions that would require an FMP amendment include:

- Changes to management objectives;
- Changes to species in the management unit;
- A change in the definition of an overfished stock;
- Amendments to any procedures required by the FMP; or
- Revisions to any management measures that are fixed in the FMP.

An FMP amendment entails an extensive development and adoption process including input from advisory committees, public hearings, and an extended period for public comment and peer review. In addition, amendment of an FMP requires CEQA analysis of the proposed changes to the document. Once a draft plan amendment is completed, it will have to undergo the full rule-making process described in the next Section.

5.3.2 Framework Actions

There are three different categories of management actions, each of which requires a slightly different process. Management measures may be established, adjusted or removed using any of the following three procedures:

<u>A. Full Rule Making Actions (Regulatory Amendment)</u>
These include any proposed management measure that is highly controversial or any

measure which directly allocates the resource. The Commission normally will follow the three-meeting procedure, which means the identification of issues and the development of proposals will begin at a Commission meeting prior to the first decision meeting. Subsequent to this meeting there will be two decision meetings, the first meeting to develop proposed management measures and their alternatives, the second meeting to make a final decision.

Management measures recommended to address a resource conservation issue must be based upon the establishment of a point of concern and consistent with the specific procedures and criteria listed in Section 5.4.1. Management measures recommended to address social or economic issues must be consistent with the specific procedures and criteria described in Section 5.4.2.

B. “Notice” Actions
These include all management actions other than prescribed actions that are either non-discretionary or have probable impacts that have been previously analyzed. The Commission will require at least one Commission meeting to approve routine management measures.

These actions are intended to have temporary effect and the expectation is that they will need frequent adjustment. They may be recommended at a single Commission meeting, although the Commission will provide as much advance information to the public as possible concerning the issues it will be considering. The primary examples are management actions defined as routine in Section 5.3.3. These include trip landing and frequency limits for all gear types and recreational bag limits. Previous analysis must have been specific as to gear type before a management measure can be defined as routine and acted upon at a single Commission meeting.

C. Prescribed Actions
Prescribed management actions may be initiated by the Department Director or Commission without prior public notice, opportunity to comment, or a Commission meeting. These actions are ministerial and the impacts must have previously been taken into account. Examples include fishery, season, or gear type closures when a quota is attained.

5.3.3 Routine Management Measures

Routine management measures are those that the Commission determines are likely to be adjusted on an annual or more frequent basis. Measures are classified as routine by the Commission through either the full or abbreviated rule making process. In order for a measure to be classified as routine, the Commission will determine that the measure is of the type normally used to address the issue at hand and may require further adjustment to achieve its purpose with accuracy.

As in the case of all proposed management measures, prior to initial implementation as routine measures, the Commission will analyze the need for the measures, their impacts, and the rationale for their use. Once a management measure has been classified as routine through one of the two rule making procedures outlined above, it may be modified thereafter through the single meeting notice procedure if: (1) the modification is proposed for the same purpose as the original measure, and (2) the impacts of the modification are within the scope of the impacts analyzed when the measure was originally classified as routine. The analysis of impacts need not be repeated when the measure is subsequently modified if the Commission determines that they do not differ substantially from those contained in the original analysis. The Commission may also recommend removing a routine classification.

5.4 White Seabass FMP Framework

The FMP framework for white seabass resource management is composed of several elements, which taken individually or together, will allow the Commission to react quickly to changes in the white seabass population off California without the need for a full amendment. Management measures are normally imposed, adjusted, or removed at the beginning of the fishing year but may, if the Commission deems necessary, be imposed, adjusted, or removed at any time during the year. Management measures may be imposed for resource conservation, social or economic reasons consistent with the criteria, procedures, goals, and objectives set forth in the WSFMP.

The WSFMP framework consists of a points of concern process, socioeconomic process, allocation criteria, and harvest control rules, which give the Commission specific guidelines for making management decisions. However, these guidelines are intended to be flexible and allow for other management strategies that would effectively achieve the goals and objectives of this FMP and MLMA.

5.4.1 Points of Concern Process

The points of concern process is one of the tools the Commission has for exercising its resource stewardship responsibilities for white seabass. The process is intended to foster a continuous and vigilant review of the white seabass stocks and fisheries to prevent overfishing or other resource damage. To facilitate this process, a Department White Seabass Management Team (WSMT) will be created to monitor the fisheries throughout the year, taking into account any new information on the status of each species or species group to determine whether a resource conservation issue exists that requires a management response. The points of concern criteria are intended to assist the Commission in determining when a focused review on a particular species is warranted, and which may result in the need to recommend management measures to address the issue.

This FMP framework provides the authority to act based solely on the points of concern. Thus, the Commission may act quickly and directly to address a resource conservation issue. In conducting this review, the WSMT will utilize the most current catch, effort, abundance and other relevant data.

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

- Catch is projected to significantly exceed the current harvest control rule or quota;
- Any adverse or significant change in the biological characteristics of the white seabass stock (age composition, size composition, age at maturity, or recruitment) is discovered;
- An overfished condition exists or is imminent;
- Any adverse or significant change in the availability of white seabass forage or in the status of a dependent species is discovered;
- An error in data or a stock assessment is detected that significantly changes estimates of impacts due to current management.

Once a point of concern is identified, the WSMT will evaluate current data to determine if a resource conservation issue exists and will provide its findings in writing at the next scheduled Commission meeting. If the WSMT determines a resource conservation issue exists, it will provide its recommendation, rationale, and analysis for the appropriate management measures that will address the issue. In developing its recommendation for management action, the WSMT will recommend alternatives from one or more of the most commonly used management measures listed in Section 5.1, or other necessary measures, to address resource conservation issues.

Direct allocation of the resource between different segments of the fisheries is, in most cases, not the preferred response to a resource conservation issue. Commission recommendations to directly allocate the resource will be developed, if needed, according to the socioeconomic process and criteria described in Sections 5.4.2 and 5.4.3.

After receiving the WSMT’s report, the Commission will take public testimony and, if appropriate, will implement management measures accompanied by supporting rationale and analysis of impacts. The Commission’s analysis will include a description of (a) how the action will address the resource conservation issue consistent with the objectives of the WSFMP; (b) likely impacts on other management measures and other fisheries; and (c) economic impacts, particularly the cost to the commercial and recreational segments of the fishing industry. Nothing in this Section prevents the Director from exercising the authority to take emergency action as specified in the Fish and Game Code.

5.4.2 Socioeconomic Process

From time to time, non-biological issues may arise which may require the Commission to consider management actions to address certain social or economic conditions in the fisheries. Resource allocation, seasons, or landing limits based on market quality and timing, safety measures, and prevention of gear conflicts are only a few examples of possible management issues with a social or economic basis. In general, there may be any number of situations where the Commission determines that management measures are necessary to achieve the stated social and/or economic objectives of the WSFMP.

Either on its own initiative or by request, the Commission may evaluate current information and issues to determine if social or economic factors warrant imposition of management measures to achieve the Commission's established management objectives. Actions that are permitted under this FMP framework include all of the categories of actions authorized under the points of concern FMP framework with the addition of direct resource allocation and access limitation measures.
If the Commission concludes that a management action is necessary to address a social or economic issue, it or the WSMT will prepare a report containing the rationale in support of that conclusion. The report will include the proposed management measure, a description of other viable alternatives considered, and an analysis that addresses the following criteria: (a) how the action is expected to promote achievement of the goals and objectives of the WSFMP; (b) likely impacts on other management measures and other fisheries; (c) biological impacts; (d) economic impacts, particularly the cost to the fishing industry; and (e) how the action is expected to accomplish at least one of the following:

- Enable a quota, harvest control rule, or allocation to be achieved;
- Avoid exceeding a quota, harvest control rule, or allocation;
- Increase sustainable landings;
- Reduce discards;
- Reduce gear conflicts, or conflicts between competing user groups;
- Extend fishing and marketing opportunities as long as practicable during the fishing year;
- Maintain or improve product volume and flow to the consumer or user;
- Increase economic yield;
- Maintain or improve the safety of fishing operations;
- Increase fishing efficiency;
- Maintain or improve product quality;
- Maintain or improve the recreational fishery;
- Maintain or improve data collection, including means for verification;
- Maintain or improve monitoring and enforcement; or
- Any other measurable benefit to the fishery.

The Commission, following review of the report, supporting data, public comment and other relevant information, may implement management measures accompanied by relevant background data, information and public comment. The action will explain the urgency, if any, in implementation of the measure(s).

If conditions warrant, the Commission may designate a management measure as a routine management measure to address social and economic issues provided that the criteria and procedures in Section 5.4.2 are followed.

Harvest control rules and quotas, including allocations, implemented through this FMP framework will be set annually and may only be modified in season to reflect technical corrections. In contrast, harvest control rules and quotas may be imposed at any time of year for resource conservation reasons under the points of concern mechanism. Nothing in this FMP framework chapter is intended to preclude or limit the Commission's access to the socioeconomic process.

5.4.3 Allocation Criteria

In addition to the requirements described in Section 5.4.2, the Commission will consider at least the following factors when considering direct allocation of the resource:

- Present participation in and dependence on the fisheries, including alternative fisheries;
- Historical fishing practices in, and historical dependence on, the fisheries;
- The economics of the fisheries;
- Any existing agreement or negotiated settlement between the affected participants in the fisheries;
- Potential biological impacts on any species affected by the allocation;
- Consistency with the goals and objectives of this WSFMP and the MLMA.

These criteria are in keeping with the goals of and objectives of the MLMA and as specifically outlined in §7072 (c) FGC: "To the extent that conservation and management measures in a fishery management plan either increase or restrict the overall harvest of a fishery, fishery management plans shall allocate those increases or restrictions fairly among recreational and commercial sectors participating in the fishery." §7086 (c) (2) FGC says that in the case of a fishery determined to be overfished, restrictions and recovery benefits will be allocated fairly and equitably among sectors of the fishery.

Management tools such as catch quotas, seasons, area closures, bag limits, and other regulations can be used to directly or indirectly allocate fishery resources with the intent to increase or restrict a group's access or harvest of a resource. Decisions on allocation and the tools needed to implement those decisions must take into consideration complex biological, social, and economic factors. In addition, modification of a direct allocation cannot be designated as "routine" unless the specific criteria for the modification have been established in the regulations.

5.4.4 Harvest Control Rules

Harvest control rules provide a mechanism to achieve sustainable use, prevent overfishing, and rebuild depressed stocks, each of which are described in the MLMA as primary conservation standards for fisheries management. Harvest control rules based on objective, measurable criteria provide assurance that conservation objectives will be met.

Harvest control rules usually determine target levels and upper limits for take. Input information such as stock size or reproductive potential is necessary to directly calculate allowable fishing mortality, but proxies may be used in situations where direct calculations are not possible due to inadequate data. Typically, an upper limit on fishing mortality or maximum fishing mortality threshold (MFMT) and a lower boundary on stock size or minimum stock size threshold (MSST) are set.

Harvest control rules are incorporated into prearranged plans that use information on stocks to make management decisions so the stock remains within safe biological limits. The rules include plans for decision making and procedures for invoking preset measures to manage the fishery. Objective and measurable stock status criteria, such as MFMT and MSST, must be specified in an FMP using harvest control rules.

In general, harvest control rules involve methods that are used to determine allowable fishing mortality each year. Often, formulas are given in FMPs that provide for direct calculation of the allowable harvest by using the current stock size, stock productivity, and other factors as inputs. However, in practice there are usually gaps in the current state of knowledge for individual species. Since it is common that the requisite data are not sufficiently known to directly calculate MSY or OY, defaults are sometimes specified in FMPs to allow use of the MSY/OY approach. In addition, increased risk resulting from such uncertainty is addressed with the precautionary principle, which establishes less aggressive harvest policies in response to greater uncertainty concerning the status of the stocks and their response to fishing pressure.

The MSY/OY control rule means a harvest strategy which would be expected to result in a long-term average catch approximating MSY as modified by environmental and socioeconomic factors. The MLMA does not require that sustainability and other conservation measures be achieved through MSY and OY control rules. However, alternatives to MSY and OY need objective standards for determining whether or not management measures are accomplishing the intended results.

As data become available, improved, or are updated, the formulas and procedures for setting OY, harvest guidelines, and quotas for white seabass may need to be modified. Changes and additions to these formulas are authorized by the WSFMP and may be accomplished through the points of concern process or the socioeconomic process.

5.5 Trigger Mechanisms

It is vital to have ways that measure or gauge the success of the management measures implemented by the Commission. Measurable long term fishery-dependent and fishery-independent data such as catch trends, recruitment patterns, and forage abundance indices should be used to monitor the effectiveness of current management measures. For example, sustained decreases in catch and or recruitment will alert the WSMT and WSSCAP to potential problems within white seabass stocks. The WSMT and WSSCAP will determine appropriate trigger mechanisms for the white seabass stocks and they will use them to provide management recommendations to the Commission. In turn, the Commission could implement needed management measures in a timely manner through the points of concern process.

On a continuous basis, the WSMT will review landings for which harvest control rules, quotas or specific routine management measures have been implemented, and it will make projections of the landings at various times throughout the year. If it becomes apparent that the rate of landing is substantially different than anticipated and that the current routine management measures will not achieve the management objectives, then the WSMT may recommend to the Commission in-season adjustments to those measures. Such adjustments may be implemented through the single meeting notice procedure.

5.6 Management Alternatives

In addition to the framework procedures described above, initial management alternatives are proposed for implementation upon approval of the WSFMP. If adopted by the Commission and implemented by the Department, these alternatives would become regulations affecting fisheries for white seabass. They may be modified in the future, or new regulations may be implemented, using the framework procedures in the WSFMP. Analysis of these alternatives is deferred to Chapter 6.

As mentioned in 5.1, there are many potential measures to be used in the management of white seabass, and in fact, several of those measures are currently in place (Table 4-1; Appendix B and C). The Department and WSSCAP felt that additional measures were needed to ensure the sustainability of the white seabass resource. In developing these alternatives, an MSY/OY control rule was decided upon to represent the best approach. The reasons for this are that an MSY/OY control rule: 1) contains measurable criteria for use in management decisions; 2) requires calculations using data that the Department currently collects (commercial landings, recreational catch, and fishing effort); 3) can be linked to future research and data needs; and 4) is similar to the approach taken for the management of the nearshore finfish fishery (nearshore FMP).

The data used to develop the alternatives consist of commercial landing receipt data and Commercial Passenger Fishing Vessel (CPFV) logbook data collected by the Department in combination with Marine Recreational Fishing Statistics Survey (MRFSS) data (RecFIN 2001) for private/rental boats and all shore-based fishing modes (e.g., piers, beaches). Since recreational data are presented in numbers of fish, the numbers were converted to pounds using MRFSS averaged annual white seabass weights by fishing mode. All discussions presented in this chapter are based on weight.

Harvest control rules often address allocation when more than one user group is involved. The WSSCAP, however, decided that allocation of the resource was not an issue at this time. As a group, they reached consensus on sharing the resource without the need for separate allotments and advised the Department to pursue a course of maintaining status quo; however, the panel felt that this issue should be addressed in the next few years. To guide any future discussions of allocation, the advisory panel will use the allocation criteria identified in Section 5.4.3, and any allocation policies that the Commission may develop.

The alternatives below (except A) represent different determinations of MSY/OY to be used in a harvest control rule. It is recognized that these alternatives represent only the upper target reference points and much needed data are required to determine MSST and the shape of the control rule. Once stock assessments are done and knowledge of the white seabass stock moves from data-poor toward data-rich, a better defined MSY control rule can be set. In the interim, it is suggested that the default MSY/OY control rule below (Section 5.7) be used in conjunction with one of the following alternatives.

5.6.1 Alternative A - Status Quo

This alternative provides no changes to present management of white seabass. The management of white seabass would continue through a combination of existing recreational and commercial regulations which include size and bag limits and seasonal closure (See Table 4-1 and Appendix B and C).

5.6.2 Alternative B - OY Proxies Based on National Standard Guidelines

The Magnuson-Stevens Fishery Conservation Management Act uses advisory guidelines, known as National Standard Guidelines (NSGs), to assist in the development of federal FMPs. The NSGs allow for situations where MSY cannot be estimated directly: “If a reliable estimate of pristine stock size (i.e., the long-term average stock size that would be expected in the absence of fishing) is available, a stock size approximately 40 percent of this value may be a reasonable proxy for the MSY stock size, and the product of this stock size and the natural mortality rate may be a reasonable proxy for MSY.”

For white seabass, the pre-exploitation biomass was estimated at 40 million pounds, ranging from 30 to 56 million pounds (Dayton and MacCall 1992). Estimates of natural mortality rate (M) from recreational and commercial data range from 0.08 to 0.13 (MacCall et al. 1976; Dayton and MacCall 1992). Using an intermediate value for natural mortality (0.10), the following calculations can be made:

MSY stock size = Pristine stock size (40 million pounds) x 0.40 = 16 million pounds

MSY proxy = MSY stock size (16 million pounds) x natural mortality (0.1) = 1.6 million pounds

This MSY proxy was then used for alternatives B1 and B2 below.

5.6.2.1 Alternative B1: OY=0.8125 x MSY

Under the MLMA, if management is based on an MSY then an OY must be calculated. Thus, a further step is needed that reduces the above MSY proxy to a level where the chances of overfishing are greatly reduced. Although technical guidelines suggest an upper target reference point at 75% of MSY (Restrepo et al. 1998), the advisory panel advocated an even higher percentage. Based on recent increased catches of juveniles, increased landings, and more individuals seen and caught in northern California (Monterey), the advisory panel reached consensus on an OY of 0.8125 x MSY. This value is 1.3 million pounds (0.8125 x 1.6 million pounds).

5.6.2.2 Alternative B2 (Preferred): OY=0.75 x MSY

This alternative is similar to alternative B1, except there is no deviation from the technical guidelines outlined in Restrepo et al. (1998). A target reference point of 75% of MSY is used to represent OY. This value is 1.2 million pounds (0.75 x 1.6 million pounds).

5.6.3 Alternative C - OY Proxies Based on Recent Catch Levels

This alternative is based on the use of recent catch data as a proxy for MSY, with precautionary adjustments made for OY. The Pacific Fishery Management Council (PFMC) and Commission have adopted recent catch as a proxy for MSY for management of several nearshore finfish species. The PFMC also recognized that a precautionary adjustment of 0.75 x MSY should be used to determine OY in situations when moderate information exists for a particular species. Using this approach, care must be taken to select a period representing recent catch when the stock was not presumed in decline.

For white seabass, MSY estimates were developed based on catch levels for the following number of years and time frames: 5 years (1996-2000), 10 years (1988-1989 and 1993-2000), and 15 years (1983-1989 and 1993-2000). The same calculations were done for the alternatives C1, C2, and C3: the U.S. recreational and commercial catch for the specified time frame was averaged, giving an estimate of MSY. This number was then multiplied by 0.75 to give an estimate of OY.

5.6.3.1 Alternative C1: Based on 1996-2000 Catch Data

In this alternative, the years 1996 through 2000 were selected because they represent the years following the implementation of the nearshore gill net ban. The average catch during this time period was 453,032 pounds; the OY is 339,774 pounds (453,032 pounds x 0.75).

5.6.3.2 Alternative C2: Based on 1988-1989 and 1993-2000 Catch Data

In this alternative, the years 1988 through 1989 and the years 1993 through 2000 were selected because they represent a period of time prior to the nearshore gill net ban, which reduced commercial fishing effort on the white seabass resource in California. This time period also contained several El Niño/Southern Oscillations and the years following these events. There was insufficient recreational data available to use the years 1990 through 1992 because the MRFSS program was not funded in those years. The average catch during this time period was 330,270 pounds; the OY is 247,702 pounds (330,270 pounds x 0.75).

5.6.3.3 Alternative C3: Based on 1983-1989 and 1993-2000 Catch Data

This alternative spanned the 15-year period from 1983 through 1989 and 1993 through 2000. These years were selected for the same reasons as described above. In addition, more years were included to balance fluctuations in catches due to sensitivity of white seabass to environmental conditions. The average catch during this time period was 283,979 pounds; the OY is 212,985 pounds (283,979 pounds x 0.75).

5.6.4 Alternative D - OY Proxy Based on 1947-1957 Catch Data

Similar to Alternative C, this alternative used catch data as a proxy for MSY, then reduced this number as a precautionary adjustment for OY. The time frame 1947 through 1957 was selected because it occurred during a relatively long period of stability from 1939 to 1960 when total catches were near or above 1 million pounds annually. During this period, the majority of the catch was taken commercially under a 28 inch size limit; recreational fishermen were allowed 5 undersized fish (less than 28 inches) within the bag limit. The time frame was narrowed to avoid any biases due to the advent of World War II and the ban of purse seine gear to take white seabass in 1940. All catches in Mexican waters were not included. Calculations used to determine MSY and OY were the same used for Alternative C above. The average catch during this time period was 1,140,712 pounds; the OY is 855,534 pounds (1,140,712 pounds x 0.75).

All of the proposed alternatives are summarized in Table 5-1.

Table 5-1. Proposed alternatives (harvest control rules) for management of the white seabass resource	
Alternative	OY (pounds)
Alternative A: Status quo	N/A
Alternative B: OY proxies based on National Standard Guidelines (NSGs)	
B1: OY=0.8125 x MSY (based on NSGs)	1,300,000
B2: OY=0.75 x MSY (based on NSGs)-Preferred	1,200,000
Alternative C: OY proxies based on recent catch levels	
C1: OY=0.75 x MSY (based on 1996-2000 catch)	339,774
C2: OY=0.75 x MSY (based on 1988-1989 and 1993-2000 catch)	247,702
C3: OY=0.75 x MSY (based on 1983-1989 and 1993-2000 catch)	212,985
Alternative D: OY proxy=0.75x MSY (based on 1947-1957 catch)	855,534

5.7 Default MSY/OY Control Rule

Prior to establishing MSY and OY for white seabass, it is necessary to determine the status of scientific knowledge for the stock. Stocks are generally classified as data-rich, data-moderate, or data-poor (Restrepo et al. 1998):

Data-rich
These stocks have been formally assessed and the current stock size and MSY quantities can be reliably estimated. All critical life history parameters (e.g., growth) are known and the uncertainty in stock assessments is well-defined.

Data-moderate
These stocks have been partially assessed and the current stock size and critical life history parameters are known, but reliable estimates of MSY quantities are unavailable or of limited use. The uncertainty in stock assessments is reasonably defined and quantified.

Data-poor
These stocks lack information on current stock size and reliable estimates of MSY quantities, although catch estimates and some life history information may be available. The uncertainty in stock assessments is poorly defined, and may be qualitative rather than quantitative.

White seabass stocks are currently data-poor.

In data-rich situations a stock-specific MSY fishing rate is employed if available, and downward adjustments are made for OY. A default MSY/OY control rule (Restrepo et al. 1998) is shown in Figure 5-1. The upper limit on fishing mortality or Maximum Fishing Mortality Threshold (MFMT) equals F_{msy} at higher stock sizes and is reduced proportionately as stock sizes fall slightly below biomass levels associated with MSY (B_{msy}). This facilitates rebuilding of the fishery when stock sizes decrease. As a precautionary measure, the OY target is adjusted downward and equals 0.75 x F_{msy}. If F_{oy} is exceeded, overfishing is occurring. If the stock falls below the Minimum Stock Size Threshold (MSST), then the stock is considered overfished. The MSST is constrained to be greater than 50% of B_{msy}, however the precise location of MSST relative to B_{msy} depends upon the life history characteristics of white seabass and the dynamics of the stock. As more data become available, the exact shape of the control rule–how fishing mortality is adjusted as stock sizes increase or decrease–may be changed.

An overfished or depressed stock is defined as a stock that falls below the threshold of 50% B_{msy} or 25% $B_{unfished}$ (i.e., the unfished or pristine biomass). For stocks below their overfished/rebuilding threshold, an interim rebuilding adjustment would be made to OY until a rebuilding plan is developed. Rebuilding times may be influenced by many factors, including the degree to which a stock has declined, the inherent productivity of the stock, and the mean generation time for the stock. In general, rebuilding plans allow for recovery to B_{msy} or its proxy in 10 years or less. In cases where that is not possible due to the biological characteristics of the stock, the allowable time is one generation plus the length of time to recover in the absence of fishing.

For data poor and data moderate situations, technical guidelines recommend a target default OY of 0.75, 0.50, and 0.25 x recent catch (MSY proxy) for stocks believed to be

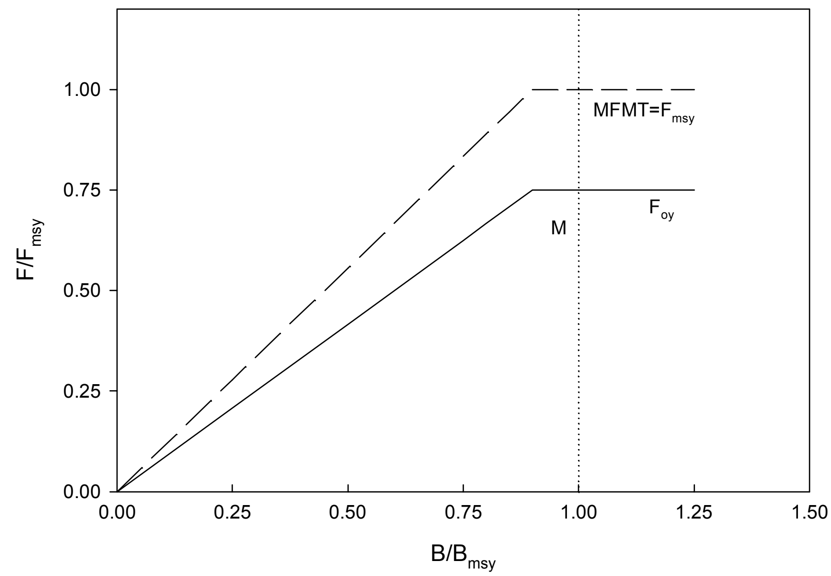

Figure 5-1. Default MSY/OY control rule (modified from Restrepo et al. 1998)

above B_{msy}, below B_{msy} but not overfished, and overfished, respectively (Restrepo et al. 1998). Since quantitative analyses of stock size relative to B_{msy} is often lacking for data poor situations, qualitative approaches may be necessary. For white seabass, there is no current stock size information. Therefore, based on considerable discussion regarding recent landing trends, recruitment, and observations of more white seabass in northern California (Monterey), the WSSCAP reached consensus that the stock size was above B_{msy}.

5.8 Trigger Mechanisms for Proposed Alternatives

In addition to the alternatives, trigger mechanisms have been developed to gauge whether the selected alternative is functioning properly and providing adequate protection for the white seabass resource in the face of changing environmental conditions and consumptive and non-consumptive use. The following trigger mechanisms will be used to monitor the resource and identify when overfishing has occurred and actions are needed:

- The total annual commercial catch of white seabass in pounds landed (from fish receipt data) for two consecutive years declines each year by 20% or greater from the prior five-year average of landings;

- A 20% decline occurs in the number of fish and average size of fish (round weight) for the same two consecutive years for white seabass caught in the recreational fishery as determined from the best available data;

- Recruitment of juvenile white seabass declines each year by 30% or greater from the prior five-year average of recruitment as determined from the best available data.

Overfishing of the white seabass resource occurres when any one of these conditions are met. If all three of the trigger mechanisms occur, then the white seabass stock is overfished. Evaluation of recreational and commercial take since 1952 indicates that the first two criteria were met eight and nine times, respectively. However, all criteria occurred in both fisheries during the same time period only twice (1960-1969). This indicates that these trigger mechanisms could be sensitive to identifying overfishing, but would not necessarily trigger an overfished condition. The average weight portion of the second and third criteria were not evaluated since there were too few data.

The Department's WSMT and the WSSCAP will further investigate situations leading to the occurrence of any trigger mechanisms, and recommend management measures to the Commission if needed.

5.9 Annual Review of Management Measures

The Commission will review the WSFMP annually. The review will include the most recent fishery-dependent data (e.g., commercial and recreational landings, length frequencies), any fishery-independent data (e.g., recruitment surveys) as well as data on changes that may have occurred within the social and economic structure of the recreational and commercial industries that utilize the white seabass resource within California. Included in this review will also be information about the harvest of white seabass in Mexico, if available, and any other pertinent data. This will permit a review of the proxies for MSY and OY that the Commission may adopt. These reviews will be carried out so that any recommendations or amendments to the WSFMP can be reviewed by the Commission and the public in accordance with the requirements of the MLMA.

5.10 Reporting and Record Keeping Requirements

Catch, effort, biological, and other data necessary for implementation of the WSFMP will continue to be collected by California under existing data collection provisions. If the Commission finds that additional data are needed, it will consult with the WSMT and the WSSCAP to determine the best method for addressing their needs. The implementation of additional reporting requirements will be done in accordance with the annual review process, and following the FMP framework and public input processes as described earlier.

Chapter 6. Analysis of Proposed Management Alternatives

Several proposed management alternatives for the white seabass fishery, along with a framework approach to management, were described in the previous chapter.   As per CEQA guidelines and the MLMA, the effects of these alternatives on target and non-target species, the environment, and the socioeconomics of the fishery are evaluated in this chapter.

6.1 Alternative A - Status Quo

6.1.1 Effects on White Seabass

This alternative would continue existing white seabass regulations. The management of white seabass over the years has been complex, consisting of several different restrictions on commercial and recreational fisheries (see Section 4.2). Unlike earlier years, a number of recent laws and regulations pertaining to white seabass have resulted in reductions of commercial fishing effort and the take of sub-legal fish by recreational anglers. These regulations in combination with favorable oceanographic conditions and the recovery of several prey populations have probably contributed to increases in the white seabass stock. Currently, the white seabass resource appears to be recovering based on catch trends seen in the recreational and commercial fisheries as well as other factors (Section 2.10). The continued abundance of prey items such as sardines and squid, and the cessation of the El Niño/Southern Oscillation, should contribute to a stable ecosystem for white seabass along the California coast.

The selection of the status quo alternative, along with a framework approach to management, would meet some of the objectives of the WSFMP and MLMA. Under the FMP framework, management of the white seabass resource avoids being split between the Legislature and the Commission, which often resulted in allocation of the resource at the expense of the different fishery participants. This in turn lead to animosity and conflict between various user groups. In addition, framework management gives the Commission a strict set of procedures and management tools to use as needs arise. This will enable the Commission to act decisively and in a timely manner in response to changing biological, oceanographic, and socioeconomic conditions affecting the resource.

Another advantage of implementing this alternative is that short-term economic impacts are unlikely. However, if overfishing and collapse of the fishery occur, long-term impacts would be substantial.

The main disadvantage of this alternative is that is does not meet one of the principle objectives of developing a sustainable fishery. To adequately accomplish this objective, it is important to identify the level at which a population can be maintained while experiencing removals of a portion of the stock through natural and fishing mortality. Without identifying this level, resource managers will not have a starting point from which to gauge whether or not fluctuations in catch and abundance indices are of serious concern. Implementation of this alternative involves considerable uncertainty and risk since a harvest limit is not in place to prevent overfishing (see Section 6.5).

Wide fluctuations in the take of white seabass by commercial and recreational fisheries have occurred since the fishery began. Fishery landings appear cyclic in which a few years of high catches are followed by many years of much lower catches, and then catches return to high levels. Environmental changes and regulations are partly responsible for these fluctuations, but the magnitude of their effects on the white seabass stock are unknown. The cyclic nature of the fishery, without upper harvest limits in place, could put the white seabass resource at considerable risk since high take of white seabass followed by poor recruitment could lead to collapse of the fishery and a very long time for recovery, despite the return of favorable conditions.

This alternative also does not use the best available information to manage the fishery. Although it is acknowledged that there are gaps in our knowledge of white seabass, enough data exist to develop an estimate of population size which can be used as a starting point for further evaluation and refinement through monitoring and research (see Chapter 7).

6.1.2 Effects on Non-Target Species

The white seabass recreational and commercial fisheries, like most other fisheries, have some bycatch, which is either kept or returned to the marine environment. In large part, gear designs used by fishermen help to lessen the take of non-targeted species. Choices such as hook design and size, bait types, mesh sizes, and how and where these gears are used help to minimize the risk of catching juvenile or undersized fish as well as non-targeted species.

Much of the data on bycatch in the white seabass commercial fishery comes from a Department study in the 1980s and observations made by NMFS in the 1990s. The Department conducted an onboard observer program that covered the nearshore white seabass gill net fishery from 1983-1989 (Vojkovich et al. 1990). During this period, 818 sets of gill nets were observed on 250 days (approximately 3% coverage of the total logged fishing activity). As previously mentioned, the NMFS observer program does not cover the white seabass gill net fishery. However, some white seabass sets were observed incidentally on vessels primarily targeting halibut in the set net fishery in southern and central California. In southern California, a total of 521 sets was observed from 1990-1993 (Caretta pers. comm.). White seabass was the primary target of these sets, but a small fraction also targeted leopard sharks. In central California, a total of 52 sets targeting white seabass and soupfin shark was observed from 1990-1994 and 1999-2000 (Forney pers. comm.). The results of these studies are presented below (Sections 6.1.2.1 through 6.1.2.5). It should be noted, however, that implementation of Proposition 132 in 1994 has moved the white seabass gill net fishery farther from shore, so the composition of incidentally-taken species may be different from these studies.

6.1.2.1 Effects on Non-Target Finfish

Recreational fishery interactions
Recreational fishermen targeting white seabass catch undersized white seabass and other finfish. The MRFSS data shows that anglers targeting white seabass commonly returned undersized white seabass, barred sand bass (*Paralabrax nebulifer*), kelp bass (*P. clathratus)*, California halibut (*Paralichthys californicus)*, California barracuda (*Sphyraena argentea*), bat rays (*Myliobatis californica*), shovelnose guitarfish (*Rhinobatos productos*), Pacific mackerel (*Scomber japonicus)*, soupfin shark (*Galeorhinus zyopterus*), and other species of sharks. In addition to these species, sargo (*Anisotremus davidsonii*), yellowfin croaker *(Umbrina roncador*), and yellowtail (*Seriola lalandi*) are caught aboard CPFV's while fishing for white seabass (Conroy pers. comm.).

From 1993 to the present, an average of 66,000 white seabass were released after being caught. Unfortunately information is not available on the condition of the released white seabass, most of which are under the 28 inch (711 mm) size limit. Anecdotal information from recreational fishermen suggests that there are high levels of mortality due to damaged air bladders. Preliminary data suggest that hooking mortality of juvenile fish is around 10%, which is similar to the levels reported for red drum on the Atlantic coast (Crooke pers. comm.). Further investigation is needed to determine whether this type of interaction could affect the resource (see Chapter 7).

Finfish species, such as Pacific sardine, are occasionally used as bait for white seabass. However, the preferred bait is live squid, and impacts on finfish used as bait are not considered significant.

Commercial fishery interactions
A total of 85 finfish species, mostly those associated with kelp beds, were taken in the white seabass gill net fishery during the Department's onboard observer study. The most common species caught were Pacific sardine (*Sardinops sagax*), spiny dogfish (*Squalus acanthius*), Pacific mackerel, swell shark (*Cephaloscyllium ventriosum*), and white seabass (Table 6-1; Vojkovich et al. 1990). Fifty-two percent of the incidental species were released dead, 29% were kept for personal use or sale, and 19% were released alive. Over 75% of the incidentally-taken fish released alive were shark species while the discarded dead species consisted of Pacific sardine (60%), miscellaneous fish (22%), spiny dogfish (15%), and white seabass (3%).

Examination of current landing receipt data show that incidental species reported in the white seabass gill net fishery include Pacific mackerel, Pacific bonito (*Sarda chiliensis)*, California barracuda, California halibut and other flatfish (*Plueronectidae* and *Bothidae* sp.*)*, giant sea bass (*Stereolepis gigas*), soupfin shark, Pacific angel shark (*Squatina californica*), shortfin mako (*Isurus oxyrinchus*), common thresher (*Alopias vulpinus*), shovelnose guitarfish, and various skates (*Rajidae* sp.). These species were also taken during the Department's onboard observer program. Non-marketable species are not recorded on landing receipts, so some incidental take is not reported.

Since much of the commercial hook and line effort takes place in nearshore waters adjacent to and within kelp beds, there are some similarities in incidental catch with the Department's gill net study. Hook and line white seabass fishermen have reported incidental catches of several nearshore sharks and rays, including bat rays, leopard sharks (*Triakis semifasciata*), soupfin sharks, and swell sharks (*Cephaloscyllium ventrosium*). In addition, California halibut, Pacific sandab (*Citharichthys sordidus*), California barracuda, "red" rockfish; such as vermillion (*Sebastes miniatus*), and canary rockfish (*S. pinniger*), copper rockfish (*S. caurinus*), gopher rockfish (*S. carnatus*), blue rockfish (*S. mystinus*), ocean whitefish (*Caulolatilus princeps*), California sheephead (*Semicossyphus pulcher*), yellowtail, and giant sea bass have been noted as incidental catch.

Table 6-1. Observed incidental catch of finfish in the white seabass gill net fishery from 1983-1989 (Vojkovich et al. 1990)

High	Moderate	Low/Rare			
Pa. sardine	yellowtail	thornback	common thresher	vermillion rockfish	rubberlip surfperch
spiny dogfish	horn shark	jack mackerel	Ca. sheephead	barred sand bass	opaleye
Pa. mackerel	Ca. lizardfish	white croaker	bocaccio	shortfin mako	other rockfish
swell shark	soupfin shark	kelp bass	smooth hammerhead	Pa. sandab	other surfperch
white seabass	Ca. halibut	English sole	Pa. hagfish	N. anchovy	other flatfish
	leopard shark	blue shark	bigmouth sole	Ca. barracuda	ocean whitefish
	Pa. bonito	bat ray	hornyhead turbot	spotted sand bass	flying fish
	Pa. angel shark	Ca. scorpionfish	chilipepper	spotfin croaker	queenfish
	ratfish	Ca. skate	diamond turbot	Pa. electric ray	sevengill shark
	Pa. hake	shovelnose guitarfish	sixgill shark	sablefish	other skates
	brown smoothound	lingcod	grey smoothound	white shark	
		cabezon	giant seabass	petrale sole	
		fantail sole	copper rockfish	barred surfperch	

6.1.2.2 Effects on Invertebrates

<u>Recreational fishery interactions</u>

Market squid is the preferred bait for white seabass. Commercial and recreational white seabass fishermen obtain their squid either by purchasing it from a live bait retailer (i.e., bait receiver or barge) or by capturing squid on their own. There is no way at this time to quantify how much squid is purchased as live bait or taken by an individual for personal use. Currently, there are approximately 12 live bait vessels operating in California that seasonally fish for squid, anchovy, sardine, and mackerel. The amount of squid taken by live bait boats and by individual fishermen is likely to be insignificant in comparison to the commercial squid fishery for human consumption, which employs over 100 vessels and has a five-year average of 71,000 tons (63,000 metric tons) annually.

Commercial fishery interactions

A total of 1,331 invertebrates were taken in the white seabass gill net fishery during the Department's onboard observer study (Table 6-2; Vojkovich et al. 1990). Sixty-nine percent of the observed invertebrate catch consisted of crab species; over 50% of this catch consisted of spider crab (*Loxorhynchus* sp.), rock crab (*Cancer sp.*), and box crab (*Lopholithodes sp.*). The remainder consisted of various mollusks and other crustaceans. About 45% of invertebrates were returned dead, 39% were returned alive, and 15% were kept or sold.

Table 6-2. Observed incidental catch of invertebrates in the white seabass gill net fishery from 1983-1989 (Vojkovich et al. 1990)

Species	Total number	Number kept/sold	Returned alive	Returned dead
crab, box	189	28	39	122
crab, decorator	9	0	5	4
crab, hermit	2	0	2	0
crab, kelp	51	5	29	17
crab, marble	3	0	1	2
crab, pelagic red	5	0	1	4
crab, pointer	92	21	8	63
crab, rock	262	108	71	83
crab, sand	1	1	0	0
crab, spider	303	25	102	176
lobster, Ca. spiny	116	3	110	3
sea cucumber	94	0	69	26
sea star	35	2	31	3
sea urchin	53	5	33	15
shrimp	3	1	1	1
mollusk	2	0	0	2
snail	5	0	4	1
sea hare	3	0	3	0
octopus	3	0	3	0
squid, market	1	0	1	0
whelk	16	0	16	0
unspecified	81	0	1	80
TOTAL	1337	199	527	602

6.1.2.3 Effects on Seabirds

A number of marine bird species, including brown pelicans (*Pelecanus occidentalis californicus*), various tern species *(Sterna* spp.), cormorants (*Phalacorcorax* spp.), and bald eagles (*Haliaeetus leucocephalus*) occur in areas where white seabass fishing activities take place. Some of these species, such as the brown pelican and bald eagle, are federally protected.

The brown pelican, an endangered marine bird, may be indirectly affected by marine fishing activities (e.g., motor noise, boat whistles, etc.) near known rookeries. In order to prevent potential disturbances to the endangered brown pelican rookery and fledgling area at Anacapa Island, Ventura County, the Commission established a fishing closure within the boundary of Anacapa Island Ecological Reserve. The closure is from 01 January to 31 October each year, and encompasses an area 4,000 feet (1,219 m) long on the north side of west Anacapa Island, and extends offshore to a depth of approximately 120 feet (37 m).

The California least tern *(Sterna albifrons*), an endangered species, nests on a few beaches bordering the southern California coast and feeds on small live fish. Interactions between least terns and fishing activities are unlikely, since this species typically feeds in shallow water areas. However, other tern species are known to become entangled in fishing line after getting hooked while going after an angler's bait. Fishermen normally release the hooked tern by cutting the line. When hooked terns return to their nesting area, they can become entangled when the trailing fishing line snags on debris. In an attempt to free itself, a bird may thrash itself to death, and it may entangle other terns in the colony. Between the months of April and August, several species of terns breed at the Bolsa Chica Ecological Reserve (BCER) in Huntington Beach. In addition to a large (up to 2,000 pairs) colony of elegant terns (*S. elegans*), caspian terns (*S. caspia*), forster's terns (*S. forsteri*) and black skimmers (*Rynchops niger*), also nest at BCER (Collins pers. comm.; O'Reilly, pers. comm.). Annually, approximately 10 dead terns are found entangled in fishing line at the BCER seabird colony. Since terns feed primarily on small bait fish such as northern anchovy (*Engraulis mordax*), it is unlikely that interactions would occur with hook and line fishermen targeting while seabass because squid is the primary bait used.

Another protected bird found seasonally along the coast and the islands of California is the bald eagle (*Haliaeetus leucocephalus*). A recovery plan is currently in place that establishes geographical goals for population enhancement. More than 30 eagles have been released at Santa Catalina Island and some live on the mainland near Santa Barbara County. The eagles feed on live fish in the waters surrounding their habitat, so fishery interactions may be possible but are considered unlikely.

<u>Recreational fishery interactions</u>
Because of the fishing techniques employed in the white seabass recreational fishery, it is highly unlikely that there would be any interactions with surface foraging seabirds.

Baited fishing lines are weighted so they sink rapidly underwater where they are unavailable to birds such as the brown pelican, least tern, and bald eagle. However, these marine birds and cormorants often have interactions with anglers who fish for other species on the surface. The interactions take place when live bait (usually anchovy or sardine) is used as chum or for bait. When the bird goes after the bait, it can become caught on the hook or entangled in the fishing line. In most instances the bird is freed. No data exists to quantify these interactions, but the effect on the total population is not considered significant.

<u>Commercial fishery interactions</u>
Gill nets can capture surface foragers (e.g., gulls) as well as diving birds such as terns and cormorants. Seabird bycatch has been a problem in the nearshore gill net fisheries of central California, particularly for the marbled murrelet (*Brachyramphus marmoratus*), a threatened species, and the common murre (*Uria aalge*). The marbled murrelet is rare in southern California, and none have been reported killed in the gill net fisheries of this region (USFWS 1997). Therefore, the white seabass gill net fishery is not likely to impact this species since the majority of fishing occurs south of Point Conception. Common murres are winter visitors to southern California, so interactions are possible, but unlikely since the highest level of fishing effort occurs during the summer months. Eighty-two percent of white seabass landings using gill nets from 1995-2000 occurred from June through July, while only 11% of landings occurred from November through February.

During the Department's onboard observer study, a total of ten cormorants (*Phalacrocorax* sp.) died as a result of gear interactions. No other bird species suffered injuries or died. During the NMFS observer program, 14 cormorants died in the white seabass gill net fishery in southern California while 20 common murres were entangled in gill nets in central California.

Set longlines could potentially catch surface feeding birds if birds attempted to take the bait on the line, and be pulled under the water and drown. However, a commercial white seabass longliner reported having no seabird interactions (Athens pers. comm.). As in the sport fishery, commercial hook and line (other than longline) fishing interactions are unlikely, due to the techniques employed. However, current data are not available on seabird mortalities in the white seabass hook and line commercial fishery.

6.1.2.4 Effects on Marine Mammals

Interactions are possible with a number of marine mammal species, including California sea lions (*Zalophus californianus*), harbor seals (*Phoca vitulina*), northern elephant seals (*Mirounga angustirostris*), common dolphins (*Delphinus delphis*), and California gray whales (*Eschrichtius robustus*) since fishing for white seabass takes place primarily throughout the Southern California Bight (south of Point Conception). All marine mammals, especially threatened and endangered species, are fully protected by

Federal and State law, and special provisions have been established for those areas with highest interaction rates. Elephant seal, harbor seal, and sea lion rookeries are present on several of the Channel Islands in the Southern California Bight. Closures have been enacted by the Commission to keep fishing boats away from rookeries to minimize interactions and disturbances, particularly during pupping and breeding seasons [§630(b)(28), Title 14, CCR]. Elephant seals are also protected by another closure at Point Año Nuevo State Reserve in northern California [§29.05(b)(3), Title 14, CCR].

Recreational fishery interactions

California sea lions and harbor seals frequently follow sport fishing vessels to feed on bait used to chum for fish, and take hooked fish. There are many of these interactions and sea lions are occasionally hooked when they try to take catches (Hanan et al. 1989). Although legal in the past, all lethal methods to prevent depredation by marine mammals have been outlawed by the Federal government.

The MRFSS collected data on pinniped interactions with recreational anglers in California in 1999. Some data were available on interactions with anglers targeting white seabass (Table 6-3; RecFIN 2001). The data show variability in levels of interaction by season. Interactions tended to be lowest during winter, coinciding with a high availability of squid to marine mammals during this time. Higher interaction levels occurred during late spring and early summer when white seabass angling peaked, and throughout the summer months which coincides with the breeding season for California sea lions. Sea lion populations in southern California are highest at this time, when adults congregate at rookeries on offshore islands. In the fall, males migrate north and the population in southern California drops. Similar marine mammal interaction trends are seen in the overall survey data for recreational anglers in southern California.

Table 6-3. Pinniped interactions with recreational anglers targeting white seabass in 1999. Interviewed anglers reported pinnipeds within 100 yards of their fishing area (RecFIN 2001).

Months	Total number of interviews	Interviews reporting pinnipeds	Interviews where pinnipeds were reported when the animal approached angler's gear or catch	Interviews where pinnipeds were reported when physical contact was made with gear or catch
Jan-Feb	12	42%	20%	0%
Mar-April	48	54%	12%	4%
May-June	171	75%	40%	6%
July-Aug	60	33%	50%	25%
Sept-Oct.	53	43%	30%	26%
Nov.-Dec	97	53%	41%	12%
Annual	441	56%	37%	12%

Migrating gray whales (*Eschrichtius robustus*) often come very close to shore, and are frequently observed in kelp beds. Anglers fish for white seabass in the same areas during the early spring months. Although gray whales do not eat fish, they could be affected by the presence of recreational anglers. However, because the number of gray whales in an area at any one time is very small, the impact of recreational fishing for white seabass on these animals is probably not significant.

Commercial fishery interactions

The National Marine Fisheries Service (NMFS) considers the white seabass gill net fishery to be a Category I fishery, which is defined as a fishery in which it is highly likely that one marine mammal will be taken by a randomly selected vessel during a 20-day period. Currently, neither the Department nor NMFS has a marine mammal observer program for the white seabass gill net fishery. However, incidents of marine mammal deaths and injuries resulting from commercial fishing activities are reported by fishermen through the Marine Mammal Authorization Program (MMAP). Data on white seabass gill net interactions collected from this reporting system are combined with data on other gill net fisheries (angel shark, halibut, barracuda, leopard shark, perch and white croaker, rockfish, yellowtail, soupfin shark, and various other sharks excluding the swordfish/thresher shark fishery).

Reported marine mammal interactions for all of these fisheries combined consisted of one common dolphin; ten California sea lions and two harbor seals in 1996; three common dolphins and four California sea lions in 1997; and two common dolphins and two California sea lions in 1998. It is not clear how many of these interactions, if any, occurred in the white seabass gill net fishery because MMAP data is collected in aggregate for these fisheries. Marine mammal interactions are believed to be under-reported to the MMAP (Forney 2000).

During the Department's onboard observer study, six common dolphins, one Pacific white sided dolphin, and seven California sea lions died as a result of gear interaction. During the NMFS observer program, four California sea lions became entangled in white seabass gill nets in southern California while one harbor porpoise and two harbor seals were entangled in gill nets in central California.

Other marine mammals can become entangled in active gill net or surface longline fishing gear, and in fragments of gill net or monofilament line that have been lost or discarded. From 1990 through 1998, 37 gray whales were reported entangled in various fishing gears off the coast of California (Hill 1999). However, the entanglements could have occurred anywhere along the gray whale's migration route, which extends from Alaska to Baja California, Mexico. No gray whales have been observed entangled in active white seabass gill net gear.

No data are currently available on commercial white seabass hook and line interactions with marine mammals. Interactions with rod and reel are probably similar to those in the recreational fishery. Longlines employed in this fishery are set on the bottom, and are not likely to hook marine mammals swimming through the water column. A white seabass longliner reported having no marine mammal entanglements while fishing

(Athens pers. comm.).

6.1.2.5 Effects on Marine Turtles

Marine sea turtles, though uncommon, occur in California waters. Four species of federally protected sea turtles are found in California waters: green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), and olive ridley sea turtles (*Lepidochelys olivacea*). Stranding records indicate that the leatherback sea turtle is the most common in our waters. A relatively high level of leatherback sightings occurs off the Monterey area, peaking in August. Green sea turtles are thought to be the second most abundant species off California. A resident population of 50-60 adults lives in San Diego Bay, congregating in the warm water effluents of the local power plant. Loggerhead sea turtle sightings typically peak from July through September in the eastern Pacific. Olive Ridley sea turtles are highly pelagic and very rarely found off the California coast.

Recreational fishery interactions
Interactions of recreational hook and line fishing with sea turtles are possible, although highly unlikely. An MRFSS sampler observed a sea turtle become entangled in gear from a CPFV off Santa Catalina Island; the turtle was released unharmed (Horeczko pers. comm.). Sea turtles, however, are vulnerable to boat collisions. The NMFS Recovery Plan for the Eastern Pacific green sea turtle states that 80% of recent green sea turtle deaths in San Diego Bay and Mission Bay were associated with boat collisions.

Commercial fishery interactions
Observer programs conducted by NMFS (1990-2000) have documented all four species interacting with various commercial fishing gears including the halibut and angel shark set net fishery, the shark/swordfish drift gill net fishery, and the high seas longline fishery (NMFS 2000). The observed take for the halibut/angel shark fishery was five sea turtles from 1990-1994, with observer coverage ranging from 0% to 15.4%; four of these mortalities occurred off Ventura.

During the Department’s onboard observer study, there were no sea turtle interactions with white seabass gill nets. The lack of interactions, in part, may be due to the differences in mesh size that exist between the white seabass fishery (6 to 7.5 inches) and the halibut (8.5 inches) and shark/swordfish (14 inches) fisheries. During the NMFS observer program, no sea turtle entanglements were observed in white seabass gill nets in southern California.

Marine turtles may be vulnerable to ingestion of marine debris. One adult green sea turtle was recently found dead in San Diego Bay with monofilament netting tightly packed in its esophagus.

6.1.2.6 Ecological interactions

Most of this document has focused on the direct effects of fishing activities on white seabass and other species. However, the removal of white seabass through fishing activities may also have indirect effects on the ecosystem. Unfortunately, our knowledge of white seabass and their relationships with other species in the ecosystem is limited.

White seabass are known to prey on squid, sardines, and other pelagic species, and in turn, are eaten by other fish and sea lions. However, it is not known how increased catches of white seabass would effect this food chain. There may also be competition between white seabass and other species since they are often caught with other migratory species, such as bonito and yellowtail, that have similar food habits. Again, we do not know the extent of these interactions and how the removal of white seabass from the ecosystem would affect this.

6.1.3 Habitat Impacts

6.1.3.1 Effects of Consumptive Use on Environment

Fishermen engaged in the take of white seabass may dispose of trash and other items while fishing. Evidence suggests that marine vessels and fishing activity are a primary source for anthropogenic debris in the Southern California Bight (Moore 1998). Lost gill nets can continue to capture marine animals. Lost or discarded monofilament fishing line can cause death or injury to marine animals if they become entangled (High 1984). Marine debris such as plastics and styrofoam can also cause death or injury to animals in the marine environment when it is ingested or entangles an animal (NOAA 1998).

Fishermen often target white seabass in and around kelp habitat. Boat traffic through kelp beds can damage or cut loose kelp fronds. However, this has no lasting effect on the kelp beds as a whole (Feder 1974). Giant kelp (*Macrocystis* spp.) comprises the bulk of the kelp beds in southern California, although forests of Elk kelp are present off San Diego County. Giant kelp can grow as much as two feet (0.6 meters) per day, and approximately 60,000 tons (54,432 metric tons) are commercially harvested each year throughout southern California. Due to the growth characteristics of giant kelp, the effects on kelp beds by fishing vessels are considered insignificant.

6.1.3.2 Effects of Non-consumptive Use on Environment

Non-consumptive users, such as underwater photographers and animal watchers, can have an impact on the environment. Divers entering the water from shore may trample organisms, or become entangled in kelp, causing temporary damage to kelp beds. Southern California intertidal populations susceptible to trampling include fleshy seaweeds, coralline algae, fragile tube-forming polychaetes, bivalves such as mussels, acorn barnacles, limpets, and grapsid crabs that seek refuge under loose rocks and seaweeds during low tide (Ghazanshahi 1983; Murray 1998).

The potential impacts and effects of scuba divers on white seabass habitats and breeding behavior have not been studied. However, the sensitivity of white seabass to noise suggests that scuba divers could cause some minor disturbances to their mating cycle. If a dive site is a potential spawning ground, and is used frequently by many divers, a possibility exists that fish would abandon that site for a less disturbed location.

Non-consumptive users may also dispose of trash in the marine environment, contributing to the problem of anthropogenic debris.

6.1.4 Economic Implications

Economic effects are not expected to be significant under this alternative. If it becomes necessary to modify current management measures, effects on the fishery-based economies would be addressed under the WSFMP framework process, in accordance with the MLMA.

6.1.5 Social Implications

Social effects are not expected to be significant under this alternative. If it becomes necessary to modify current management measures, effects on the fishery-based economies would be addressed under the WSFMP framework process, in accordance with the MLMA.

6.2 Alternative B - OY Proxies Based on National Standard Guidelines

6.2.1 Effects on White Seabass

This alternative estimates the white seabass population based on information about the virgin biomass (spawning stock) and estimates of natural mortality to obtain a proxy for MSY. An OY was obtained by multiplying MSY by 0.8125 (alternative B1) or 0.75 (alternative B2) as a precautionary adjustment (see Section 5.6.2).

The establishment of an OY through this alternative, along with the framework management approach, meets one of the principle objectives of developing a sustainable fishery. The OY places an upper harvest limit on the total take of white seabass to prevent overfishing while the framework management allows for regulations to be put in place quickly if harvest levels exceed OY. In addition, framework management can adjust OY or other control rule parameters, if needed, as more biological and socioeconomic data become available. This alternative would allow continued recovery of white seabass while important data were collected to yield a better defined MSY/OY control rule.

Unlike alternative A, this alternative provides a good starting point for sustainable fisheries management. However, as noted earlier due to data limitations (see Section

5.6), alternatives B, C, an D only address the upper harvest limit. Because of this, it is strongly recommended that the default control rule (Section 5.7) accompany all of these alternatives. An MSY/OY approach to management should be considered an interim solution when knowledge of a stock is data-poor, as is the case with white seabass. Therefore, this accentuates the need to do a stock assessment and develop a specific MSY/OY control rule for white seabass (see Section 7.4.1).

The MSY proxy of 1.6 million pounds for this alternative is very similar to sustained catch levels seen from the 1940s through the 1960s (with the exception of 1958-1959 (Table 3-1). This MSY proxy is almost identical to an MSY estimate produced in the lone stock assessment done for white seabass. For that assessment, MacCall et al. (1976) used catch-per-unit-effort (CPUE) data from United States-based commercial and recreational catches and calculated an MSY for white seabass of 1.65 million pounds. The similarity of the two MSY estimates calculated by different methods suggests that the MSY proxy has some value.

This alternative assumes that the existing biomass is close to or similar to pristine levels. This may not be the case and might lead to overfishing and cause the resource to become overfished. If this is allowed to continue for too long, the fishery could collapse. Implementation of this alternative involves some uncertainty and risk (see Section 6.5).

This alternative assumes that natural mortality approximates fishing mortality, which is most likely not the case based on recent catch trends. Another factor to consider is that there appears to be a shift in the catch and effort of the white seabass resource from the commercial to the recreational fishery. This may be important due to the large number of white seabass that are recreational-caught and released (see Section 3.6). Many of these fish may become injured or die, but the number of white seabass that suffer this fate is unknown and unaccounted for in estimating their total fishing mortality. In the red drum (*Sciaenops ocellatus*) fisheries, hooking mortality of released fish was important and managers considered this effect in their estimates of MSY (NCDMF 2000).

Alternatives B1 and B2 are similar, and differ only in the adjustments of MSY to yield OY. Since there are many uncertainties in the calculation of an MSY for white seabass based on our current knowledge, it is prudent to make precautionary adjustments. Technical guidelines (Restrepo et al. 1998) recommend that 75% of an MSY proxy in data-poor situations represent the upper harvest target, in the best of conditions (i.e., the current stock size is above the biomass level associated with MSY). Although there are several positive indicators that white seabass numbers are increasing, we feel it is prudent to adhere to the guidelines and be more conservative to help ensure the continued recovery of the white seabass resource. Therefore, we recommend alternative B2 over alternative B1.

6.2.2 Effects on Non-Target Species

6.2.2.1 Effects on Non-Target Finfish

Effects on non-target finfish are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.1).

6.2.2.2 Effects on Invertebrates

Effects on invertebrates are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.2).

6.2.2.3 Effects on Seabirds

Effects on seabirds are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.3)

6.2.2.4 Effects on Marine Mammals

Effects on marine mammals are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.4).

6.2.2.5 Effects on Marine Turtles

Effects on marine sea turtles are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.5).

6.2.2.6 Ecological Interactions

Ecological interactions are largely unknown, but effects on them are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.6).

6.2.3 Habitat Impacts

6.2.3.1 Effects of Consumptive Use on Environment

Effects of consumptive use on the environment are not expected to be significant and differ from effects under alternative A (see Section 6.1.3.1).

6.2.3.2 Effects of Non-consumptive Use on Environment

Effects of non-consumptive use on the environment are not expected to be significant and differ from effects under alternative A (see Section 6.1.3.2).

6.2.4 Economic Implications

Effects on the fishery-based economy are not expected to be significant and differ from effects under alternative A (see Section 6.1.4). However, if harvest limits are reached and fishing effort is reduced, there could be a negative impact.

6.2.5 Social Implications

Effects on the fishing community structure are not expected to be significant and differ from effects under alternative A (see Section 6.1.5).

6.3 Alternative C - OY Proxies Based on Recent Catch Levels

6.3.1 Effects on White Seabass

Since our knowledge of white seabass stocks is data-poor, this alternative uses a proxy for MSY based on recent catch, and adjusts it downward (multiplied by 0.75) as a precautionary approach to get an OY (see Section 5.6.3).

This alternative and the framework management approach, like alternative B, address one of the primary objectives of developing a sustainable fishery for white seabass by setting an upper harvest limit. This is the most conservative of all the alternatives and would impact the white seabass resource the least. This alternative, like alternative B would allow continued recovery of white seabass while important data were collected to yield a better defined MSY/OY control rule. Implementation of C1, C2, or C3 would have some uncertainty, but the risk of overfishing the stock to an overfished condition relative to the other alternatives is by far the least (see Section 6.5).

One of the difficulties with selection of this alternative is choosing an appropriate time period for the basis of MSY/OY. Indeed, the creation of three different time frames attests to this fact. Using recent catch for an MSY proxy has been suggested, with the stipulation that the time period be stable, especially showing no declines. Unfortunately, the white seabass commercial and recreational catches have been very unstable, thus recent catch as a proxy for MSY may be unsuitable.

Implementation of C1, C2, or C3 would require the development of additional regulations that would limit the take of seabass by each of the fishery components when the upper harvest limit was reached within a particular fishing year. Types of regulations or controls that could achieve this would be:

- Cessation of fishing when harvest target is reached;
- Elimination of catch during the spawning season;
- Elimination of fishing during the full moon phase in March, April, May and June;
- Increase of the size limit to 32 inches;
- Reduction of the recreational bag limit; and any
- Combinations of the above.

The amount of white seabass take that would be reduced by implementing one of these regulations can be calculated using data from MRFSS (RecFIN 2001) and the Department's market sampling program (Department unpubl. data). For example, an estimate of all fish taken under 32 inches can be obtained from these databases and subtracted from the total U.S. take of white seabass to yield a reduced estimate of total catch as a result of implementing a minimum size limit of 32 inches. This can be done similarly for the other potential regulations to see their effect on total catch. Based on total U.S. take in 2000 (928,950 lbs), these potential management tools would have to be used in combination to reduce take of white seabass to levels that do not exceed OY under this alternative (OY for C1=339,774 lbs; C2=247,702 lbs ; C3=212,985 lbs).

Table 6-4. Reduction estimates of white seabass catch and resulting take using various controls or regulations. Based on 2000 catch data.

Control or regulation	% reduction (recreational)	% reduction (commercial)	Estimated take (total)
Closed season from 3/15-6/15	46	1	540,022
No fishing during full moon from 3/15-6/15	43	27	563,526
Increased size limit to 32 inches	49	9	558,825
Reduced bag limit (2 fish only)*	4	not applicable	900,298

* Used 1999 estimates for bag limit reduction; 2000 effort data not available.

The selection of any of the options under alternative C would result in a reduction of take and a disruption of fishing activity as well as the implementation of further regulation and increased enforcement needs. Based on recent catches, this would occur in 2002.

Another issue that affects alternative C, as well as alternatives B and D, is the present inability to track recreational catch in a timely fashion. Unlike commercial fishing, there is limited collection of recreational harvest data other than the Commercial Passenger Fishing Vessel (CPFV) logbook data. This would be a particular problem for alternative C since these harvest limits would be reached much sooner than the others. One potential solution to tracking the amount of recreational catch in a timely fashion (less than 2 months lag time) would be to use CPFV logbook data and expand that data by the proportion of the previous years' private/rental boat and shore-based fishing from the MRFSS.

6.3.2 Effects on Non-Target Species

6.3.2.1 Effects on Non-Target Finfish

Effects on non-target finfish are not expected to be significant. Impacts (see Section 6.1.2.1) may be greatly reduced if harvest limits are reached and fishing effort for white seabass decreases. However, a reduction in allowable take of white seabass as per alternatives C1, C2 , and C3 would probably cause fishing effort to shift to other finfish in the commercial and/or recreational fisheries.

6.3.2.2 Effects on Invertebrates

Effects on invertebrates are not expected to be significant. Impacts (see Section 6.1.2.2) may be greatly reduced if harvest limits are reached and fishing effort for white seabass decreases.

6.3.2.3 Effects on Seabirds

Effects on seabirds are not expected to be significant. Impacts (see Section 6.1.2.3) may be greatly reduced if harvest limits are reached and fishing effort for white seabass decreases.

6.3.2.4 Effects on Marine Mammals

Effects on marine mammals are not expected to be significant. Impacts (see Section 6.1.2.4) may be greatly reduced if harvest limits are reached and fishing effort for white seabass decreases.

6.3.2.5 Effects on Marine Turtles

Effects on marine turtles are not expected to be significant. Impacts (see Section 6.1.2.5) may be greatly reduced if harvest limits are reached and fishing effort for white seabass decreases.

6.3.2.6 Ecological Interactions

Ecological interactions are largely unknown, but effects on them are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.6).

6.3.3 Habitat Impacts

6.3.3.1 Effects of Consumptive Use on Environment

Effects of consumptive use on the environment are not expected to be significant. Impacts (see Section 6.1.2.3) may be greatly reduced if harvest limits are reached and fishing effort for white seabass decreases. However, a reduction in allowable take of white seabass would probably cause fishing effort to shift to other species in the commercial and/or recreational fisheries, producing an unknown effect.

6.3.3.2 Effects of Non-consumptive Use on Environment

Effects of non-consumptive use on the environment are not expected to be significant. Impacts (see Section 6.1.3.2) may increase if harvest limits result in greater availability of white seabass in the environment for photography and wildlife viewing. This could result in increased human pressure in white seabass habitat areas such as kelp beds and rocky reefs.

6.3.4 Economic Implications

This alternative may have a significant impact on the fishery-based economy, affecting both recreational and commercial industries. The proposed OY proxies under this alternative would have varying degrees of impacts, ranging from the least disruptive (C1) to the most disruptive (C3). Under the guidelines of C1, no more than 339,774 pounds (154,119 kg) could be harvested annually. This harvest level is 53% of the average annual harvest (646,459 lbs or 293,229 kg) for the years 1998-2000. Under C3 an annual harvest limit of 212,985 (96,608 kg) would be set, which is 33% of the 1998-2000 average annual harvest. These options could have a severe impact on revenues generated by recreational and commercial fishing.

Commercial ex-vessel revenues closely parallel landings, so a significant decrease in landings would be expected to have a severe impact on revenues for commercial fishermen targeting white seabass. Reductions of annual commercial harvests from alternatives C1 and C3 could result in a loss of ex-vessel revenues ranging from $212,000 to $132,000, based on 2000 revenues. However, many of these fishermen also participate in other fisheries, and could re-allocate their effort to target alternative species, offsetting this potential loss in income. Estimates of losses incurred to the commercial fishing industry (fish markets, grocery stores, restaurants, etc.) as a whole have not been estimated. Most fish businesses receiving white seabass are located in southern California; primarily in Orange, Los Angeles, Ventura, and Santa Barbara counties. Local economies in these counties would be hardest hit by revenue losses.

The extent of impact on the recreational fishery is difficult to predict, and is largely dependent on a recreational angler's motivation for fishing. An angler who primarily targets white seabass may not reduce his fishing effort altogether, but may decide to target another species such as yellowtail or kelp bass if white seabass fishing was reduced to meet annual harvest levels. According to the MRFSS estimates, white seabass were named as the target species for less than 1% to nearly 5% of angler trips annually from 1980 to 2000 in southern California, with white seabass popularity peaking in 1999 and 2000 when availability to the California recreational fishery increased (Figure 3-2). If more conservative catch restrictions were imposed, it is likely that effort would shift to other species, minimizing economic impacts on the recreational fishery. If however, effort did not shift and reductions in take resulted in reductions in total fishing effort, a 53% to 33% decrease in white seabass angling expenditures could result. This amounts to a potential maximum estimated loss of $52 million to $32 million based on 2000 expenditure estimates, resulting in a 1% to 2% decrease in total marine angling expenditures for California (Section 3.3.1).

6.3.5 Social Implications

The proposed OY proxies under this alternative may have a significant impact on the fishing community structure by limiting harvest levels for commercial and recreational anglers, and therefore potentially limiting revenues generated by both fisheries. A drop in recreational fishing activity could cause a ripple effect for all industries that directly or indirectly serve white seabass fishermen. A drop in potential earnings for commercial operators targeting white seabass could result in these operators leaving the fishery altogether, or expending more effort targeting other commercial species. Dealers, markets, and restaurants handling white seabass may have to supplement business with other species or with white seabass from foreign markets in order to offset the effects of reduced availability of white seabass in California.

6.4 Alternative D - OY Proxy Based on 1947 to 1957 Catch Data

6.4.1 Effects on White Seabass

This alternative is similar to C, using catch data as a proxy for MSY and then reducing this number as a precautionary adjustment for OY (see Section 5.6.4).

This alternative and the framework management approach, like alternatives B and C, address one of the primary objectives of developing a sustainable fishery for white seabass by setting an upper harvest limit. This alternative is intermediate between the limits set in the other two alternatives. This alternative, like alternatives B and C, would allow continued recovery of white seabass while important data were collected to yield a better defined MSY/OY control rule. Implementation of alternative D would have some uncertainty and risk, similar to alternative B (see Section 6.5).

This alternative, unlike alternative C, does not use recent catch as a proxy for MSY, but instead uses catch data from many years ago. Using an earlier time period (1947-1957) when new white seabass regulations were not implemented and catches were fairly stable might provide a better estimate of MSY/OY. However, the use of an earlier time period may not be very reflective of current conditions, yielding an inaccurate MSY/OY value. This may be especially true for white seabass because there has been considerable loss and modifications of their habitat, particularly embayments, since 1947-1957.

6.4.2 Effects on Non-Target Species

6.4.2.1 Effects on Non-Target Finfish

Effects on non-target finfish are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.1). Impacts may be reduced if harvest limits are reached and fishing effort is reduced.

6.4.2.2 Effects on Invertebrates

Effects on invertebrates are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.2). Impacts may be reduced if harvest limits are reached and fishing effort is reduced.

6.4.2.3 Effects on Seabirds

Effects on seabirds are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.3). Impacts may be reduced if harvest limits are reached and fishing effort is reduced.

6.4.2.4 Effects on Marine Mammals

Effects on marine mammals are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.4). Impacts may be reduced if harvest limits are reached and fishing effort is reduced.

6.4.2.5 Effects on Marine Turtles

Effects on marine turtles are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.5). Impacts may be reduced if harvest limits are reached and fishing effort is reduced.

6.4.2.6 Ecological Interactions

Ecological interactions are largely unknown, but effects on them are not expected to be significant and differ from effects under alternative A (see Section 6.1.2.6).

6.4.3 Habitat Impacts

6.4.3.1 Effects of Consumptive Use on Environment

Effects of consumptive use on the environment are not expected to be significant and differ from effects under alternative A (see Section 6.1.4). Impacts may be reduced if harvest limits are reached and fishing effort is reduced.

6.4.3.2 Effects of Non-consumptive Use on Environment

Effects of non-consumptive use on the environment are not expected to be significant and differ from effects under alternative A (see Section 6.1.5).

6.4.4 Economic Implications

Effects on the fishery-based economy are not expected to be significant and differ from effects under alternative A (see Section 6.1.4). However, if harvest limits are reached and fishing effort is reduced, there could be a negative impact of unknown magnitude.

6.4.5 Social Implications

Effects on the fishing community structure are not expected to be significant and differ from effects under alternative A (see Section 6.1.5).

6.5 Risk Analysis of the Alternatives

Managing the white seabass fishery with an MSY/OY control rule when little stock information exists undoubtedly has considerable uncertainties and associated risks. Establishment of an OY that is too high (more aggressive take) for the current stock size can lead to overfishing. If this is allowed to continue for too long, the stock can become overfished and the fishery could collapse. On the other hand, if the OY is set too low (less aggressive take), the fishery could suffer substantial economic losses.

It is impossible to assess the absolute uncertainty and risk of managing under one of the proposed alternatives since we do not know the “true“ values for MSY and OY. However, it is possible to determine the relative risk of managing under one of the alternatives (more aggressive take) when one of the other alternatives (less aggressive take) would be more appropriate (i.e., the current stock size is smaller than predicted). Table 6-5 presents relative risk in number of years it would take for the white seabass resource to become overfished, if fishing continued at an OY that was more appropriate for a smaller stock size (i.e., overfishing was occurring). Alternative A was not evaluated in the analysis since it does not establish an OY, and therefore has the most risk of the alternatives. The assumptions and details of the models used in the analysis are discussed in Appendix D.

The results clearly indicate that the least risk is associated with alternative C, especially C3. Managing white seabass under any of the options under C would not cause the fishery to become overfished for many years. However, management under alternatives B or D could bring about an overfished condition in as few as 2 to 3 years.

The uncertainty and risk associated with these alternatives again emphasizes the need for more data to be collected so a better defined MSY/OY control rule can be developed.

Table 6-5. Number of years for the white seabass stock to become overfished when management is by one alternative (Y) while stock status suits another alternative (X). OK denotes no undue risk. The two numbers represent results from two different models.

	Y(management)					
X(actual stock status)	B1	B2	D	C1	C2	C3
B1	OK	OK	OK	OK	OK	OK
B2	65-73	OK	OK	OK	OK	OK
D	15-17	18-22	OK	OK	OK	OK
C1	3-4	4-4	6-7	OK	OK	OK
C2	2-3	3-3	4-4	19-23	OK	OK
C3	2-2	2-3	3-4	13-15	39-45	OK

6.6 Effects Found Not to be Significant

California Environmental Quality Act Guidelines (§15128, Title 14, CCR,) require that an environmental document include a brief statement indicating the reasons that various environmental issues were determined to be not significant and therefore not discussed in detail in the document. The following environmental factors were evaluated as having little relevance and insignificant effects on the white seabass resource: aesthetics, mineral resources, public services, utilities/service systems, agricultural resources, cultural resources, geology/soils, land use/planning, population/housing, and transportation/traffic; thus, they were not analyzed in this document.

6.7 Cumulative Effects

White seabass are affected by human generated activities other than fishing in State waters. The combination of effects from the proposed alternatives plus activities not regulated under the WSFMP are expressed cumulatively as declines in the health of the white seabass stock or the ecosystem upon which it depends. Other activities that influence the health and population structure of white seabass include: fishing outside state waters, illegal take, and coastal electric power generation operations. See Chapter 9 for other ecological concerns affecting the white seabass resource.

6.7.1 Take of White Seabass Outside California Waters

As mentioned in Section 2.5, the California fisheries for white seabass target the northern component of the resource, which ranges from Point Conception to Magdalena Bay, Baja California. The center of the population appears to be off central Baja California, Mexico, and could be greatly affected by the Mexican fishery. However, the present and historical size of the Mexican fishery for white seabass is unknown. MacCall et al. (1976) noted that approximately 70,000 pounds (31,752 kg) were commercially-caught annually during the 1960s. By the early 1970s, the catch had increased to 100,000 pounds (45,360 kg). Assuming an average weight of 25 pounds (11.3 kg) per fish, this would equate to an annual catch of 2,500 fish in the 1960s and 4,200 fish in the 1970s. This approximates the commercial harvest in California prior to implementation of Proposition 132. Recent landing figures are unavailable for the Mexican fishery; however, current Mexican regulations recommend that fishing effort not be increased for the artisan fishery, which takes white seabass and other croaker species.

The number of fish currently being taken by the recreational fishery in Mexico is unknown at this time, although anecdotal information indicates that white seabass less than 28 inches are being taken. There are no data to indicate whether the harvest in Mexico is affecting the white seabass population. The extent to which small fish are taken, along with the magnitude of the commercial and recreational Mexican fisheries, could have serious consequences for California’s fishery.

6.7.2 Illegal Take of White Seabass

Some seabass are taken illegally by the recreational fishery either out of ignorance or as a calculated circumvention of the regulations. While there are no accurate estimates of the number taken illegally, Wine (1978;1979;1982) reported that in 1976-77,1977-78, and 1980, private boat fishermen landed nearly 2,400, 1,950, and 1,500 undersized white seabass, respectively. This illegal take by a portion of the angling public exceeded the legal take in the CPFV fishery in all three of these time periods. This trend continues today (RecFin 2001).

Poaching (taking fish illegally or during a closed season) and taking undersized white seabass also occurs in the commercial fishery. Few undersized white seabass are taken in the directed white seabass fishery. Vojkovich et al. (1990) found that less than 3% of the catch was less than 28 inches. However, the percentage of undersized white seabass reported in the halibut and white croaker fisheries totaled more than 50% of the incidental white seabass catch; and nearly all were discarded dead. The annual catch of undersized white seabass in these two fisheries was small (approximately 1,700 fish) but together they are similar to the annual catch of the CPFV anglers from 1970 through 1998 (see Figure 3-1). There is no longer a fishery for white croaker because of the health concerns associated with eating that fish. Movement of the halibut gill net fishery and white seabass directed fishery outside of State waters has probably reduced this take.

Although a serious issue, it is not possible at this time to determine whether the illegal take of white seabass poses a significant threat to the long-term survival of the species. Increased enforcement activity and greater public awareness in the past decade has contributed to lessening this problem.

6.7.3 Coastal Electric Power Generation Operations

Coastal electric power generation stations draw in large amounts of water, millions to billions of gallons per day, from nearshore waters for cooling purposes. Marine life can be either entrained or impinged by power plant operations. Entrained organisms are those not strong enough to swim against the current of the intake system. Impinged organisms are those that are collected on traveling screens designed to remove large debris (mostly kelp and trash) from the water entering the power plant. As part of normal operations to eliminate the growth of encrusting organisms growing on the inside of the intake pipes, heated water flows out through the intake pipes for an extended period of time, often several hours. Encrusting organisms such as mussels and barnacles, and fish living within the intake pipes are killed by this process.

Power plants kill billions of fish larvae and hundreds of thousands of juveniles and adults each year (Herbinson 1981). Clean Water Act studies have documented that more than 80% of the larval fish entrained are less than 10 days old (less than 6 mm long) indicating that potential local recruitment is being lost due to power plants; the studies assume that 100 percent of the organisms entrained are killed. In addition to fish, larval forms of invertebrates and adult zooplankton will be lost to the ecosystem.

There are several coastal power plants in southern California. These power plants often impinge juvenile white seabass. They also entrain and impinge potential prey items of white seabass, such as queenfish, white croaker, and northern anchovy, in large numbers. For example, the Huntington Beach Generating Station alone killed over 4 million of these three prey species combined from 1979-1998 (MBC Applied Environmental Sciences 2001). During this same period, over 2,400 juvenile white seabass were impinged. The number of white seabass eggs and larvae entrained, however, is unknown. These numbers could be substantial since white seabass young-of-the-year reside in shallow nearshore waters (Allen and Franklin 1992).

6.8 Summary Analysis of the Proposed Alternatives

Proposed alternatives for management of the white seabass fishery have been analyzed in this chapter. A comparison of these alternatives and their effects on the objectives for the WSFMP and the MLMA enables identification of which alternatives would best meet management needs. Although each one of the alternatives has some benefits for management, only alternatives B and D address most of the objectives of the WSFMP and MLMA (Table 6-6). Alternatives B and D, with similar risks of producing an overfished condition, would allow continued recovery of white seabass while important data were collected to yield a better defined MSY/OY control rule.

However, alternative B would have less economic impact on the recreational and commercial fisheries. The WSSCAP reached consensus that alternative B, with the inclusion of several trigger mechanisms aimed at minimizing the chance of overfishing the white seabass resource, was the preferred alternative.

Table 6-6. Summary of potential effects of proposed alternatives on white seabass fishery management plan (WSFMP) and Marine Life Management Act (MLMA) objectives.

WSFMP & MLMA objectives	Alternative A	Alternative B	Alternative C	Alternative D
Provide for sustainable uses	Does not provide long-term protection	Lessens likelihood of overfishing	Greatly reduces likelihood of overfishing	Lessens likelihood of overfishing
Use adaptive management	Yes	Yes	Yes	Yes
Minimize bycatch and waste	Yes	Yes	Potential to increase mortality of juvenile fish	Yes
Promote research for better management	Yes	Yes	Yes	Yes
Effective monitoring & enforcement	Yes	Yes	Creates enforcement problems	Yes
Restore & protect critical habitats	No effect	No effect	No effect	No effect
Economic effect on local communities	No effect	No effect or small negative effect	Significant effect	No effect or small-moderate effect
Base decisions on best available data	No	Yes	Maybe	Yes
Involve all parties	No effect	No effect	No effect	No effect

6.9 Mitigation

Fishing activities will result in the removal of individual white seabass from the population. However, specific safeguards included in the WSFMP such as management based on OY, regulation of seasons, bag and possession limits, size limits, and waters with restricted fishing and gear are designed to ensure that removal of those fish will not exceed sustainable levels. These provisions allow for both the conservation and maintenance of white seabass off California. Since no negative effect of this proposed project is expected on the white seabass population, mitigation measures have not been provided.

6.10 Consistency With Statewide/Regional Plans

The Department has concluded that the WSFMP is not inconsistent with air quality attainment or maintenance plans, area-wide waste treatment and water quality control plans, regional transportation plans, regional housing allocation plans, habitat conservation plans, natural community conservation plans, other regional land use plans, or any other terrestrial-based plans.

Chapter 7. Fishery Research Protocols

Fisheries sustainability is an elusive goal for marine resource managers. The cornerstone of effective resource management is a comprehensive spatial-temporal knowledge of the resource. However, there is a paucity of this knowledge for most marine resources, mainly because of our limited powers of direct observation. In the ocean most processes occur out of our view, thus our knowledge of marine communities, species abundance patterns and ecological interactions is fragmentary.

Fishery research is necessary to understand the many complex factors that contribute to the health and decline of our resources. This research is needed to provide management with guidance in making decisions to ensure sustainable fisheries. The MLMA recognizes the importance of research and requires all FMPs to contain fishery research protocols (§7081 FGC). These research protocols must:

- describe past and ongoing monitoring of the fishery;
- identify essential fishery information (EFI) for the fishery, and if any is lacking, identify resources and time to acquire it; and
- indicate steps to monitor the fishery and obtain EFI.

Little biological information on white seabass has been gathered in the past 30 years. Thus, EFI is lacking in many areas. Future research should work toward acquiring this EFI, and involve collaborative efforts of the fishing industry (both commercial and recreational) and qualified university or private fisheries research companies. In accordance with MLMA, this chapter describes fishery research protocols designed to implement the WSFMP; it identifies gaps in the current knowledge of white seabass stocks and fisheries and the steps needed to obtain this information for implementation to be successful.

7.1 Essential Fishery Information

The MLMA provides an opportunity for fishermen, scientists, fishery managers, conservationists, and other concerned constituents to develop a new approach for managing our marine resources. The MLMA recognizes the importance of a collective body of biological, ecological, physical, economic and social information known as "essential fishery information" (EFI). This information is critical for the sustainable use and successful management of the State's marine resources. The MLMA calls for the Department to base FMPs on the best available scientific information (§7072(b) FGC). In addition, any gaps in EFI of a fishery are to be identified, along with steps to close those gaps (§7081 FGC). Essential fishery information generally falls into two broad categories based on how the data were obtained: fishery-dependent (related to the take of fishermen), and fishery-independent information (data gathered independent of the fishery).

7.1.1 Grouping Essential Fishery Information

There are numerous parameters that comprise EFI. In an attempt to identify which EFI the Department should focus its resources on, nine broad EFI groups were created. It is important to emphasize that these groups are not mutually exclusive of one another since one group may include components that also fall under another. These groups were formed so EFI could be prioritized based on what information was most crucial for management. The nine EFI groups are:

Age and growth characteristics:
Age and growth studies typically measure how long a species lives, the age at which it reproduces, and how fast individuals grow. This information is very important to determine a population's ability to replenish itself, at what rate it might be harvested, and when individuals will reach a harvestable size. Changes in the age structure and growth rate of a population also serve as indicators of that population's health. This information is often essential for stock assessments and models that guide management strategies. Specific EFI includes von Bertalanffy growth parameters (k), length/weight ratios, longevity, age/length ratios, age/size at sexual maturity, and age/length at recruitment into the fishery.

Distribution of stocks:
A stock is a population unit that is selected for management purposes. It may be defined based on its ecology, genetics, and/or geographic separation. Discrete stocks of a given species may have very different growth rates, reproductive schedules and capacity, and even ecological relationships. Stock distribution refers to where a stock is found, and is important in addressing jurisdictional issues. Specific EFI includes the depth and geographic range of a species, the amount of gene flow and genetic structure of the stock, and whether stocks are separate or continuous.

Ecological interactions:
This information identifies the interaction of fishes within the environment, habitat, and ecological community. Ecological relationships include the effects of oceanographic regimes and anthropogenic perturbations on physiological, energetic, or behavioral variables; ecological niches and placement in food webs (prey and predators); density-dependent and density-independent interrelationships within and among species; and the importance of essential fish habitat and habitat quality to a species. Estimation of any ecological relationship demands a species-specific within-habitat approach due to environment and organism cross correlations.

Estimates of abundance:
This information helps to determine how many individuals of a population are out there and available to the fishery. This information is essential for all predictive modeling of marine resources. Estimates of stock size can be determined through direct (e.g., surveys) or indirect (e.g., examination of the exploitation history) means. Specific EFI includes relative densities of target and non-target species, habitat-specific absolute

densities, length frequency distributions, relative density estimates of life stages (i.e., eggs, larvae, young-of-the-year, juveniles, or adults), recapture rates of tagged fish, and catch-per-unit-effort information.

Movement patterns:
This information identifies the spatial distribution of fish and their residence time in specific habitats. Many species may exhibit movement patterns that are associated with specific oceanographic conditions. Certain species may aggregate in specific areas for spawning, move in predictable patterns, or move to certain locales that make them especially vulnerable to harvest. Insights into the movement patterns of fish are important to the development of management strategies based on regional catch quotas or marine protected areas. Specific EFI includes the home range, homing ability, seasonal migrations, environmental cues, and spawning grounds of a species.

Recruitment:
Recruitment refers to a measure of the number of fish that survive to a particular life stage, and is often used to predict future population size. In this context, recruitment refers to both recruitment to the fishery and recruitment to the population. Many species depend on successful recruitment events for replenishment of the stock. Recruitment success can be highly variable because it depends on the proper combination of many factors. As a result, sustainable harvest of the fishery may depend on only a few strong cohorts (born the same year) to provide harvestable stocks until the next successful recruitment event. Resource managers must consider this variable recruitment success when setting harvest levels by allowing sufficient portions of stocks to "escape" harvest and provide spawning biomass for future recruitment successes. Specific EFI includes the duration and distribution of egg and larvae, size and timing of settlement, and annual cohort success. Information on the availability of habitats and levels of predators and prey items is also important.

Reproductive characteristics:
This information helps describe the reproductive potential of a fish stock and its ability to replenish itself. Understanding key reproductive characteristics allows managers to set appropriate open and closed seasons as well as opened and closed areas based on important spawning habitat. This information is also crucial in selecting size/slot limits, escape mechanisms for traps, and mesh-size restrictions. Specific EFI for a species includes the number of eggs released, size at maturity, fertilization and spawning period, geographic spawning area, and the nature of mating systems.

Total mortality:
This information refers to all removals of fish from the biomass, and is used to predict how many animals remain to reproduce and replenish the population. Mortality figures are essential for stock assessments and models to determine the number or weight (biomass) which may be safely harvested from a population or stock on a sustainable basis. Total mortality is traditionally separated into natural mortality and fishing mortality. Natural and fishing mortality rates comprise the sum of all individuals

removed from a population over a fixed period of time (often over one year). Fishing mortality is the number of animals which are removed from the population by fishing. Natural mortality refers to all other forms of removal of fish from the population such as predation, old age, starvation, or disease. Specific EFI includes catch data by species and area, amount and sizes of discarded catch, landings by gear type, and survivability of fish that are released.

Socioeconomic:
The economic stability of coastal communities and quality of life may be affected by changes in activities related to recreational fishing, or commercial fishing and processing. These changes may be caused by indirect factors or regulatory changes that directly affect fishing activities. Indirect factors include triggers from consumer or financial markets such as 1) changes in consumer demand due to the favorable pricing and supply of a substitute item for a fishery product(s); 2) inflation; and, 3) tax changes that affect business investments or activities. These effects may be manifested locally through resultant changes in business output, employment, population, and public service demand. The four broad categories of socioeconomic information include:

1. Employment:
Overall impacts to local community earnings and employment can be gauged using input-output multipliers to project the changes to local personal income and the number of local jobs. This procedure takes the direct change in final demand for an industry product or service in revenue or sales dollars and multiplies this direct change by a total income coefficient to estimate total change in local personal income. Similarly, multiplying the direct change by an employment coefficient yields estimates of changes in the number of local jobs.

2. Expenditures:
Regulatory changes that directly affect recreational or commercial fishing revenues in local economies have a downstream effect on other economic sectors which receive and re-spend those revenues. This turnover refers to the number of times a dollar changes hands in the local economy. Output multipliers are used to describe the turnover effect and interrelationships between the basic-sector and downstream business sectors in the local economy.

Additionally, changes that directly affect end-user demand for recreational fishing activities or commercial fisheries products may change end-user spending patterns. Depending on the nature of end-user demand for a given service or product, end-users may spend less if the quantity or quality of the service or product is decreased. Conversely, we would expect end-users to spend more if the quantity or quality was improved. These changes in spending patterns may also affect purchases of related or ancillary goods or services provided in the local economy.

For example, a recreational fisherman may value a charter fishing trip limited to ten fish at $50 per trip. The fisherman may value this trip more than a fishing trip that is restricted to only five fish, for which the fisherman is only willing to pay $35.

Furthermore, the recreational fisherman who plans to take six $50 charter trips per year may take only three trips per year if the price is raised to $80 per trip.

Lastly, the costs (usually expenditures) of production of a good, service, or activity provide a means to compare the relationship between resources used to benefits derived. Often, this is expressed as the benefits-to-cost comparison. In the case of commercial fishing activities, by monitoring costs of production at various levels of output, we can define production where we have maximum economic benefit (or "profits"). This is important in creating harvest guidelines which foster optimum economic yield and economic efficiency in the fishing fleet. Economic efficiency equates to cost and waste minimizing practices.

3. Resource Demand:
Changes in the quantity or quality of available fishery-related goods or services affect the individual end-user's demand for those goods or services. How much this demand may be affected depends on individual income, tastes, preferences, and the accessibility to substitute goods or services. The aggregate demand, based on the combined responses of individuals to changes in a good or service, yields an overall demand function for a good or service. This demand function is used to predict the reactions of end-users to changes in the quantity or quality of goods or services, and to estimate the relative value and benefits end-users derive from a good. Consequently, the effects of in-season adjustments to harvest limits, or changes in bag limits, can be projected in terms of the anticipated response of the target group of end-users, as well as changes in the corresponding revenue streams.

4. Revenue:
This category includes revenue from the sale of local goods or services within the community and those goods or services which are exported out of the community. Revenue information allows resource managers to assess how changes in resources or regulations may affect industry-sector revenues and ultimately, the local community's economic output and vitality. Revenue generated by fishery-dependent activities (e.g., by commercial landings, recreational direct expenditures, or end-user consumption of commercial products) provides basic information for calculating contributions to local economies and a means to compare relative values of goods and services derived from the fishery.

7.2 Past and Ongoing Monitoring of the Commercial and Recreational Fishery

Three major categories of monitoring have been employed by the Department. These include dockside/skiff surveys, landings/market sampling, and onboard observer programs. These types of data collection activities have been ongoing for several years in both the commercial and recreational sectors of fisheries, and form the bulk of the Department's data collection for white seabass.

Along these lines, the Department has also coordinated with other agencies and research institutions to augment its own monitoring of the fisheries. One of the largest such projects is the Marine Recreational Fisheries Statistics Survey (MRFSS), which started in 1979. The MRFSS is coordinated by the Pacific States Marine Fisheries Comission (PSMFC) and funded by the National Marine Fisheries Service (NMFS). The MRFSS samples finfish taken by recreational fishing (i.e., party boat, shore fisherman, etc.) from Crescent City to San Diego.

7.2.1 Past Fishery-Dependent Monitoring

Fishery dependent data for white seabass have been collected from the commercial and recreational sectors of the fishery since 1916 and 1936, respectfully (Thomas 1968; Hill and Schneider 1999). Commercial data in the form of landing receipts or “fish tickets,” which are filled out when the catch is sold to fish businesses or by fishermen selling directly to the public, are a major source of information on the amount of fish landed, landing location, gear used and value of the catch. Landing receipts to date have provided little essential fisheries information other than a broad idea of when and where fishing activity occurs and total dressed (gutted) catch. Logbooks are another useful tool for tracking fishing activity and one that helps to supplement and ground truth data gathered from landing receipts. In the case of white seabass, logbook information is gathered from the set and drift gill net fishery. The information recorded on the logs consists of date, boat name and identification number, crew size, catch location, numbers or pounds of fish, gear type used, mesh size, principle target species, associated species taken and landing receipt number. For the recreational sector of the white seabass fishery, the Commercial Passenger Fishing Vessel (CPFV) logbook has been the primary source for recreational fishing activity. Data entered on these logs includes date, vessel name and number, port of landing, number of anglers, species and number caught, hours fished, and catch location (Young 1969).

In addition to the collection of passive data sets, the Department has actively collected fishery dependent data on white seabass through dockside and at-sea interception of commercial and recreational fishermen. The typical data collected are species identification, size, weight, and disposition (i.e., kept, discarded), fishing method, catch location, and date. Additional data gathered whenever possible consist of sex, maturity through gonad collection, prey items through examination of stomachs, and ageing from otoliths.

For the commercial component of the white seabass fishery, biological data have been collected at commercial fish businesses from San Diego to Santa Barbara during the mid-1970s and through an at-sea commercial gill net observation project between 1983 and 1989. Data have been collected from various segments of the recreational fishery by the Department since 1962. Included in these surveys are a launch-ramp study, an at-sea CPFV survey, and a survey of private boat owners’ catch and effort. As mentioned above, recreational catch data have been collected through the MRFSS program continuously since 1979 with the exception of a three-year period from 1990 to

1993.

7.2.2 Problems with Past and Ongoing Fishery-Dependent Monitoring

Currently, some fishery-dependent data suffer from being of limited use or inaccurate. Fishery-dependent monitoring, through the use of landing receipts and logbooks, does not provide adequate information about fishing location. The fishing blocks used by the Department are 10 nautical miles (nm) by 10 nm representing 100 square nautical miles of area. The size of the blocks is too large to identify specific fishing locations and/or populations of white seabass and does not lend itself to ecosystem management. In addition, the tendency among some fishermen is to alter the location data to prevent identification of “secret” fishing sites. In general, fish businesses have no idea where fishing activity has occurred and will use either a favorite block code to identify fishing location or fail to record catch information. Spatially explicit understanding of fishing spots can lead to identification of stocks, localized fishing mortality, and areas of stock depletion--all of which are important elements for proper fishery management.

Another problem area for fishery managers is inconsistent fishery dependent research and sampling effort. Fishery-dependent research of white seabass is plagued by a lack of consistent sampling effort that results from unstable funding, the inability to retain sampling personnel, and the changing nature of the fishing industry. Most fishery dependent research is funded through a mixture of state and federal programs. Budget shortfalls from one year to the next often result in reduced allocation of funds. This in turn leads to either reduced monitoring and sampling effort or complete cessation. In addition, most sampling programs rely on temporary employees, who can only work up to nine months per year and receive relatively low pay. Thus, constant turn over of temporary staff causes cessation of research and sampling activities, while permanent staff expends time hiring and training new temporary employees.

Finally, there has been a change in the way fish businesses operate. Traditionally, fish businesses operated out of a fixed location where sampling of offloaded catch was relatively easy. In the past twenty years, however, there has been a transition to mobility commonly known as the white-van fleet. Fish businesses, using large vans or trucks, now go to various locations within a port complex to meet fishing vessels. This shift makes it difficult to sample the catch since there are multiple locations where it can be offloaded. As a result, a large proportion is often offloaded and driven to market without being sampled.

In general, fishery-dependent data when used alone has performed poorly in predicting stock decline, especially for residential species (National Research Council 2000). Imprecise recording of fish landings, which are documented by fishery-dependent data, can actually hide precipitous declines in fished populations (Karpov et al. 2000). Vigorous and refined ecosystem-based sampling is needed to help adequately address the complex issues now faced by fishery managers.

7.2.3 Past Fishery Independent-Research

Fishery-independent data are important because they yield estimates of the abundance and distribution and the life history characteristics of the stocks that are more objective than those obtained from fishery-dependent data. Fishery-independent data: 1) provide measures of the relative abundance, trends, and estimates of the size and age structure of fish stocks which are not affected by fishing practices or management regulations; 2) calibrate trends in fishery-dependent estimates and tune assessment models; and 3) encompass a broad suite of information on the biological community, the physical environment and the ecosystem as a whole, that cannot be obtained directly via fishery-dependent measures. These data facilitate alternatives to classical demographic modeling (e.g., bioenergetic, mass-balance, and dynamic modeling). More powerful and sophisticated models can, in turn, enhance the accuracy of stock estimates and the predictability of fishable biomass.

There have been few fishery-independent studies on white seabass. Over the years, these studies have been limited to collecting data on age and growth in the 1920s, 1930s and 1990s; movement patterns, fecundity, and genetics in the mid-1970s (Maxwell 1977b); the effects of gear to quantify at-sea observations of the commercial fishery in the mid-1980s; and settlement patterns and habitat of young-of-the-year in the late 1980s and early 1990s. Over the past ten years, fishery-independent research has mainly focused on ways to improve hatchery operations and survivability of hatchery-reared fish. This research has included studies on genetics, aquaculture commercialization, feeding ecology, and the distribution and abundance of juvenile fish (HSWRI 2001).

7.2.4 Problems with past and Ongoing Fishery Independent-Research

Fishery-independent research has, and continues to be, conducted by a multitude of organizations through a diverse set of funding sources. Unfortunately, the bulk of the research suffers from the following problems:

- It has limited spatial coverage;
- It has been collected using a multitude of techniques;
- It has been conducted on some subset of the ecosystem;
- It cannot easily be compared with other data sets; and
- It can be very expensive.

Further, many of the samples and data sets previously amassed have yet to be fully analyzed. Resource limitations (i.e., personnel, financial) often prohibit the completion of projects and their integration across large spatial, temporal, or ecological scales. In addition, earlier fishery-independent research was sharply constrained as a result of being considered a minor component of the overall assessment strategy, too costly, or too difficult to approach due to the complexity of interacting natural and anthropogenic factors.

7.3 Current Knowledge of Essential Fishery Information

Currently, EFI for white seabass is limited for management purposes. More data and analyses are needed for stock assessments, life history, ecological interactions, and socioeconomics. A description of the data currently available on white seabass is outlined below:

<u>Estimates of abundance</u>:
A current stock assessment has not been done for white seabass. There is only limited indirect information regarding current abundances from catch data only. MacCall et al. (1976) estimated the abundance of white seabass in the mid-1970s, and a pre-exploitation abundance was estimated by Dayton and MacCall (1992).

<u>Distribution of stocks</u>:
Little information on stock distribution exists for white seabass other than the work done by Allen and Franklin (1988) and Franklin (1997).

<u>Movement patterns</u>:
Adult white seabass are believed to move northward with seasonally warming ocean temperatures (Skogsberg 1939). Little data exist for migration of the wild stock of juvenile and adult white seabass and how they are affected by oceanographic changes; however, there is increasing data for the movement of hatchery-reared white seabass.

<u>Reproductive characteristics</u>:
Some of the reproductive characteristics of white seabass have been identified. Fecundity and preferred spawning temperatures are known from laboratory studies; however, size at first maturity information is limited to a study done many years ago with very few samples (Clark 1930).

<u>Age and growth characteristics</u>:
Length-at-age and length-weight relationships have been calculated for white seabass but need to be verified by further age and growth studies. Thomas (1968) produced the best known estimate of a length-weight relationship for white seabass, which has been supplemented by work done by Donohoe (1997) and otolith ageing conducted by the Department (unpublished data).

Recruitment:
Some recruitment information is available. CalCOFI surveys between 1950 and 1978 identified the distribution of eggs and larvae along the Baja/California coast (Moser et al. 1983). In addition, work by Allen and Franklin (1997) and Allen et al. (2001) have furthered our knowledge of the rates, patterns and magnitude of white seabass recruitment.

Total mortality:
The current level of total mortality for white seabass is unknown. However, there are a few studies which provide estimates of total mortality for various time periods throughout the fishery (Thomas 1968; MacCall et al. 1976)

Ecological interactions:
No statewide coordination exists for studies of ecological interactions of white seabass. Consequently, little is known about the region-specific effects of oceanographic regimes and anthropogenic effects on the physiological, energetic, and behavioral characteristics of white seabass, or the species that they interact with as prey, predators, or competitors.

Socioeconomic:
Adequate information on employment, expenditures, and revenues for certain basic-sector industries are readily available or can be derived from existing sources. Such sources include the periodic surveys and reports prepared by the Bureau of the Census, the Bureau of Labor and Statistics, the Bureau of Economic Analyses, the USFWS, the California Department of Fish and Game, and local institutions and academic affiliates. Combined information from these sources allows analyses of impacts or contributions to local economies by commercial fishing activities, and to some degree, by recreational charter activities. However, these sources do not provide adequate information relevant for a thorough recreational fishing analysis in the California nearshore area.

In addition, there is little information available regarding resource demand by the recreational community, commercial industry, or consumer end users. Consequently, there are no means of analyzing or predicting reactions of these user groups when faced with changes in the costs, quantity, or quality of goods, services, or raw materials derived from the fishery. This is essential information which must be considered when deciding harvest levels or the allocation of fisheries resources between competing user groups.

7.4 Research Needed to Obtain Essential Fishery Information

The following research needs are necessary to fill white seabass EFI gaps identified above. The overall goal is to bring our knowledge of white seabass stocks up from data-poor to data-rich; data-poor management using MSY control rules should be considered an interim solution. In order to better allocate the Department's limited resources (i.e., staff), research needs are categorized in terms of short-term operational and long-term strategic goals. From the standpoint of maintaining healthy white seabass stocks, the research needs identified under short-term goals should be addressed first by the WSSCAP following the adoption of this FMP.

7.4.1 Short-Term Research Goals and Needs

Goal: <u>Perform white seabass stock assessment</u>
Successful implementation of this WSFMP requires a current stock assessment. To date, only one stock assessment has been done for white seabass, which was based on a simple model using fishery dependent data collected from 1947-1973 (MacCall et al. 1976). We recommend, at a minimum, repeating the approach used by MacCall et al. (1976), using current fishery dependent data to calculate a more current estimate of MSY. We also suggest improvements to this model by devising better estimates of total mortality (see below), and improving the catch/effort estimates and biological sampling of the commercial and recreational fisheries.

A formal stock assessment using fishery independent data is also recommended. This will enable the Department and WSSCAP to better evaluate the plan's preferred alternative and recommended default MSY control rule. This stock assessment should strive to determine total mortality, a current stock size relative to B_{msy}, and a minimum stock size threshold (MSST). These resultant data can then be used instead of proxies to develop a better-fitted MSY control rule. Deciding upon the exact nature of the stock assessment (e.g., the data collected and type of model used) will be one of the first tasks for the Department and WSSCAP upon implementation of this FMP. Some of the models to consider involve catch-at-age data, egg and larval surveys, and yield per recruit analyses. As a starting point, it is strongly recommended that existing and ongoing data sets, such as the OREHP recruitment studies (Allen et al. 2001) and CalCOFI surveys, be evaluated as potential inputs.

Goal: <u>Evaluate current white seabass regulations</u>
As mentioned in 4.2, there are several management measures currently in place to manage the white seabass resource. The 28 inch minimum size regulation for recreational and commercial fisheries was put in place to allow for spawning of individual white seabass at least once before being taken by the fisheries. The data indicating this size limit, however, was based on only a few samples many years ago. Many feel 28 inches is below minimum size at maturity. Age/length at first maturity and at what size 50% of the white seabass are mature are questions that need to be answered with more data.

Because there is a minimum size limit, immature or undersized white seabass caught by recreational and commercial fisheries are released or discarded. It is unknown how often this occurs or the level of associated mortality. More accurate data on size frequency and mortality of released or discarded white seabass are needed for several reasons. First, regulatory improvements could be made to reduce this impact . For example, if it was determined that smaller hooks have a higher tendency to catch undersized fish, a regulation could be adopted to eliminate their use in the fishery. Likewise, conventional hooks could be prohibited from use when targeting white seabass if they are found to produce higher rates of injury to white seabass than circle hooks. Striped bass mortality, for example, was reduced considerably when circle hooks were used versus conventional hooks (Lukacovic 1999). Second, if mortality of released or discarded white seabass is high, then total mortality estimates could be greatly underestimated. For some species, such as coho salmon, hooking mortality may be particularly high, up to 25% of the fish released. This can have drastic effects on stock assessments since most models use estimates of total mortality. In addition, some models such as Virtual Population Analysis (VPA) or cohort analysis require catch-at-age data for assessing mortality on individual age classes. This necessitates data collection on size frequency and mortality of white seabass following regulatory and voluntary release from recreational and commercial fisheries.

Goal: Determine accurate estimates of bycatch
Limiting the type and amount of bycatch is one of the objectives for sustainable fisheries management under the MLMA (FGC 7056 (d)). This is also one of the specific goals of the WSFMP (see section 1.2.2). The WSFMP addresses bycatch in section 6.4.4, however, most of the data on the commercial fishery come from past gill net studies done inshore of current fishing efforts. Implementation of Proposition 132 in 1994 eliminated all gill nets from nearshore waters south of Point Conception. Therefore, present gill netting for white seabass takes place offshore and may have interactions with a very different assemblage of animals. It is necessary to investigate these interactions, particularly with regard to pinnipeds, birds, and sea turtles through an at-sea observer program.

Goal: Collect age/growth data
Age and growth of fishes is critical EFI for fisheries management. This information from scales (Thomas 1968) and otoliths (Department unpubl. data) is available for white seabass, but more information is needed. Few data exist for larger fish and more work on validating ages, especially for older age classes is desired. The age structure of the white seabass population is also needed. Catch at-age-data collected over a time series (years) provides the basis for assessing stock size using techniques such as VPA.

7.4.2 Long-Term Research Goals and Needs

Goal: Develop more sophisticated stock assessments and models
As mentioned above, a first step to assessing current white seabass stock size is through a simple model using data that are currently collected by the Department. However, the goal for white seabass management is to develop a more sophisticated model as more and better data becomes available. For example, white seabass catches have fluctuated considerably over the years, partly in response to changing oceanographic conditions. If a relationship can be found between temperature,

productivity, or some other variable and white seabass abundance, then this would provide valuable information for predictive modeling. Also, analysis of the recruitment data currently being collected (Allen et al. 2001), and other fishery-independent data can be input into models to yield better stock assessments.

Goal: <u>Move toward ecosystem-based management approach</u>
Although the WSFMP is a single species FMP, the Department's goal is to move toward ecosystem-based management. The development of more sophisticated models with more variables is a step in this direction. Analysis of the relationship between white seabass and important prey such as coastal pelagic species, especially the California market squid, involves several FMPs and will provide a better understanding of ecosystem functioning. It is also important to identify the habitat preferences, environmental conditions, and human impacts (e.g., pollution, dredging, and beach replenishment) that affect white seabass, especially the spawning and early life history stages. The end result may be the evolution of the WSFMP into a multispecies ecosystem-based FMP.

Goal: <u>Expand studies of hatchery-reared white seabass</u>
The Ocean Resources Enhancement and Hatchery Program (OREHP) realized their best production year in 2001 regarding numbers of white seabass released to the wild. As this production success continues, more legal-sized white seabass will be available to recreational and commercial fishermen. With more data, the efficacy of using cultured white seabass to restore native stocks should be fully evaluated, including cost/benefit analyses.

In addition to distinguishing hatchery-reared white seabass from wild stock fish, the tagging of individuals provides useful information for management. Mark-recapture data on white seabass provides information on inshore/offshore and along shore migration patterns. It can also be used in deriving population estimates. It is recommended that tagging of hatchery-reared white seabass continue and a wild stock tagging program be re-initiated.

Goal: <u>Expand socioeconomic data collection and analyses</u>
Much of the necessary socioeconomic data can be obtained or derived from existing sources. However, much of this information, including resource demand data, is not specific to the white seabass fishery. Resource-demand surveys of the primary user groups, namely commercial fishers and processors, recreational fishers, end-users of commercial products, and non-extractive users are necessary to adequately describe the socioeconomics of a particular fishery to managers and constituents. This information is particularly important when allocation of resources is necessary. To date, this kind of information has not been collected for white seabass in any deliberate, objective, or systematic manner.

To address this need, periodic user surveys should be conducted to derive user-group demand functions for discrete white seabass uses. In addition, costs-of-production for major user-sectors should be obtained from Department-initiated surveys or possibly from information collected by other state or federal agencies. These data will enhance our understanding of the economic and social repercussions to user groups brought on by management changes to the white seabass fishery.

Goal: Develop cooperative research with Mexico
As mentioned in Section 6.7.1, the California fisheries for white seabass target fish whose center of population appears to be off central Baja California, Mexico, and could be greatly affected by the Mexican fishery. The present and historical size of the Mexican fishery for white seabass is unknown; however, current Mexican regulations recommend that fishing effort not be increased for the artisan fishery, which takes white seabass. The magnitude of the commercial and recreational Mexican fisheries could have serious consequences for California's fishery.

Cooperative research with Mexico is needed and would enable us to understand the extent of their fisheries for white seabass and their effects on California's fishery. In addition, collaboration with Mexican fishery scientists would enable us to conduct more sophisticated stock assessments, better understand the essential habitats for white seabass, and learn how white seabass respond to changing oceanographic conditions.

Management of trans-boundary species, such as white seabass, is difficult. There are several issues that need to be resolved before cooperative research with Mexico is successful. These issues include differences in management philosophies, logistical problems (e.g., expenses), differences in socioeconomics of the fisheries, and distrust of intentions stemming back to 1982 when the Mexican government banned the United States commercial fleet from its territorial waters. However, if these issues can be resolved, the resulting information would be invaluable, and perhaps essential for the successful management of the white seabass resource in California.

7.5 Resources and Time Needed to Fill Essential Fishery Information Gaps

Resources and time are critical factors and potential obstacles to obtaining data necessary to fill EFI gaps. There needs to be a commitment of stable, long term funding to filling EFI needs for white seabass as well as other finfish that inhabit the same ecosystem. Once this commitment is made, effective use of the funds can be accomplished through coordination of research within the Department and with outside researchers. In addition to funding, an estimated one to three scientific aides per major Southern California port area (San Diego, Orange, Los Angeles, Ventura and Santa Barbara Counties) will be needed to gather biological information adequately. One to two biologists would also be needed to analyze the data and update the FMP. An economist could also be used to better determine socioeconomic factors of the fishery.

If improvements are to be made in data collection, fishermen and the public must be willing to shoulder a share of the costs by allowing more intrusive methods of collecting that data. The Commission must also be willing to implement new strategies in fishery management, and to provide for heavy penalties for non-compliance.

Depending on the availability of Department resources and the cooperation of the fishing industry (both commercial and sport), the time needed to gather sufficient EFI information could take anywhere from two to five years.

7.6 Steps to Monitor the Fishery and Obtain Essential Fishery Information

The Department will have to provide more personnel than are currently available in order to begin some of the research needed to address EFI issues. This may be accomplished by shifting priorities away from other fisheries and/or increasing the number of biologists and scientific aide positions. To effectively monitor the fisheries and maintain a well trained, efficient cadre of samplers, the Department will have to develop a permanent fishery technician classification to reduce the high turnover rate of scientific aides that currently impedes research and monitoring. The repeated hiring and training of personnel for at-sea sampling, ageing otoliths, and collecting other biological data is expensive and time consuming.

In addition to the steps identified above, several more steps need to be initiated that will benefit the Department's efforts to manage white seabass and other marine resources. The Department should in the next few years:

- Develop an infra-structure to facilitate communication, logistical support, standardization of data collection methods, preliminary analysis, and reporting;
- Initiate educational outreach programs to include angling ethics, fish identification and ecosystem management;
- Assess the effectiveness of enforcement and adjust as necessary to better manage resource (i.e., increasing penalties and/or enforcement);
- Obtain recommendations from WSSCAP of the best data collection activities and models for white seabass stock assessment;
- Assess relevance of previously collected data, publish for peer review, and use in management decisions;
- Collaborate with other state and federal agencies, academia, and the user groups to conduct EFI research; and
- Seek external funding sources.

These recommendations work toward providing needed EFI and bringing the Department closer to an ecosystem-based approach to the management of white seabass fisheries.

Chapter 8. Implementation Requirements

This chapter provides estimated costs for the implementation of the WSFMP. The costs are grouped into the categories of enforcement, ongoing and future research, and administrative management. Estimating the individual costs of implementing the WSFMP is made by estimating the time to perform certain tasks such as the enforcement of regulations, collecting data, and reviewing documents. Generally, these kinds of costs are underestimated, because there is no way to determine how difficult some issues may be. Nevertheless, estimates are useful for determining what the actual costs may be and for comparing different options that may be proposed. These cost estimates include expenditures that are incurred regardless of whether or not the WSFMP is partially or fully adopted. These expenses are termed “sunk” costs and equate to the costs of enforcement, data collection, and monitoring that the Department must perform as part of its resource stewardship charge.

8.1 Enforcement

Due to the extensive size of California, it is necessary to employ a variety of measures to ensure the protection of California’s wildlife and compliance with the laws of the State. These measures include land-based, ocean-based and air-based enforcement activities. With few exceptions, costs within the Department are attributed to programs (e.g., MLMA, Environmental License Plate Fund) and not to specific species. Thus, it is impossible to determine exactly how much it costs to enforce existing white seabass laws and regulations. However, a reasonable approximation can be calculated by determining the percentage of white seabass landings within the total number of all nearshore finfish landings made in the year 2000. The resulting percentage can then be multiplied by the total cost of nearshore enforcement in 2000. Enforcement personnel hours coded to MLMA were used because they represent nearshore enforcement activity. These hours were further limited to only those in the southern patrol district (Monterey County line to the U.S./Mexico border) since white seabass are primarily taken in the nearshore waters of southern California.

The estimated cost of enforcing nearshore Fish and Game laws in the southern patrol district in 2000 was approximately $562,591 (Table 8-1). Of this amount, an estimated $50,633 can be attributed to time spent on the enforcement of white seabass laws and regulations. If fishing effort and/or landings increase, the subsequent cost of enforcing Fish and Game laws and regulations will increase.

Table 8-1. Enforcement costs in 2000		
	Cost of all nearshore enforcement	Estimated cost for white seabass enforcement
Game Warden Salaries	$393,983.00	$35,458.00
Benefits at 32%	$126,075.00	$11,347.00
Subtotal	$520,058.00	$46,805.00
Operation expenses (travel, postage, telephones, auto and boat fuel, misc. equipment)	$35,444.00	$3,190.00
Overhead at 20%	$7,089.00	$638.00
Subtotal	$42,533.00	$3,828.00
Total	$562,591.00	$50,633.00

8.2 Ongoing and Future Research

Ongoing research

In order to fully realize the goals and objectives of the WSFMP, it will be necessary to continue monitoring the commercial and recreational landings of white seabass. The monitoring effort will need to consist of the collection of fishery dependent data such as commercial fishing landing receipts, commercial fishing and CPFV logbooks and the dockside collection of biological data (e.g., length, weight) from both user groups. Once annual catch data are collected and edited for accuracy, they will be analyzed for short and long-term trends in the white seabass fisheries. The estimated costs of gathering these data are substantial. They have been separated into two categories; 1) statistical data and 2) biological sampling (Table 8-2, 8-3). Since the 1916, the Department has maintained the Commercial Fisheries Information System (CFIS) database. The annual cost of inputting, editing, and maintaining the white seabass recreational and commercial fisheries information in the CFIS system is an estimated $16,411.00.

Since 1983, the Department has conducted a market sampling program for white seabass, other nearshore finfish, sharks, swordfish and invertebrates such as spot prawn and ridgeback prawn. This sampling program involves opportunistic sampling of the commercial catches in the counties of Santa Barbara/Ventura, Los Angeles/Orange, and San Diego. In 1998, Department samplers began to scan commercially-caught white seabass with a coded-wire tag detector to determine if hatchery-reared fish were contributing to the commercial fishery. The annual cost of maintaining the fishery dependent sampling program described is approximately $91,000.00.

Table 8-2. Estimated cost of collection and maintenance of statistical (landing receipt, CPFV and commercial logbook) data. Pm = cost per person per month.	
Editing receipts and logs; data entry	$679.00
Maintain databases	$287.00
Printing receipts and logbooks	$5,000.00
Supplies	$500.00
Telephones	$360.00
Mailing	$1,500.00
Personnel - (1 Pm at Marine Biologist level, 1 Pm at Program Technician level)	$6,125.00
Benefits at 32%	$1,960.00
Total	$16,411.00

Table 8-3. Estimated cost of fishery dependent biological sampling. PY = annual salary or wage per person.	
Personnel costs - 2.5 PY at Scientific Aide level	$56,970.00
Travel and vehicle maintenance	$8,000.00
Supplies	$3,500.00
Telephone	$825.00
Data processing	$900.00
Rent	$6,000.00
Training	$1,000.00
Indirect costs	$13,802.00
Total	$90,997.00

All of the above costs summarize the effort now directed toward white seabass dependent data collection through the use of Fish and Game Preservation Fund and Sport Fish Restoration Act monies. Since these costs will continue with or without the WSFMP, they can be considered sunk costs (pre-existing commitment of funds with anticipated continuation). The total cost of collecting fishery dependent data is $107,408.00.

Another heavily relied upon source of fishery dependent data available to the State is the Marine Recreational Fisheries Statistics Survey (MRFSS), conducted by the Pacific States Marine Fisheries Commission. This coastwide sampling program intercepts recreational anglers at launch ramps, piers and jetties, and on CPFV vessels. MRFSS data are presently provided free of charge, and are currently our only source of information on the take of white seabass by shore-based and private or rental boat fishermen. These user groups take more than 50% of the recreational white seabass catch. In the future, it may become necessary for the Department to provide funding for the MRFSS program if the current funding provided by NMFS is reduced or eliminated, as in 1991 through 1993, or if the funding is not increased on an annual basis as needed. Should either of these events occur, the State would need to find another way to estimate recreational take for private/rental boats and shore-based fishing or provide up to $400,000 annually to maintain the southern California portion of the MRFSS study.

Future research

Despite being an important species to the recreational and commercial fisheries of the State, very little biological information has been gathered on white seabass in the past 30 years and the current knowledge of the essential fisheries information is limited (see Section 7.3). One of the most pressing needs is a current stock assessment. Also, there are several fishery-based issues that need to be addressed, such as, hooking mortality and survival rates for white seabass released by commercial and recreational fishermen. An on-board observer program is needed to determine accurate estimates of bycatch associated with the commercial white seabass fishery. Genetic studies are needed to determine the variation within wild seabass stocks and the effect, if any, hatchery-reared stocks may have on these stocks. The costs summarized in Table 8-4 can be viewed as either new costs required by the WSFMP, or the reallocation of more of the Marine Region budget from other species to white seabass.

Table 8-4. Cost of fishery independent data collection. PY = annual salary or wage per person.

Personnel costs (1.5 PY at Associate Marine Biologist level; 1 PY at Permanent Intermittent Marine Biologist level)	$123,546.00
Benefits at 32%	$39,535.00
Travel, supplies, fuel, gear, etc.	$150,000.00
Overhead at 20%	$30,000.00
Ship time (20 days)	$70,000.00
Special surveys (22 days)	$4,400.00
Total	$417,481.00

In addition to the costs described in Table 8-4, it would be necessary to contract for further investigation of white seabass genetics and additional work on white seabass habitat needs. The approximate cost of contracting for this work would be $200,000 annually for a three-to five-year period.

The combined cost of conducting research, including the costs of collecting and maintaining statistical data; the collection of fishery dependent and fishery independent data by the Department; fishery independent data studies conducted through contracts; and, possibly funding MRFSS sampling is estimated to be between $724,889 and $1.2 million annually.

8.4 Administrative Management

The following cost estimates (Tables 8-5 through 8-7) cover the managerial aspects of implementing the WSFMP. These estimates are based on staff processing time and costs above the staff level are included in overhead costs. This section does not address the question of whether or not there is sufficient staff or personnel time available to complete the tasks associated with the implementation of this FMP.

8.4.1 Coordination of the White Seabass Fishery Management Plan

The implementation of the WSFMP will require that Department staff perform a variety of new activities which include:

- Analyze commercial and recreational catch data;
- Prepare reports on current fishery and oceanographic trends;
- Prepare updates on research for the WSSCAP and the Commission;
- Organize annual Advisory Panel meetings and other public meetings pertaining to white seabass fisheries;
- Prepare reviews of management recommendations made by the WSSCAP or by other interested parties to address potential impacts to the white seabass resource and socioeconomic impacts on user groups;
- Prepare various notices and regulatory packages necessary to maintain compliance with the Administrative Procedures Act (i.e., notice of intent, rule making packages) and with CEQA.

In addition, the Department staff will need to travel to public meetings and Commission hearings to give presentations, answer questions and take notes on public input. The estimated annul cost associated with the coordination of the WSFMP is $73,966.00 (Table 8-5).

Table 8-5. Administrative cost of coordination for the WSFMP. PY = annual salary or wage per person.	
Personnel - (0.5 PY at Associate Marine Biologist level; 0.5 PY at Office Technician level)	$46,944.00
Benefits at 32%	$15,022.00
Operating expense/travel	$10,000.00
Overhead at 20%	$2,000.00
	$73,966.00

8.4.2 Annual Meetings

A meeting of the White Seabass Scientific and Constituent Advisory Panel will be held annually at the Department's Los Alamitos office in southern California. The members of the WSSCAP volunteer their time, however, the Department will reimburse them for mileage and per diem lodging and meals. Assuming that the Panel consists of seven members who will attend each meeting, the maximum cost of each of these meetings will be $1,655.50 (Table 8-6).

Table 8-6. Costs associated with the annual White Seabass Advisory Panel Meeting (seven panelists)			
Per Diem ($135/day)	1.5 days	$202.50	$1,417.50
Travel ($0.34/mile)	100 miles	$34.00	$238.00
Total per meeting			$1,655.50

8.4.3 Publication of White Seabass Amendments

As the need arises, the WSFMP will undergo amendment. The costs associated with amending the plan are covered under the costs of coordinating the WSFMP (Section 8.4.1 above). However, the production and publication costs were not included in that section. The MLMA and CEQA require that all interested parties have an opportunity to review any proposed changes prior to a Commission hearings on the topic. Any

WSFMP amendments will be sent to all Fish and Game regional offices and federal depository libraries in the State. In addition, notices will be sent out to all interested individuals and fishery participants whenever possible. The cost associated with amending the WSFMP is estimated to be $6,382.00. (Table 8-7).

Table 8-7. Publication costs for White Seabass FMP amendments and notices	
Publication of notices & amendments (200 copies)	$6,000.00
Mailings (200 pieces @ $1.40)	$280.00
Mailings (300 pieces @ $0.34)	$102.00
Total	$6,382.00

Chapter 9. Other Ecological Concerns

Even though living marine resources are managed, for the most part, through regulatory measures that limit or alter fishing effort, factors beyond regulatory management often influence the health of fisheries. In general, factors such as pollution, water quality, habitat degradation, coastal development and land use have not been addressed by fishery management. Increasing scientific evidence that irrefutably ties these factors to the degradation of nearshore ecosystems requires that management acknowledge, mediate, or accommodate for these influences on the nearshore environment.

9.1 Environmental Variability

The management of living marine resources is primarily concerned with regulating the activities of people and has been largely preoccupied with the direct effects associated with the exploitation of these resources. However, climatic fluctuations in winds, ocean temperatures, and ocean circulation patterns also have measurable effects on the health and variability of these resources. The distribution of white seabass and success of fisheries in California waters appear to be strongly influenced by environmental conditions. The fishery presently exploits the northern fringe of the stock, and oceanic temperatures strongly influence the availability of seabass to fishermen (Radovich 1961).

El Niño/Southern Oscillation (ENSO) climate anomalies occur when the ocean-atmospheric system in the tropical Pacific is disrupted, effecting weather patterns over much of the globe. ENSOs are characterized by heavy rainfall, monsoons and warm sea-surface temperatures (SSTs) in the Eastern Pacific (Rasmusson and Wallace 1983). Along the coast of California, El Niños depress the thermocline and diminish the California Current (Dayton and Tegner 1984). Depression of the thermocline away from the upper surface layer reduces primary productivity and adversely affects the food chain in coastal up-welling ecosystems (Barber and Chavez 1985). White seabass are a component of food chains in southern Californian and Mexican (along Baja California) coastal waters. Hence, white seabass populations are affected by ENSO events in these waters.

ENSO events are known to affect white seabass habitat and prey. During mild ENSOs, such as the 1977-1978 and 1992-1993 events, and severe ones (1941, 1957-1958, 1982-1984, and 1997-1998), anomalously warm water adversely affected kelp beds. (CDFG 1994; CDFG 1999). Since juvenile and adult white seabass are associated with kelp beds, the reduction or loss of kelp habitat potentially effects these fish by removing shelter and prey. During the ENSO events mentioned above, two species preyed upon by white seabass, anchovies (Fiedler 1984) and market squid (CDFG 1999; Yaremko, pers. comm.) were not present, or were greatly reduced, in the Southern California Bight (SCB). During the 1997-1998 ENSO for example, statewide landings of market squid decreased from over 70,000 tons (63,504 metric tons (t)) in 1997 to 2,709 tons (2,458 t) in 1998 (CDFG 1999; Yaremko, pers. comm.). Although some white seabass prey are reduced during ENSO years, others such as sardines, increase in abundance.

The above normal water temperatures that result from ENSO events affect the migration patterns of white seabass and often increase the availability of these fish to California fishermen. During non-ENSO years, white seabass landings center around Los Angeles and San Diego, with few fish landed north of Point Conception. However, during ENSO events, catches north of Point Conception increase (Vojkovich and Reed 1983; Karpov et al. 1995). For example, during the warm water years of 1957-1959, white seabass were caught as far north as Alaska (Radovich 1961).

9.2 Water Quality

Water quality is important to the health of marine organisms. Some characteristics, such as dissolved oxygen and water quality, are fundamental to life in the marine environment. Contamination can also have a profound effect on water quality. Contaminants enter coastal waters in a variety of ways, including ocean outfalls, rivers, ocean dumping, oil operations, and via current transport. Pollutants such as heavy metals, hydrocarbons, and agricultural chemicals (chlorinated hydrocarbons and organo-phosphates) are of particular concern because of their toxicity to aquatic biota. These substances are not readily transported from the ecosystem, nor are they readily broken down since the physical, chemical, and biological processes affecting them are slow. Polycyclic aromatic hydrocarbons (PAHs) and polychlorinated byphenyls (PCBs) are known to suppress the immune systems of mammals and increase their susceptibility to disease (Ward 1985). PCB's and dichloro-diphenyl-trichloroethane (DDT) are known to disrupt the endocrine systems of organisms. These chemicals have a negative affect on an organism's reproduction and other processes regulated by hormones. PAHs, PCBs, and DDT bioaccumulate in marine food chains, thus, the effect of these pollutants are most damaging to apex predators including marine mammals and humans.

Juvenile white seabass are known to inhabit nearshore areas that are historically high in water contamination. According to Fitch (1958), juvenile white seabass in nearshore areas in Los Angeles County such as Belmont Shore, and areas within Santa Monica Bay, may be sensitive to some contaminants. White seabass he studied in these areas had experienced eye hemorrhaging, which often leads to blindness, and these fish frequently had external parasites attached to fins and other body parts; a sign of stress to the immune system. Although these observations imply that white seabass populations may be affected by pollution, the specific effects on white seabass have not been studied.

9.2.1 Municipal Discharge

<u>Sewage</u>

Historically, municipal wastewater (sewage) has been a significant source of contamination in southern California coastal waters and this problem is expected to worsen as a result of increases in the human population and the volume of wastewater discharged from inland and coastal development projects (Napoli, pers. comm.).

Run-off

Urban runoff and storm water contamination in the SCB is a region-wide problem. The limited data and high variability of storm water discharge volume make it difficult for researchers to describe trends in run-off pollution. Associated pollutants include heavy metals, coliform bacteria, enteric viruses, pesticides, nutrients, PAHs, PCBs, organic solvents, sediments, trash and debris (Swamikannu 1997). White seabass may be directly affected by run-off pollutants, and indirectly affected when preying on fish and invertebrate species that have accumulated toxins in their tissues.

Urban runoff containing nitrogen and phosphorus can be detrimental to biotic communities in bays and estuaries. These pollutants cause plankton blooms which can lead to oxygen depletion and the possible reduction of other phytoplankton species that are an important food source for juvenile fish and invertebrates. Planktonic blooms can also harm the marine grasses and algae that serve as shelter for juvenile white seabass.

Industrial wastewater

Industrial wastewater effluent is regulated by the United States Environmental Protection Agency (EPA) through the National Pollution Discharge Elimination System (NPDES) permitting program. Non-power plant industrial dischargers have the potential to be an important source of ocean contaminants because a large percentage of their effluents can contain chemicals that are discarded as by-product of the industrial or manufacturing process (Raco-Rands 1997). In 1995, industrial facilities accounted for only 0.2% of the combined total volume of effluent generated by municipal wastewater dischargers, power generating stations, and industrial facilities discharging into the bight. Contributions of constituents from industrial facilities were usually less than 1% of the combined mass emissions from these three sources with the exception of selenium (7%), arsenic (4%), and chromium (1%) (Raco-Rands 1997).

9.2.2 Dredge and Non-dredge Material Disposal

Dredging can make formerly isolated contaminants available, several of which are known to bioaccumulate (SWRCB 1989). Three to five percent of dredged material is considered seriously contaminated. Examples of periodic dredging in marine habitats include the removal of sediments from navigation channels and the creation of new projects such as building marinas. The dredging process involves the removal or redistribution of sediments which changes the ecology of the dredged sea bottom.

Most contaminated material comes from dredging ports and harbors, or from areas where municipal and industrial discharges have polluted estuaries and coastal waters. Contaminant-laden sediments on the sea bottom may be resuspended, transported, and redeposited in areas far from the original source. Under certain conditions, contaminants may "break free" from sediments (a process known as desorption) and be released into the water, making the bottom sediments not only a sink, but also a source of contaminants. Desorption is becoming less of a problem, however, because potential sources are ‘capped’ or covered over with non-contaminated sediments. Pollutants commonly found in dredge material include metals, chlorinated hydrocarbons, PCBs, DDT, PAHs, and other petroleum products (USHCMMF 1993).

White seabass are known to inhabit both Los Angeles Harbor and San Diego Bay (Emmett et al. 1991). Chemical analysis of outer Los Angeles Harbor sediments has shown elevated levels of mercury, DDE (the degradation product of DDT), and tributyl tin (TBT) in surface and near surface sediments (LAHD 1992). TBT is an active ingredient used in antifouling marine paints. Sediment toxicity was found to occur throughout much of San Diego Bay, and it was found to be quite severe in isolated areas near a naval station and in several of the marinas and boat harbors (NOAA 2000). It may be assumed that the effects of contamination from dredged sediments on white seabass would be similar to the effects related to municipal discharge and runoff.

Kelp and eelgrass beds are important white seabass habitat and could be significantly impacted by turbidity plumes created by dredging activity. Dredging and disposal of dredge spoils contribute to elevated levels of turbidity. Turbidity from dredging activities lowers light levels in the water column and leads to a decrease in primary production. Light, temperature, salinity, tidal range, and water motion influence the growth and productivity of eelgrass beds which are important for larval seabass. Light most often appears to be the controlling factor. Processes that increase the overall turbidity of the estuarine environment could have marked effects on eelgrass density and distribution. Suspended sediment can interfere with photosynthesis by lowering light levels and also can interfere with kelp recruitment (LAHD 1992). Recent dredging projects that could potentially affect white seabass habitat include the 147 acre fill at Pier J in Long Beach Harbor, and the Pier 400 landfill project in Los Angeles Harbor.

The Marine Protection Research and Sanctuaries Act of 1972 (MPRSA) is the principle statute regulating ocean disposal of dredged material.

9.2.3 Coastal Shipyards and Industrial Pollutants

Shipyards

Marine repair yard services typically include the repair and maintenance of mechanical systems, structural components, upholstery, electrical systems, and finished surfaces. Typical wastes generated from these operations include oils, coolants, lubricants, and cleaning agents; various chemicals, paints, and coatings; and dust from sanding, sand blasting, polishing and refinishing operations (EPA 1991). Wastes generated from these services that make their way into the marine environment could have a detrimental effect.

Tributyl tin (TBT) and copper are metal-based active ingredients used as pesticides in antifouling marine paints. These substances are harmful to non-targeted marine life including fouling organisms (e.g., tunicates, bivalves, and algae). Metals can enter the water column and bottom sediments through sloughing of paint while vessels are in use and through the discharge of anti-fouling paint chips and paint removal materials during vessel maintenance activities. Studies have shown that low levels of TBT cause adverse reproductive effects on shellfish. Concerns about TBT's potency resulted in a 1989 federal law banning TBT from all non-aluminum vessels less than 25 m (82 ft) in length.

Elevated levels of pollutants exist in the bay bottom sediment adjacent to several shipyards in San Diego Bay (SWRCB 2000). A study conducted at the naval shipyard in San Diego Bay found in water hull cleaning to be a minor source of copper contamination. However, the leaching of copper from the hulls of naval vessels and recreational vessels was found to be the major source of copper contamination in the bay (Valkirs 1994). Contamination from shipyards could impact white seabass and their prey. However, pollution from shipyard contaminants is expected to decrease in the future due to increased restrictions in California on the criteria governing the allowable levels of these pollutants.

<u>Oil and gas production</u>
Currently, there are twenty-six production platforms, one processing platform, and six artificial oil and gas production islands located in California offshore waters. Four of the platforms are located within State waters and are offshore of Santa Barbara and Orange counties. The principal wastes from oil production are produced water (PW) and drilling muds (DM). Pollutants found in PW are oil and grease, metals, ammonia, phenols, cyanides, naphthalenes, and BTEX (benzene, toluene, ethylbenzene, and xylene) (MMS 2000).

In addition, the possibility of oil spills associated with commercial oil production is a potential threat to white seabass and the nearshore environment in which they live. The largest oil spill in the Pacific Outer Continental Shelf (OCS) Region occurred in 1969, when a blowout occurred on Platform A off Santa Barbara and spilled an estimated 80,000 barrels into the channel (Van Horn et al. 1988). No spill of this magnitude has since occurred anywhere on the U.S. OCS. Since then, a number of preventive measures have been implemented (MMS 2000).

Research has demonstrated that hydrocarbons and other constituents of petroleum spills can, in sufficient concentrations, cause adverse impacts to fish (NRC 1985, GESAMP 1993). The effects can range from mortality to sublethal effects that inhibit growth, longevity, and reproduction. Benthic macrofaunal and intertidal communities, which provide food and habitat to fish, can be severely impacted. Fish can accumulate hydrocarbons from contaminated food and studies have demonstrated food web magnification in fish. Fish have the capability to metabolize hydrocarbons and can excrete both metabolites and parent hydrocarbons from the gills and the liver. Nevertheless, oil effects in fish can occur in many ways: histological damage, physiological and metabolic perturbations, and altered reproductive potential (NRC 1985).

The egg, early embryonic, and larval-to-juvenile stages of fish appear to be the most sensitive to oil for several reasons (Malins and Hodgins, 1981). Embryos and larvae lack the organs found in adults that can detoxify hydrocarbons, and most are not mobile enough to avoid or escape spilled oil. In addition, the egg and larval stages of many species, including white sea bass, are concentrated at surface waters where they are more likely to be exposed to the most toxic components of an oil slick (MMS 2000) and the dispersant chemicals used during oil spill clean-up operations (Napoli, pers. comm).

9.2.4 Fuel Use

According to the Environmental Protection Agency (EPA), spills that occur during boat fueling are a major contributor to the pollution of our waterways. Fuel is easily spilled into surface waters from the fuel tank air vent while fueling a boat and oil is easily discharged during bilge pumping (EPA 2001). Small oil spills released from motors and refueling activities contain petroleum hydrocarbons which attach to waterborne sediments and can persist in the aquatic environment. Fish and shellfish larvae are extremely sensitive to even small amounts of petroleum products. For example, one gallon of used motor oil dumped in one million gallons of water is enough to kill half of all Dungeness crab larvae (OSPR 2000). Emissions produced by two-cycle marine engines contain substances that have a negative impact on fish at all life stages (Balk 1994). Private and commercial fishing vessels engaged in the take of white seabass, in addition to other marine vessels operating in white seabass habitat, may have a cumulative impact on white seabass populations due to the combined effects of fuel spilled into the water column.

9.3 Air Quality

California's concern about air quality is second only to the concern over water quality. The State has adopted air quality standards that are as stringent as federal standards (Aspen Environmental Group 1992). The impacts to air quality are of greater concern in highly urbanized areas due to the existence of long term land-based impacts. Air quality is affected by local climatic and meteorological conditions. Therefore, in the Los Angeles basin where there are persistent temperature inversions, predominant onshore winds, long periods of sunlight, and topography that traps wind currents, the effects of pollutants are more severe than along the coast of central California where one or more of these components is missing.

Air quality is determined by measuring ambient concentrations of pollutants that are known to have deleterious effects. The degree of air quality degradation is then compared to health-based standards such as the California Ambient Air Quality Standards (CAAQS) and the National Ambient Air Quality Standards (NAAQS).

Air quality can be affected by emissions from gas and diesel engines in commercial and sport fishing vessels engaged in the take of white seabass. The calculation of emissions from CPFV's (commercial passenger fishing vessels) and commercial fishing vessels can be determined using the following emission factors for diesel fuel and gasoline:

Diesel

Carbon Monoxide (CO) = 110 lb/1000 gal fuel
Hydrocarbons (HC) = 50 lb/1000 gal fuel
Nitrogen Oxides (NO_x) = 270 lb/1000 gal fuel
Sulfur Oxides (SO_x) = 27 lb/1000 gal fuel

Gasoline

Carbon Monoxide (CO) = 1,822 lb/1000 gal fuel
Hydrocarbons (HC) = 11 lb/1000 gal fuel
Nitrogen Oxides (NO_x) = 96 lb/1000 gal fuel
Sulfur Oxides (SO_x) = 6 lb/1000 gal fuel

Table 9-1. South Coast vessel emissions (tons per day) (from Pera 1999)

Pollutant	CPFV's	All fishing vessels	All marine vessels
CO	0	0.9	4.8
HC	0.1	0.3	3.3
NOx	0.6	6.3	44.2
SOx	0.1	1.1	26.7
PM	0	0.1	3.2

Pollution emissions released when vessels are underway are influence by a variety of factors including power source, engine size, fuel use, operating speed, and load. Emission factors can only provide a rough approximation of daily emission rates. Most commercial vessels and CPFV's engaged in the take of white seabass have diesel engines. Currently, two-cycle diesel engines are most common, but four cycle engines, which are more efficient, are becoming more popular for CPFV use (Fadley, pers.comm.). Overall, fishing operations are responsible for less than 1% of the daily emissions from all sources (mobile and nonmobile) in California (CARB 1989; 1991; 1994), and do not have a significant effect on air quality in the nearshore environment.

9.4 Importance of Habitat Loss, Degradation, and Modification

White seabass have differing habitat needs throughout their lives. The most critical white seabass habitats influenced by human activities include nearshore waters, bays, and estuaries. Many changes have occurred in each of these habitats over the last century which could limit the survival of white seabass. In addition to the habitat degradation caused by sources of pollution described above, 90% of California's estuaries have been lost to coastal development projects.

9.4.1 Coastal Development and Land Use

Growth along the Southern California coast from Santa Barbara to San Diego has been rapid. This region of the State accounts for more than 13% of the nation's coastal population (USDC 1999). Not surprisingly, southern California's high coastal population and growth rate has affected nearshore ecosystems.

Since the 1850s, 90% of the California's coastal wetland acreage has been destroyed, and the remaining 10% is continuously exposed to increasing sedimentation from eroding watersheds, raw sewage spills, and urban run-off pollutants. Because of soaring coastal land prices, wetlands are also subjected to the threat of being filled in. Water quality in some of these areas is very poor and high levels of toxins are present (Marcus 1989). Efforts are being made to change many of these potentially harmful situations by improving wastewater discharge requirements, erosion control, pollution control, and by the purchase of wetland areas for preservation. Juvenile white seabass are found in coastal wetland habitats, so recruitment could be affected by loss and degredation of this habitat.

An important characteristic of two large coastal wetlands in southern California, Mission Bay and San Diego Bay, is the presence of large eelgrass beds. (Marcus 1989). Eelgrass beds are a productive refuge for juvenile fish including white seabass. Eelgrass is an important and often critical component of the nearshore ecosystem. Eelgrass is commonly found in relatively calm estuarine environments and is vulnerable to coastal urbanization that heavily targets these same environments. White seabass are known to inhabit the Mission Bay and San Diego Bay wetlands during their second year of their life, and probably during other life stages as well (Crooke 1989b). Degradation of these eelgrass beds could have a negative effect on the survival of young white seabass. Mitigation of this potential loss by the planting of larger eelgrass beds, has been taking place for more than 15 years and continues to this day.

Another possible threat to white seabass habitat is the introduction of non-native species, which can potentially out compete native species and alter ecosystems that support white seabass. Recently, a green alga native to tropical waters, *Caulerpa taxifolia,* was discovered in a San Diego county lagoon. *C. taxifolia* poses a substantial threat to southern California coastal ecosystems, particularly to eelgrass beds and other benthic environments (Woodfield 2000).

Very small white seabass are often found with drifting kelp and debris near the surf line along sandy beaches (Allen and Franklin 1988). The construction of breakwaters and jetties along the coast have altered this habitat by affecting erosion and sedimentation processes. For example, approximately 77% of the coastline between Carpinteria and Ventura contains engineered structures (Sherman 1997). The effects of this habitat alteration on white seabass are unknown.

9.4.2 Gear Use In the Marine Environment

Gear used in the commercial and sport fisheries of California can impact the nearshore environment inhabited by white seabass. Fishing gear was found to be the most common type of benthic anthropogenic debris in the central region (Point Dume to Dana Point) of the SCB (Moore 2000). Gill nets used by commercial fishermen can be lost and this gear will continue to capture fish, mammals, and invertebrates which become entangled and die. In addition, species that are not targeted during active fishing, can incur physical trauma from contact with nets and this trauma can increase susceptibility to disease. Finally, fishing debris such as lost hooks may be attractive to fish or other animals and cause injury if ingested, and the animals can become entangled in the monofilament line attached to the hooks.

9.4.3 Noise Effects in the Marine Environment

The response of animals to acoustic stimuli will depend upon the species and the characteristics of the stimuli (i.e., amplitude, frequency, pulsed or non-pulsed); season; ambient noise; physiological or reproductive state of the animal; and other factors. The possible adverse effects from loud sounds include discomfort, potential masking of other sounds, and behavioral responses resulting in avoidance of the noise source (MMS 1987).

Very little data on the effects of sound on fish, larvae, and eggs have been collected. There are some data showing that sound can cause some damage to sensory cells of the ears of fishes, but not of the lateral line or cristae of the semicircular canals (vestibular receptor) (Hastings et al. 1996). Some behavioral studies of fish suggest that anthropogenic sounds could affect a fish’s ability to detect biologically meaningful environmental sounds (Gisiner 1998). This may have significance for white seabass because sciaenids are known to produce sounds which may be used to communicate with one another (Moyle 1996). Thus, potential sources of anthropogenic noise affecting white seabass are commercial shipping activities, military operations, fishing and recreational vessels, and machinery associated with dredging and other forms of coastal construction. Currently, no data exist on the effects of human generated noise on white seabass.

Literature Cited

Allen L.G. White Seabass: 2000. The King Croaker. www.csun.edu/~nmfrp/wonanob1.htm

Allen, L.G. and M.P. Franklin. 1988. Distribution and abundance of young-of-the-year white seabass, *Atractoscion nobilis*, in the vicinity of Long Beach Harbor, California in 1984-1987. Calif. Fish Game 74(4)245-248.

Allen, L.G. and M.P. Franklin. 1992. Abundance, distribution, and settlement of young-of-the-year white seabass *Atractoscion nobilis* in the Southern California Bight, 1988-89. Fishery Bulletin, U.S. 90:633-641

Allen, L.G., D.J. Pondella, R. Ford, and M. Shane. 2001. Nearshore gill net sampling program for white seabass (age I-IV). Field Sampling Annual Report for 2000-2001.

Ally, J.R.R., D.S. Ono, R.B Read, and M. Wallace. 1991. Status of major southern California marine sport fish species with management recommendations, based on analyses of catch and size composition data collected on board commercial passenger fishing vessels from 1985 through 1987. Calif. Dept. Fish Game, Mar. Res. Div. Admin. Rep., No. 90-2.

Arntz, W.E. 1985 El Niño and Peru: positive aspects. Oceanus 27(2) :36-40.

Balk, L., G. Ericson, E. Lindesjoo, I. Petterson, U. Tjarnlund, and G. Akerman. 1994. Effects of exhaust from two-stroke outboard engines on fish. TemaNord. 528.

Barber, R.T., and F.P. Chavez. 1983. Biological consequences of El Niño. Science 222. p.1203-1210.

Bargmann, G., D. Hanan, S.F.Herrick, K.Hill, L.Jacobson, J.Morgan, R.Parrish, J.Spratt and J.Walker. 1998. Amendment 8 to the Northern Anchovy Fishery Management Plan incorporating a name change to: The Coastal Pelagic Species Fishery Management Plan. December 1998, D-9 pp.

Barlow, J., R. W. Baird, J. E. Heyning, K. Wynne, A. M. Manville II, L. F. Lowry, D. Hanan, J. Sease, and V. N. Burkanov. 1994. A review of cetacean and pinniped mortality in coastal fisheries along the west coast of the USA and Canada and the east coast of the Russian Federation. Rept. Int. Whaling Comm., Special Issue 15:405-425.

Bartley, D.M. and D.B. Kent. 1990. Genetic structure of white seabass populations from the southern California bight region: applications to hatchery enhancement. Calif. Coop. Oceanic Fish. Invest. Rep. 31: 97-105.

Barsky, K.C. 1998. Southern California Fisheries Monitoring Summary for 1995 and 1996. Calif. Dept. of Fish and Game, Mar. Reg. Admin. Rpt. 98-2. 30 pp.

Beeson, M. J. and D. A. Hanan. 1994. Effort estimates of California gill net fisheries: halibut-angel shark set net, shark-swordfish drift net, and white seabass-yellowtail set and drift net for the 1993 calendar year (January 1st, 1992 - December 31st, 1993). Final rep. coop. agreement no. NA37FX0265 submitted to NOAA/NMFS SWR, June 1994. 11 pp.

Beeson, M. J. and D. A. Hanan. 1996. An evaluation of pinniped-fishery interactions in California. Report to the Pacific States Fisheries Commission, 46 p. (Available from Pacific States Marine Fisheries Commission, 45 SE 82nd, Gladstone, OR 97027).

Brown, R. F. and S. J. Jeffries. 1993. Preliminary report on estimated marine mammal mortality in Columbia River fall and winter salmon gillnet fisheries, 1991-1992. Columbia River Area Marine Mammal Observer Program, 53 Portway St., Astoria, OR. 13 pp.

Bureau of Economic Analysis. 2000. Regional accounts data. www.bea.doc.gov/bea/regional/data.htm. U.S. Dept. of Commerce. (01/01).

Bureau of Labor Statistics. 2000. CPI Inflation Calculator. http://stats.bls.gov/cpihome.htm

Bureau of Labor Statistics. 2000. Data. www.bls.gov/datahome.htm (2/01).

Bureau of Marine Fisheries. 1949. Commercial Fish Catches of California for the year 1947 With an Historical Review 1916-1947. Department of Natural Resources. Div. of Fish and Game. Calif. Fish Bull. 74:126-128.

Caddy, J.F. 1999. Fisheries management in the twenty-first century: will new paradigms apply? Rev. Fish. Biol. Fish. 9:1-43.

California Air Resources Board. CARB. 1991a. Inventory of air pollutant emissions from marine vessels. Prepared by California Air Resources Board Mobile Source Division. Technical assistance by Booz, Allen, and Hamilton, Inc. 47 pp.

California Air Resources Board. 1991b. Methods for assessing air source emissions in California 1989. Sacramento, California. 100 pp.

California Air Resources Board. 1994. Emission inventory and -1991. Prepared by Technical Support Division. Air Resources Board. California Environmental Protection Agency. Sacramento, California. 36 pp. + appendices.

California Department of Fish and Game. 1998. Informational Bulletin-Marine Region 8-14-98. 2 pp.

California Department of Fish and Game. 1990. Alternative gear development program, final report. 149 pp.

California Department of Fish and Game 1991. Final program environmental document, ocean sportfishing regulations. 222 pp.

California Department of Fish and Game. 1991. Draft supplement environmental document: ocean sportfishing, white seabass. 75 pp.

California Department of Fish and Game. 1994. Comprehensive hatchery plan (CHP) for the enhancement of white seabass (*Atractoscion nobilis*): Including Techniques for Culturing , Transporting, Tagging, Releasing, and Bioeconomic Modeling. 38pp. + appendices.

California Department of Fish and Game. 1994. Giant and bull kelp commercial and sport fishing regulations: draft environmental document.

California Department of Fish and Game. 1999. Review of some California fisheries for 1998: pacific sardine, pacific mackerel, pacific herring, market squid, sea urchin, groundfishes, swordfish, sharks, nearshore finfishes, abalone, dungeness crab, prawn, ocean salmon, white seabass and recreational. Calif. Coop Oceanic Fish. Invest. Rep. 40:9-28.

California Department of Fish and Game 1999. Recovered hatchery-produced legal-size white seabass. The Reef Report. Vol.4 No.12. 4 pp.

California Department of Fish and Game 2000. Giant and bull kelp commercial and sport fishing regulations, draft final environmental document.

California Department of Fish and Game. Office of Spill Prevention and Response (OSPR). 2000. Oil spills. www.dfg.ca.gov/Ospr/spills.html (11/00).

California Department of Fish Game. 2001. Past and Ongoing Essential Fishery Information (EFI): Collection and Future Needs prepared by C. Dawson. *In* Draft Master Plan: A Guide for the Development of Fisheries Management Plans. pp. 5-1 - 5-2.

California Department of Finance. 2000. California demographics. www.dof.ca.gov/html/demograp/druhpar.htm. (01/01).

California Employment Development Department. 2000. Occupational and employment wage data. Labor market information. www.calmis.cahwhet.gov (01/01).

California Technology Trade and Commerce Agency. 2000. Labor force and occupations. www.commerce.ca.gov/california/economy/es202. (02/01).

California Water Quality Control Board, Region 9. 2000 Sediment investigation and cleanup at shipyards. www.swrcb.ca.gov/rwqcbp/Programs/Shipyards.html (12/12/00).

Chen, M.F., D. Henry-Ford, and J.M. Groff. 1995. Isolation and Characterization of *Flexibacter maritimus* from Marine Fishes of California. Journal of Aquatic Animal Health. Vol. 7:318-326.

City of Los Angeles. 2000. Demographics. www.lacity.org/COUNCIL/cd9/demogra.htm (2/01).Claritas Inc. 1996. Complimentary marketview comparison report for the San Pedro Chamber of Commerce. 11pp.

Clark, F.N. 1930. Size at first maturity of the white seabass (*Cynoscion nobilis*). Calif. Fish Game 16(4):319-323.

Clark, W.A. 1991. Groundfish exploitation rates based on life history parameters. Can. J. Fish. Aquat. Sci. 48:734-750.

Collins, R.A. 1981. Pacific coast croaker resources. Pp. 41-49. *In:* Marine Recreational Fisheries---6 (Henry Clepper, ed.) Sport Fishing Institute, Washington, D.C.

Collyer, R.D. 1949. Marine sportfishing. *In*: The commercial fish catch of California for the year 1947 with an historical review 1916-1947. Calif. Dept. Fish Game Fish Bull. 74:180-183.

Committee Staff on Merchant Marine and Fisheries, US House of Representatives (USHCMMF). 1993. The effects of ocean disposal of contaminated materials on our marine environment and potential alternatives to ocean disposal of contaminated material. United States House of Representatives. Washington D.C. p.50-59.

County of Santa Barbara (CSB). 2001. Census data. www.co.santa-barbara.ca.us/cao/specialprojects/redistricting/censusdata.htm. (5/01).

Croker, R.S. 1937. White Seabass. *In*: The commercial fish catch of California for the year 1935. Calif. Dept. Fish Game Fish Bull. 49:1-73 pp.

Crooke, S.J. 1989a. The ocean enhancement and hatchery program 1988. Calif. Dept. Fish Game, Rpt. to the Legislature. 25 pp.

Crooke, S.J. 1989b. The ocean enhancement and hatchery program 1989. Calif. Dept. Fish Game, Rpt. to the Legislature. 22 pp.

Crooke, S.J. 1990. The ocean enhancement and hatchery program 1990. Calif. Dept. Fish Game, Rpt. to the Legislature. 6 pp.

Dayton, P.K., and M.J. Tegner. 1984. Catastrophic storms, El Niño and patch stability in a southern California kelp community. Science 224:283-285.

Dayton, P.K. and A.D. MacCall. 1992. Pre-exploitation Abundances of Important Large Recreational and Commercial Fishes off Southern California. University of California, San Diego. R/F-125. *In* California Sea Grant biennial report of Completed projects 1988-90. Calif. Sea Grant, Publication R-CSGCP-033. Pp 91-96.

Donohoe, C.J. 1997. Age, growth, distribution, and food habits of recently settled white seabass, *Atractoscion nobilis*, off San Diego County, California. Fish. Bull. 95(4): 709-721.

Eldridge, M.B. 1977. Factors influencing distribution of fish eggs and larvae over eight 24-hr samplings in Richardson Bay, CA. Calif. Fish Game 63(2):101-116.

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries, Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 pp.

Environmental Protection Agency. 1991. Guides to pollution prevention: the marine maintenance and repair industry. EPA/625/7-91/015. pp.5-19.

Environmental Protection Agency. 2001. Draft: national management measures to control nonpoint source pollution from marinas and recreational boating. www.epa.gov/owow/nps/mmsp/index.html (12/11/00).

Feder, H.M., C.H. Turner, C. Limbaugh. 1974. Observations on fishes associated with kelp beds in southern California. Calif. Dept. Fish Game, Fish Bull. 160:1-144

Fiedler, P.C., 1984. Some effects of El Niño 1983 on the northern anchovy. Calif. Coop. Oceanic Fish Invest. Rp, 25:53-58.

Fitch, J.E. 1958. Offshore fishes of California. Calif. Dept. Fish and Game.

Fitch, J.E., R.J. Lavenberg. 1971. Marine food and game fishes of California. Univer. of Calif. Press.

Forney, K.A., J. Barlow, M.M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, J.V. Carreta. 2000. Draft U.S. Pacific Marine Mammal Stock

Assesments:2000. NOAA technical memorandum NOAA-TM-NMFS-SWFSC-XXX. 302 pp.

Franklin, M.P. 1997. An investigation into the population structure of white seabass (*Atractoscion nobilis*), in California and Mexican waters using microsatellite DNA analysis. Phd Dissertation. University of California Santa Barbara. 109 pp.

GESAMP (Group of Experts on the Scientific Aspects of Marine Pollution). 1993. Impact of oil and related chemicals on the marine environment. Reports and Studies No. 50. International Maritime Organization, London, 180+ix pp.

Ghanzanshahi, J., T. D. Huchel, and J.S. Devinny. 1983. Alteration of southern California rocky shore ecosystems by public recreational use. Journal of Environmental Management. 16:379-394

Gisiner, R. 1998. Workshop on the effects of anthropogenic noise in the marine environment. Marine Mammal Science Project. Office of Naval Research. 140pp.

Goodyear, C.P. 1993. Spawning stock biomass per recruit in fisheries management: foundation and current use. *In* S.J. Smith, J.J. Hunt, and D. Rivard [eds.]. Risk evaluation and biological reference points for fisheries management. Can. Spec. Publ. Fish. Aquat. Sci. 120:67-81.

Hanan, D. A., D. B. Holts, and A. L. Coan, Jr. 1993. The California drift gill net fishery for sharks and swordfish, 1981-82 through 1990-91. Calif. Dept. Fish Game, Fish. Bull. 175:1- 95.

Hanan, D. A., L. M. Jones, and R. B. Read. 1989. California sea lion interaction and depredation rates with the commercial passenger fishing vessel fleet near San Diego. Calif. Coop. Oceanic Fish. Invest. Rep. 30:122-126.

Hartmann, A.R. 1980. Southern California partyboat angler survey. Calif. Dept. Fish Game, Mar. Res. Admin. Rep. (80-7), 33 pp.

Herbinson, K.T. 1981. 316(b) Fish impingement inventory. Res. Develop. Ser. Southern Californnia Edison, Rosemead, CA. 178pp.

High, W.L. 1984. Some consequences of lost fishing gear. *In* Proceedings of the workshop on the fate and impact of marine debris 27-29 November 1984, Honolulu Hawaii. Shomura and Yoshida (eds.). US Dept. of Commerce. p. 430-437.

Hill, P.S. 1999. Gray whale entanglements in California, Oregon/Washington, and Alaska, 1990-98. Unpubl. doc. submitted to the Workshop to Review the Status of the Eastern North Pacific Stock of Gray Whales, 16-17 March 1999, Seattle, WA.

Hill, K.T. , and N. Schneider. 1999. Historical logbook databases from California's Commercial Passenger Fishing Vessel (Partyboat) Fishery, 1936-1997. SIO Reference Series No. 99-19. University of California, San Diego. 13 pgs + tables.

Hubbs Seaworld Research Institute. 2000. Fisheries and Aquaculture Research Programs. Publications. http://www.hswri.org/orehpublications.htm (26 Feb. 2001).

Karpov, K.A., D.P. Albin, W.H. Van Buskirk. 1995. The marine recreational fishery in northern and central California, a historical comparison (1958-86), status of stocks (1980-86), and effects of changes in the California current. Calif. Dept. Fish Game, Fish Bull. 176:1-192.

Karpov, K.A., P.L. Haaker, I.K. Taniguchi and L. Rogers-Bennett. 2000. Serial depletion and the collapse of the California abalone (Haliotis spp.) fishery. *In* Workshop on Rebuilding Abalone Stocks in British Columbia. A. Campbell, ed. Cn. Spec. Publ. Fish. Aquat. Sci. 130.

Kent, D.B. and R.F. Ford. 1990. Determination of the natural mortality rate for juvenile white seabass (*Atractoscion nobilis*) and California halibut (*Paralichthys californicus*). Ann. Prog. Rpt. to ORHEP. 18 pp.

Leeworthy, V. and P. Wiley. 2000. A socioeconomic overview of the Santa Barbara and Ventura counties as it relates to marine related industries and activities. Channel island marine sanctuary revised management plan. NOAA. p.1-60. www.cinms.nos.noaa.gov/pdf/SocEconOV.pdf (02/05/01).

Los Angeles Harbor Dept., and US Army Corps of Engineers. 1992. Final environmental impact statement: environmental impact report, deep draft navigation improvements, Los Angeles and Long Beach harbors, San Pedro Bay, California.

Love, M.S. and M. Moser. 1983. A Checklist of Parasites of California, Oregon, and Washington Marine and Estuarine Fishes. NOAA Technical Report NMFS SSRF-777. US Department of Commerce. National Oceanic and Atmospheric Administration. National Marine Fisheries Service. p. 207-208

Lukacovic, R. 1999. 1999 Striped bass circle hook study. http://www.dnr.state.md.us/ fisheries/fishingreport/crsb.html

MacCall A.D., G.D.Stauffer, and J.P.Troadec. 1976. Southern California recreational and commercial marine fisheries. Mar. Fish. Rev. 38(1):1-32.

Malins, D.C., and H.O. Hodgins. 1981. Petroleum and marine fishes: A review of uptake, disposition, and effects. Environmental Science and Technology, 15(11):1272-1280.

Marcus, L. 1989. *In* The coastal wetlands of San Diego County State Coastal Conservancy, Sacramento, Ca. 65 pp.

Maxwell, W.D. 1977a. Age composition of California barracuda, *Sphyraena argentea*; Pacific bonito, *Sarda chiliensis*; white seabass, *Cynoscion nobilis*; and yellowtail, *Seriola dorsalis* from southern California partyboats 1972-74. Calif. Dept. Fish Game, Mar. Res. Admin. Rpt. (77-3). 23 pp.

Maxwell, W.D. 1977b. Progress Report of Research on white seabass, *Cynoscion nobilis*, Calif. Dept. Fish Game, Mar. Res. Admin. Rpt. (77-14), 13pp.

Maxwell, W.D. 1975. The croakers of California. Calif. Dept. Fish Game, Mar. Res. 16 pp.

MBC Applied Environmental Sciences. 2001. National Pollutant Discharge Elimination System 2000 Receiving Water Monitoring Report. AES Huntington Beach L.L.C. Generating Station Orange County, California. 2000 Survey. 52pp.

McGinnis, M.V. 1990. The multiple uses of the coastal zone and ocean offshore California. Calif. Sea Grant College, Working Paper No. P-T-51. 23 pp.

McKee-Lewis, Kimberly K., and Robert B. Read. 1997. Southern California fisheries monitoring summary for 1993 and 1994. Calif. Dept. Fish Game, Mar. Res. Div. Adm. Rep. (97-4). 24 pp.

McWilliams, B. and G. Goldman. 1994. Commercial and recreational fishing in California - their impact on the state economy. University of California. p. 1-26.

Minerals Management Service. 1987. Northern California proposed oil and gas lease sale 91: draft environmental impact statement. Vol 1. P. IV40-IV46.

Minerals Management Service. 2000. Draft OCS environmental assessment: extended-reach exploratory drilling project cavern point unit, leases OCS-P 0210 and OCS-PO527 Venoco Inc. and Poseiden Petroleum LLC. 62pp. www.mms.gov/omm/pacific/lease/cpufullea.pdf (12/00).

Moore, S.L., and M.J. Allen. 2000. Distribution of anthropogenic and natural debris on the mainland shelf of the southern California bight. Southern California Coastal Water Research Project. p.1-6.

Moser H.G., D.A. Ambrose, M.S. Busby, J.L. Butler, E.M. Sandknop, B.Y. Sumida, and

E.G. Stevens. 1983. Description of early stages of white seabass, *Atractoscion nobilis*, with notes on distribution. Calif. Coop. Oceanic Fish. Invest. Rep. 24: 182-193.

Moyle, P.B., and J.J. Cech. 1996. Fishes: an introduction to ichthyology. University of California , Davis. Prentice Hall, New Jersey. p.174.

Murray, S.N. 1998. Effectiveness of marine life refuges on southern California shores. *In* California and the world ocean '97. Taking a look at California's ocean resources: an agenda for the future, O.T. Magoon, H. Converse, B. Baird and M. Miller-Hensen, eds. Reston: American Society of Civil Engineers, p.1453-1465.

National Geographic Society. 1987. Field guide to the birds of north America. Scott, Shirley, ed. 464 pp.

National Marine Fisheries Service 2000b. Biological opinion on issuance of permit under Section 101 (a) (5) (E) of the Marine Mammal Protection Act (MMPA) to the California/Oregon drift gilllnet fishery for the taking of listed species under the Endangered Species Act (ESA) and the continued implementation of the Pacific Offshore Cetacean Take Reduction Plan (plan). Endangered Species Division, Office of Protected Resources, NMFS. 127 pp.

National Marine Fisheries Service and United States Fish and Wildlife Service. 1998a. Recovery plan for the U.S. Pacific populations of the east pacific green turtle (*Chelonia mydas*). p.40.

National Marine Fisheries Service and United States Fish and Wildlife Service. 1998b. Recovery plan for the U.S. Pacific populations of the leatherback turtle (*Demochelys coriacea)*. p.55.

National Marine Fisheries Service and United States Fish and Wildlife Service. 1998c. Recovery plan for the U.S. Pacific populations of the loggerhead turtle (*Caretta caretta*). p.49.

National Marine Fisheries Service and United States Fish and Wildlife Service. 1998d. Recovery plan for the U.S. Pacific populations of the olive ridley turtle (*Lepidochelys olicacea*). p43.

National Oceanic and Atmospheric Administration (NOAA). 1998. Marine debris. Technical Memorandum NMFS F/AKR-9. Editors: Alan R. Bunn and James M. Coe. U.S. Department of Commerce, National Marine Fisheries Service.

National Oceanic and Atmospheric Organization (NOAA). (1999). Sediment toxicity. *In* NOAA's state of the coast report. www.state-of-coast.noaa.gov/bulletins/html/sed (12/00).

National Research Council (NRC). 1985. Oil in the sea: inputs, fates, and effects. National Academy Press, Washington, DC. 601+xviii pp.

North, W.J., D.E. James, and L.G. Jones. 1993. History of kelp beds *(Macrocysti*s) in Orange and San Diego Counties, California. Proc. Fourteenth Int. Seaweed Sym. 14:277-283.

Norton, J., D. McLain, R. Brainard, and D. Husby. 1985. The 1982-83 El Niño event of Baja and Alta California and its ocean climate context. *In* El Niño North: Niño effects in the eastern subarctic pacific ocean. W.S. Wooster and D.L. Fluharty, (eds). p.44-72.

Pacific Fishery Management Council. 1998. The coastal pelagic species fishery management plan draft amendment eight. p.A78-A90.

Pacific Fisheries Management Council. 2000. DRAFT Research and data needs 2000 - 2002. Fisheries Research and Data. http://www.pcouncil.org (22 Feb. 2001).

Pacific States Marine Fisheries Commission. 2000. EFIN. Employment and wage data. www.psmfc.org/efin/dataser_desc.html#WAGE-CA (2001).

PADI. 2001. PADI Diver Statistics. Facts for commonly asked questions. Http://www.padi.com/news/stats/default.stm (29 Jan. 2001).

Pera, C.J. 1996. Marine vessel emissions inventory and control strategies. South Coast Air Quality Management District. Acurex Environmental final report FR-119-96. Sections 10-13.

Pera, C.J. 1999. Analysis of marine emissions in the South Coast air basin. US Environmental Protection Agency. Arcadis final report FR-99-100.

Pinkas, L., J.C. Thomas, and J.A. Hanson. 1963. Marine sport fish survey of southern California piers and jetties, 1963. Calif. Dept. Fish Game 53(2):88-104.

Pinkas, L., M.S. Oliphant and C.W. Haugen. 1968. Southern California sport fishing survey: private boats, 1964; shoreline, 1965-1966. Calif. Dept. Fish Game, Fish Bull. 143:1- 42.

Raco-Rands, V. 1997. Characteristics of effluents from nonpower industrial facilities in 1995. Southern California Coastal Water Research Project. 16pp. www.sccwrp.org/annrpt/97/ (11/00).

Raco- Rands, V. 1998. Characteristics of effluents from large municipal wastewater treatment facilities in 1996. Southern California Coastal Water Research Project. 36pp. www.sccwrp.org/annrpt/98/ (11/00).

Rasmusson, E. M., and J. M. Wallace. 1983. Meteorological aspects of the El Niño/Southern Oscillation. Science. 222:1195-1202.

Recreational Fisheries Information Network (RecFIN). 2001. Ed. Wade Van Buskirk. Pacific States Marine Fisheries Commission. 2001. www.recfin.org

Radovich, J. 1961. Relationships of some marine organisms of the northeast Pacific to water temperatures, particularly during 1957 through 1959. Calif. Dept. Fish Game, Fish Bull. 54:1- 62.

Restrepo, V.R., G.G. Thompson, P.M. Mace. W.L. Gabriel, L.L. Low, A.D. MacCall, R.D. Methot, J.E. Powers, B.L. Taylor, P.R. Wade, and J.F. Witzig. 1998. Technical guidance on the use of precautionary approaches to implementing national standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-#. 22 pp.

Roberts, R.J. 1975. The effects of temperature on diseases and their histopathological manifestations in fish. *In* The Pathology of Fishes. Edited by W.E. Ribelin and G. Migaki. University of Wisconsin Press. Pp. 477-496.

Salt Water Sportsman.1999. Hooking mortality matters. www.saltwatersportsman.com/news/fishing/990428.6.html

Sherman, D.J. 1997. Human impacts on California's coastal sediment supply. *In* California and the world ocean '97. University of Southern California Sea Grant. p.551-559.

Skogsberg, T. 1925. White seabass. *In*: Preliminary investigations of the purse seine industry of southern California. Calif. Div. Fish Game, Fish Bull. 9:53-63.

Skogsberg, T. 1939. The fishes of the family Sciaenidae (croakers) of California. Calif. Div. Fish Game, Fish Bull. 54:1- 62.

Smith, F.G. (1975). Crustacean parasites of marine fishes. *In* The Pathology of Fishes. Edited by W.E. Ribelin and G. Migaki. University of Wisconsin Press. Pp. 189-201.

Squire, J.L., Jr. 1972. Apparent abundance of some pelagic marine fishes off the southern and central California coast as surveyed by an airborne monitoring program. U.S. Fish. Bull 70(3):1005-1019.

Squire, J.L., Jr. 1983. Warm water and southern California recreational fishing: a brief review and prospects for 1983. Mar. Fish Rev. 45(4-6):27-34.

Swamikannu, X. 1997. An integrated strategy for managing urban runoff pollution in

Los Angeles county. *In* Stormwater runoff into Santa Monica Bay: sources and impacts. California and the world ocean ‘97. San Diego, California. p.876-887.

Tegner, M.J., and P.K. Dayton. 1987. El Niño effects on southern California kelp forest communities. Advances in Ecological Research 17:243-279.

Thomas, J.C. 1968. Management of the white seabass (*Cynoscion nobilis*) in California waters. Calif. Dept. Fish Game, Fish Bull. 142:1- 34.

Thompson, C.J., and S. J. Crooke. 1991. Results of the southern California sportfish economic survey. NOAA NMFS Technical Memorandum NOAA-TM-NMFS-SWFSC-78, 70 pp.

United States. 1973. Atomic Energy Commission. Nuclear generating station, Diablo Canyon units 1 & 2, Pacific Gas and Electric Co., Docked Nos. 50-275 and 50-323, Final Environmental Statement. May 1973.

United States. 1974. Department of the Interior, Bureau of Land Management. A summary of knowledge of the Southern California Coastal Zone and offshore areas, vol.1 - physical environment. Prep. By: Southern California Ocean Studies Consortium of the California State Universities and Colleges. Contract No. 08550-CT4-1.

United States. 1990. Department of Commerce, National Ocean Survey. Coastal environmental quality in the United States, 1990-chemical contamination in sediments and tissues. October 1990. 34 pp.

United States Census Bureau. 2000. www.census.gov/ (01/01).

United States Dept. of Comm. 1986. Marine Recreational Fisheries Statistics Survey, Pacific Coast, 1985. Current Fish. Stat. No. 8328., Nat. Oceanic and Atmospheric Admin., Nat. Mar. Fish. Ser.

United States Dept. of Comm. 1999. Trends in United States coastal regions 1970-1998. www.state-of-coast.noaa.gov/natdialog/index.html (12/11/00).

United States Fish and Wildlife Service. 1995. Introduction to fish health management. B.A. Lasee, Editor. U.S. Dept. of Interior. 139 pp.

United States Fish and Wildlife Service. 1997. Recovery plan for the threatened marbled murrelet in Washington, Oregon, and California. Region 1, Portland, Oregon. 286 pp.

Valkirs, A.D. , Davidson, Kear, and Fransham. 1994. Environmental effects from in-water hull cleaning of ablative copper antifouling coating. Technical Document

2662. NCOSC. RDT&E Division.

Van Horn, W., A. Melancon, and J. Sun (eds.). 1988. Outer continental shelf oil and gas program: cumulative effects. U.S. Department of the Interior, Minerals Management Service, Herndon, VA. OCS Report MMS 88-0005.

Vojkovich, M. 1992. White seabass. *In* California's living marine resources and their utilization. Ca Sea Grant. p. 165-167.

Vojkovich, M., Miller, and D. Aseltine. 1990. A summary of 1983-1989 southern California gill net observation data with an overview on the effects of gill nets on recreational catches. Sport Fish Restoration Proj. F-50-R Final Rep. 52 pp.

Vojkovich, M., K.E. Miller, and D.A. Aseltine. 1989. Summary of nearshore gill net observation data for 1988 and 1989. Calif. Dept. Fish Game. Mar. Res. Div. 45 pp.

Vojkovich, M., K.E. Miller, and R.J. Reed. 1988. Progress report: southern California nearshore gill and trammel net study 1987. Calif. Dept. Fish Game. Mar. Res. Div. 57 pp.

Vojkovich, M., R.J. Reed, and K.A. Hieb. 1987. Progress report: southern California nearshore gill and trammel net study 1986. Calif. Dept. Fish Game. Mar. Res. Div. 54 pp.

Vojkovich, M., R.A. Collins, R.J. Reed, and K.A. Heib. 1986. Progress report: southern California nearshore gill and trammel net study 1985. Calif. Dept. Fish Game. Mar. Res. Div. 50 pp.

Vojkovich, M., R.A. Collins, and R.J. Reed. 1985. Progress report: southern California nearshore gill and trammel net study 1984. Calif. Dept. Fish Game. Mar. Res. Div. 40 pp.

Vojkovich, M., R.A. Collins, A. R. Hartmann, and R.J. Reed. 1984. Progress report: southern California nearshore gill and trammel net study 1983. Calif. Dept. Fish Game. Mar. Res. Div. 33 pp.

Vojkovich, M. and R.J. Reed. 1983. White seabass, *Atractoscion nobilis*, in California-Mexican waters: status of the fishery. Calif. Coop. Oceanic Fish. Invest. Rep. 24: 79-83.

Wallace, R.K., W. Hosking, and S.T. Szedlmayer. 1994. Fisheries Management for Fishermen: A manual for helping fishermen understand the federal management process. MASGP-94-012 Auburn University Marine Extension & Research Center. Sea Grant Extension. NOAA Award No. NA37FD0079. 56 pp.

Ward, E.C., M.J. Murray and J. H. Dean. 1985. Immunotoxicity of nonhalogenated polycyclic aromatic hydrocarbons. *in* J. Dean, M. I. Luster and A.E. Munson, editors. Immunotoxicology and Immunopharmacology. Raven Press, New York. p.291-313

Weinstein, M.P. 1981. Biology of adult sciaenids. Pp. 125- 138 in Marine Recreational Fisheries---6 (Henry Clepper, ed.) Sport Fishing Institute, Washington, D.C.

Welsh, W. W. and C.M. Breder, Jr. 1923. Contributions to the life histories of the Sciaenidae of the eastern United States coast. Bull. U.S. Bur. Fish. 39:141-201.

Whitehead, S.S. 1930a. White seabass. *In* The commercial fish catch of California for the year 1928. Bureau of Comm. Fish., Calif. Div. Fish Game, Fish Bull. 20: 48-51.

Whitehead, S.S. 1930b. Analysis of boat catches of white seabass (*Cynoscion nobilis*) at San Pedro, California. Calif. Div. Fish Game, Fish Bull. 21:1- 27.

Wine, V. 1978. Southern California independent sport fishing survey annual report No.2. Calif. Dept. Fish Game, Mar. Res. Admin. Rep. (78-2), 79 pp.

Wine. V. 1979. Southern California independent sport fishing survey annual report No.3. Calif. Dept. Fish Game, Mar. Res. Admin. Rep. (79-3), 100 pp.

Wine. V. 1980. Southern California pier fishermen: How familiar are they with the sport fishing regulations? Calif.Dept. Fish Game, Mar. Res. Admin Rep. (80-2), 6 pp.

Wine. V. 1982. Southern California marine sport fishing: private-boat catch and effort during 1981. Calif. Dept. Fish Game, Mar. Res. Admin. Rep. (82-7), 78 pp.

Woodfield, R. 2000. Noxious algae found in southern California coastal waters. www.swr.nmfs.noaa.gov/hcd/caulerpa.htm. (12/00).

Young, P.H. 1969. The California Partyboat Fishery 1947 - 1967. Calif. Dept. Fish Game, Fish Bull. 145:1- 91.

Young, P.H. 1973. The status of the white seabass resource and its management. Marine Resources Technical Report 15. Calif. Dept. Fish Game.

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Arenas, Pablo. Fisheries Biologist. Inter-American Tropical Tuna Commission. La Jolla, CA.

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Appendix A. Glossary of Terms and Abbreviations

Absolute Abundance - The total number of a kind of fish in the population. This is rarely known, but usually estimated from relative abundance, although other methods may be used.

Abundance - See **Relative Abundance** or **Absolute Abundance**

Adaptive Management - In regard to a marine fishery, means a scientific policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions are designed so that even if they fail, they will provide useful information for future actions. Monitoring and evaluation shall be emphasized so that the interaction of different elements within the system can be better understood.

Age Class - A group of individual organisms of the same age range in a population. "Year-Class" or "cohort" are terms generally synonymous with age class, but are identified by the actual year in which the cohort was produced (e.g., 1991 year-class or sardines resulted from the 1991 spawning season).

Age Composition - Identifies the proportions of a population of fishes by age or age group.

Allocation - The opportunity to fish is distributed among user groups or individuals. The share which a user group gets is sometimes based on historic harvest amounts.

Allowable Biological Catch (ABC) - A term used by a management agency which refers to the range of allowable catch for a species or species group. It is set each year by a scientific group created by the management agency. The agency then takes the ABC estimate and sets the annual Total Allowable Catch (TAC).

Assessment - A judgment made by a scientist or scientific body on the state of a resource (e.g., size, health, pollution impacts) usually for passing advice to management authority.

Availability - In a general sense, used to describe periods of poor (low availability) or good (high availability) catches, regardless of the size or health of a fish population. In a strict sense, it refers to the fraction of a population which is susceptible to fishing during a given fishing season.

Biomass - The total weight or numbers of a stock or population of fish at a given point in time. Spawning Biomass - That portion of total biomass that is mature and spawning.

Byatch - Catches of non-targeted species in a fishery that is directed primarily at another species. Also, referred to as incidental catch; the bycatch usually results from the use of commercial fishing gear (e.g., trawls, gill nets).

CalCOFI - California Cooperative Oceanic Fisheries Investigations

Catch - Refers sometimes to the total amount (numbers or weight) caught, and sometimes only to the amount landed or kept. Catches which are not landed are called discards.

Catchability - A value that modifies a unit of fishing effort in the calculation of fishing mortality which usually will depend on the habits of the fish, its abundance, and the type and deployment of fishing gear.

Catch Per Unit Effort (CPUE) - The catch obtained by a vessel, gear or fisherman per unit of fishing effort (e.g., number of fish caught per hour of trawling).

CCR - California Code of Regulations

CDFG - California Department of Fish and Game

CEQA - California Environmental Quality Act

Cohort - A group of fish spawned during a given period, usually within a year. See also: **age class**.

Commission - California Department of Fish and Game Commission

Compensatory Mechanism - A process by which the effect of one factor on a population tends to be compensated for by a change in another factor. For example, a reduction in the egg production (spawning) may be compensated for by an increase in the survival rate of eggs.

Competition -Active demand between organisms for a common resource that is in limited supply.

Condition Factor - Used to compare weight and length in a particular sample or individual. The heavier a fish is at a given length, the larger the factor and (by implication) the better "condition" it is in.

CPFV - Commercial Passenger Fishing Vessel

Density Dependence - When the density of a population of organisms directly affects other processes which can then affect the abundance of that population. For example, a reduction in the numbers of a population might lead to increased growth per individual (because of earlier maturity).

Department - California Department of Fish and Game

Depletion Methods - These methods are based on the principle that a decrease in CPUE over time and for finite periods of time (usually years or seasons) bears a direct relationship to the extent of the decrease of the population. If this assumption is true, and a substantial proportion of the population is being removed over time, then this method can be used to estimate the population present at the beginning of that time.

Depressed - With regard to a marine fishery, means the condition of a fishery for which the best available scientific information, and other relevant information indicates a declining population trend has occurred over a period of time appropriate to that fishery. With regard to fisheries for which management is based on maximum sustainable yield, or in which a natural mortality rate is available, "depressed" means the condition of a fishery that exhibits declining fish population abundance levels below those consistent with maximum sustainable yield.

Direct Enumeration - The counting of individuals in a population through direct visual observations, or through the use of such aids as sonar or video. Typically involves estimating species density along sampling transects, and applying the result to an entire survey area in order to estimate abundance. These methods have only limited value for the marine resource manager. Their usefulness has generally been limited to enclosed (freshwater) or anadromous (e.g., salmon) resources, where direct observations and subsequent counts can result in estimates of abundance.

Discards - Fish that are taken in a fishery but are not retained because they are of an undesirable species, size, sex, or quality, or because they are required by law not to be retained.

Drift Net - A negatively buoyant, single walled gill net suspended at or near the surface by lines extending from a series of floats attached along its length. Not anchored; the net remains secured to the vessel and floats with the current.

Ecosystem - The relationships between the sum total biological and non-biological factors present in the area.

Effort - The amount of time and fishing power used to harvest fish. Fishing power includes gear size, boat size, and horsepower.

Egg and Larval Surveys - Involves the collection of larvae, usually with a tow net, within a predefined geographic area. These surveys are typically carried out in conjunction with other studies in order to determine fishery information such as abundance and recruitment. They can also be used to define the geographic extent and peak time of spawning activity.

Egg Production Method - While this method is very expensive, it can provide a real-time, fishery-independent estimate of spawning biomass, that is directly calculated from population reproductive values that are measured by extensive at-sea sampling of eggs and adults on the spawning grounds.

Equilibrium Yield - The yield in weight taken from a fish stock when it is in equilibrium with fishing at a given intensity, and its abundance is not changing from year-to-year. Also called: **sustainable yield.**

Escapement - That part of the stock which survives at the end of a fishing period (e.g., season, year).

Essential Fishery Information - With regard to a marine fishery, means information about fish life history and habitat requirements; the status and trends of fish populations, fishing effort, and catch levels; fishery effects on fish age structure and on other marine living resources and users, and any other information related to the biology of a fish species or to taking in the fishery that is necessary to permit fisheries to be managed according to the requirements of §7060 FGC.

Ex-vessel - Refers to activities that occur when a commercial fishing boat lands or unloads a catch. For example, the price received by a captain for the catch is an ex-vessel price.

Fecundity - The production of eggs per individual or per unit weight of an individual.

FGC - Fish and Game Code

Fishery - Population of marine species that is treated as a unit for the purpose of conservation and management. It is comprised of the species or group of species being managed, the environment and geographic area in which the species lives, ecological interactions, scientific and technological aspects, and the people that catch, process and market the fish.

Fishing Effort - The amount of effort expended by a gear which is usually standardized (e.g., number of net hauls per unit of time per size of net) and summed before being used as an index of total effort. Also see **Effort**.

Fishing Mortality (F) - A measurement of the rate of removal of fish from a population by fishing. Fishing mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous is that percentage of fish dying at any one time. The acceptable rates of fishing mortality may vary from species to species.

Float Net - A positively buoyant (surface fishing) set net.

FMP - Fishery Management Plan

Fork Length - The length of a fish as measured from the tip of its snout to the fork in the tail.

Gill Net - A passive capture gear constructed of vertical panels of netting set in a straight line in which fish can become entangled.

Growth Overfishing - A reduction in the proportion of fish caught would be more than compensated for by an increase in their average size. This is more likely to occur when a fishery is taking too many younger individuals;

Growth Rate - Usually refers to the average growth of individuals, in length or weight by successive ages over the life span of the particular species.

Habitat - The physical, chemical, and biological features of the environment where an organism lives.

Habitat Enhancement - Refers to improving habitat usually for the benefit of a select number of species which depend on that habitat. Wetlands restoration, artificial reefs, and kelp reforestation are examples of habitat enhancement.

Harvest Control - A management measure having a numerical harvest objective, differing from a quota in that closure of a fishery is not automatically required when the harvest goal is reached.

Hook and Line - Includes trolling , jigging, and longline gear types.

Incidental Catch - See **Bycatch**

Incidentally-Taken Species - See **Bycatch**

Indices of Abundance - These measures usually do not translate to an estimate of actual biomass of a population, and are usually collected over time (years) to reflect trends in a population. The indices can be compiled from a number of sources, usually reported annually (e.g., CPUE, aerial spotter, and acoustic, egg, larval, or adult research survey data). Indices of abundance, because of their simplicity, are seriously evaluated regarding the assumptions in their calculation. When they can be closely matched to more direct and precise of estimates of abundance, they can be cost-effective tools of tracking the trends of a population.

Landings - The number or weights of fish unloaded at a dock by commercial fishermen or brought to shore by recreational fishermen for personal use. Landings are reported at the points at which fish are brought to shore. Note that landings, catch, and harvest define different things.

Limited Entry - Restriction of the right to participate in a fishery, by the use of permits or other means.

Longline - A form of hook and line fishing involving multiple baited hooks. A horizontal main line supports numerous short vertical fishing lines; each having a baited hook.

Marine Living Resources - Includes all wild mammals, birds, reptiles, fish, and plants that normally occur in or are associated with salt water, and the marine habitats upon which these animals and plants depend for their continued viability.

Marine Mammals - Animals that live in marine waters and breathe air directly. Females give live birth and can produce milk. These include whales, dolphins, seals, walruses, manatees, sea otters, and polar bears.

Mark-Recapture Methods - These methods are most well adapted for use on small, discrete freshwater stocks, and have been applied to wildlife and insect studies. They are not generally suited for estimating the abundance of marine organisms, but can provide valued information on the growth and migration of stocks.

Maximum Sustainable Yield - The largest average catch or yield that can continuously be taken from a stock. Theoretically, it is a level or catch that occurs at some intermediate level of fishing effort, such that to harvest at a lower level of effort would be to waste fish (that are not really needed to ensure continuing high levels of recruitment) and to harvest at a higher level of effort would be wasteful of effort (because annual catches would decline).

Mesh Size - The size of openings in a fishing net. Minimum mesh sizes are often prescribed in an attempt to avoid the capture of young fish before they reach their optimal size for capture.

MLMA - Marine Life Management Act

Mortality (Total) - The sum total of individual deaths within a population. Usually, it is stated as an annual rate and calculated as the sum of fishing mortality - deaths due to fishing and natural mortality - deaths due to natural causes (e.g., predation, disease) and nonfishing, artificial causes (e.g., pollution, seismic surveys).

MRFSS - Marine Recreational Fishery Statistics Survey

NMFS - National Marine Fisheries Service

Optimal Sustainable Yield - A sustainable yield that takes into account biological, social, and political values, and the effect of harvesting on dependent or associated species, in an attempt to produce the maximum benefit to society from a stock of fish.

Overfished - With regard to a marine fishery, means both of the following:
(a) A depressed fishery.
(b) A reduction of take in the fishery is the principal means for rebuilding the population.

Overfishing - In a general sense, any level of fishing greater than some defined, optimal level. In a classical sense, a level of fishing such that a reduction of this level would eventually lead to an increase in the total catch. Two distinct types of classical overfishing are recognized: **Growth Overfishing** and **Recruitment Overfishing**.

Participants - In regard to a fishery means the sport fishing, commercial fishing, and fish receiving and processing sectors of the fishery.

Party Boat - All boats regardless of size that carry passengers (anglers) for a fee. Usually operated by a skipper knowledgeable in marine sportfishing methods and practices. Also known as a commercial passenger fishing vessel (CPFV).

Pelagic - Pertaining to the water column, or referring to organisms living in the water column.

Performance Standard - A qualitative and/or quantitative standard used to judge whether the performance of a particular individual, tool or process is functioning properly. The standard used must be objective and readily detectable. In fisheries biology, a performance standard use to gauge a specific management process could be the long-term recruitment success of a particular species as measured through a standard biological survey method.

PFMC - Pacific Fishery Management Council

Population - A distinct group of individuals of a species which are reproductively isolated from other populations (see **Stock**).

Predator - A species that feeds on other species. The species being eaten is the prey.

Prey - A species being fed upon by other species. The species eating the other is the predator.

Productivity - Generally used loosely to refer to the capacity of a stock to provide a yield.

PSMFC - Pacific States Marine Fisheries Commission

Purse Seine - A net used to encircle aggregations of fish by closing the bottom of the net. The net is continuous, with corks along the top and leads along the bottom. Purse seines have a drawstring running the length of the lead line, which is pulled tight after the set.

Quota - A limit on the amount of fish which may be landed in any one fishing season or year. May apply to the total fishery or to an individual share.

Recreational Fishery - Harvesting fish for personal use, fun, and challenge. Recreational fishing does not include sale of catch. Refers to and includes the fishery resources, fisherman, and businesses providing needed goods and services.

Recruit - A relatively young fish entering the exploitable stage of its life cycle.
Prerecruit - A fish which has not yet reached the recruitment stage for the fishery.

Recruitment - It can mean either the rate of entry of recruits into the fishery or the process by which such recruits are generated. It is usually associated with attainment of a particular age or size, but can also be dependent on such factors as the fishes' appearance on a particular fishing ground, or how they grow to a size large enough to be captured by a certain mesh gear.

Recruitment Overfishing - A reduction in the proportion of fish caught would be more than compensated for by the increased number of recruits. It results in a total mortality that seriously reduces the reproductive potential of the stock.

Relative Abundance - Usually measured by indices over time that track trends of a population biomass (i.e., CPUE), but it is not a direct or usually precise estimate of biomass.

Restricted Access - With regard to a marine fishery, means a fishery in which the number of persons who may participate, or the number of vessels that may be used in taking a specified species of fish, or the catch allocated to each fishery participant, is limited by statute or regulation.

Selectivity - Refers to selective nature of fishing gear; in that, almost all kinds of gear catch fish of some sizes more readily than other sizes.

Set Net - A single walled, negatively buoyant (bottom resting) gill net anchored at both ends.

Size at Age Composition Analysis - Closely associated with indices of abundance, this is one of the basic tools used by fishery biologists to detect population trends, particularly in a new and developing fishery. An inordinate or substantial change in the composition of the catch from older/larger to younger/smaller individuals is often a signal for concern.

Spawning Biomass - See **Biomass**

Stock (see **Population**) - In a strict sense, a distinct, reproductively isolated population. In practice, the members of a species inhabiting any conveniently defined area, which can be discreetly managed.

Stock Enhancement - Usually refers to increasing the stock by artificial methods, such as hatchery rearing, improving spawning facilities, or habitat.

Stock-Recruitment Relationship - This defines the dependence of recruitment on the size of the breeding stock.

Surplus Production - Production of new weight (i.e., growth) by a fish stock, plus recruitment, minus what is removed by natural mortality. In theory, a harvest increases production per unit stock and so creates this surplus.

Surplus Production Models - These models are useful in calculating yields where exact aging of fishes, estimates of growth, mortality or reproduction rates are not available. In the simplest terms they rely on catch and effort information collected over a number of years.

Survival Rate - Number of fish alive after a specified time interval (usually a year) divided by the initial number.

Sustainable, Sustainable Use, and Sustainability - with regard to a marine fishery, mean both of the following:

(a) Continuous replacement of resources, taking into account fluctuations in abundance and environmental variability.

(b) Securing the fullest possible range of present and long-term economic, social, and ecological benefits, maintaining biological diversity, and, in the case of fishery management based on maximum sustainable yield, taking in a fishery that does not exceed optimum yield.

Total Allowable Catch (TAC) - The annual recommended catch for a species or species group. The regional council sets the TAC from the range of the Allowable Biological Catch (ABC).

Total Length - The length of a fish as measured from the tip of the snout to the tip of the tail.

Trammel Net - A two or three walled set net consisting of large meshed outer wall(s) and a small meshed inner wall. Fish become entangled as their forward swimming movement creates a bag of small mesh pushed through the large meshed outer wall.

Trawl - A large bag net that is tapered and forms a flattened cone. The mouth of the net is kept open while it is towed or dragged over the sea bottom.

USC - United States Code

Virtual Population (Cohort) Analyses (VPA) - These methods of analysis result in estimates of abundance derived from long series of age composition data. They are particularly appropriate for historical analyses and for calibrating other indices of abundance. They are more precise at estimating the abundance in previous years and, as such, are of little use as a real-time monitoring tool, especially for highly variable fish stocks.

WSSCAP - White Seabass Scientific and Constituent Advisory Panel.

Yield - Sometimes this term is synonymous with catch, but it more often implies a degree of sustainability over a number of years.

Yield-Per-Recruit - The yield (usually expressed in weight) for each recruit. For a given species with a specific growth curve, and constant natural mortality, the yield-per-recruit will vary as a function of age at first capture and fishing mortality.

Yield-Per-Recruit Model - This model can be used to predict the yield from any given level of recruitment if just the natural mortality, present fishing mortality and growth rates can be estimated. Furthermore, this model can be manipulated to estimate yields for any combination of natural mortality, fishing mortality and age-at-first-capture. This information could then allow management to adjust mesh sizes and, thus age-at-first-capture, to provide for maximum or optimal yield-per-recruit, regardless of population size.

Appendix B. Regulations Specific to the Take of White Seabass

Commercial (From Fish and Game Code)

§2362: White seabass may be imported from Mexico according to regulations established by the Fish and Game Commission.

§8051(a)(a18): Landing tax of $0.0125 per lb.

§8383: Commercial fishing closed 15 March to 15 June, inclusive, between Pt. Conception and the Mexican border. No inter-boat transfers of fish. Restrictions do not apply to fish taken in Mexican waters. A valid permit issued by the Mexican government is evidence that seabass were taken in Mexican waters.

§8383.5: Unlawful to possess, sell, or purchase any white seabass smaller than 28 inches total length.

§8623(a): Unlawful to use purse seine or round haul nets for white seabass.

§8623(b): Unlawful to possess white seabass on a boat carrying or using any purse seine or round haul net unless taken off Mexico.

§8623(d): Six inches minimum stretched mesh size for gill nets used to take white seabass except during 16 June to 14 March when not more than 20% by number of white seabass (greater than 28 in.), up to 10 fish per load, can be taken in gill or trammel nets with meshes 3.5 to 6 inches.

§8610(b): Marine Resources Protection Act of 1990, effective as of 01 January 1994. Specifies that white seabass, in addition to all other species, cannot be taken by gill and trammel nets in ocean waters: 1) 0-3 miles from the mainland shore between Point Arguello and the U.S.-Mexico border, 2) in waters less than 35 fathoms between Point Fermin and the south jetty at Newport Beach, or 3) in waters less than 70 fathoms deep or within one mile, whichever is less, of the Channel Islands.

Recreational (From Title 14, California Code of Regulations)

§27.60: Daily bag and possession limit for white seabass is three fish except as provided in Section 28.35.

§27.65: Fillets taken from white seabass must be a minimum of nineteen inches in length. Each fillet shall bear intact a one-inch square patch of silver skin.

§28.35: The minimum size for white seabass is twenty-eight inches total length or twenty and one-half inches alternate length. The season is open all year. The daily bag and possession limit for white seabass is three except that only one fish may be taken in waters south of Pt. Conception, Santa Barbara County, between March 15 and June 15.

Appendix C. Additional Regulations

FISH AND GAME CODE

§2362. Yellowtail, barracuda, and white seabass taken in waters lying south of the international boundary line between the United States and Mexico, extended westerly in the Pacific Ocean, may be delivered to California ports aboard boats, including boats carrying purse seine or round haul nets in accordance with such regulations as the commission may make governing the inspection and marking of such fish imported into this State. The cost of such inspection and marking shall be paid by the importer.

§7070. The Legislature finds and declares that the critical need to conserve, utilize, and manage the state's marine fish resources and to meet the policies and other requirements stated in this part require that the state's fisheries be managed by means of fishery management plans.

§7071. (a) Any white seabass fishery management plan adopted by the commission on or before January 1, 1999, shall remain in effect until amended pursuant to this part. Notwithstanding paragraph (2) of subdivision (b) of Section 7073, any white seabass fishery management plan adopted by the commission and in existence on January 1, 1999, shall be amended to comply with this part on or before January 1, 2002. (b) In the case of any fishery for which the commission has management authority, including white seabass, regulations that the commission adopts to implement a fishery management plan or plan amendment for that fishery may make inoperative, in regard to that fishery, any fishery management statute that applies to that fishery, including, but not limited to, statutes that govern allowable catch, restricted access programs, and time, area, and methods of taking. (c) On and after January 1, 2000, the commission may adopt regulations as it determines necessary, based on the advice and recommendations of the department, and in a process consistent with Section 7059, to regulate all emerging fisheries, consistent with Section 7090, all fisheries for nearshore fish stocks, and all fisheries for white seabass. Regulations adopted by the commission
may include, but need not be limited to, establishing time and area closures, requiring submittal of landing and permit information, regulating fishing gear, and establishing restricted access fisheries.

§7072. (a) Fishery management plans shall form the primary basis for managing California's sport and commercial marine fisheries. (b) Fishery management plans shall be based on the best scientific information that is available, on other relevant information that the department possesses, or on such scientific information or other relevant information that can be obtained without substantially delaying the preparation of the plan. (c) To the extent that conservation and management measures in a fishery management plan either increase or restrict the overall harvest in a fishery, fishery management plans shall allocate those increases or restrictions fairly among recreational and commercial sectors participating in the fishery. (d) Consistent with

Article 17 (commencing with Section 8585), the commission shall adopt a fishery management plan for the nearshore fishery on or before January 1, 2002, if funds are appropriated for that purpose in the annual Budget Act or pursuant to any other law.

§7073. (a) On or before September 1, 2001, the department shall submit to the commission for its approval a master plan that specifies the process and the resources needed to prepare, adopt, and implement fishery management plans for sport and commercial marine fisheries managed by the state. Consistent with Section 7059, the master plan shall be prepared with the advice, assistance, and involvement of participants in the various fisheries and their representatives, marine conservationists, marine scientists, and other interested persons. (b) The master plan shall include all of the following: (1) A list identifying the fisheries managed by the state, with individual fisheries assigned to fishery management plans as determined by the department according to conservation and management needs and consistent with subdivision (f) of Section 7056. (2) A priority list for preparation of fishery management plans. Highest priority shall be given to fisheries that the department determines have the greatest need for changes in conservation and management measures in order to comply with the policies and requirements set forth in this part. Fisheries for which the department determines that current management complies with the policies and requirements of this part shall be given the lowest priority. (3) A description of the research, monitoring, and data collection activities that the department conducts for marine fisheries and of
any additional activities that might be needed for the department to acquire essential fishery information, with emphasis on the higher priority fisheries identified pursuant to paragraph (2). (4) A process consistent with Section 7059 that ensures the opportunity for meaningful involvement in the development of fishery management plans and research plans by fishery participants and their representatives, marine scientists, and other interested parties. (5) A process for periodic review and amendment of the master plan. (c) The commission shall adopt or reject the master plan or master plan amendment, in whole or in part, after a public hearing. If the commission rejects a part of the master plan or master plan amendment, the commission shall return that part to the department for revision and resubmission pursuant to the revision and resubmission procedures for fishery management plans as described in subdivision (a) of Section 7075.

§7074. (a) The department shall prepare interim fishery research protocols for at least the three highest priority fisheries identified pursuant to paragraph (2) of subdivision (b) of Section 7073. An interim fishery protocol shall be used by the department until a fishery management plan is implemented for that fishery. (b) Consistent with Section 7059, each protocol shall be prepared with the advice, assistance, and involvement of participants in the various fisheries and their representatives, marine conservationists, marine scientists, and other interested persons. (c) Interim protocols shall be submitted to peer review as described in Section 7062 unless the department, pursuant to subdivision (d), determines that peer review of the interim protocol is not justified. For the purpose of peer review, interim protocols may be combined in the following circumstances: (1) For related fisheries. (2) For two or more interim protocols that the commission determines will require the same peer review expertise. (d) The commission, with the advice of the department, shall adopt criteria to be applied in determining whether an interim protocol may be exempted from peer review.

§7055. The Legislature finds and declares that it is the policy of the state that: (a) California's marine sport and commercial fisheries, and the resources upon which they depend, are important to the people of the state and, to the extent practicable, shall be managed in accordance with the policies and other requirements of this part in order to assure the long-term economic, recreational, ecological, cultural, and social benefits of those fisheries and the marine habitats on which they depend. (b) Programs for the conservation and management of the marine fishery resources of California shall be established and administered to prevent overfishing, to rebuild depressed stocks, to ensure conservation, to facilitate long-term protection and, where feasible, restoration of marine fishery habitats, and to achieve the sustainable use of the state's fishery resources. (c) Where a species is the object of sport fishing, a sufficient resource shall be maintained to support a reasonable sport use, taking into consideration the necessity of regulating individual sport fishery bag limits to the quantity that is sufficient to provide a satisfying sport. (d) The growth of commercial fisheries, including distant-water fisheries, shall be encouraged.

§7056. In order to achieve the primary fishery management goal of sustainability, every sport and commercial marine fishery under the jurisdiction of the state shall be managed under a system whose objectives include all of the following: (a) The fishery is conducted sustainably so that long-term health of the resource is not sacrificed in favor of short-term benefits. In the case of a fishery managed on the basis of maximum sustainable yield, management shall have optimum yield as its objective. (b) The health of marine fishery habitat is maintained and, to the extent feasible, habitat is restored, and where appropriate, habitat is enhanced. (c) Depressed fisheries are rebuilt to the highest sustainable yields consistent with environmental and habitat conditions. (d) The fishery limits bycatch to acceptable types and amounts, as determined for each fishery. (e) The fishery management system allows fishery participants to propose methods to prevent or reduce excess effort in marine fisheries. (f) Management of a species that is the target of both sport and commercial fisheries or of a fishery that employs different gears is closely coordinated. (g) Fishery management decisions are adaptive and are based on the best available scientific information and other relevant information that the commission or department possesses or receives, and the commission and department have available to them essential fishery information on which to base their decisions. (h) The management decision-making process is open and seeks the advice and assistance of interested parties so as to consider relevant information, including local knowledge. (i) The fishery management system observes the long-term interests of people dependent on fishing for food, livelihood, or recreation. (j) The adverse impacts of fishery management on small-scale fisheries, coastal communities, and local economies are minimized. (k) Collaborative and cooperative approaches to management, involving fishery participants, marine scientists, and other interested parties are strongly encouraged, and appropriate mechanisms are in place to resolve disputes such as access, allocation, and gear conflicts. (l) The management system is proactive and responds quickly to changing environmental conditions and market or other socioeconomic factors and to the concerns of fishery participants. (m) The management system is periodically reviewed for effectiveness in achieving sustainability goals and for fairness and reasonableness in its interaction with people affected by management.

§7057. Notwithstanding Section 7550.5 of the Government Code, on or before February 1, 2000, the commission shall make recommendations to the Legislature in regard to changes in statutes governing restricted access commercial fisheries, the recommendations to be based on both of the following: (a) Any restricted access fishery policies adopted by the commission. (b) The experience of the commission and department in applying the restricted access policies adopted by the commission in developing or revising a restricted access program for a fishery managed by the state, with priority given to the pink shrimp fishery, for which a restricted access program statute is scheduled to be repealed on April 1, 2001.

§7058. Any fishery management regulation adopted pursuant to this part shall, to the extent practicable, conform to the policies of Sections 7055 and 7056.

§7059. (a) The Legislature finds and declares all of the following: (1) Successful marine life and fishery management is a collaborative process that requires a high degree of ongoing communication and participation of all those involved in the management process, particularly the commission, the department, and those who represent the people and resources that will be most affected by fishery management decisions, especially fishery participants and other interested parties. (2) In order to maximize the marine science expertise applied to the complex issues of marine life and fishery management, the commission and the department are encouraged to continue to, and to find creative new ways to, contract with or otherwise effectively involve Sea Grant staff, marine scientists, economists, collaborative fact-finding process and dispute resolution specialists, and others with the necessary expertise at colleges, universities, private institutions, and other agencies. (3) The benefits of the collaborative process required by this section apply to most marine life and fishery management activities including, but not limited to, the development and implementation of research plans, marine managed area plans, fishery management plans, and plan amendments, and the preparation of fishery status reports such as those required by Section 7065. (4) Because California is a large state with a long coast, and because travel is time consuming and costly, the involvement of interested parties shall be facilitated, to the extent practicable, by conducting meetings and discussions in the areas of the coast and in ports where those most affected are concentrated. (b) In order to fulfill the intent of subdivision (a), the commission and the department shall do all of the following: (1) Periodically review marine life and fishery management operations with a view to improving communication, collaboration, and dispute resolution, seeking advice from interested parties as part of the review. (2) Develop a process for the involvement of interested parties and for fact-finding and dispute resolution processes appropriate to each element in the marine life and fishery management process. Models to consider include, but are not limited to, the take reduction teams authorized under the Marine Mammal Protection Act (16 U.S.C. Sec. 1361 et seq.) and the processes that led to improved management in the California herring, sea urchin, prawn, angel shark, and white seabass fisheries. (3) Consider the appropriateness of various forms of fisheries comanagement, which involves close cooperation between the department and fishery participants, when developing and implementing fishery management plans.

(4) When involving fishery participants in the management process, give particular consideration to the gear used, involvement of sport or commercial sectors or both sectors, and the areas of the coast where the fishery is conducted in order to ensure adequate involvement.

§7850. (a) Excepting persons expressly exempted under this code, no person shall use or operate, or assist in using or operating, any boat, aircraft, net, trap, line, or other appliance to take fish or amphibia for commercial purposes, and no person shall cause to be brought ashore, any fish or amphibia at any point in the state for the purpose of selling them in a fresh state or shall contribute materially to the activities on board the commercial fishing vessel, unless the person holds a commercial fishing license issued by the department. (b) Any person not required under subdivision (a) to hold a commercial fishing license shall register his or her presence on board the commercial fishing vessel in a log maintained by the owner or operator of the vessel according to the requirements of the department. (c) As used in this section, "person" does not include persons who are less than 16 years of age, a partnership, corporation, or association. Any person, partnership, corporation, limited liability company, or association may pay the fees for a license issued to any person. (d) This article does not apply to the taking, transporting, or selling of live freshwater fish for bait by the holder of a live freshwater bait fish license issued pursuant to Section 8460.

§7145. (a) Except as otherwise provided in this article, every person over the age of 16 years who takes any fish, reptile, or amphibia for any purpose other than profit shall first obtain a license for that purpose and shall have that license on his or her person or in his or her immediate possession or where otherwise specifically required by law to be kept when engaged in carrying out any activity authorized by the license. In the case of a person diving from a boat, the license may be kept in the boat, or in the case of a person diving from the shore, the license may be kept within 500 yards on the shore.

§7146. A license granting the privilege to take fish, reptiles, and amphibia for purposes other than profit shall be issued and delivered, upon application in writing, by the department or by any person authorized by the department.

§7920. The owner of any boat or vessel who, for profit, permits any person to fish therefrom, shall procure a commercial passenger fishing boat license. This article applies only to a boat or vessel whose owner or his employee or other representative is with it when it is used for fishing. A person operating a guide boat, as defined in Section 46, is not required to obtain a commercial passenger fishing boat license.

§7923. The holder of a license shall keep a true record in the English language of all fish taken, and shall comply with such regulations as the commission may prescribe. Such a record and the information contained in it shall be confidential, and the record shall not be a public record.

§8623. (a) It is unlawful to use any purse seine or round haul net to take yellowtail, barracuda, or white sea bass. (b) It is unlawful to possess any yellowtail, barracuda, or white sea bass, except those taken south of the international boundary between the United States and Mexico, and imported into the state under regulations of the commission as provided in Section 2362, on any boat carrying or using any purse seine or round haul net, including, but not limited to, a bait net as described in Section 8780. (c) Gill nets with meshes of a minimum length of 31/2 inches may be used to take yellowtail and barracuda. (d) Gill nets with meshes of a minimum length of six inches may be used to take white sea bass; however, during the period from June 16 to March 14, inclusive, not more than 20 percent by number of a load of fish may be white seabass 28 inches (711 mm) or more in total length, up to a maximum of 10 white seabass per load, if taken in gill nets or trammel nets with meshes from 31/2 to 6 inches in length. (e) Notwithstanding the provisions of this section, the department may issue permits to hook and line commercial fishermen to possess a bona fide bait net on their vessels for the purpose of taking bait for their own use only.

§8383. White sea bass may not be taken for commercial purposes between March 15th and June 15th, inclusive, between the United States-Mexico International Boundary and a line extending due west (true) from Point Conception. Any fish so taken shall not be transferred to any other vessel. The restrictions in this section shall not apply to white sea bass taken in waters lying south of the International Boundary Line between the United States and Mexico extended westerly into the Pacific Ocean. A current fishing permit issued by the Mexican Government is evidence that white sea bass were taken south of the international boundary.

§8383.5. It is unlawful to take, possess, sell, or purchase any white sea bass less than 28 inches in length, measured from the tip of the lower jaw to the end of the longer lobe of the tail.

§8385. No person holding a commercial fishing license while on any barge or boat which is for hire and carries any sport fisherman may take or have in his possession in any one day more than the aggregate number of the following kinds of fish permitted in the case of sport fishing: bluefin tuna, yellowfin tuna, skipjack, yellowtail, marlin, broadbill swordfish, black sea bass, albacore, barracuda, white seabass, bonito, rock bass, kelp bass, California halibut, California corbina, yellowfin croaker, and spotfin croaker.

§8576. (a) Drift gill nets shall not be used to take shark or swordfish from February 1 to April 30, inclusive. (b) Drift gill nets shall not be used to take shark or swordfishing ocean waters within 75 nautical miles from the mainland coastline between the westerly extension of the California-Oregon boundary line and the westerly extension of the United States-Republic of Mexico boundary line from May 1 to August 14, inclusive.
(c) Subdivisions (a) and (b) apply to any drift gill net used pursuant to a permit issued under Section 8561 or 8681, except that drift gill nets with a mesh size smaller than eight inches in stretched mesh and twine size number 18, or the equivalent of this twine size, or smaller, used pursuant to a permit issued under Section 8681, may be used to take species of sharks other than thresher shark, shortfin mako shark, and white shark during the periods specified in subdivisions (a) and (b). However, during the periods of time specified in subdivisions (a) and (b), not more than two thresher sharks and two shortfin mako sharks may be possessed and sold if taken incidentally in drift gill nets while fishing for barracuda or white seabass and if at least 10 barracuda or five white seabass are possessed and landed at the same time as the incidentally taken thresher or shortfin mako shark. No thresher shark or shortfin mako shark taken pursuant to this subdivision shall be transferred to another vessel prior to landing the fish. Any vessel possessing thresher or shortfin mako sharks pursuant to this section shall not have any gill or trammel net aboard that is constructed with a mesh size greater than eight inches in stretched mesh and twine size greater than number 18, or the equivalent of a twine size greater than number 18. (d) Notwithstanding the closure from May 1 to August 14, inclusive, provided by subdivision (b), a permittee may land swordfish or thresher shark taken in ocean waters more than 75 nautical miles from the mainland coastline in that period if, for each landing during that closed period, the permittee signs a written declaration under penalty of perjury that the fish landed were taken more than 75 nautical miles from the mainland coastline. (e) If any person is convicted of falsely swearing a declaration under subdivision (d), in addition to any other penalty prescribed by law, the following penalties shall be imposed: (1) The fish landed shall be forfeited, or, if sold, the proceeds from the sale shall be forfeited, pursuant to Sections 12159, 12160, 12161, and 12162. (2) All shark or swordfish gill nets possessed by the permittee shall be seized and forfeited pursuant to Section 8630 or 12157. (f) From August 15 of the year of issue to January 31, inclusive, of the following year, swordfish may be taken under a permit issued pursuant to this article.

§10664. In the Laguna Beach, Newport Beach, Point Fermin, South Laguna Beach, Niguel, Irvine Coast, and Doheny Beach Marine Life Refuges, the following fish, mollusks, and crustaceans may be taken under the authority of a sport fishing license as authorized by this code: abalone, lobster, rockfish (Scorpaenidae), greenling, lingcod, cabezon, yellowtail, mackerel, bluefin tuna, kelp bass, spotted sand bass, barred sand bass, sargo, croaker, queenfish, corbina, white seabass, opaleye, halfmoon, surfperch (Embiotocidae), blacksmith, barracuda, sheephead, bonito, California halibut, sole, turbot, and sanddab. Finfish shall be taken only by hook and line or by spearfishing gear. All other fish and forms of aquatic life are protected and may not be taken without a written permit from the department.

§10667. (a) In the Dana Point Marine Life Refuge below the intertidal zone, the following fish, mollusks, and crustaceans may be taken under the authority of a sportfishing license as authorized by this code: abalone, lobster, rockfish (Scorpaenidae), greenling, lingcod, cabezon, yellowtail, mackerel, bluefin tuna, kelp bass, spotted sand bass, barred sand bass, sargo, croaker, queenfish, corbina, white seabass, opaleye, halfmoon, surfperch (Embiotocidae), blacksmith, barracuda, sheephead, bonito, California halibut, sole, turbot, and sanddab. Finfish shall be taken only by hook and line or by spearfishing gear. All other fish and forms of aquatic life are protected and may not be taken without a written permit from the department. (b) Except as expressly provided in this section, it is unlawful to enter the intertidal zone in the Dana Point Marine Life Refuge for the purpose of taking or possessing, or to take or possess, any species of fish, plant, or invertebrate, or part thereof, to use or have in possession any contrivance designed to be used for catching fish, to disturb any native plant, fish, wildlife, aquatic organism, or to take or disturb any natural geological feature. This subdivision does not prohibit persons from entering the intertidal zone for the purpose of entertainment, recreation, and education while having a minimum impact on the intertidal environment and the living organisms therein. For this purpose, minimum impact includes foot traffic, general observation of organisms in their environment with immediate replacement of any unattached organisms to their natural location after temporary lifting for examination, and photography. Minimum impact does not include removal of attached organisms from their environment, gathering of fishing bait, littering, collecting rocks and shells, or turning rocks or other acts destructive to the environment. (c) For the purposes of this section, "intertidal zone" means the area of the refuge between the mean lower low-water mark and the mean high-tide line described in Section 10907. (d) Notwithstanding subdivision (a) or (b), the Director of the Dana Point Marine Life Refuge, or any person, who has a scientific collector's permit from the department, to whom the Director of the Dana Point Marine Life Refuge has issued a permit pursuant to Section 10502.6, may take, for scientific purposes, any fish or specimen of marine plant life under the conditions prescribed by the department pursuant to Section 10502.6. (e) This section does not prohibit the entry of state and local law enforcement officers, fire suppression agencies, and employees of the department in the performance of their official duties. This section does not prohibit or restrict navigation in the Dana Point Marine Life Refuge pursuant to federal law.

§15300. Aquatic plants or animals may be legally obtained for use as brood stock from all of the following sources: (a) A holder of a commercial fishing license. (b) A registered aquaculturist. (c) The department. (d) Imported sources authorized by Chapter 7 (commencing with Section 15600).

Title 14 Regulations

Definitions

§1.05. Angling. To take fish by hook and line with the line held in the hand, or with the line attached to a pole or rod held in the hand or closely attended in such manner that the fish voluntarily takes the bait or lure in its mouth.

§1.14. Authorization for Taking Fish. Fish, amphibians, reptiles, mollusks and crustaceans may be taken only in the amounts, only during the open season and only with the gear authorized and shall not be taken otherwise.

§1.17. Bag and Possession Limit. No more than one daily bag limit of each kind of fish, amphibian, reptile, mollusk or crustacean named in these regulations may be taken or possessed by any one person unless otherwise authorized; regardless of whether they are fresh, frozen, or otherwise preserved. Exceptions: See Sections 7.00 and 7.50(a).

§1.35. Closed or Closure. Refers to waters or areas closed to all fishing unless otherwise authorized.

§1.38. Closed Season. That period during which the taking of fish, amphibians, reptiles, mollusks or crustaceans is prohibited.

§1.41. Date. Dates of seasons and closures are inclusive.

§1.48. Gill Net. A single wall of webbing, bound at the top by a float line and at the bottom by a weighted line and used for entangling fish.

§1.59. Limit. Refers to daily bag limit and possession limit per person.

§1.62. Minimum Size. No fish, mollusks or crustaceans less than the legal minimum size (total, fork or alternate) may be possessed, except as otherwise provided. Total length is the longest straight-line measurement from the tip of the head to the end of the longest lobe of the tail. Fork length is the straight-line distance from the tip of the head to the center of the tail fin. Tip of the head shall be the most anterior point on the fish with the mouth closed and the fish lying flat on its side. Alternate length is the straight-line distance from the base of the foremost spine of the first dorsal fin to the end of the longest lobe of the tail. Unless otherwise provided, all fish, mollusks or crustaceans less than the legal minimum size must be returned immediately to the water from which they were taken.

§1.68. Open Season. That period of time during which the taking of fish, amphibians, reptiles, mollusks and crustaceans is authorized.

§1.80. Take. Hunt, pursue, catch, capture or kill fish, amphibians, reptiles, mollusks, crustaceans or invertebrates or attempting to do so.

§1.85. Trammel Net. Two or more walls of webbing, bound at the top by a float line and at the bottom by a weighted line and used for entangling fish.

§1.87. Waste of Fish. It is unlawful to cause or permit any deterioration or waste of any fish taken in the waters of this state.

<u>Recreational</u>

§27.65. Filleting of Fish on Vessels.
(a) Definition of Fillet: For the purpose of this section a fillet is the flesh from one side of a fish extending from the head to the tail which has been removed from the body (head, tail and backbone) in a single continuous piece.
(4) White seabass: Fillets must be a minimum of 19 inches in length. Each fillet shall bear intact a one-inch square patch of silver skin.

§28.35. White Seabass.
(a) Minimum size: Twenty-eight inches total length or twenty and one-half inches (546 mm) alternate length.
(b) Season: Open all year.
(c) Limit: Three, except that only one fish may be taken in waters south of Pt. Conception between March 15 and June 15.

§700. Display of License. (a) Display of Sport Fishing License: Every person, while engaged in taking any fish, amphibian or reptile, shall display their valid sport fishing license by attaching it to their outer clothing at or above the waistline so that is plainly visible, except when diving as provided in §7145 FGC. Persons diving from a boat or shore may have their license on the boat or within 500 yards of shore, respectively (see Fish and Game Code Section 7145).

<u>Commercial Fishing</u>
§109. Importation of Yellowtail, Barracuda, and White Seabass from Mexico. No person, firm, or corporation shall deliver, accept, or unload any yellowtail, barracuda, or white sea bass from any vessel carrying a purse seine or round haul net until the Fish and Game Patrol office nearest the point of delivery shall have issued a written inspection clearance to the master or operator of such vessel, or his agent, permitting said delivery. Such clearances shall be on such forms as the Department of Fish and Game shall prescribe. Such clearances shall be issued upon presentation of evidence satisfactory to the Department of Fish and Game of the fact that such fish was taken south of the International Boundary between the United States and Mexico.

§155. White Seabass, Commercial Take. (adopted 4/7/00, effective 6/2/00)
(a) Notwithstanding Fish and Game Code Section 8383, white seabass may not be taken for commercial purposes between March 15 and June 15, inclusive, between the United States-Mexico International Boundary and a line extending due west (true) from Point Conception, except that one white seabass not less than 28 inches in total length may be taken, possessed, and sold by a vessel each day if taken incidental to gill and trammel net fishing operations conducted under authority of a permit issued pursuant to Fish and Game Code Section 8681. Any fish so taken shall not be transferred to any

other vessel.
(b) The restrictions in this section shall not apply to white seabass taken in waters lying south of the International Boundary Line between the United States and Mexico extended westerly into the Pacific Ocean. A current fishing permit issued by the Mexican Government is evidence that white seabass were taken south of the international boundary.

Appendix D. Risk assessment of proposed management alternatives for the white seabass fishery.

One of the primary objectives of the WSFMP (White Seabass Fishery Management Plan) is to provide for future management that will promote long-term sustainability of the white seabass stock and fishery. A major proposed management feature is an annual limit on harvested biomass (i.e., pounds of fish taken). Section 5.4 of the WSFMP presents several specific alternatives for this harvest limit. In order of less restrictive (more aggressive take) to more restrictive (less aggressive take), alternatives are: A (no limit), B1, B2, D, C1, C2, C3.

One of the fundamental questions regarding the implementation of any one of these alternatives is to what extent would each of the alternatives involve risk to the sustainability of the stock and fishery? In particular, for each given alternative: under what conditions and in how many years would use of that option likely result in an overfished condition of the stock?

Underlying uncertainty and risk

The better the available information about the stock size (e.g., abundance, biomass) the higher the harvest limit that can be allowed, with reasonable guarantee of sustainability of the stock and fishery.

Two kinds of information about stock size are most needed: a good estimate of the stock size now, and a good idea (model) of the stock dynamics (i.e., how stock size is likely to change). Both sorts of information are now highly uncertain for the white seabass stock. Precisely because of this uncertainty, several different alternatives and harvest limits have been proposed instead of a single definitive harvest limit. Each of the alternatives is based on a plausible estimate of what the underlying facts might be, but no one of these estimates represents certain knowledge.

One alternative can briefly be discussed now and will not further be analyzed. Alternative A imposes no harvest limit at all. As a result, this alternative imposes no guaranteed safeguard to prevent the stock from becoming overfished, possibly even within a single year. Alternative A represents a policy of maximum possible risk.

Other Alternatives

Each other alternative uses a harvest limit which is equal to an estimate of Maximum Sustainable Yield (MSY). MSY is the maximum amount which, on average over different years, could in perpetuity be harvested from the stock, so long as the stock size starts out large enough. If the alternative's allowed harvest limit is no higher than the stock's actual MSY, and we are willing to assume that the stock's present initial size is sufficiently large, then use of the alternative poses no undue risk. Suppose, however, that the alternative's allowed harvest limit is higher than the stock's actual

MSY. Assume further - as our quantitative analysis below does for simplicity - that in fact the fishery takes every year an amount equal to (or anyhow close to) the harvest limit. Then it will only be a matter of time before the stock becomes overfished. Here, the term 'overfished' not only has a readily appreciated practical import but also by conventional definition (National Standard Guidelines) has a precise meaning: that stock size which is at most half the size needed to sustain an average yield equal to MSY.

Precisely how much time, to becoming overfished, depends on three inputs or assumptions: the harvest limit itself; the stock's actual status - namely present size and actual MSY; and the underlying model of stock dynamics.

<u>Risk analysis results</u>
Table J-1 summarizes the results of the risk analysis. Here is how the above three inputs enter into the Table:
Since each of the alternatives makes a precautionary adjustment downward to MSY (multiplied by 0.75) for OY, we have used the OY values in the risk analysis. Each cell in the table corresponds to a given harvest limit - the one corresponding to the alternative noted at the top of the cell's column. The cell also corresponds to a given stock status. Namely, the alternative noted at the left of the cell's row corresponds to an OY value, and the stock size is assumed to be the minimum size needed to yield that OY. The cell will contain the entry 'OK' if there is no undue risk, that is, if the harvest limit (from the column alternative) is less than the actual OY (from the row alternative). However, if the column alternative's harvest limit is greater than the row alternative's OY, then the cell contains two numbers, representing number of years to overfished status. The numbers come from using two different plausible dynamics models described below.

<u>Model details</u>
The two dynamics models used are of the same general kind, known as production models, or surplus yield models. Namely, absent fishing, such a model assumes that every year the stock size grows - adds extra biomass or 'yield'. When stock size is very small, yield is small. When stock size is very large, near a maximum or 'carrying capacity' value, yield again is small. However, when stock size is intermediate, yield is larger. If yield (vertical coordinate y) is plotted against existing stock size (horizontal coordinate x) the resulting curve is dome-shaped, with MSY = the largest value of y.

Both models are of the form $y = m(x^p - x^{2p})$, where y = annual yield, and x = stock size (with biomass unit chosen so that 1 = maximum possible stock size (i.e., 'carrying capacity' or 'virgin biomass'). In each cell, the smaller entry is for a value of p (very nearly p = 3/4) such that the stock size which yields MSY will be equal to 40% of the virgin biomass. The larger entry is for the value p=1, so that the stock size which yields MSY will be equal to 50% of virgin biomass (from a suggestion of Restrepo et al.

1998).

The annual mortality coefficient (m) of the fully recruited white seabass stock is the fraction of initial biomass which no longer lives at year's end. This choice for m comes from the following assumption suggested in the fisheries literature, namely that for smaller stock sizes (with $0<x<<1$) allowable fishing mortality may be taken equal to natural mortality. For small x, this assumption calls for gross growth to approximate twice natural mortality, so that net yield y is approximately mx (=loss by natural mortality. From various white seabass studies, the numerical value for m is 0.1 Note that both models get MSY equal to (m/4) times the virgin biomass.

Table D-1. The number of years for the white seabass stock to become overfished when management is by one alternative (Y) while stock status suits another alternative (X). OK denotes no undue risk.

Table D-1. Number of years for the white seabass stock to become overfished when management is by one alternative (Y) while stock status suits another alternative (X). OK denotes no undue risk. The two numbers represent results from two different models.

	Y(management)					
X(actual stock status)	B1	B2	D	C1	C2	C3
B1	OK	OK	OK	OK	OK	OK
B2	65-73	OK	OK	OK	OK	OK
D	15-17	18-22	OK	OK	OK	OK
C1	3-4	4-4	6-7	OK	OK	OK
C2	2-3	3-3	4-4	19-23	OK	OK
C3	2-2	2-3	3-4	13-15	39-45	OK

Appendix E. Peer Review

Procedure for Selecting Peer Review Panels for the Draft Nearshore and White Seabass Fishery Management Plans (10/18/01)

First, a master list was compiled consisting of 34 names. The list came from several different sources. The individuals on the list were sorted according to their area of expertise (*i.e.,* their field, and specialty within their field). We decided that there should be four reviewers on the white seabass panel and six on the nearshore panel, because the nearshore plan was longer, more complex and included 19 species. We also decided that on each panel there should be at least one resource economist or social scientist, one population dynamicist, and one fish ecologist. We thought, too, that it would be desirable to have representation from outside California, if possible. With those criteria in mind we ranked our candidates.

After ranking, we began contacting the candidates to ascertain if they were available and interested in participating. They were offered an honorarium and reimbursement of travel costs. For the nearshore plan we needed the peer review report to be completed within one month and the panel to be able to meet for a day at the end of that month. For the white seabass plan we had six weeks. Many of the people we contacted were not able to participate. Reasons included scheduling conflicts/lack of time (the most frequent reason), self-declared conflict of interest (several had acted in an advisory capacity during plan development), and lack of interest (one recent retiree was not ready to resume his recently discarded profession). Most of the people who declined suggested other candidates. Most of the people suggested were already on our list, but a few were not and they were evaluated. Most of the candidates wished to consider the invitation for a while before saying yes or no, and this further slowed the process as we approached our targeted quotas. We didn’t want to have more invitations issued than we had positions for. Through this process, we filled both panels. We believe that the C.V.s which will be appended to each report will confirm that both panels were comprised of highly qualified scientists.

Appendix F. Public Input

Prior to preparing the initial and amended draft environmental documents, the Department developed notices of preparations (NOP). The notices were provided to individuals and organizations that have expressed prior interest in Commission regulatory actions. The NOPs were also submitted to the State Clearinghouse for distribution to appropriate responsible and trustee agencies for their input and comments. No comments were received in response to the NOPs.

1. Summaries of Public Hearings and Meetings

1.1 Initial White Seabass Fishery Management Plan

In addition to the NOPs, the Department conducted three public meetings with a sub-panel of the Director's Marine Resources Advisory Committee (11 October 1994; 31 January 1995; and 31 March 1995) and three public meetings with a panel of scientists (24 October 1995; 06 February 1995; and 09 March 1995) chosen to advise the Department on WSFMP preparation.

At the Commission's 04 August 1995 and 03 November 1995 meetings, the Department provided the Commission information regarding background leading to the development of the draft WSFMP (environmental document), how the draft WSFMP was developed, and what the draft WSFMP proposed to do. Also, the Commission received public testimony on the draft WSFMP at these meetings.

The combination of Department and public testimony, and the discussion of the draft WSFMP's proposed consolidation of management and regulatory authority for white seabass at the 03 November 1995 meeting prompted the Commission to direct the Department to revise the draft WSFMP. The revision, provided for by §7022 FGC, was to reflect that the Commission would have authority for management and regulation of the recreational and commercial white seabass fisheries.

The environmental document that constitutes the WSFMP was revised as directed by the Commission. To comply with CEQA requirements, the revised WSFMP was sent out for a 45-day public review and comment period. Following the end of the public review period, the Department informed the Commission of the public comments and the Department's responses to those comments. The Commission adopted the revised WSFMP on 08 March 1996.

1.2 Amended White Seabass Fishery Management Plan

Amendment of the 1996 version of the WSFMP to bring it into compliance with the MLMA began in October 2000. Under FGC Section §7071(a), the previous plan is to remain in effect until the amended version is brought into compliance with the MLMA

(1998) and adopted by the Commission. On 30 January 2001, the first advisory meeting concerning the WSFMP revision took place. The purpose of the meeting was to provide the Department with feedback and recommendations from constituent groups regarding the development of an MLMA-compliant WSFMP. The next advisory meeting was held 04 June 2001. Management alternatives were discussed, and a preferred management option was agreed upon.

On 05 July 2001, an amended WSFMP was sent out for a 45-day public review period to comply with CEQA requirements. The document was presented to the Commission on 04 August 2001 and public comments were given at the following two Commission meetings (24 August 2001 and 05 October 2001). At the 05 October 2001 meeting, the Department informed the Commission of public comments following the end of the 45-day public review and the Department's responses to those comments.

On 05 July 2001, the revised WSFMP was sent out to a scientific panel for review. The Department received a summary of the scientific review panel’s comments and recommendations in early October 2001 and met with the panel on 29 October 2001 to discuss the panel’s comments at length. As a result of the scientific review panel’s comments on the WSFMP, the Department did not present it to the Commission in January 2002 as originally planned. Also, on 18 December 2001, the Department met with the ad hoc White Seabass Advisory Committee (WSAC) to inform it of the scientific review panel’s comments and recommendations. On 22 January 2002, the Department and WSAC met a second time to discuss changes the Department was recommending in order to incorporate several of the scientific review panel’s recommendations into the revised WSFMP. The WSAC agreed to the Department’s recommended changes to the WSFMP. The WSFMP is scheduled to be presented to the Commission for approval on 04 April 2002.

2. Persons, Organizations, and Public Agencies Commenting on the WSFMP’s

2.1 Initial White Seabass Fishery Management Plan

A) Director's Marine Resources Advisory Subpanel and B) Scientific Advisory Panel

A	B
Mr. John Beuttler United Anglers of California	Dr. Larry Jacobsen National Marine Fisheries Service
Mr. Nello Castagnola California Gillnetters Association	Ms. Cindy Thomson National Marine Fisheries Service
Mr. Dan Frumkes United Anglers of California	Dr. Larry Allen California State University, Northridge
Mr. Bill Perkins Western Fishboat Owners Association	Dr. Mia Tegner University of California, San Diego

Mr. Tony West
California Gillnetters Association

Mr. Locky Brown
Greater LA Council of Divers

Mr. Robert C. Fletcher, President
Sportfishing Association of California

Dr. Richard Glenn
United Anglers of California

Mr. Tom Raftican (alternate)

Dr. Ashley Mullen
Inter-American Tropical Tuna Commission

Dr. John Stephens Jr.
Occidental College

Dr. Michael Domeier
Department of Fish and Game
Marine Resources Division

Dr. John Stephens Jr.
Occidental College

Mr. Mike McCorkle (alternate)

2.2 Amended White Seabass Fishery Management Plan

The following individuals acted as members of an ad hoc White Seabass Advisory Committee for the preparation of the amended WSFMP:

Mr. Bob Fletcher
Sporting Association of California

Mr. Tom Raftican
United Anglers of California

Mr. Bob Osborn
United Anglers of California

Mr. Dan Frumkes
Statistician

Dr. Ashley Mullen
Population Biologist,
Inter-American Tropical Tuna Commission

Mr. Gary Burke
Commercial Fisherman

Mr. Tony West
California Gillnetters Association

Mr. Tim Athens
Commercial Fisherman

Mr. Mike McCorkle
Commercial Fisherman

3. Comments Received and Response to Comments

The comments received on the initial WSFMP were incorporated into that document and will not be discussed here. During the Commission meetings on the amended WSFMP, several comments were received. The comments were either in support of the WSFMP or asked for clarification of some aspect of the plan. The comments and the Department's response are listed below:

Comment A. Ron Gaul, Sea Turtle Restoration Project. 04 August 2001 and 24 August 2001.

Mr. Gaul had concerns about the white seabass gill net fishery with regard to potential marine mammal, marine turtle, and seabird mortality; the lack of an observer program; and an observed high rate of discard mortality of finfish in white seabass gill nets. He also wanted the Commission to ensure that the gill net fishery would be conducted in a manner that is safe and sustainable for several named marine resources (See Section D4).

Response:

A1. Discard mortality rate: With regard to the 52% discard mortality rate that Mr. Gaul attributes to the white seabass drift gill net fishery, this number comes from the six year average of observation data from 1983 through 1988, and does not accurately illustrate the discard mortality rate. Analysis of the data shows that the annual discarded mortality rate ranges from 20 to 80%. The disparity in values was the result of two anomalous years, 1985 and 1987. In each of these years, there was an unusually high catch of one species (spiny dogfish in 1985, Pacific sardines in 1987), which skewed the six year average. If the two years are removed, 40% of the catch taken in white seabass drift gill nets were either sold or kept by the fishermen, approximately 35% of fish and invertebrates were discarded alive and about 25% of finfish and invertebrates were discarded dead.

The ratios reported in the study (Vojkovich et al. 1990) do not reflect the bycatch mortality associated with the white seabass gill net fishery relative to the impact of the other gill net fisheries which have higher landings overall. The total number of fish and invertebrates taken by the white seabass fishery compared to the total taken by all gill net fisheries accounted for only 5%. In comparison, the halibut gill net fishery and the white croaker gill net fishery took eight and ten times the number of animals, respectively. Thus, available data suggests that the white seabass drift gill net fishery takes significantly fewer fish compared to other net fisheries.

A2. White seabass gill net fishery should be conducted in a manner that is safe for nontarget species such as marine mammals, turtles and birds: As stated in Chapter 6, of the WSFMP, there are few documented interactions between marine mammals and marine seabirds and no documented take of sea turtles in white seabass drift gill nets. Onboard observation of this fishery during the 1980s found that interactions with marine mammals and seabirds accounted for less than one marine mammal per set day and less than one seabird per every four set days. Based on the NMFS take numbers for pinnipeds, cetaceans and sea birds, this level of take does not impede the long term sustainability of these resources. For this reason, the NMFS does not require onboard observation of this fishery despite its classification as a Category I fishery.

The Department has identified the need to conduct on-board observations of the white seabass commercial fishing fleet to document possible changes in bycatch composition that may have occurred following Proposition 132, which moved the fleet further offshore in 1994 (Chapter 7, Section 7.4.1).

A3. White seabass gill net fishery should be conducted in a manner that is sustainable for targeted species such as sharks, tunas, billfish, halibut and white seabass: It is unclear from Mr. Gaul's comments if he is addressing the take of the above mentioned species in the white seabass fishery specifically or in drift gill net fisheries generally. However, as for the take of sharks, observation of the white seabass drift gill net fishery identified about a dozen species that were captured in white seabass drift gill nets. The majority were nearshore, kelp bed species such as brown and gray smoothounds, horn sharks, swell sharks, and leopard sharks. Several marketable species of shark (i.e., mako, Pacific angel, soupfin, and thresher) were also taken by this gear. The overall disposition of the shark catch resulted in 18% kept or sold, 51% discarded alive and 31% discarded dead during the six year study. The disposition for unmarketable species or those without size limits was 16% kept for personal use, 74% returned alive and 10% discarded dead. The total number of sharks taken by this fishery during the six year period was less than 3,000. Additionally, the take of shortfin mako and common thresher by all fishing gears has been addressed in the draft Highly Migratory Species Fishery Management Plan prepared by the National Marine Fishery Service.

As for billfish, there has never been documented take of either species group in the white seabass drift gill net fishery. Bluefin tuna and thresher sharks are occasionally captured in gill nets, however, this incidental take is considered insignificant. Further, any questions about the sustainability of these species groups have been addressed in the Pacific Fisheries Management Council's draft Highly Migratory Species Fisheries Management Plan.

Few halibut are taken in the commercial white seabass fishery. During the Department's six year observation project, the entire white seabass fleet took an estimated average of 3,556 lb (1159 kg) of California halibut, which represented less than 0.5% of annual landings during the 1980's. This figure is expected to be even smaller now due to the movement of this fishery outside of three miles along the mainland coast and outside of one mile around the islands. Based on these factors, the take of California halibut by the white seabass fishery is not likely to impact the halibut resource.

<u>Comment B</u>. Mike McCorkle, Commercial fisherman. 04 August 2001.

Mr. McCorkle supported the WSFMP. In addition, he stated that the white seabass drift gill net fishery is one of the cleanest fisheries, and stated that he believed the comments made by Mr. Gaul were politically motivated.

<u>Response</u>: no response.

Comment C. Bob Fletcher, Sportfishing Association of California. 24 August 2001.

Mr. Fletcher stated that allocation was a contentious issue, but it was not necessary to decide that issue now. He went on to say that the Commission should maintain management of white seabass with the existing regulations and with the addition of the proposed harvest guideline.

Response: no response.

Comment D. Eric Hopper, Commercial Fisherman. 24 August 2001.

Mr. Hopper stated that he did not feel that allocation was an issue at this time but he did not agree with the proposed harvest guideline because up to 75% of fishing areas closed to commercial take. He stated that he did not support a harvest limit as it was unnecessary.

Response: no response.

Comment E. Bob Osborne, United Anglers of Southern California. 24 August 2001.

Mr. Osborne agreed with Mr. Fletcher's comments and requested that the WSFMP undergo scientific peer review to assure the correctness of the proposed harvest guideline. In addition, Mr. Osborne requested that the issue of allocation be addressed in the Marine Life Management Act Master Plan as this would provide direction and consistency between all fishery management plans.

Response:

The WSFMP was sent out for scientific peer review on 05 July 2001. The conclusions of the peer review panel were received October 2001 and several of its recommendations of have been incorporated into the latest revision of the WSFMP.

Comment F. Chris Hoeflinger, Commercial Fisherman and Nearshore Advisory Panel member. 24 August 2001.

Mr. Hoeflinger supports the WSFMP proposed project, and hopes that the Nearshore Fishery Management Plan will be of as high quality as the WSFMP.

Response: no response.

Comment G. Ron Gaul for Tom Raftican, United Anglers of Southern California. 04 August 2001.

Mr. Raftican supported the WSFMP but requested the Commission take into consideration the following issues when determining allocation of the white seabass resource: 1) fishery data, 2) legality of commercial fishing, 3) access, 4) significance to user group, and 5) economic value.

Response:

With the exception of the second item, all of the allocation criteria raised by Mr. Raftican are already part of the Allocation section of the WSFMP. The previous advisory committee spent considerable time on the issue of allocation and their decisions resulted in the allocation criteria that was adopted in the initial white seabass FMP and have been brought forward in the amendment (Section 5.4.3).

The question raised regarding the legality of commercial fishing was addressed by Mr. Joseph Milton, DFG staff counsel:

"At the Fish and Game Commission meeting of August 4, 2001, comments on the White Seabass Fishery Management Plan were submitted on behalf of Mr. Tom Raftican of United Anglers of Southern California, which requested that the Commission take into consideration several issues when determining allocation of the white seabass resource, including the legality of commercial fishing. Mr. Raftican contends that the state constitution gives every citizen the right to recreational fish but not commercial fish. Mr. Raftican has also intimated that this right to fish precludes the Fish and Game Commission from barring recreational fishing in Marine Protected Areas (MPAs). This contention is incorrect, for the following reasons.

First, the courts have considered section 25 in the context of both recreational and commercial fishing.[1] The so-called "right to fish" is neither absolute nor fundamental, but has been characterized by the courts as only a "privilege" or a "qualified right" subject to the Legislature's regulation of fishing.[2] Indeed, it is well-settled that section 25 must be read in connection with article 4, section 20 (formerly section 25½), which states that the Legislature may enact appropriate laws for protection of fish and game, and may delegate to the Fish and Game Commission such powers relating to protection and propagation of fish and game.[3] In that respect, the California Supreme Court found it "most apparent" that the purpose of (now) article 4, section 20 "was to clothe the Legislature with ample power to adequately protect the

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See e.g. *In re Quinn* (1973) 35 Cal.App.3d 473; *State of California v. San Luis Obispo Sportsman's Association* (1978) 22 Cal.3d 440) [recreational]; *Paladini v. Superior Court* (1918) 178 Cal. 369; *California Gillnetters Association v. Department of Fish and Game* (1995) 39 Cal.App.4th 1145 [commercial].

[2]*Paladini*, supra, 178 Cal. 372; *California Gillnetters*, supra, 39 Cal.App.4th 1153.

[3]*Ex parte Parra* (1914) 24 Cal.App. 339, 340.

fish and game of the state."[4] Further, the California Supreme Court has long declared that the power to regulate fishing has always existed as an aspect of the inherent power of the Legislature to regulate the terms under which a public resource may be taken by private citizens.[5] Without question, this regulatory power applies to both recreational and commercial fishing.

Mr. Raftican has also asserted that sportfishing license revenues cannot fund the establishment of MPAs because such revenues cannot be used to support commercial fishing programs or nongame fish and wildlife programs. (See Fish & G. Code § 711(c).) However, the Legislature has yet to appropriate any funds for the implementation of the MPA program, and neither the Department nor the Commission has ever suggested that MPAs should be exclusively funded from sportfishing license revenue. This does not mean that sportfishing revenues can never fund a share of MPA development. In enacting the Marine Life Protection Act, the Legislature declared that MPAs are necessary to maintain marine biological diversity, which is "a vital asset" and important to "ocean-dependent industry," and because of the expansion of fishing activities to formerly inaccessible marine areas that once recharged nearby fisheries. The enhancement of fishery resources in general is a stated goal as is the enhancement of recreational opportunities in particular. Thus, MPAs are clearly intended to benefit recreational fisheries, as well as commercial fisheries and nongame fish. The law is clear that a portion of marine resource protection costs may be allocated to those who use and benefit from management of the marine fishery resources. This reasonably includes ocean sportfishers as well as other extractive and non-extractive users who benefit from MPAs".

Comment H. Todd Steiner, Sea Turtle Restoration Project. 26 November, 2001

Mr. Steiner expressed concern that the WSFMP would be implemented "without adequate oversight of the environmentally harmful effects of gillnet fishing." Specifically, he stated that the impact on protected species from the white seabass gill net fishery may have worsened since the implementation of Proposition 132 which moved the fishery farther off shore. Also, the observed coverage of the white seabass gill net fishery during a 1983-1989 DFG study was low relative to total fishing effort and no observer program has been initiated since 1989. Mr. Steiner recommended that an observer program be initiated for the white seabass fishery and that such a program have 100% observer coverage.

Mr. Steiner pointed out that several named species observed in the 1983-1989 study as white seabass gill net mortalities are protected under the Marine Mammal Protection Act or the Migratory Bird Treaty Act. Mr. Steiner expressed concern about a potential

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[4] *In re Makings* (1927) 200 Cal. 474, 479.

[5] *In re Phoedovius* (1918) 177 Cal. 238, 245-246; *People v. Monterey Fish Products Company* (1925) 195 Cal. 548, 563.

impact from white seabass gill nets on sea otters around the Channel Islands and Ventura and elephant seals at San Miguel Island. Mr. Steiner also brought up the 52% finfish discard mortality rate recorded in the 1983-1989 DFG study for the white seabass gill net fishery.

Mr. Steiner expressed concern about the recent emergence of a tuna gill net fishery, known as a white seabass fishery because it uses the same size mesh, but that is actually targeting albacore and bluefin tuna and therefore may potentially impact dolphins.

Response:

H1. Need for an observer program: As stated above in our response to Mr. Gaul, the Department has identified the need to conduct on-board observations of the white seabass commercial fishing fleet to document possible changes in bycatch composition that may have occurred following Proposition 132, which moved the fleet further offshore in 1994 (Chapter 7, Section 7.4.1). Although we recognize that a high rate of observer coverage is desirable, implementing 100% coverage is unrealistic because of the costs involved (i.e., hiring more observers and higher charter boat costs for transporting those observers to off-shore fishing boats).

H2. Potential gill net mortality of marine mammals, including elephant seals at San Miguel Island, and seabirds: Please see Response A2 to Comment A above.

H3. Potential gill net mortality of sea otters around the Channel Islands and Ventura, if the otter population expands southward from Point Conception: Currently, the southern sea otter (*Enhydra lutris nereis*) population ranges along the California coastline from Half Moon Bay in San Mateo County to Gaviota in Santa Barbara County. Although otters have been sited as far south as San Diego County in southern California, they are rare in that portion of the state. The 2001 sea otter survey showed a decrease in the number of otters in the southern portion of the species' range (Pt. Conception to Gaviota) from 50 (in 2000) to 26 (G. Sanders, USFWS pers. comm.). With the exception of San Nicholas Island, sea otters are sparsely scattered on the Channel Islands; though they have been consistently observed on the west end of San Miguel Island during annual aerial surveys. The Marine Resources Protection Act of 1990 (effective 01 January 1994) established a gill and trammel net exclusion zone (Section §8610.2 FGC) which protects areas that include sea otter habitat. Since the white seabass gill net fishery is restricted to waters outside typical sea otter habitat, it is unlikely to catch otters in its active nets.

H4. Discard mortality rate: Please see response A1 to Comment A above.

H5. California tuna gill net fishery: no response.

Comment I. Craig S. Harrison, Pacific Seabird Group. 26 November, 2001

Mr. Harrison complemented the Commission and the Department for the development of fishery management plans as mandated by the MLMA. Mr. Harrison expressed concern about the bycatch associated with the white seabass drift gill net fishery and he recommended that the Department implement an independent fishery research program to collect data on bycatch.

Response: Please see Response A2 to Comment A above.

Comment J. Ashley Mullen, Tuna Commission and Bob Osborn, United Anglers of California. 18 December 2001.

Dr. Mullen and Mr. Osborn expressed their concern with regard to Section 51.04(a) of the white seabass regulations which refers to the annual white seabass harvest allocation “in pounds”. The gentlemen suggested that removing the words “in pounds” from the regulatory language would improve the flexibility of this regulation and allow for other means of measuring catch, such as number of fish, when determining allocation of white seabass between the recreational and commercial fisheries.

Response: In response to the above comment, and additional discussion during the 18 December meeting, the following changes were made in the Title 14 regulations: 1) Section 51.04(a) now reads “Allocation of an annual white seabass harvest between recreational and commercial fisheries will be determined consistent with options specified in the White Seabass Fishery Management Plan.” 2) Section 51.04(b) now reads “The commission shall consider at least the following factors in the allocation of white seabass:”...

The Pre-adoption Statement of Reasons for Revised White Seabass Fishery Management Plan containing the above mentioned changes was submitted to the Office of Administrative Law on 05 February 2002 for publication in the Notice Register.

Comment K. Robert W. Hetzler, President of Harbour Ocean Preservation Enhancement. 18 March 2002

K1. The plan states that the fishery is fully recovered and derives an MSY from data collected in the 1970s. Mr. Hetzler did not understand the rationale for using a historical MSY, stating that the historical catch data doesn’t support the plan’s proposed MSY. According to Mr. Hetzler, the fishery has been unable to support an MSY of 1.5 million pounds since the 1950s. Mr. Hetzler strongly recommended a more conservative OY such as option C1 which used recent catch data rather than an OY based on a historical MSY.

K2. The plan does not address why stock levels remained very low for nearly 20 years (1980s to1997) and why it recently increased during the last three years. “What happened to allow the stock to go from depleted to fully recovered in just three years?"

Preliminary landings in 2001 are down significantly, which indicates that the population cannot withstand the current level of fishing mortality.

K3. The plan is flawed because it lacks a new estimate of mortality and data on year classes, spawning biomass capacity, and recruitment levels. The present stock has a different year class makeup: the stock of the 1950s and 1960s consisted of more mature fish which provided greater recruitment levels and was able to sustain a higher OY. The current white seabass spawning biomass is substantially below that of the 1950s and 1960s and therefore can not sustain as high an MSY.

K4. Mr. Hetzler was concerned about the plan's call for a reassessment of the stock in two years, because adjustments that may be made in the fishery at that time may come too late and cause a set back in the recovery of the stock. He felt that the proposed OY of 1.2 million pounds could severely deplete the stock before it is determined that the yield was set too high.

Response:

K1. The plan does not state that the fishery is fully recovered, but that it is recovering. The preferred alternative uses National Standard Guidelines (NSGs), which are used to assist in the development of federal FMPs, to derive an MSY proxy for the white seabass fishery. The NSGs allow for situations when MSY can not be estimated directly. The lone stock assessment for white seabass used catch and effort data in the 1970s and came up with an MSY similar to the preferred alternative. The similarity of the two MSY estimates suggests that the MSY proxy has some value. Recent catch data was not used for determining an MSY since recent catches have not been stable.

Harvest levels below 1.5 million pounds since the 1950s may be due to other factors, and not necessarily related to the fishery's inability to presently support this level. During the 1980s to the present, more restrictive regulations have been implemented that have limited the number of white seabass that can be landed. Oceanographic changes favorable for white seabass have also occurred during the last few years (see response K2) and may explain the increased landings since 1997.

K2. This comment was more applicable to an earlier draft of the plan. The present plan provides a possible explanation for this: A pattern seen in the 1890s and 1940s seems to be occurring today whereby white seabass abundance increases substantially following a shift from warmer to colder ocean waters. Warmer waters occurred in the Southern California Bight from the late 1970s to mid 1990s, but have become colder over the last few years. Again, the plan does not state that the fishery is fully recovered, but that it is recovering.

Although not available at the time of plan preparation, final white seabass landings for

2001 are actually higher than in 2000, indicating that the stock is supporting the current level of fishing mortality.

K3. We agree that current estimates of mortality, year class strengths, and spawning biomass are valuable data; we have emphasized that a current stock assessment for white seabass is needed. Information on recruitment is currently being collected through studies done by OREHP. We are unaware of any data showing that the present stock of white seabass consists of smaller fish and a spawning biomass substantially below that of the stock of the 1950s and 1960s. Recreational fishery data and anecdotal information from the commercial fishery suggest that the average size of white seabass being caught has increased in recent years.

K4. The plan recommends that a current stock assessment be done immediately. The plan also calls for the Department's white seabass management team to monitor the fishery throughout the year and for the Commission to evaluate the effectiveness of management measures annually. The fishery management plan framework allows the commission to adjust, impose, or remove management measures at any time during the year for resource conservation, social or economic reasons. This allows for adaptive management of the fishery, enabling quick adjustment of OY if needed.

–End of response to comment K–

The Department presented the White Seabass Management Plan to the Commission for adoption at the 04 April 2002 meeting in Long Beach, California. Following Ms. Marija Vojkovich's presentation, members of the public were invited by the Commission to comment on the plan. The following individuals spoke at this meeting.

<u>Comment L</u>. Bob Strickland, United Anglers of Southern California

Mr. Strickland directed the following questions to Ms. Vojkovich: What data source was used to determine that most of the white seabass take is by the recreational component of the fishery, are these data accurate, and do these data actually capture the take by private boaters up and down the whole coast?

<u>Response</u> by Ms. Vojkovich: Marine Recreational Fisheries Statistical Survey (MRFSS) data are used to estimate the take by recreational fishers and to estimate the pounds of white seabass taken by this component of the fishery. Yes, these data estimates could be wrong. Yes, these surveys do cover the entire coast of California.

<u>Comment M</u>. Chris Miller, California Lobster and Trap Fisherman's Association

Mr. Miller stated that he supports the WSFMP and that because we share the white seabass resource with Baja California, Mexico, resource managers from California should strive to have a cooperative relationship with their Mexican colleagues for the sharing of data gathered for white seabass stock assessments. Mr. Miller encouraged the Commission to consider this issue as it moves forward with the implementation of the MLMA.

Response: President Flores thanked Mr. Miller for his comments.

Comment N. Tom Raftican, President of United Anglers of Southern California (UASC)

Mr. Raftican thanked the Department for compiling an impressive compilation of data on the white seabass resource and he felt that the document (WSFMP) highlighted the necessity of using fishery management plans for managing fished stocks. Mr. Raftican stated that the plan lacks any substantial precautions in managing the white seabass fishery because the management options, although within the National Standard Guidelines for managing fisheries, are based on very optimistic assumptions about the current status of the white seabass stock. Mr. Raftican stated that there are important elements in this plan that still need to be completed and these include 1) ongoing fishery monitoring and review of the plan's successes and failures; 2) obtaining research to fill a wide assortment of data gaps; 3) and establishing an allocation policy. Mr. Raftican continued by saying, "We [UASC] are particularly concerned with performance standards and triggers that would quickly implement additional regulations in a timely manner. The plan indicates the Department intends to continue to monitor and develop standards and triggers to better manage the fishery." Mr. Raftican told the Commission the white seabass fishery is an extremely valuable resource to the recreational fishing community. Mr. Raftican stated that "the success of this plan will hinge upon the speed and precision with which the Department is able to monitor the fishery and ultimately fill the data gaps." Mr. Raftican commended and thanked "Ms. Marija Vojkovich and the new staff of this plan for stepping in late in the plan process and doing an excellent job of putting together a couple of very productive meetings and productive revisions to previous drafts that have vastly improved this plan." Mr. Raftican stated that the vulnerability of this fishery and the problems associated with managing it have not been glossed over in the plan and this is an indication of the quality of the plan. Mr. Raftican stressed, however, that "the success of the plan is clearly dependent upon timely and committed implementation." "In adopting this plan, we [UASC] urge the Commission to establish priorities within the Department to move this fishery to the top of the list of state managed species and to establish active and effective mechanisms to proactively manage the fishery while doing their best to obtain funding to improve the data situation."

Response: President Flores thanked Mr. Raftican for his comments and Commissioner Schuchat asked Ms. Vojkovich if there is a priority list by which the Department manages species under the purview of California. Ms. Vojkovich responded that there is no written document; however, priority is based on what was indicated by the Legislature. For the nearshore species these include the white seabass and squid management plans.

Comment O. Mr. Bob Osborn, United Anglers of Southern California

Mr. Osborn identified himself to the Commission as one of the members of the White Seabass Advisory Panel and he supported the position expressed by Mr. Raftican.

Response: No response.

Comment P. Robert Hetzler

Mr. Hetzler told the Commission that he considered the plan to be well-developed and he commended the Department for its work on the plan. Mr. Hetzler questioned the need for setting an optimal yield (OY) for this fishery at this time because he felt that this OY was based on historical stock levels and that it had nothing to do with the current stock size. Mr. Hetzler stated that the current stock size is probably much different than it was in the past and that there may have been changes in habitat, recruitment and spawning biomass. Mr. Hetzler recommended that the harvest level be set at a lower, more precautionary level in order to build up the stock.

Response: In response to Mr. Hetzler's comments, President Flores asked Ms. Vojkovich to state why the Department had chosen the annual harvest limit of 1.2 million pounds for white seabass. Ms. Vojkovich told the Commission that the limit was set as a starting point to begin setting boundaries on the fishery because, under the status quo, there is no harvest limit.

Once all public comment had been heard, the Commission voted unanimously to adopt the WSFMP. Mr. Bob Treanor, Executive Director of the Fish and Game Commission, announced that the environmental document would be certified at the 09 May 2002 Commission meeting, and the regulations would also be adopted at that time.

SEA TURTLE RESTORATION PROJECT
POB 400/40 Montezuma Avenue • Forest Knolls, CA 94933
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California Fish and Game Commission
Robert Treanor, Executive Director
Mike Chrisman, President
Sam Schuchat, Vice President
Michael Flores, Commissioner
1416 Ninth Street
Sacramento, California 95814

August 14, 2001

Dear Mr Treanor, and Commissioners Chrisman, Schuchat and Flores;

The Sea Turtle Restoration Project is pleased to comment on the white seabass (WSB) fishery management plan (FMP). While we are primarily concerned with the conservation and restoration of marine turtles, we have an interest in all protected species that interact with fishing gear.

The WSB gillnets are one example of such gear. NOAA Fisheries categorizes the WSB gillnet fishery as "Category I" under the MMPA, meaning that it is highly likely to interact with marine mammals. DFG had a gillnet observer study from 1983 to 1989, and NMFS had an observer program on the halibut gillnet fishery from 1990 to 1994 and 1999 to 2000. These studies included 6"-7" mesh nets used in the WSB gillnet fishery. Data we have analyzed from these observer programs demonstrates that pinnipeds and dolphins can be entangled in the 6"-7" mesh nets that are used in WSB gillnets, and suffer mortalities. Seabirds, such as cormorants and grebes, also have interactions with these nets.

The WSB gillnet fishery, along with the larger halibut gillnet fishery, currently have no observer program. These nets have been pushed farther offshore since 1994, but this is no guarantee that interactions with protected species has lessened. In fact it may be worse. The swordfish gillnet fishery fishes farthest offshore than any other of California's drift gillnet fisheries. Yet the swordfish nets have a high impact on marine turtles and mammals. Another concern is the high level of waste in the WSB gillnet fishery. According to the 1983-89 DFG study, there is a 52% discard mortality rate of finfish in the WSB gillnets, the highest of all gillnet fisheries observed in the DFG study.

As a result we respectfully ask the Commission for the following:

1. California's WSB gillnet fishery should be conducted in a manner that (a) is safe for non-target species including protected marine mammals, turtles and birds, and (b) is sustainable for targeted species such as sharks, tuna, billfish, halibut, and white seabass.
2. If this fishery can't be proven safe and sustainable, then it should be closed.

Thank you for your consideration in this matter.

Sincerely,

[illegible], Marine Species Campaigner, Sea Turtle Restoration Project

Cc: Robert Hight, Director, California DFG
William Hogarth, Assistant Director, NOAA Fisheries

SEA TURTLE RESTORATION PROJECT
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November 26, 2001

California Fish and Game Commission
Robert Treanor, Executive Director
Mike Chrisman, President
Sam Schuchat, Vice President
Michael Flores, Commissioner
1416 Ninth Street
Sacramento, California 95814

Dear Mr Treanor, and Commissioners Chrisman, Schuchat and Flores;

The Sea Turtle Restoration Project (STRP) is concerned that the White Sea Bass Fishery Management Plan (WSBFMP) will move forward without adequate oversight of the environmentally harmful effects of gillnet fishing. We would like to provide a synopsis of the white sea bass (WSB) gillnet fishery and recommendations for its regulation.

The impact on protected species may have worsened with the implementation of Proposition 132 because WSB gillnet fishing moved farther offshore. Based on earlier DFG studies, we believe there is a likelihood that this fishery is now impacting species protected under the state and federal Endangered Species Act and the state Fully Protected Species Act (see below).

In 1999, two thirds of the days fished by white sea bass gillnets were with setnets, the rest with driftnets. A 1983-1989 Department of Fish and Game (DFG) study showed that protected species like seabirds, dolphins and pinnipeds are entangled in nets with 6-7" mesh, which is the size used in white sea bass nets.

Of the 7,633 estimated days of effort in the WSB gillnet fishery from 1983-1989, 250 were observed (3.3% coverage).

The mortalities observed in WSB nets in the 1983-89 DFG study include:

Common Dolphin	6
Pacific White sided Dolphin	1
Pelagic Cormorant	4
Brandt's Cormorant	4
Unidentified Cormorant	1
California Sea Lion	7

These species are protected under the Marine Mammal Protection Act or the Migratory Bird Treaty Act. Also there is WSB gillnetting around the Channel Islands and Ventura, which may impact sea otters that may expand southward from Pt Conception, and elephant seals, which have

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a nursery on San Miguel Island. Both these species are protected under the state Fully Protected Species Act.

It is worth also noting that the WSB gillnet fishery also had the highest rate of finfish discard mortalities of any gillnet fishery, 52% (by count for all species observed), as recorded in the 1983-1989 DFG study. This included both targeted and untargeted finfish. No other observer program specifically for WSB gillnets has been in place since 1989.

The California tuna gillnet fishery
The California tuna gillnet fishery is a recent phenomenon, but is also referred to as a "white sea bass fishery." This is because it uses the same 6-7" mesh. The difference is that it is in offshore waters, apparently fishing the same areas of the California/Oregon drift gillnet swordfish fishery (which uses larger mesh, 14" or larger). Despite major similarities with the federally managed swordfish fishery, this tuna fishery, which is targeting albacore and bluefin, is presently managed exclusively by the state, and presently has no observer program. The DFG warden in Morro Bay received reports of dolphin interactions in this fishery this year.

There are other fisheries of concern currently managed by the state:

1. California high seas pelagic longline fishery; (unobserved)
2. California/Oregon swordfish drift gillnet fishery (20% observer coverage)
3. California halibut gillnet fishery (unobserved)

All of these fisheries have recorded interactions with protected species, as well as significant economic and regulatory discard mortalities of finfish. In light of the cumulative impacts of the fisheries listed above, we believe the proposals in the WSBFMP to regulate the WSB/tuna gillnet fishery are inadequate.

In conclusion, we recommend redrafting the WSBFMP with options incorporating the following:

1. the new WSBFMP seriously evaluate the cumulative impacts of all gillnet and pelagic longline fisheries on protected species and reduce the WSB gillnet impacts significantly;
2. the WSB gillnet fishery implement a 100% observer coverage plan in order to effectively assess impacts on protected species, as well as other non-targeted finfish species;
3. various gillnet fisheries be regulated and permitted in a coherent manner that does not allow fishers to avoid certain protective regulations by changing its so-called "intended target species" or mesh size.

Sincerely,

Todd Steiner
Director

Cc: Robert Hight, Director, California DFG
William Hogarth, Assistant Director, NOAA Fisheries

Pacific Seabird Group

DEDICATED TO THE STUDY AND CONSERVATION OF PACIFIC SEABIRDS AND THEIR ENVIRONMENT

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November 26, 2001

John M. Duffy
Assistant Executive Director
Fish and Game Commission
1416 Ninth Street
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Sacramento, CA 94244-2090

Re: Comments on Proposed Regulations for the White SeaBass Fishery

Dear Mr. Duffy,

These are the comments of the Pacific Seabird Group (PSG) on the Fish and Game Commission's (Commission) proposed changes in regulations under Title 14 of the Fish and Game Code pertaining to white seabass (*Atractoscion nobilis*) and the draft White Seabass Fishery Management Plan (White Seabass FMP). PSG is an international organization that was founded in 1972 to promote knowledge, study and conservation of Pacific seabirds. PSG draws its members from the rim of the entire Pacific Basin, including the United States, Canada, Mexico, Japan, China, Australia, New Zealand, and Russia. Among PSG's members are biologists who have research interests in Pacific seabirds, state and federal officials who manage seabird populations and refuges, and individuals with interests in marine conservation. Over the years we have advised and worked cooperatively with government agencies to further these interests. PSG is especially active with regard to seabird-fishery conflicts and oil spill restoration.

First, we applaud the Commission and the Department of Fish and Game (CDFG) for the development of Fishery Management Plans in general, as mandated by the Marine Life Management Act of 1998. These plans hold much promise to more effectively manage

California's fisheries, better assuring healthy stocks and reduced ecological impacts. The draft of the updated White Seabass FMP holds many positive proposals for white seabass management. However, we feel that any adopted plan requires implementation of a program, independent of the fishery, to collect data on fishery bycatch on non-target species, to assess the extent of this bycatch and its potential ecological impacts, and provide guidance for mitigation of bycatch impacts. The commercial set and drift gill net fishery for white seabass is of particular concern because of the high bycatch typical of such gill net fisheries and the relatively large size of this fishery. Information provided in Chapter 2 of the draft White Seabass FMP suggests that the white seabass gill net fishery is no exception. According to the draft White Seabass FMP, seabirds, marine mammals, invertebrates, and 145 species of fish were recorded as white seabass gill net bycatch during an on-board observation study conducted by CDFG in 1982 to 1988.

While the only seabirds reported caught in the observer study were 10 cormorants (*Phalacrocorax* spp.), observers covered only 3% of fishing days. Thus, this study may have grossly underrepresented seabird bycatch during the study period. This study is also outdated. Since the fishery moved farther offshore following the gill net closure within state waters south of Point Conception in 1994, the level of bycatch and species taken as bycatch likely have changed. In the past, species that forage close to shore, such as cormorants, likely were most susceptible. Currently, species that forage over more open waters, such as Sooty Shearwater (*Puffinus griseus*), Common Murre (*Uria aalge*), Xantus's Murrelet (*Synthliboramphus hypoleucus*), Cassin's Auklet (*Ptychoramphus aleuticus*), and Rhinoceros Auklet (*Cerorhinca monocerata*), would be more susceptible to gill net capture. Common Murres, and to a lesser extent, Sooty Shearwaters and other species, were common bycatch in the California halibut set gill net fishery. The Xantus's Murrelet, which breeds on the California Channel Islands and forages throughout the offshore waters of the Southern California Bight, is a California Species of Special Concern.

In summary, we highly recommend the implementation of an onboard observer program for bycatch in the white seabass gill net fishery as part of the White Seabass FMP. Such a program would need higher observer coverage than the past study, with adequate temporal and spatial coverage to assess the entire fishery. For example, in the Monterey Bay set gillnet observer program conducted by the National Marine Fisheries Service in 1999 and 2000, observer coverage ranged from 20% to 31% per quarter. In addition, the potential need for bycatch data from the smaller-scale white seabass longline fishery requires examination. Longline fisheries are well-known for high seabird bycatch. Without observer data, it will be impossible to make necessary, scientifically-based decisions regarding potential ecological impacts of the white seabass gill net and longline fisheries, and all gill net and longline fisheries.

Sincerely,

Craig S. Harrison
Vice Chair for Conservation

March 18, 2002

Mr. Micael Flores, President
California Fish & Game Commission
1416 Ninth Street
Sacramento, CA. 95814

Re: White Sea Bass Management Plan

Dear Mr. Flores:

I recently received a copy of the Department of Fish & Game's (DFG) White Sea Bass. Plan (dated 12/01) (Plan) and after reviewing it, I am concerned about the conclusions and recommendations made therein. I am a former fishery biologist having worked under Dr. B. Schaefer at the Inter - American Tropical Tuna Commission, ialso have worked as an executive for Star-Kist Foods Inc. for 31 years retiring in 1991. Since then I have been a Director of United Anglers of Southern California (UASC) and am presently President of Harbour Ocean Preservation Enhancement, a white sea bass grow out pen located in Huntington Harbour. During all these years I have been a avid recreational angler. Although I am sure you have received many comments on the plan, I believe my views may be somewhat different than you have received so far.

After pushing for a White Sea Bass Management Plan (Plan) for a number of years, I am happy to see that it has finally arrived. I would like to commend the DFG for a well developed Plan and the information and data provided therein. They have done a great job with the limited available data as acknowledge in the plan itself. This is a concern as the Plans recommendations and stock assessments are based on very limited current data. The average annual fish size cannot be determined from the data presented in the plan because it does not represent the actually number of fish caught (in the commercial landings) nor the actual weight landed (in the recreational landings) with possible exception in the most recent years for recreational catches (since 1990). As a result, the plan has no valid data to determine the fish size and year class strengths in the fishery. Actually, the plan has no current information as to the year class make up of the current sea bass stocks. This information is imperative to have in order to determine what spawning level the stock can produce and thereby the level of recruitment of replacement fish that is available to harvest.

The historical catch data itself does not support the Plan's proposed Maximum Sustainable Yield (MSY). The Plan's position is that the white sea bass fishery has fully recovered and has a MSY based on a model calculations derived in the 1970's of 1.6 million pounds. Yet when we look at the historic landing data, on an average, the fishery was not able to support an average catch level of 1.5 million pounds in the 1950's. The following table taken from the landings table in the Plan reflects the average catch from only California waters in ten year average increments.

1950-1959	1,553,630 lb.
1960- 1969	708,772 lb.
1970- 1979	598,090 lb.
1980- 1989	112.257 lb.
1990- 1999	238,332 lb.

As is evident from the table, the sea bass stocks could not sustain the higher catches in the 1950's, dropping by about 55 percent in the 1960's and continued to drop thereafter to a low of only 112, 257 pounds in the 1980's. At the low, the stocks could yield only about eight percent of the 1950's average catch levels. These low catch levels persisted through 1997 and reflect the stock reaching an equally low equilibrium size that sustained these catch amounts.

The Plan does not answer some very important questions about why the stock levels remained very low for nearly twenty years (1980's through the 1997's) and why it suddenly increased in the last three years (1998 - 2000). What happened to allow the stock to change from a depleted stock to a fully recovered stock in just three years? If one looks at the data through 1997, the indices show the stock is still at a very low level. Based on the growth rates of three to five years from spawning to when a fish enters the fishery and the average age of 7 to 10 years to reach the average size of the past average commercial and recreational fish size (remember the size data is flawed), how did the fishery fully recover in only three years? The answer is obvious that the stock did improve, but has definitely not recovered to the 1950's level in such a short period of time. If this position is correct, can the current recovered stock support the Plan's recommended 1.2 million pound OY catch level? The answer is no, it cannot and the 2000 catch of over nine hundred thousand pounds probably was greater than the MSY yield the current stock could support, meaning the stock has been reduced somewhat with that catch level. Preliminary landings in 2001 are down significantly, by as much as 25 to 30 percent, which is indicative that the population could not support this level of fishing mortality. The next few years data will tell, but it appear that the 2000 fishing mortality level reduced the current standing stock.

The Plan's conclusions appear flawed because there is no data as to the year class make up of the current stock, no evaluation on the spawning biomass capacity nor its recruitment level. There are also no new estimates of mortality level. The Plan uses historical data to make these estimates assuming the parameters are the same today as they were 30 to 50 years ago when this information was available. The problem is that the sea bass stock today does not have the same year class make up as it did in the early years and, as a result, has a different spawn and recruitment level. In the 1950's and 1960's, the stock was mature and had a much larger make up of bigger older fish. Larger fish spawn a much greater quantity of eggs than smaller fish. The mature stock in this earlier period had a high spawn level providing a large recruitment into the fishery and thereby a higher optimum fishing yield. The current sea bass stocks are recovering from a depleted state and thereby would appear to have a much younger year class makeup. As as result, its spawning biomass level is substantially below that of the 1950's and 1960's stock and thereby cannot sustain as high a MSY level.

There have been other changes over the years that have probably adversely impacted the stock and its current potential yield level. The inshore habitat has changed substantially with the loss of coastal estuaries and bays. Such loss can reduce the level of recruitment of fish back into the fishery. The natural mortality levels have probably changed as well. The increased seal population, as an example, probably has a greater negative impact on the current recruitment level than in earlier years. All of these changes have a negative impact on both the current MSY and OY the current stock can support . One positive area that has not been evaluated in the plan is the impact the OREHP hatchery and grow out program will provide. In 2001, over 100,000 sea bass were released into the wild. Because of improvements in the hatchery's process, the number of released fish is expected to exceed 200,000 in 2002 and could even meet the hatchery's capacity of 400,000 fish per year. In 2000, the estimated individual fish catch was over 46,000. It is obvious that the the hatchery program could become an important factor in maximizing the yield from the sea bass stocks. In time it could help raise the MSY level of the stocks.

The Plan calls for a reassessment of the stocks in two years and to make adjustments in the levels of catch at that time. My concern here is that if the recommended OY catch level of 1.2 million pound is accepted, at this level, the stocks could be severely depleted by the time it is determined that the yield was set too high. California and its fishing industries would then have lost the present level of recovery of the fishery and the ten years or so to rebuild it back to what it is today (note it has taken 20 years to reach current levels). What I don't understand is why the DFG is recommending the historical MSY of 1.6 million pounds (adjusted by twenty-five percent to a OY of 1.2 million pounds as a precautionary figure) rather than use the 1996 / 2000 data supported MSY less the precautionary twenty-five percent of 453,000 pounds as provided in option C-1. I strongly recommend that the commission take a conservative approach in setting the annual catch limits at this lower level so that we do not loose the stock level improvement obtained so far. I think it is far better to be in a position to further increase catch limits in the future when the data provides better estimates of the stock size, spawning biomass and recruitment than to have to cut catch limits because the Plan erred on the high side.

I hope this letter helps you make the decision on the yield level the Plan should adopt and that it is a correct one that allows the white sea bass fishery to recover to its former level. I have tried to present my views, concerns and question in a concise way knowing that you do not have the time for a long dissertation on the merits and problems with the Plan. If you have any questions, I would be happy to try to answer them.

Sincerely,

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Appendix G. Methods and Data Sets

G1 Methods

G1.1 Recreational

Commercial Passenger Fishing Vessel (CPFV) data from Department databases were used rather than RecFIN, because the Department's CPFV logbook data is thought to be more accurate than MRFSS's RecFIN estimates for CPFV. In addition, Department data can be used to identify the DFG block locations where fish are caught. Although RecFIN data estimates for recreational fishing modes for private/rental boats, man-made structures and beaches was the best data available, many of these data sets had high standard errors, especially those for shore-based fishing modes.

Since RecFIN length data for white seabass was taken in fork lengths (FL), and RecFIN's total length conversion option yielded the same measurements, 15 mm (0.59 in.) was added to RecFIN fork length data to convert to total length (TL). This was done in order to better estimate the number of legal size (28 in. (711 mm TL)) fish kept by different recreational fishing modes. Tim Hovey, a former hatchery manager for the HUBBS white seabass hatchery, recommended 15 mm and no other conversion factor was found.

<u>Historical CPFV logbook data</u>

Annual estimates of landings, effort, and CPUE were calculated for white seabass using CPFV logbook data from 1995 to 1999. Annual estimates of landings (number of fish) for white seabass were calculated by summing white seabass landings from all identified white seabass trips from each year. Annual estimates of effort (angler-days) were calculated by summing the total number of passengers from all white seabass trips from each year. This effort calculation was based on the assumption that each submitted CPFV log represented one trip-day, and therefore, the number of angler-days for each trip was equal to the number of passengers. Annual estimates of CPFV (number of fish per 100 angler-days) was calculated by taking the annual estimate of landings and dividing it by the annual estimate of effort, then multiplying the result by 100.

CPFV hook-and-line trips were separated from CPFV diving trips using catch composition and trip information from the logs and vessel information. Logs with CDFG blocks for Mexico and the San Francisco Bay Delta were removed from the hook-and-line data. Next, records with invertebrate species, species codes or landings equal to zero, or missing data were deleted. Finally, white seabass trips were selected from the remaining data using the following procedure: Total landings for each trip were calculated for three groups: A) white seabass, B) white seabass, yellowtail, and California barracuda, and C) all finfish species except white seabass, yellowtail, California barracuda, Pacific bonito, Pacific mackerel, jack mackerel, and kelp bass. A trip was considered a white seabass trip if the total landings of white seabass were greater than 10% of the landings of white seabass in group C combined, or if the total landings from group B was greater than 50% of the landings of groups B and C combined.

G1.2 Commercial

The data used to identify commercial fish landings and trends came from the Department's Commercial Fishing Information System. These data are entered into a computerized database. The procedures used to ensure accuracy are as follows: The landing receipt data was entered into the database, then a complete line by line check of the landing receipt was done. Whenever questions arose regarding information on the landing receipt a call was placed to the fish business or vessel operator to obtain accurate information. Since 1996, Department biologists have pre-edited landing receipts before the data is entered into the system. This procedure has improved the accuracy of the database.

Extracts of commercial data were done for white seabass from January 1981 to September 2000. For all fields (i.e., boat number, license number, pounds landed, or fishing gear) where there was missing data, the procedure was to check the original landing receipt whenever possible. If that information was not available, the data was sorted by vessel identification number or fisherman license number to determine what gear was typically used or price received for seabass. If a fisherman used more than one gear type, his catch was assigned to the gear most often used.

G2 Data Sets

Catch Data	Source	Years	Availability	Units
Commercial				
California waters	CDFG	1916 to present	Published (CDFG Fish Bulletins)	Weight
Mexican waters	CDFG	1936 to 1981	Published (CDFG Fish Bulletins)	Weight
Recreational				
Comm. Passenger Fish. Vessel	CDFG	1936 to present	Published (CDFG Fish Bulletins)	Number
Long Range Party boats	CDFG	1960 to present		Number
Barge	CDFG			Number
	MRFSS	1980 to present	www.psfmc.org/recfin	Number/weight
Private boat	CDFG	1964	Published (CDFG Fish Bull. 143)	Number
	MRFSS	1980 to present	www.psfmc.org/recfin	Number/weight
Pier and Jetty	CDFG	1963		Number
	MRFSS	1980 to present	www.psfmc.org/recfin	Number/weight
Shoreline	CDFG	1965-66		Number
Beach and bank	MRFSS	1980 to present	www.psfmc.org/recfin	Number/weight

Socioeconomic data	Source	Years	Availability	Units
commercial				
ex-vessel revenue	CDFG	1980-2000	unpublished data	dollars
market price	CDFG	1980-2000	unpublished data	dollars
vessels	CDFG	1980-2000	unpublished data	number
processors	CDFG	1980-2000	unpublished data	number
recreational				
trips	MRFSS	1993-1999	www.st.nmfs.gov/recreational/index.html	number
anglers	MRFSS	1993-1999	www.st.nmfs.gov/recreational/index.html	number

Appendix H. Location in the Fishery Management Plan of Each Requirement of the Marine Life Management Act

General Policies of Fishery Management Plans	Location in the
§7070. Findings and Declarations	Exec. summary
§7071. Management Authority of the Commission	Exec. summary
§7072. Management of Sport and Commercial Fisheries	Exec. summary
Plan Preparation, Approval, and Regulations Fisheries.	
§7075. Preparation of Fishery Management Plans	Chapter 1,
§7076. Advice and Assistance During Development	1.3.1.1; 1.3.1.2
§7077. Notice of Proposed Plans, Plan Amendments, Hearing Schedules, and Agendas	Chapter 1
§7078. Public Hearings; Implementing Regulations	Chapter1
Marine Life Management Act Requirements	
§7080. Best Available Fishery Information	
(a) Species and Location	1.5; 2.1
Number of Vessels and Participants	3.2.1; Chapter 7
Fishing Effort	3.2.2
Historical Sport/Commercial Landings	3.2
History of Conservation and Management Measures	Chapter 4
(b) Natural History, Population Dynamics, and Effects of Changing Oceanic Conditions	2.5
(c) Habitat and Threats to Habitat	2.9; Chapter 9
(d) Ecosystem Role Related to the Fishery	Chapter 6.
(e) Economic and Social Factors of the Fishery	3.3
§7081. Research Protocol	Chapter 7
(a) Past Monitoring of the Fishery and Ongoing Monitoring	7.2
(b) Identification of Essential Fishery Information	7.1
Age and Growth	2.3
Minimum Size at Maturity	2.4
Spawning Season	2.4
Population Age Structure	
Food	2.7
Predation	2.7
Competition	2.8
§7082. Measures for Conservation Management	
(a) Limitations on the Fishery	Chapter 5
(b) Creation or Modification of Restricted Access	

(c) Procedure to Establish, Review, and Revise Catch Quota	5.4; 5.9
(d) Requirement for a Permit and Reasonable Fees	
§7083. Incorporation of Existing Measures; Effects of Additional Measures	
(a) Existing Conservation and Management Measures	Chapter 1
(b) Additional Conservation and Management Measures Effects	Chapter 6
1. Fish Populations and Habitats	
2. Fishery Participants, Coastal Communities, and Businesses	
§7084. Measures to Minimize Adverse Effects on Marine Fishery habitat	Chapter 5
§7085. Fisheries in which Bycatch Occurs	
(a) Amount and Type of Bycatch	Chapter 6
(b) Analysis of Bycatch	Chapter 6
(c) In the Case of Unacceptable Bycatch, Implementation of Conservation or Management	
1. Minimize Bycatch	
2. Minimize Mortality of Discards	
§7086. Measures to Address Overfishing	
(a) Criteria for Identifying Overfishing	5.8
(b) Address and Rectify Overfishing	5.8; 5.4
(c) Address By:	
1. Specifying a Time Period for Recovery	5.7
2. Allocation of overfishing restrictions and recovery benefits	5.4.3
§7087 Amendment of plan and adoption of regulations	5.3.1
§7088 Effect of plan on statutes and regulations	

Appendix I. Location in the Fishery Management Plan of Each Requirement of the California Environmental Quality Act

California Environmental Quality Act Requirements	Location in the FMP
Summary of Proposed Project	Exec. Summary
Proposed Project	Exec. Summary
Effects on the Environment	Exec. Summary
Public Input	Exec. Summary
Areas of Controversy	Exec. Summary
Issues to be Resolved	Exec. Summary
Conclusion	Exec. Summary
Table of Contents	i
Project Description	Chapter 1
Proposed Project	Chapter 5
Project Objectives	1.3
Functional Equivalent	1.4.1.1
Scope and Intended Use of Env. Document	1.4.1.2
Management Techniques	5.1
Regulatory	4.2
Nonregulatory	4.3
Authorities and Responsibilities	1.4
Location and General Characteristics of the Project Area	1.1.1
Environmental Settings	
General Description of the Environment	1.1.1
Habitat	2.9
Life History	Chapter 2
Taxonomy and Morphology	2.1
Distribution	2.2
Life Cycle	2.5
Reproduction and Development	2.4
Dispersal and Recruitment	2.2
Age and Growth	2.3
Food Habits	2.7
Competition	2.8
Natural Mortality	2.5
Importance of Habitat Loss, Degradation, and Modification	9.4
Municipal Discharge	9.2.1
Dredge and Non-Dredged Material Disposal	9.2.2
Unusual Weather Events	9.1
Status of the White Seabass Population (Stock)	2.10