ENVIRONMENTAL ASSESSMENT

To Implement a Program for the Conservation of Tuna in the Eastern Pacific Ocean in 2009-2011 as Agreed Upon by the Inter-American Tropical Tuna Commission

PREPARED BY:

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Cover Sheet

Environmental Assessment of Multiannual Program for the Conservation of Tuna in the EPO

Proposed Action:	Implement IATTC Resolution C-09-01 in 2009, 2010, and 2011 for the conservation of tunas in the EPO.
Type of Statement:	Environmental Assessment
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Abstract

The National Marine Fisheries Service (NMFS) is proposing regulations under authority of the Tuna Conventions Act of 1950 to implement a resolution adopted by the Inter-American Tropical Tuna Commission (IATTC). That resolution requires that members of the IATTC, including the United States, ensure that in the eastern Pacific Ocean (EPO) the total catch of bigeye tuna (*Thunnus obesus*) by longline vessels over 24 m in length overall (large-scale longline vessels) does not exceed specified harvest levels in each of the years 2009, 2010, and 2011, and that purse seine vessels class sizes 4-6 do not fish during established closure periods. This action is necessary for the United States to satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party. This environmental assessment (EA) assesses the potential environmental impacts on the human environment that could result from implementation of the proposed restrictions on the longline and purse seine fisheries in the EPO. Various alternatives for implementing these restrictions are analyzed in this EA. Impacts to the human environment (e.g., effects of the proposed action on the natural environment (i.e., protected species, finfish, seabirds), and the socioeconomic environment) were found to be insignificant. The proposed action is to implement a 500 metric ton (mt) quota on bigeye tuna caught by large-scale longline vessels in the EPO and prohibit purse seine vessels class sizes 4-6 (greater than 182 mt carrying capacity) from fishing in the IATTC Convention Area for a period of 59 days in 2009, 62 days in 2010, and 73 days in 2011. The IATTC Convention Area includes the waters bounded by the coast of the Americas, the 40° N. and 40° S. parallels, and the 150° W. meridian. Class size 4 purse seine vessels would be allowed to make one fishing trip of up to 30 days duration during the specified closure periods, provided that the vessel carries an observer of the On-Board Observer Program of the Agreement on the International Dolphin Conservation Program (AIDCP). In addition, a closure would be implemented which would prohibit purse seine vessels class sizes 4-6 from fishing for yellowfin (*Thunnus albacares*), bigeye, and skipjack (*Katsuwonus pelamis*) tunas within an established closure area to the west of the Galapagos Islands for 30 days in 2009, 2010, and 2011. Purse seine vessels would also continue to be required to retain and land all skipjack, bigeye, and yellowfin tunas caught; however, the measure would only apply to purse seine vessels class sizes 4-6, and the exception would be modified to only apply to fish considered unfit for human consumption for reasons other than size (a single exemption of this would be the final set of a trip, when there may be insufficient well space remaining to accommodate all the tuna caught in that set)

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List of Acronyms

AIDCP- Agreement on the International Dolphin Conservation Program
AMSY- Average Maximum Sustainable Yield
BET- Bigeye Tuna
BO- Biological Opinion
CCS- California Current System
CEQ- Council on Environmental Quality
CFR- Code of Federal Regulations
CH- Critical Habitat
CITES- Convention on International Trade in Endangered Species
CPFV- Commercial Passenger Fishing Vessels
CPS- Coastal Pelagic Species
CPUE- Catch Per Unit of Effort
CZMA- Coastal Zone Management Act
DGN- Drift Gillnet
DPS- Distinct Population Segment
DSLL- Deep-set Longline
EA- Environmental Assessment
EEZ- Exclusive Economic Zone
EFH- Essential Fish Habitat
EFP- Exempted Fishing Permit
EIS- Environmental Impact Statement
EJ- Environmental Justice
ENSO- El Niño Southern Oscillation
EO- Executive Order
EPO- Eastern Pacific Ocean
ESA- Endangered Species Act
FEIS- Final Environmental Impact Statement
FONSI- Finding of No Significant Impact
FMP- Fishery Management Plan
FR- Federal Register
HMS- Highly Migratory Species
HMS FMP- Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species
HMSAS- Highly Migratory Species Advisory Subpanel
HMSMT- Highly Migratory Species Management Team
HSFCA- High Seas Fisheries Compliance Act
IATTC- Inter-American Tropical Tuna Commission
ITS- Incidental Take Statement
IUCN- International Union for Conservation of Nature
IWC- International Whaling Commission
LAAL- Laysan Albatross
LOF- List of Fisheries
MBTA- Migratory Bird Treaty Act
MCSST- Multi-Channel Sea Surface Temperature
MMPA- Marine Mammal Protection Act
MSA- Magnuson-Stevens Fishery Conservation and Management Act
MSY- Maximum Sustainable Yield
MUS- Management Unit Species
NEPA- National Environmental Policy Act
NMFS- National Marine Fisheries Service

NPTZ- North Pacific Transition Zone
NOAA- National Oceanic and Atmospheric Administration
OY- Optimum Yield
PacFIN- Pacific Fisheries Information Network
PBR- Potential Biological Removal
PDO- Pacific Decadal Oscillation
Pelagics FMP- Fishery Management Plan for Pelagics Fisheries of the Western Pacific Region
PFMC- Pacific Fishery Management Council
PIFSC- Pacific Islands Fisheries Science Center
POCTRP- Pacific Offshore Cetacean Take Reduction Plan
PRA- Paperwork Reduction Act
PRD- Protected Resources Division
RecFIN- Recreational Fisheries Information Network
RFA- Regulatory Flexibility Act
RIR- Regulatory Impact Review
RFMO- Regional Fisheries Management Organization
SAFE- Stock Assessment and Fishery Evaluation Report
SAFZ- Subarctic Frontal Zone
SAO- Southwestern Atlantic Ocean
SAR- Stock Assessment Report
SCB- Southern California Bight
SSLL- Shallow-set Longline
SST- Sea Surface Temperature
STAL- Short-Tailed Albatross
STFZ- Subtropical Frontal Zone
TDR- Time and Depth Recorder
TRP- Take Reduction Plan
TRT- Take Reduction Team
USFWS- United States Fish and Wildlife Service
WPFMC- Western Pacific Fishery Management Council
WCPFC- Western and Central Pacific Fisheries Commission
WCPFCIA – Western and Central Pacific Fisheries Commission Implementation Act
WCPO- Western Central Pacific Ocean
ZMRG- Zero Mortality Rate Goal

Glossary

Biological Opinion: The written documentation of a Section 7 Endangered Species Act consultation.

Biomass: The estimated amount, by weight, of a highly migratory species (HMS) population. The term biomass means total biomass (age one and above) unless stated otherwise.

Bycatch: Animals which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Such term does not include fish released alive under a recreational catch and release fishery management program.

Commercial fishing: Fishing in which the fish harvested, either in whole or in part, are intended to enter commerce through sale, barter, or trade.

Council: The Pacific Fishery Management Council, including its Highly Migratory Species Management Team (HMSMT), Highly Migratory Species Advisory Subpanel (HMSAS), Scientific and Statistical Committee (SSC), and any other committee established by the Council.

Endangered Species Act (ESA): Enacted in 1973, the ESA directs Federal departments and agencies to conserve endangered species and threatened species and utilize their authorities in furtherance of the purposes of the ESA.

Exclusive Economic Zone (EEZ): The zone established by Presidential Proclamation 5030, dated March 10, 1983, is that area adjacent to the United States which, except where modified to accommodate international boundaries, encompasses all waters from the seaward boundary of each of the coastal states to a line on which each point is 200 nautical miles (370.40 km) from the baseline from which the territorial sea of the United States is measured (3 CFR part 22).

High Seas: All waters beyond the EEZ of the United States and beyond any foreign nation's EEZ, to the extent that such EEZ is recognized by the United States (Note, this definition is used in the HMS Fisheries Management Plan (FMP) and differs from the definition in the Magnuson-Stevens Act, which defines "high seas" as waters beyond the territorial sea).

Highly Migratory Species: Pelagic species of fish (those that live in the water column as opposed to on the surface or on the bottom) including tunas, sharks, billfish/swordfish and which undertake migrations of significant but variable distances across oceans for feeding or reproduction.

Inter-American Tropical Tuna Commission Convention Area: The area of the Pacific Ocean bounded by the coastlines of North, Central, and South America, 50° N. and 50° S. latitudes, and 150° W. longitude.

Incidental take: "Take", as defined under the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, or collect, or to attempt to engage in any such conduct, individuals from a species listed under the ESA. Incidental take is the non-deliberate take of ESA-listed species during the course of an otherwise lawful activity (e.g., fishing under an FMP).

Incidental Take Statement: A requirement under the ESA Section 7 consultation regulations and, provided following the conclusion of a biological opinion, it specifies the impact of any incidental taking of endangered or threatened species and provides reasonable and prudent measures that are necessary to minimize impacts.

Jeopardy: The conclusion of a Section 7 consultation if it is determined that the proposed action would reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the numbers, reproduction, or distribution of that species.

Maximum sustainable yield (MSY): The largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions.

Mortality or serious injury: A standard used for measuring impacts on marine mammals under the Marine Mammal Protection Act (MMPA). Serious injury is defined as an injury likely to result in the mortality of a marine mammal.

Optimum Yield: The amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and, taking into account the protection of marine ecosystems; that is prescribed on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factor; and, in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY in such fishery.

Overfishing or Overfished: As defined in the Magnuson-Stevens Fishery Conservation and Management Act, the terms "overfishing" and "overfished" mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.

Potential Biological Removal: A requirement of the MMPA, it is the estimated number of individuals that can be removed from a marine mammal stock while allowing the stock to maintain or increase its population.

Section 7 consultation: A requirement of all discretionary Federal actions to ensure that the proposed action is not likely to jeopardize ESA listed endangered or threatened species. Refers to Section 7(a)(2) of the ESA.

Stock: A group of fish with some definable attributes which are of interest to fishery managers; for example, the bigeye tuna stock.

Strategic Stock: As defined under the MMPA, a marine mammal stock for which the level of direct human-caused mortality exceeds the potential biological removal level which, based on the best available scientific information, is declining and is likely to be listed within the foreseeable future or is already listed as a threatened or endangered species under the ESA of 1973.

1.0 INTRODUCTION

1.1 Organization of the Document

This Environmental Assessment (EA) provides a detailed analysis of the proposed restrictions on the longline and purse seine fisheries in the eastern Pacific Ocean (EPO).

Environmental impact analyses have four essential components: 1) a description of the purpose and need for the proposed action; 2) alternatives that represent different ways of accomplishing the proposed action; 3) a description of the human environment affected by the proposed action; and 4) an evaluation of the expected direct, indirect, and cumulative impacts of the alternatives. The human environment includes the natural and physical environment and the relationship of people with that environment, as defined at 40 CFR 1508.14. These elements allow the decision maker to look at different approaches to accomplishing a stated goal and understand the likely consequences of each choice or alternative. Based on this structure, the document is organized into six main chapters:

- Chapter 1 describes the purpose and need, the proposed action, the proposed action area and considerations that went into the development of this EA.

- Chapter 2 outlines the alternatives that have been considered to address the purpose and need of the proposed action.

- Chapter 3 describes the components of the human environment potentially affected by the proposed action (the "affected environment"). The affected environment represents the baseline condition, which would be potentially changed by the proposed action.

- Chapter 4 evaluates the effects of the alternatives on components of the human environment in order to provide the information necessary to determine whether such effects are significant, or potentially significant.

- Chapter 5 provides information on those laws and Executive Orders, in addition to the Tuna Convention Act and the National Environmental Policy Act (NEPA), that an action must be consistent with, and how this action has satisfied those mandates.

Additional Chapters (6-8) list those who contributed to this EA, information on EA distribution, and the references cited list.

Information from the following EAs are incorporated by reference and cited accordingly in this EA:

- Environmental Assessment for the Implementation of the Decisions of the Fifth Regular Annual Session of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean: Fishing Restrictions and Observer Requirements in Purse Seine Fisheries for 2009-2011 and Turtle Mitigation Requirements in Purse Seine Fisheries and Bigeye Tuna Catch Limits in Longline Fisheries in 2009, 2010, and 2011;
- Draft Environmental Assessment for the Characterization of the West Coast Deep-set Longline Fishery Operating Outside of the U.S. Exclusive Economic Zone;
- Fishery Management Plan and Environmental Impact Statement for U.S. West Coast Fisheries for Highly Migratory Species.

1.2 Proposed Action

The following measures would apply to the U.S. longline vessels greater than 24 meters (m) in length and purse seine vessels class sizes 4-6 operating in IATTC Convention Area (as defined is Section 1.3). From 2005-2008, there was an annual average of 18 large-scale longline vessels with reported catches of bigeye tuna in the EPO (combining shallow-sets and deep-sets). In addition, one large-scale longline vessel based out of California has participated in the fishery annually since 2005. In addition, there are currently five U.S. purse seine vessels listed on the IATTC Vessel Register that would be affected by the proposed measures.

The proposed action is to implement the following measures in the IATTC Convention Area:

i) Establish a 500 mt annual catch limit for bigeye tuna caught by longline vessels greater than 24 m in length overall in 2009, 2010, and 2011;

ii) Prohibit fishing for skipjack, bigeye, and yellowfin tunas in the IATTC Convention Area for a period of 59 days in 2009, 62 days in 2010, and 73 days in 2011 by purse seine vessels class sizes 4-6 (class size 4 purse seine vessels would be allowed to make one fishing trip of up to 30 days duration during the specified closure periods, provided that the vessel carries an observer of the On-Board Observer Program of the Agreement on the International Dolphin Conservation Program (AIDCP));

iii) Prohibit fishing for skipjack, bigeye, and yellowfin tunas by purse seine vessels class sizes 4-6 within the area of 96° and 110° W. longitude and 4° N. and 3° S. latitude from 0000 hours on September 29 to 2400 hours on October 29;

iv) Continue to require that all skipjack, bigeye, and yellowfin tunas caught by applicable purse seine vessels are retained and landed except if considered unfit for human consumption for reasons other than size in 2010 and 2011 (a single exemption of this shall be the final set of a trip, when there may be insufficient well space remaining to accommodate all the tuna caught in that set).

1.3 Proposed Action Area

The proposed action area analyzed in this EA is the IATTC Convention Area, which includes the waters bounded by the coast of the Americas, the 50° N. and 50° S. parallels, and the 150° W. meridian. This area includes the U.S. west coast Exclusive Economic Zone (EEZ); however, most of the fishing that would be affected by the proposed action occurs on the high seas in the Convention Area.

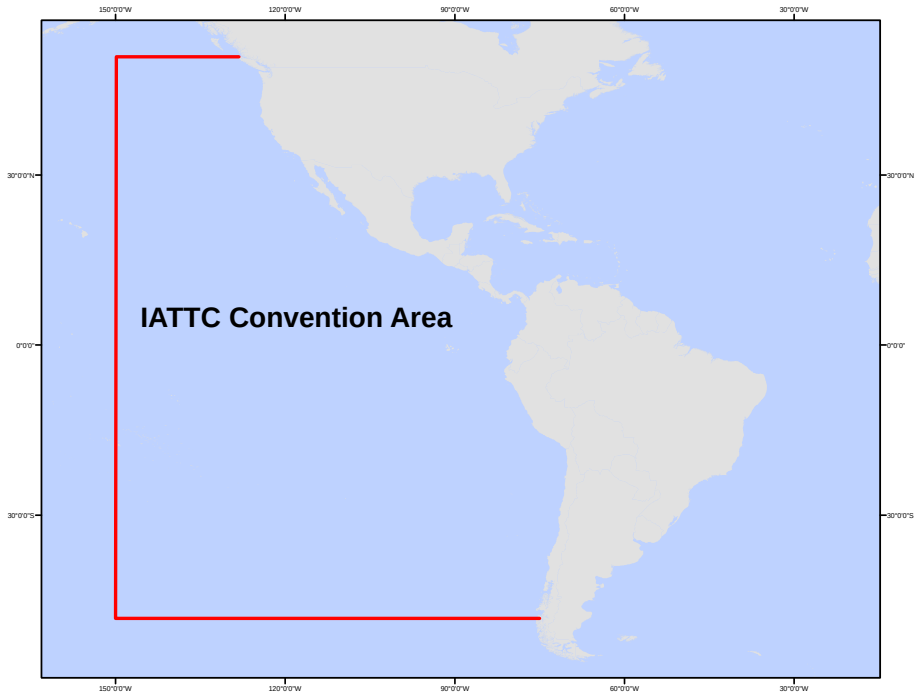

Figure 1. Map of IATTC Convention Area.

1.4 Purpose and Need

The purpose of the proposed action is to implement a resolution adopted by the IATTC which has the conservation objective of reducing the fishing mortality rate of bigeye tuna in the EPO. This action is necessary for the United States to satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna Commission, to which it is a Contracting Party, as well as to reduce fishing pressure on bigeye tuna, a shared international resource which is currently subject to overfishing according to NMFS.

1.5 Background

The 1949 Convention for the establishment of an Inter-American Tropical Tuna Commission entered into force in May 1949. The full text of the Convention is available at: http://www.iattc.org/PDFFiles/IATTC_convention_1949.pdf. The Convention focuses on the conservation and management of highly migratory species (HMS) and the management of fisheries for HMS, and has provisions related to non-target, associated, and dependent species in such fisheries.

The IATTC, established under the Convention, is comprised of the Members, including High Contracting Parties to the Convention and fishing entities that have agreed to be bound by the regime established by the Convention. Other entities that participate in the IATTC include Cooperating Non-Parties, Cooperating Fishing Entities, and Regional Economic Integration Organizations. Cooperating Fishing Entities participate with the authorization of the High Contracting Parties with responsibility for the conduct of their foreign affairs. Cooperating Non-Parties are identified by the IATTC on a yearly basis. In accepting Cooperating Non-Party status, such States agree to implement the decisions of the IATTC in the same manner as Members.

The current Members of the IATTC are Colombia, Costa Rica, Ecuador, El Salvador, France, Guatemala, Japan, Mexico, Nicaragua, Panama, Peru, Republic of Korea, Spain, United States, Vanuatu, and Venezuela. The current Cooperating Non-Parties, Cooperating Fishing Entities and Regional Economic Integration Organization are Belize, Canada, China, Cook Islands, Kiribati, Chinese Taipei, and the European Union.

As a Contracting Party to the Convention and a Member of the IATTC, the United States is obligated to implement the decisions of the IATTC in a legally binding manner. The Tuna Conventions Act of 1950 (16 U.S.C. 951-961 and 971 *et seq.*) authorizes the Secretary of Commerce, in consultation with the Secretary of State and the Secretary of the Department in which the United States Coast Guard (USCG) is operating (currently the Department of Homeland Security), to promulgate such regulations as may be necessary to carry out the obligations of the United States under the Convention, including the decisions of the IATTC. The authority to promulgate regulations has been delegated to NMFS.

At its Eightieth Meeting, in June 2009, the IATTC adopted the Resolution on a Multiannual Program for the Conservation of Tuna in the Eastern Pacific Ocean in 2009-2011 (Resolution C-09-01) related to bigeye and yellowfin tuna stocks in the EPO. The resolution, available with other decisions of the IATTC at http://www.iattc.org/ResolutionsActiveENG.htm, places certain obligations on the IATTC's High Contracting Parties, Cooperating Non-Parties, Cooperating Fishing Entity, and Regional Economic Integration Organization (collectively, CPCs). With respect to bigeye tuna, the resolution is based in part on the analysis and recommendations of IATTC scientific staff and the 2009 stock assessment completed by IATTC staff. The assessment verified that the stock of bigeye tuna in the EPO is experiencing a fishing mortality rate greater than the rate associated with average maximum sustainable yield, and the spawning stock biomass is below that which supports average maximum sustainable yield, thus the stock is subject to overfishing and is overfished as defined and codified by NMFS. The Convention calls for the IATTC to adopt measures designed to maintain or restore stocks at levels capable of producing average maximum sustainable yield, as qualified by relevant environmental and economic factors. Accordingly, Resolution C-09-01 has the objective of reducing, over the period 2009-2011, the fishing mortality rate for bigeye tuna in the EPO. The IATTC scientific staff estimated that the fishing mortality of bigeye tuna would be reduced by 19 percent in 2009, 20 percent in 2010, and 24 percent in 2010 based on averages over the 1995-2003 time period.

Among other provisions, the resolution establishes specific catch limits for bigeye tuna captured in the CPCs' longline fisheries for the years 2009, 2010, and 2011. The limits, which only apply to large-scale longline vessels, are prescribed relative to catches made during specified baseline periods, and commensurate with the estimated reductions in catch of bigeye tuna in the purse seine fishery with the implementation of the closure period. China, Japan, Korea, and Chinese Taipei, the countries with the highest levels of historic bigeye tuna catch in longline fisheries in the EPO, have specific catch levels for 2009 and 2010. Other CPCs must ensure their annual longline catches of bigeye tuna in the EPO during 2009-2010 do not exceed the greater of 500 mt or their respective catches of bigeye tuna in 2001. The U.S. catch of bigeye tuna in longline fisheries in the EPO for 2001 was only about 150 mt; therefore, the U.S. longline catch limit of bigeye tuna would be 500 mt in the EPO for 2009 and 2010. For 2011, the total annual longline quotas of bigeye tuna in the EPO would be adjusted to be commensurate with the measures adopted for purse seine vessels by the Commission in 2011.

IATTC Resolution C-09-01 also establishes closures of CPCs' purse seine fisheries for the years 2009, 2010, and 2011. The closures, which only apply to purse seine vessels class sizes 4-6 fishing in the IATTC Convention Area, would last for a period of 59 days in 2009, 62 days in 2010, and 73 days in 2011. Each CPC must choose one of two periods in each year as follows: for 2009, August 1 to September 28, or November 21 to January 18; for 2010, July 29 to September 28, or November 18 to January 18; and for 2011, July 18 to September 28, or November 7 to January 18. In 2011, the results of

the conservation measures adopted will be evaluated by the Commission, in the context of the results of the stock assessments for 2011 and, depending on the conclusions reached by the scientific staff of the Commission, the period of duration of the closure for that year shall be ratified or adjusted. Notwithstanding these provisions, purse seine vessels of IATTC capacity class size 4 (between 182 and 272 mt carrying capacity) will be able to make one single fishing trip of up to 30 days duration during the specified closure periods, provided that any such vessel carries an observer of the On-Board Observer Program of the AIDCP. In addition, IATTC Resolution C-09-01 establishes a closure for all purse seine vessels class sizes 4-6 within the area of 96° and 110° W. longitude and 4° N. and 3° S. latitude from 0000 hours on September 29 to 2400 hours on October 29 for 2009, 2010, and 2011 (also known as "el corralito" closure), and continues to require that all skipjack, bigeye, and yellowfin tuna caught be retained on board and landed unless considered unfit for human consumption for reasons other than size (the single exemption of this would be the final set of a trip, when there may be insufficient well space remaining to accommodate all the tuna caught in that set).

2.0 ALTERNATIVES

2.1 Alternatives for the Proposed Restrictions on the Longline Fishery in the EPO

The bigeye tuna limits established in Resolution C-09-01 are termed "catch" limits. However, the baseline amount of bigeye tuna specified for the United States in the resolution, from which the limit is derived, is from information provided to the IATTC by the NMFS. That information is expressed in terms of bigeye tuna that is retained on board, not captured per se. Accordingly, the proposed rule would establish a limit of 500 mt on retained catches of bigeye tuna caught by large-scale longline vessels. The limit would have the purpose of reducing the fishing mortality rate of bigeye tuna. Once NMFS determines in any of the years 2009, 2010, or 2011 that the limit is expected to be reached by a specific future date in that year, NMFS would publish a notice in the Federal Register announcing that the limit has been reached and that specific restrictions would be effective on that particular date until the end of the calendar year. NMFS would publish the notice at least seven calendar days before the effective date of the restrictions to provide fishermen advance notice of the restrictions. NMFS would also endeavor to make publicly available, such as on a website, regularly updated estimates and/or projections of bigeye tuna landings in order to help fishermen plan for the possibility of the limit being reached. In Resolution C-09-01, the IATTC has reserved the option of reversing or amending its adoption of the bigeye tuna catch limits in longline fisheries at its regular annual session in June 2011. If such a decision occurs, NMFS will take appropriate action to rescind any closed areas that are established by regulation.

All of the following alternatives would be applicable to longline vessels over 24 m length overall, that fish for yellowfin, bigeye, and skipjack tunas in the EPO in 2009, 2010, and 2011.

Alternative 1: Implement a longline quota of 500 mt of bigeye tuna by prohibiting all large-scale longline vessels from fishing in the IATTC Convention Area after the closure is announced.

Starting on the announced date of the closure and extending through the last day of that calendar year, U.S. large-scale longline vessels would be prohibited to fish in the IATTC Convention Area. All longline fishing would be prohibited in the action area. In addition, it would be prohibited to retain on board and land bigeye tuna caught by large-scale longline vessels.

These restrictions would not apply to U.S. longline fishing operations outside of the Convention, such as in the western and central Pacific Ocean (WCPO), or to U.S. longline vessels 24 m in length or less. However, to ensure compliance with the restrictions in the Convention Area, NMFS would prohibit applicable vessels from fishing with longline gear in areas both within and outside the Convention Area during the same fishing trip.

Alternative 2 (Preferred Alternative): Implement a longline quota of 500 mt of bigeye tuna by prohibiting the retention, landing, and transshipment of bigeye tuna caught by large-scale longline vessels in the IATTC Convention Area after the closure is announced.

Starting on the announced date of the closure and extending through the last day of that calendar year, it would be prohibited to retain on board, transship, or land bigeye tuna captured in the Convention Area by a large-scale longline vessel, except any bigeye tuna already on board a fishing vessel upon the effective date of the restrictions may be retained on board, transshipped, and/or landed, provided that they are landed within 14 days after the restrictions become effective. In the case of a vessel that has declared to NMFS pursuant to 50 CFR 665.23(a) that the current trip type is shallow-setting, the 14-day limit would be waived, but the number of bigeye tuna retained on board, transshipped, or landed must not exceed the number on board the vessel upon the effective date of the restrictions, as recorded by the NMFS observer

on board the vessel. Starting on the announced closure date and extending through the last day of that calendar year, it would also be prohibited to transship bigeye tuna caught in the Convention Area by a large longline vessel to any vessel other than a U.S. fishing vessel operated in compliance with a valid permit issued under 50 CFR 660.707 or 665.21.

These restrictions would not apply to bigeye tuna caught by longline gear outside the Convention Area, such as in the western and central Pacific Ocean, or to U.S. longline vessels 24 m in length or less. However, to help ensure compliance with the restrictions related to bigeye tuna caught by longline gear in the Convention Area, there would be two additional, related, prohibitions that would be in effect starting on the announced date and extending through the last day of that calendar year. First, it would be prohibited for applicable vessels to fish with longline gear both inside and outside the Convention Area during the same fishing trip, with the exception of a fishing trip that is in progress at the time the announced restrictions go into effect. In that exceptional case, the vessel, unless on a declared shallow-setting trip, would still be required to land any bigeye tuna taken within the Convention Area within 14 days of the effective date of the restrictions, as described above. Second, if an applicable vessel is used to fish using longline gear outside the Convention Area and the vessel enters the Convention Area at any time during the same fishing trip, the longline gear on the fishing vessel would have to be stowed in a manner so as not to be readily available for fishing while the vessel is in the Convention Area.

Alternative 3: Implement a longline quota of 500 mt of bigeye tuna by prohibiting all deep-set (vessels targeting yellowfin, bigeye, and skipjack tunas) longline fishing by large-scale longline vessels in the Convention Area after the closure is announced.

Starting on the announced date of the closure and extending through the last day of that calendar year, it would be prohibited for a U.S. large-scale longline vessel to fish with deep-set longline gear[1] to target tunas in the IATTC Convention Area. In addition, it would be prohibited to retain on board and land bigeye tuna caught by large-scale longline vessels (e.g., large-scale longline vessels engaged in shallow-setting).

These restrictions would not apply to U.S. longline fishing operations outside of the Convention Area, such as in the western and central Pacific Ocean, or to U.S. longline vessels 24 m in length or less. However, to ensure compliance with the restrictions in the Convention Area, NMFS would prohibit applicable vessels from fishing with longline gear in areas both within and outside the Convention Area during the same fishing trip.

Alternative 4: No Action. Under this alternative there would be no additional fishing restrictions in the Hawaii- and west-coast-based longline fisheries under this action. Currently there is no bigeye tuna quota for U.S. longline fisheries operating in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party.

2.2 Alternatives for the Proposed Restrictions on the Purse Seine Fishery in the EPO

These alternatives establish a prohibition on fishing to applicable vessels for a period of 59 days in 2009, 62 days in 2010, and 73 days in 2011. After the final rule is published in the Federal Register, the chosen closure period dates would become effective and it would be prohibited to use a U.S. purse seine vessel class size 4-6 (more than 182 mt carrying capacity) to fish for yellowfin, bigeye, and skipjack tunas in the EPO. A class size 4 vessel would be able to make one fishing trip of up to 30 days duration during the

[1] The deepest point in each sag of the main line would have to be at a depth greater than 100 m (328.1 ft or 54.6 fm) below the sea surface.

specified closure periods, provided that any such vessel carries an observer. In Resolution C-09-01, the IATTC has reserved the option of reversing its adoption of the closure at its regularly scheduled annual meeting in June 2011. If such a decision occurs, NMFS will take appropriate action to rescind any closed areas that are established by regulation.

Resolution C-09-01 established two possible closure periods for CPC's to choose from for each year applicable year. For 2009, NMFS does not have the discretion to choose the earlier closure period which would have started on August 1, 2009, due to the timeframe associated with the rulemaking process in the United States. Thus, for 2009, there are only two alternatives.

For 2009:

> **Alternative 1a (Preferred Alternative):** Establish a purse seine closure in the EPO from 0000 hours on November 21, 2009, to 2400 hours on January 18, 2010; or
>
> **Alternative 1b:** No action. Under this alternative there would be no EPO closure in the purse seine fishery for 2009 under this action. Currently there are no U.S. purse seine closures in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party.

For 2010:

> **Alternative 2a:** Establish a purse seine closure in the EPO from 0000 hours on July 29, 2010, to 2400 hours on September 28, 2010; or
>
> **Alternative 2b:** Establish a purse seine closure in the EPO from 0000 hours on November 18, 2010, to 2400 hours on January 18, 2011; or
>
> **Alternative 2c:** No action. Under this alternative there would be no EPO closure in the purse seine fishery for 2010 under this action. Currently there are no U.S. purse seine closures in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party.

For 2011:

> **Alternative 3a:** Establish a purse seine closure in the EPO from 0000 hours on July 18, 2011, to 2400 hours on September 28, 2011; or
>
> **Alternative 3b:** Establish a purse seine closure in the EPO from 0000 hours on November 7, 2011, to 2400 hours on January 18, 2012; or
>
> **Alternative 3c:** No action. Under this alternative there would be no EPO closure in the purse seine fishery for 2010 under this action. Currently there are no U.S. purse seine closures in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party.

In addition, the proposed rule would establish two additional measures that would affect the purse seine fishery.

Alternative 4a (Preferred Alternative): Establish an additional area closed to fishing by U.S. purse seine vessels class sizes 4-6 from September 29 to October 29 for 2009, 2010, and 2011. The area was chosen due to the high levels of juvenile bigeye tuna catch by purse seiners in the area. The closed area is within the area of 96° and 110° W. longitude and 4° N. and 3° S. latitude from 0000 hours on September 29 to 2400 hours on October 29 for 2009, 2010, and 2011. The area is within the Convention Area and is depicted on the map in Figure 2.

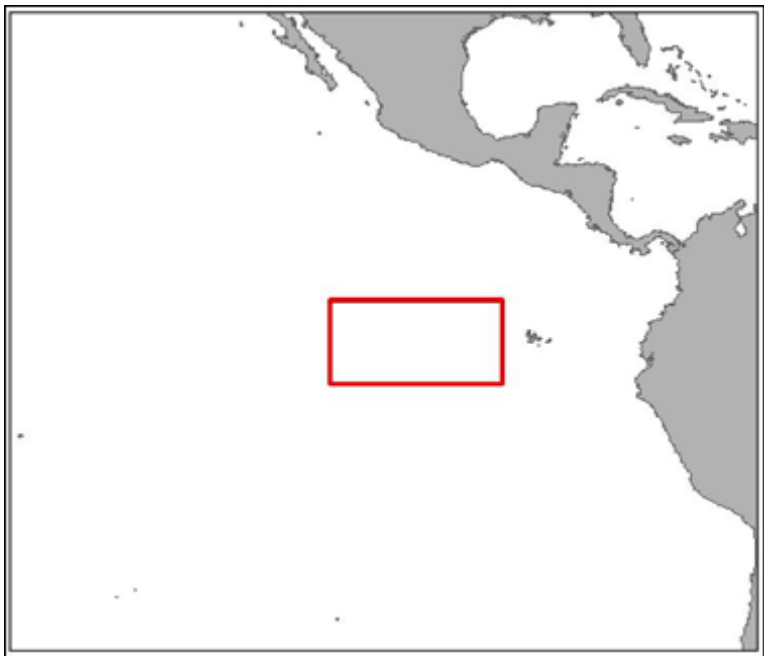

Figure 2. Proposed closure area. The area that would be closed to purse seine fishing is the high seas area within the rectangle bounded by the bold red lines. This map displays indicative maritime boundaries only.

Alternative 4b: No action. Under this alternative there would be no 30-day closure to the west of the Galapagos in the purse seine fishery for 2009-2011 under this action. Currently there are no U.S. purse seine closures in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party.

Alternative 5a (Preferred Alternative): Purse seine vessels would continue to be required to retain on board and then land all skipjack, bigeye, and yellowfin tuna caught; however, there would be a minor change to the existing regulations at 50 CFR 300.24(e) and 300.25(e)(1) that would amend the exception to the tuna retention measure and make the regulations only applicable to purse seine vessels class sizes 4-6. Tuna would not need to be retained for fish considered unfit for human consumption for reasons other than size, and the single exemption of this would be the final set of a trip, when there may be insufficient well space remaining to accommodate all the tuna caught in that set. Currently the language is slightly different than this but with similar intent, so the amendment would serve to make the regulatory language consistent with IATTC Resolution C-09-01. The efficacy and impacts of the tuna retention requirement will be reviewed at the annual Commission meeting in 2010 and the Commission will decide whether to continue it. If the IATTC exercises that option, NMFS will take appropriate action to rescind any catch retention measures that are established by regulation.

Alternative 5b: No Action. Under this alternative there would be no changes to the current regulations in regards to tuna retention.

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3.0 AFFECTED ENVIRONMENT

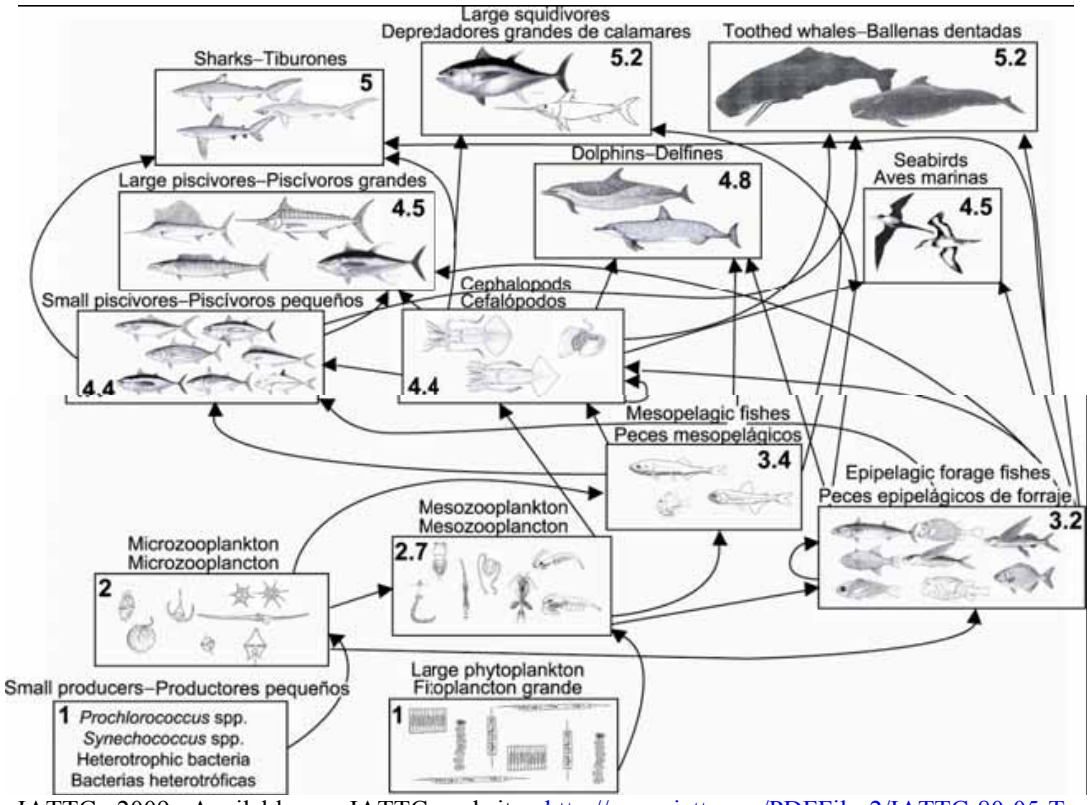
3.1 Introduction

This EA considers the effects of the alternatives on different parts of the human environment, which are referred to as *environmental components*. Three environmental components have been identified for further evaluation and discussion in these chapters: target and non-target finfish, protected species (marine mammal, sea turtle and seabird species), and the socioeconomic environment (fishermen, processors, consumers, etc.).

3.2 Climate and Biophysical Factors Contributing to Baseline Effects

3.2.1 Pelagic Ecosystem

Figure 3-1 illustrates a simplified food-web diagram of the pelagic ecosystem in the tropical EPO and the approximate trophic levels of each group.



Source: IATTC. 2009. Available on IATTC website: http://www.iattc.org/PDFFiles2/IATTC-80-05-Tunas-and-billfishes-in-the-EPO-2008.pdf

Figure 3-1. Simplified food-web diagram of the pelagic ecosystem in the tropical EPO. The numbers inside the boxes indicate the approximate trophic levels of each group.

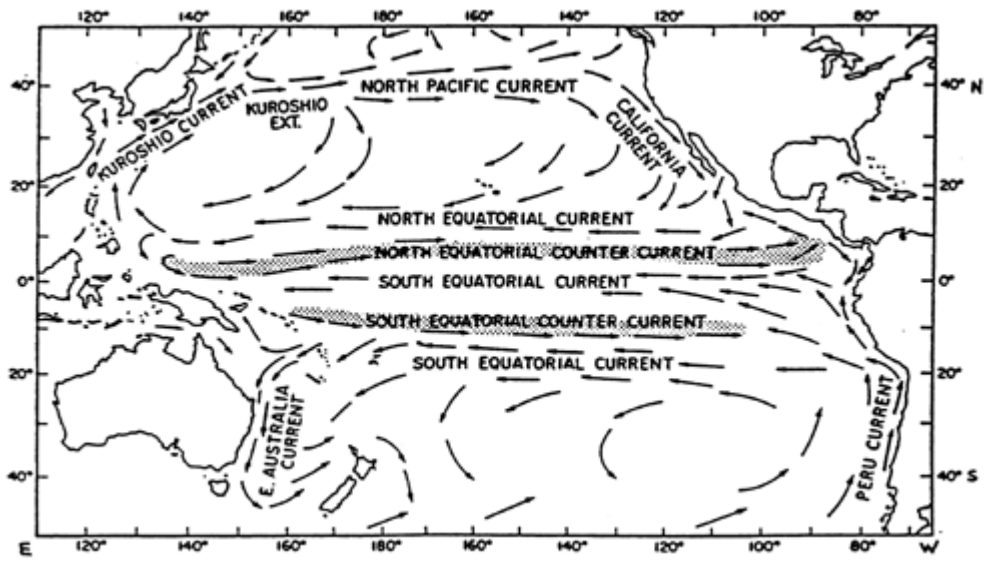
3.2.2 Tuna Movements Correlated to Oceanographic Conditions

The following is a summary of Section 3.1.1 of the EA prepared by NMFS for the implementation of the decisions of the fifth regular session of the WCPFC (NMFS 2009b).

Ocean currents transport plankton, fish, heat, momentum, salts, oxygen, and carbon dioxide. Wind is the primary force that drives ocean surface currents; however, Earth's rotation and the wind determine the direction of current flow. Figure 3-2 illustrates the two main subtropical gyres (the North Pacific subtropical gyre in the northern hemisphere and the South Pacific subtropical gyre in the southern hemisphere) and the other major Pacific Ocean currents.

Subtropical gyres rotate clockwise in the northern hemisphere and counter clockwise in the southern hemisphere in response to trade and westerly wind forcing. Due to this, the Central Pacific Ocean (~20°N-20°S) experiences weak mean currents flowing from east to west, while the northern and southern portions of the Pacific Ocean experience a weak mean current flowing from west to east. Imbedded in the mean flow are numerous mesoscale eddies created from wind and current interactions with the ocean's bathymetry. These eddies, which can rotate either clockwise or counter clockwise, have important biological impacts.

Eddies create vertical fluxes, with regions of divergence (upwelling) where the thermocline shoals and deep nutrients are pumped into surface waters enhancing phytoplankton production, and also regions of convergence (downwelling) where the thermocline deepens. The edges of eddies, or oceanic fronts where the mixing is greatest, are often targeted by fishermen as these are areas of high biological productivity.



Source: http://www.fao.org/docrep/005/t1817e/T1817E12.gif

Figure 3-2. The dominant ocean current systems in the Pacific Ocean.

Oceanic fronts are characterized by steep gradients in temperature and salinity. These fronts serve as habitat and foraging areas for swordfish, tunas, seabirds and sea turtles. In the North Pacific two major frontal regions important to the tuna fisheries occur, the subarctic frontal zone (SAFZ) occurs between 40° and 43° N. latitude, and the subtropical frontal zone (STFZ) occurs between 27° N. and 33° N. latitude (see Figure 3-3). The STFZ occurs variously as a temperature front from late fall to summer and all year as a salinity front (Bigelow, *et al.* 1999). This oceanographic feature creates ideal fishing conditions for the tuna fishery within the proposed action area during the winter and spring months. Within these zones fronts develop, persist, and shift seasonally in complex patterns (Seki, *et al.* 2002). Seki, *et al.* (2002) identifies two prominent semi-permanent fronts within the STFZ: the Subtropical Front (STF) located between 32° N. and 34° N. latitude, and the South Subtropical Front (SSTF) located

between 28° N. and 30° N. latitude. The STF is identifiable by the 17° Celsius sea surface temperature (SST) isotherm and 34.8 isohaline (line of equal salinity) while the SSTF can be identified by the 20° Celsius isotherm and 35.0 isohaline and 24.8 isopycnal (line of equal density) (Seki, *et al.* 2002). Large geological features such as islands and seamounts can create divergences and convergences which concentrate tuna prey species. Tuna species are also attracted to upwelling zones along ocean current boundaries such as the transition zone west of the California Current System (CCS).

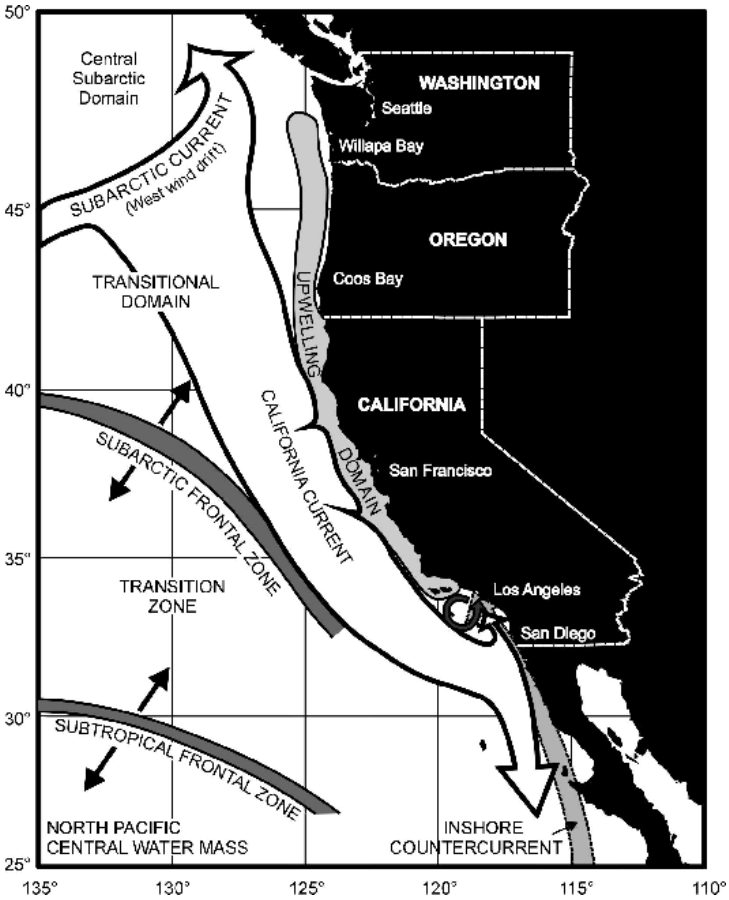


Figure 3-3. Major current and water mass systems that influence essential fish habitat of highly migratory management unit species in the U.S. west coast EEZ.

Studies on the movements of bigeye tuna have shown similar patterns in vertical and horizontal migrations related to temperature and oxygen (Bertrand, *et al*. 2002; Sibert, *et al*. 2003; Dagorn, *et al*. 2000). Bigeye tuna are able to withstand a range of sea temperatures (10-26º C) and their unique anatomy and physiology allow them to forage at the surface and at depth (Holland, *et al*. 1992; Holland and Sibert 1994). The depth distribution for bigeye tuna can range between the surface and 600 m but they may spend most of their time around 250-400 m (11-20º C) depending on the latitude. Bigeye tuna will migrate up and down throughout this vertical range during the day spending a longer period of time at depth in the morning hours (Dagorn, *et al*. 2000). In the North Pacific, the hook depth to catch tunas is usually shallower than in tropical areas because the temperatures are cooler at a shallower depth. Bigeye tunas can also forage in low oxygen waters giving them an advantage over other tuna species that are not capable of tolerating these conditions. Horizontal movements of tagged bigeye tuna were tracked throughout several months to a year and the data showed high site fidelity to geographical points of attraction such as weather buoys, seamounts, and islands (Sibert, *et al*. 2003). Yellowfin and albacore

tuna are caught at shallower depths than bigeye tuna and are not as tolerant of low temperatures and oxygen levels (Bertrand, *et al*. 2002). Albacore and yellowfin tuna are both found throughout the action area.

3.2.3 Climate Variability

The following is a summary of Section 3.2.3 of the draft EA prepared by NMFS to characterize the west coast deep-set longline fishery (NMFS 2008). Two meso-scale climate phenomena likely affect frontal activity and the distribution of tuna, other target and non-target finfish, and protected species that may be caught in the proposed action area. The first is El Niño-Southern Oscillation (ENSO), which is characterized by a relaxation of the Indonesian Low and subsequent weakening or reversal of westerly trade winds, causing warm surface waters in the western Pacific to shift eastward. Although the effects can be global, especially during an intense event, off the West Coast an El Niño event brings warm waters and a weakening of coastal upwelling. Tropical species, such as tuna and billfish, are found farther north during El Niño years. During the strong El Niño event from 1997 to 1999, striped marlin were recorded off the Oregon coast (Field and Ralston 2005). A related condition is termed La Niña and results in inverse conditions such as an intensified Indonesian Low, strengthened westerly trade winds, pooling of warm water in the western Pacific, and relatively cooler water in the eastern tropical Pacific and CCS. Etnoyer, *et al.* (2004) found the Northeast Pacific was less active in terms of front concentration and persistence during El Niño and relatively more active during La Niña.

Longer period cycles, which are partially identified by an index termed the Pacific Decadal Oscillation (PDO), also have important ecological effects in the CCS. Regime shifts indicted by the PDO have a periodicity operating at both 15-25 and 50–70 year intervals (Schwing 2005). The PDO indicates shifts between warm and cool phases. The warm phase is characterized by warmer temperatures in the Northeast Pacific (including the West Coast) and cooler-than-average sea surface temperatures and lower-than-average sea level air pressure in the Central North Pacific; opposite conditions prevail during cool phases. Rapid phase shifts occurred in 1925, 1947, 1977, and 1989. A regime change has been detected occurring in 1998. The 1977 shift, from a cool to warm phase in the CCS produced less productive ocean conditions off the West Coast and more favorable conditions around Alaska. Hare, *et al.* (1999) documented the inverse relationship between salmon production in Alaska and the Pacific Northwest and related this to PDO-influenced ocean conditions. Researchers have identified similar relationships between meso-scale climate regimes and the productivity of other fish populations (see Francis, *et al.* 1998 for a review). However, both the 1989 and 1998 shifts have different characteristics from previous shifts. The 1989 shift did not bring cooler water and enhanced upwelling to the West Coast. This has apparently resulted in a further decline in the productivity of some fish populations in the Northeast Pacific (McFarlane, *et al.* 2000). The 1998 shift resulted in dramatic cooling of west coast waters, but the characteristics of this phase are obscured by the short time series since onset and the development El Niños in 1998-99 and 2002-03. The cooling trend was interrupted or may have ended in 2003 (Schwing 2005).

Because the effects are similar, "in-phase" ENSO events (i.e., an El Niño during a PDO warm phase) can be intensified. However, aside from these phase effects, regime conditions identified by the PDO index, although of much longer duration than ENSO events, are milder. It is also important to note that—while the fundamental causes of PDO are not fully understood—they are known to be different from those driving ENSO events. And while ENSO has its primary effect on the Tropical Pacific, with secondary effects in colder regions, the opposite is true of PDO; its primary effects occur in the Northeast Pacific.

The ecosystem effects of PDO conditions are pervasive. Climate conditions directly affect primary production (phytoplankton abundance), but ecosystem linkages ensure these changes influence the

abundance of higher trophic level organisms, including fish populations targeted by fishers (Francis, *et al.* 1998; MacCall 2005).

3.2.3.1 Climate Change

The following is a summary of Section 3.1.2 of the EA prepared by NMFS for the implementation of the decisions of the fifth regular session of the WCPFC (NMFS 2009b). Climate change can affect the marine environment by impacting the established hydrologic cycle (a change in precipitation and evaporation rates) (Roessig, *et al*. 2004). Climate change has been associated with other effects to the marine environment, including rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation (IPCC 2007a). These effects are leading to shifts in the range of species, changes in algal, plankton, and fish abundance (IPCC 2007b), and causing damage to coral reefs (Scavia, *et al*. 2002). Climate change is also increasing the incidence of disease in aquatic organisms (Roessig, *et al*. 2004). Studies on plankton ecosystems, demonstrate that climate change is affecting phytoplankton, copepod herbivores, and zooplankton carnivores, which cause affects to ecosystem services, such as oxygen production, carbon sequestration, and biogeochemical cycling (Richardson, *et al*. 2004). These studies concluded that fish, seabirds, and marine mammals will need to adapt to a changing spatial distribution of primary and secondary production within pelagic marine ecosystems (Richardson, *et al*. 2004).

Studies conducted by Perry, *et al*. (2005) indicate that climate change is impacting marine fish distributions, which in turn may have important ecological impacts on fish as well as important impacts on commercial fisheries. How climate change can impact commercial fisheries include: (1) increases in ocean stratification leading to less primary production, which in turn leads to less overall energy for fish production; (2) decreases in spawning habitat from shifts in areas of well-mixed water zones leading to decreased stock sizes; and (3) changes in currents that may lead to changes in larval dispersals and retention, which could lead to decreases in stock sizes (Roessig, *et al*. 2004).

3.3 Finfish, Billfish and Sharks

This section describes the baseline conditions of the finfish species likely to be caught within the proposed action area. The baseline conditions include the range of fisheries contributing to mortality of the stocks, fishery catches on a stock-wide basis, and a summary of stock status.

3.3.1 Baseline Description of Fisheries in the Proposed Action Area

The target species for the proposed action are bigeye, yellowfin, and skipjack, tunas. Baseline descriptions are provided for tuna species, and several major non-target finfish species. The amended HMS FMP provides a detailed description of the baseline environment for most U.S. HMS fisheries operating in the EPO and the reader is referred to that document for further insight (PFMC 2007a).

There are numerous foreign fisheries that operate throughout the Pacific Ocean using, among other gears, pelagic longline, pole-and-line, drift gillnet, purse seine, and troll gears. By comparison, U.S. fisheries generally harvest a small fraction of the total Pan-Pacific harvest of HMS. The U.S. catch of tuna in the EPO (with all gear types combined) has averaged about 2.6 percent of the total catch of tuna in the EPO from 2002 to 2006; in 2006 the U.S. catch of tuna in the EPO was only about 0.2 percent of the total tuna catch in the EPO (IATTC 2007).

Descriptions of the industrial scale longline and purse seine fisheries in the IATTC Convention Area are presented followed by a brief description of other fisheries that interact and harvest HMS species.

3.3.1.1 U.S. EPO Longline Fisheries

The U.S. longline fishery in the Pacific Ocean includes three distinct fleets (Hawaii, American Samoa, and the west coast longline fleets), which are primarily differentiated by their geographic location. During the last few years, there have been a small number of vessels with permits for longline fishing based out of Guam or the Commonwealth of the Northern Marianas Islands (CNMI). Below is a detailed description of the Hawaii and west coast longline fleets, which would be impacted by the proposed rule.

Longline fishing gear consists of a main line strung horizontally across 1-100 kilometers (< 1-62 miles) of ocean, supported at regular intervals by vertical float lines connected to surface floats. Descending from the main line are branch lines, each ending in a single, baited hook. The main line droops in a curve from one float line to the next and bears between 2-25 branch lines between floats. Fishing depth is determined by the length of the floatlines and branchlines, the number of branchlines between baskets, and the amount of sag in the main line between floats. The depth of hooks affects their efficiency at catching different species (NMFS 2009b). Retrieval requires seven to ten hours. Generally, longline gear targeting tuna is set in the morning at approximate depths ranging between 100-300 m, and hauled in the evening. Longline gear targeting swordfish is set at sunset at depths less than 100 m and hauled at sunrise.

Hawaii Longline Fleet (NMFS 2009b)

Fleet Characteristics

The Hawaii-based limited entry longline fishery has the largest U.S. longline fleet operating in the Convention Area. The fleet has historically operated, and continues to operate, in two distinct modes based on gear deployment: deep-set longline by vessels that target primarily bigeye tuna and shallow-set longline by those that target swordfish. Fishing effort is mainly exercised to the north and south of the Hawaiian Islands between the Equator and 40° N and longitudes 140° and 180° W. However, the majority of deep-set fishing occurs south of 20° N. Most DSLL and SSLL fishing occurs in the U.S. EEZ around Hawaii, Palmyra, Kingman, Johnston and Jarvis Islands, and in adjacent high seas waters.

Management

The Hawaii-based longline fishery is managed through the FMP for the Pelagic Fisheries of the Western Pacific Region developed by the Western Pacific Fishery Management Council (WPFMC) pursuant to the MSA. The primary regulations implementing the FMP, as set forth at 50 CFR Part 665, are summarized in Table 3-1. The HSFCA and the WCPFC Implementation Act (WCPFCIA) also regulate this fishery.

Existing regulations set the annual limit for leatherback sea turtle (*Dermochelys coriacea*) interactions with the gear being fished by Hawaii longline vessels at sixteen and the annual limit for loggerhead sea turtle (*Caretta caretta*) interactions at seventeen. Once either limit is reached, the shallow-set component of the longline fishery is closed (50 CFR §665.33).

Table 3-1. Requirements for the Hawaii-based longline fleet.

<table>
<tr><th colspan="2">Both Shallow-Set and Deep-Set Longline Requirements</th></tr>
<tr><td colspan="2">▪ Carry on board a Hawaii Longline Limited Access Permit established under 50 CFR § 665.21 for Pelagic Fisheries of the Western Pacific Region. There are 164 transferable permits;
▪ A maximum vessel length of 101 feet is permitted;
▪ All U.S. vessels that fish on the high seas are required to have a permit issued by NMFS in accordance with the HSFCA. Permits are valid for five years and require that vessels fish on the high seas in accordance with international conservation and management measures recognized by the United States;
▪ Complete a NMFS Daily Longline Fishing Log sheet for each set after each fishing day;
▪ Carry NMFS-owned and operated VMS units;
▪ If engaging in shallow-setting, possess a valid shallow-set certificate (of which no more than 2,120 are issued each year) for each shallow-set made;
▪ Carry a NMFS observer, if requested by the Pacific Islands Regional Office;
▪ Follow sea turtle mitigation techniques and requirements;
▪ Cease fishing if fishery is closed as a result of reaching sea turtle interaction limit (17 per year for loggerhead and 16 per year for leatherback); and
▪ Seabird mitigation techniques: When deep-setting or shallow-setting north of 23° N latitude or shallow-setting south of 23° N latitude, owners and operators of vessels registered for use under a Hawaii Longline Limited Access Permit, must either:
1. side-set according to 50 CFR § 665.35 (a)(1);
2. or fish in accordance with 50 CFR § 665.35 (a)(2).</td></tr>
<tr><th>(a)(1). Side setting</th><th>(a)(2). Alternative to side setting</th></tr>
<tr><td>▪ Mainline must be at least 1 meter forward from the stern of the vessel;
▪ Mainline and branch lines must be set from the port or the starboard side of the vessel;
▪ If a shooter is used it must be mounted at least 1 meter forward from the stern of the vessel;
▪ Branch lines must have weights with a minimum of 45 grams;
▪ One weight must be connected to each branch line within one meter of each hook;
▪ If seabirds are present, gear must be deployed so that baited hooks remain submerged; and
▪ A bird curtain must be deployed.</td><td>▪ Discharge fish and offal on the opposite side of the vessel where the longline gear is being set or hauled when seabirds are present;
▪ Retain sufficient fish, offal, and bait for the purpose of strategically discharging it;
▪ Remove all hooks from fish, offal, or spent bait;
▪ Remove the bill and liver of any swordfish that is caught, sever its head, and cut it down the middle;
▪ Use completely thawed bait, dyed blue;
▪ Maintain a minimum of 2 cans of blue dye on board the vessel; and
▪ Follow the requirements for deep-setting and shallow-setting below (a and b).</td></tr>
<tr><th>a. Deep-Setting North of 23°</th><th>b. Shallow-Setting</th></tr>
<tr><td>▪ Employ a line shooter; and
▪ Attach a weight of at least 45 grams to each branch line within 1meter of the hook.</td><td>▪ Deploy gear at least 1 hour after local sunset and complete deployment no later than local sunrise, using the minimum vessel lights; and
▪ Follow short-tailed albatross handling techniques.</td></tr>
</table>

Source: NMFS 2009b.

Catch and Effort

The recent characteristics, annual catch, effort, and ex-vessel revenue of the Hawaii-based longline fleet are summarized in Table 3-2.

The rapid growth of the fishery in the 1990s and the effects of the closure of the shallow-set component of the fishery from 2001-2004 are clearly seen. Also evident is the reduction in shark bycatch brought about by the combined effects of the prohibition of shallow-setting in 2001 and passage of the Shark Finning Prohibition Act of 2000 (SFPA) (Pub. L. No. 106-557). In April 2004, NMFS reopened the swordfish-targeting segment (shallow-set) of the Hawaii longline fishery under new federal rules. In 2005, 2007, and 2008, 76 percent, 76 percent, and 77 percent, respectively, of the available shallow-set certificates were used.

Table 3-2. Annual effort, catch, and ex-vessel revenue in the Hawaii longline fishery, 1996-2007.

Year	Active vessels	Trips	Tuna-directed trips	Swordfish-directed trips	Hooks set (million)	Total catch (mt)	Bigeye tuna catch (mt)	Sword-fish catch (mt)	Yellow-fin tuna catch (mt)	Ex-vessel revenue(in mill., $2007)
1996	103	1,100	657	92	14.4	9,781	1,787	2,502	630	54.9
1997	105	1,125	745	78	15.6	12,320	2,449	2,881	1,141	64.0
1998	114	1,140	760	84	17.4	12,998	3,226	3,263	722	59.6
1999	119	1,137	776	65	19.1	12,872	2,719	3,100	473	60.0
2000	125	1,103	814	37	20.3	10,789	2,644	2,815	1,205	61.3
2001	101	1,034	987	4	22.4	7,167	2,356	235	1,033	40.0
2002	100	1,163	1,163	0	27.0	7,888	4,388	309	560	45.7
2003	110	1,215	1,215	0	29.9	8,008	3,593	137	823	45.9
2004	125	1,338	1,332	6	32.0	8,380	4,325	249	707	47.7
2005	124	1,496	1,397	99	35.0	10,578	4,979	1,600	735	64.4
2006	127	1,401	1,341	60	35.3	9,762	4,429	1,167	962	57.0
2007	129	1,462	1,381	81	40.2	11,208	5,779	1,715	846	62.7
5 year average	123	1,382	1,333	49	34.5	9,587	4,621	974	815	55.5

Source: WPFMC 2009.

Economics

In 2009, the U.S. Hawaii-based longline fleet consisted of 131 FMP-permitted vessels. Out of these 131 vessels, 117 also had a high seas fishing permit (issued under the HSFCA). Vessels range from 16 to 25 m in length and can carry an average of 98 mt of fresh fish. Crew size ranges from four to six. The maximum duration of a fishing trip for vessels targeting tuna for the fresh fish market in Hawaii is three weeks. Some of the newer vessels in the fleet are larger and have onboard ice systems, allowing for greater range than in the past.

There are relatively few large-scale longline vessels (vessels over 24 m in length) in the fleet. From 2005-2008, there was an annual average of 18 large-scale longline vessels with reported catches of bigeye tuna in the EPO (combining shallow-sets and deep-sets). For the same time period, there has been an annual average of 27 large-scale longline vessels with reported catches of bigeye tuna in the WCPO. In 2008, there were 29 large-scale longline vessels in the Hawaii longline fleet with reported catches of bigeye tuna in the EPO.

In recent years, Hawaii's commercial pelagic fisheries have been greatly affected by a series of court decisions that led to the adoption of regulatory measures primarily aimed at conserving federally-listed ESA species. In 2001, the total catch and ex-vessel value decreased by about 3,747 mt and $20.1 million, respectively, primarily as a result of the implementation of court-ordered measures that eliminated the swordfish portion of the Hawaii longline fishery (Table 3-2). Swordfish, the largest component of the landings by volume in 2000, was a negligible component of the fishery from 2001 until the reopening of the swordfish shallow-set fishery in 2004. For these reasons, the period prior to 2005 is probably not a good indication of future fishing activity. Consequently, the analysis in Chapter 4 focuses on fishing patterns and performance from 2005 through 2008.

In 2006, the Hawaii-based longline fleet landed 9,775 mt for an ex-vessel value of approximately $54 million. This total represents an average gross revenue per vessel in 2006 of about $403,000, compared to the 2005-2007 average of $444,000 per vessel (Table 3-2).

West Coast Longline Fishery (NMFS 2008)

Fleet Characteristics

Longline vessels based on the U.S. West Coast fish primarily in the EPO and at the current time are restricted to fishing outside of the west coast EEZ. Given this restriction, there have been very few active west coast-based longline vessels since 2004 except for a single west-coast-based vessel which has been operating out of southern California ports since 2005. This vessel primarily targets tuna species using DSLL gear with a percentage of swordfish and other HMS taken incidentally. This vessel is considered a large-scale longline vessel. At the present time, DSLL fishing by west-coast-based vessels must take place outside of the U.S. EEZ. The high operational costs, time constraints and safety considerations of fishing outside the EEZ will most likely keep participation in this fishery at a minimum.

Management

Longline vessels based out of the U.S. West Coast are managed under the FMP for U.S. West Coast Fisheries for HMS developed by the PFMC. The HMS FMP prohibits all pelagic longline fishing inside the west coast U.S. EEZ. Shallow-set longline fishing in the adjacent high seas areas, including west of 150° W. longitude is prohibited by the HMS FMP and the ESA (50 CFR 223.206(d)(9)). Longline vessels operating on the high seas outside the EEZ are subject to the following controls set forth at 50 CFR Part 660:

1. Line clippers, dip nets, and bolt cutters meeting NMFS' specifications must be carried aboard each vessel for releasing turtles (specifications vary by vessel size);
2. A vessel may not use longline gear to fish for or target swordfish north of the equator; landing or possession of more than ten swordfish per trip is prohibited;
3. The length of each float line possessed and used to suspend the main longline beneath a float must be longer than 20 m (65.6 feet or 10.9 fathoms);
4. From April 1 through May 31, a vessel may not use longline gear in waters bounded by 0° latitude and 15° N latitude, and 145° W longitude and 180° W longitude;
5. No light stick may be possessed on board a vessel;

6. When a longline is deployed, no fewer than 15 branch lines may be set between any two floats;
7. Longline gear must be deployed such that the deepest point of the main longline between any two floats is at a depth greater than 100 m below the sea surface;
8. While fishing for management unit species north of 23° N latitude, a vessel must:
    (a) Maintain a minimum of two cans containing blue dye on board the vessel during a fishing trip;
    (b) Use completely thawed bait to fish for Pacific pelagic management unit species;
    (c) Use only bait that is dyed blue of an intensity level specified by a color quality control card issued by NMFS;
    (d) Retain sufficient quantities of offal for the purpose of discharging the offal strategically in an appropriate manner;
    (e) Remove all hooks from offal prior to discharging the offal;
    (f) Discharge fish, fish parts, or spent bait while setting or hauling longline gear on the opposite side of the vessel from where the longline is being set or hauled;
    (g) Use a line-setting machine or line-shooter to set the main longline;
    (h) Attach a weight of at least 45 grams to each branch line within one meter of the hook; and
    (i) Remove the bill and liver of any swordfish that is incidentally caught, sever its head from the trunk and cut it in half vertically, and periodically discharge the butchered heads and livers overboard on the opposite side of the vessel from which the longline is being set or hauled.

All U.S. vessels that fish on the high seas are required to have a permit issued by NMFS in accordance with the HSFCA. Permits are valid for five years and require that vessels fish on the high seas in accordance with international conservation and management measures recognized by the United States. Other management measures include requirements for the proper release and handling of turtles and seabirds, the requirement for vessel operators to attend a protected species workshop each year, and the requirement for VMS.

Catch and Effort

As of 2005, due to the low numbers in fleet size, data (landings and ex-vessel numbers) collected are confidential. Tables 3-3, 3-4, and 3-6 provide information on the number of vessels in the fleet, where the catch was made (EPO or WCPO), type of set used (deep-set to target tunas, or shallow-set to target swordfish), and amount of bigeye tuna landings from 2005 to 2008.

Table 3-3. Bigeye tuna catch, in metric tons, in the Hawaii- and west-coast-based longline fisheries, by vessel size, set type, and location of catch, 2005-2008.

Year	Deep Sets				Shallow Sets				Total
	EPO		WCPO		EPO		WCPO		
	Vessel >24 m	Vessel =< 24m	Vessel >24 m	Vessel =< 24 m	Vessel >24 m	Vessel =< 24 m	Vessel >24 m	Vessel =< 24 m	
2005	164.29	373.41	675.58	3,709.35	1.49	4.03	24.66	38.47	4,991
2006	50.05	27.96	872.07	3,447.16	1.05	0.00	22.36	34.06	4,455
2007	115.06	291.21	1,136.83	4,219.18	2.92	7.41	28.57	14.83	5,816
2008	315.72	940.98	995.01	3,573.24	9.05	8.93	36.85	18.66	5,898

Source: Hawaii and California longline observer programs.
"=<" means equal to or less than.
">" means greater than.

Table 3-4. Number of Hawaii- and west-coast-based longline vessels with bigeye tuna catch, by vessel size, set type, and location of catch, 2005-2008.

Year	EPO				WCPO			
	Deep Set		Shallow Set		Deep Set		Shallow Set	
	No. Vessels > 24 m	No. Vessels =< 24	No. Vessels > 24 m	No. Vessels =< 24 m	No. Vessels > 24 m	No. Vessels =< 24 m	No. Vessels > 24 m	No. Vessels =< 24 m
2005	14	54	6	6	21	103	9	22
2006	5	16	3	2	26	101	14	21
2007	15	61	7	10	28	101	14	13
2008	27	84	11	11	29	98	13	12

Source: Hawaii and California longline observer programs.
"=<" means equal to or less than.
">" means greater than.

Table 3-5. Number of Hawaii- and west-coast-based longline vessels with bigeye tuna catch, by vessel size and location of catch, 2005-2008.

Year	EPO		WCPO	
	No. Vessels > 24 m	No. Vessels =< 24	No. Vessels > 24 m	No. Vessels =< 24
2005	18	55	21	103
2006	8	18	26	101
2007	18	68	28	101
2008	30	88	31	98

Source: Hawaii and California longline observer programs.
"=<" means equal to or less than.
">" means greater than.

Economics

Estimates of ex-vessel revenues in the west coast longline fishery since 2005, which would be indicative of current conditions, are confidential and may not be publicly disclosed because of the small number of vessels in the fishery (PFMC 2008).

3.3.1.2 U.S. EPO Purse Seine Fishery

The majority of vessels in the U.S. purse seine fleet operating in the EPO engage in targeting skipjack and to a lesser extent yellowfin tuna throughout the equatorial regions of the Convention Area.

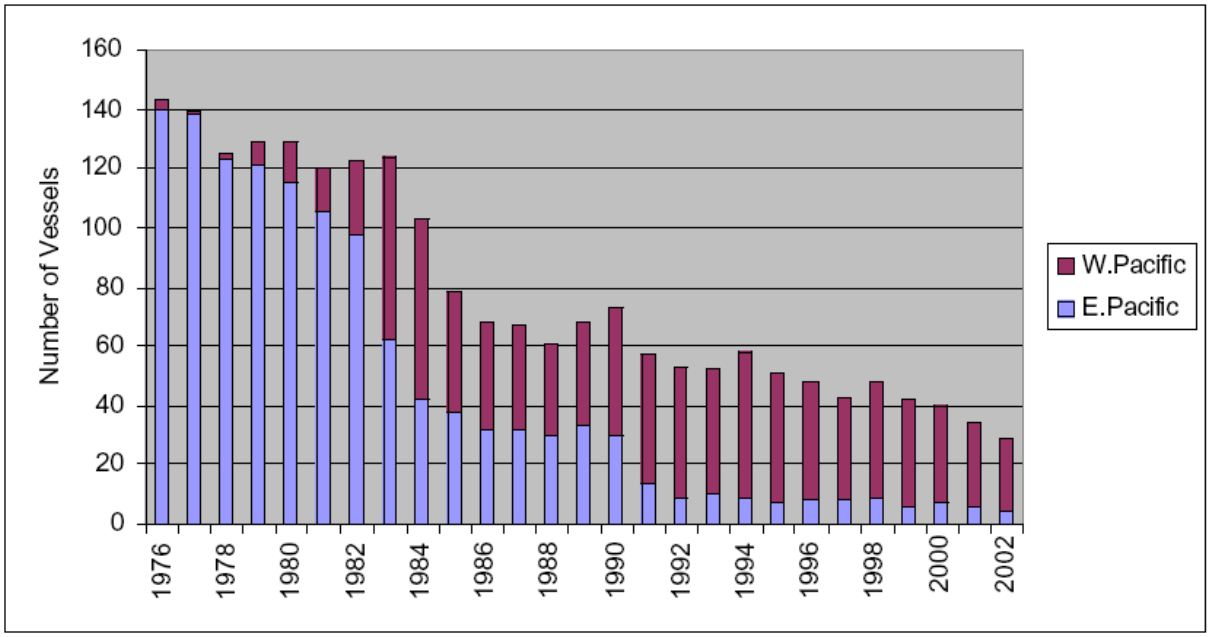
Fleet Characteristics

There are two components to the U.S. tuna purse seine fishery in the EPO: large vessels (greater than 400 short tons (st)[2] carrying capacity) and smaller vessels (equal to or less than 400 st carrying capacity). The smaller U.S. purse seine vessels range from carrying capacity class size 2-5. Purse seine vessels class size 3 and under would be exempt from the proposed rule.

[2] The IATTC uses short tons in its stock status reports. 400 short tons is equal to about 363 metric tons.

The fleet of large vessels fishing in the EPO has been greatly reduced over the past 20 years. At the height of the fishery in the 1970s, the California-based fleet consisted of 140 vessels larger than 100 gross registered tons (Gillet, *et al*. 2002). In the 1960s and 1970s the vessels of the fleet experienced restrictions on their activities, including: conservation controls resulting in short fishing seasons in the usual EPO fishing grounds, implementation of 200-mile extended jurisdictions of Latin American countries and expansion of fishing fleets in several of those countries, and adoption of U.S. domestic legislation in the early 1970s that protected dolphins. These and other factors motivated many U.S. purse seine vessels to begin fishing in the western and central Pacific Ocean (see Figure 3-4; Gillet, *et al*. 2002).

As of August 2009, there are only five U.S. purse seine vessels class sizes 4-6 that are authorized to fish in the IATTC Convention Area.[3] Since 2004, only two U.S. purse seine vessels class sizes 4-6 have made landings each year on average. From 2005-2008, less than three vessels made landings, thus the landings and revenue data from these years are confidential and cannot be released. Additional large-scale vessels could enter the EPO fishery as there is currently no limited entry program for purse seine vessels operating under the HMS FMP[4]. U.S. purse seiners typically target skipjack and yellowfin tuna found in association with drifting logs/flotsam or fish aggregating devices (FADs). In addition, U.S. purse seiners set on unassociated free-swimming schools of tuna ("school sets"). The relative proportion of the different set types has varied considerably over time as oceanographic conditions, regulations, and technology have changed.



Note: Number of vessels is the number of active vessels larger than 400 gross tons.
Source: Gillet, *et al.* 2002.

Figure 3-4. Numbers of Vessels in the U.S. Purse Seine Fleet.

[3] For the current list of authorized U.S. purse seine vessels go to the following IATTC website: http://www.iattc.org/VesselRegister/VesselList.aspx?List=AcPS&Lang=ENG

[4] The United States is bound by a capacity limit agreed upon by the IATTC of 8,969 mt of total carrying capacity in the U.S. purse seine fleet operating in the IATTC Convention Area.

Hydraulic systems on large "super seiners," require more than 1,600 m of piping, and are equipped with at least four auxiliary engines in addition to the main propulsion engine (or engines) (NMFS 2009b). The purse seine technique for catching tuna involves employing a net that is set vertically in the water, with floats attached to the upper edge and chains for weight on the lower edge. A series of rings is attached to the lower edge of the net, and a pursing cable passes through the rings, enabling a winch on board the vessel to draw the net closed on the bottom. Purse seine nets can be up to 1,600 m or more in length and 150 m in depth (NMFS 2009b). When the net is deployed from the purse seine vessel, a large skiff carrying the end of the net is released from the stern of the fishing vessel. The purse seine vessel encloses the school of tuna, keeping it in visual contact if on the surface, or using sonar if below the surface, and then retrieves most of the net onto the vessel. The fish are confined in the "sack" portion of the net, which consists of finer mesh webbing that prohibits their escape, then the catch is removed from the sack onto the vessel with large "scoops" holding one metric ton or more, and then is placed in brine tanks for freezing and later storage (NMFS 2009b).

Economics

The fish caught by the U.S. EPO purse seine fleet are frozen on board and either delivered directly to canneries or transshipped to carriers that deliver them to canneries. Deliveries are made to canneries in both the United States (American Samoa) and foreign nations (Ecuador, Mexico, Tahiti, Colombia, Costa Rica). The canned product then enters global markets.

Estimates of ex-vessel revenues in the U.S. purse seine fishery in the EPO since 2005, which would be indicative of current conditions, are confidential and may not be publicly disclosed because of the small number of vessels in the fishery. However, there are two class size 5, and three class size 6 purse seine vessels active in the IATTC Convention Area. Purse seine vessels class size 5 would be considered small business entities (revenues equal to or less than $4 million per year). It is estimated that from 2004-2008, the majority, if not all, class size 5 U.S. purse seine vessels have had revenues of less than $0.5 million per year[5]. Class size 6 vessels are categorized as large business entities (revenues in excess of $4 million per year). It is estimated that large purse seine vessel typically generate about 4,000 to 5,000 mt of tuna valued at about $4 to $5 million per year[6].

3.3.1.3 Foreign Tuna Fisheries in the EPO (IATTC 2009)

Document IATTC-80-05 provides a more detailed description of the fishery for tunas in the EPO, assessments of the major stocks of tunas and billfishes that are exploited in the fishery, and an evaluation of the pelagic ecosystem in the EPO, in 2008[7] (IATTC 2009). The report is based on data available to the IATTC staff in April 2009, and provides data on catches by gear type, species, and flag state.

The average annual retained catch of yellowfin tuna in the EPO by purse-seine and pole-and-line vessels during 1993-2007 was about 267,000 mt (range: 167,000 to 413,000 mt). The preliminary estimate of 186,000 mt of retained catch in 2008 by purse seine vessels is 9 percent greater than that of 2007, but 30 percent less than the average for 1993-2007. The purse seine fishery accounts for the majority of the retained catch of yellowfin in the EPO. During 1993-2007 catch of yellowfin tuna in the EPO by longline vessels remained relatively stable, averaging about 19,000 mt (range: 8,000 to 30,000 mt), or about 7 percent of the total retained catches of yellowfin. Yellowfin are also caught by recreational vessels, as incidental catch in gillnets, and by artisanal fisheries; during 1993-2007 they averaged about 1,000 mt.

[5] According to data obtained from PacFIN by NMFS in June 2009.
[6] According to data provided by the IATTC to NMFS in June 2009.
[7] Available on the following IATTC website: http://www.iattc.org/PDFFiles2/IATTC-80-05-Tunas-and-billfishes-in-the-EPO-2008.pdf

A preliminary estimate of the retained catch of bigeye tuna by purse seine vessels in the EPO in 2008 is about 76,000 mt. The preliminary estimate of the longline catch in the EPO in 2008 is 19,000 mt. The total catch of bigeye tuna in the EPO for 2008 was about 97,000 mt, of which about 95,000 mt were retained. Thus, the purse seine fishery accounted for a little less than 80 percent of the total retained catch of bigeye tuna in 2008, while the longline fishery accounted for about 20 percent. Prior to 1994, the average annual retained catch of bigeye taken by purse-seine vessels in the EPO was about 8,000 mt. Following the development of FADs, the annual retained catches of bigeye increased from 35,000 mt in 1994 to between 44,000 and 95,000 mt during 1995-2007. During 1979-1993, prior to the increased use of FADs and the resulting greater catches of bigeye by purse-seine vessels, the longline catches of bigeye in the EPO ranged from 46,000 to 104,000 mt (average: 74,000 mt) about 89 percent, on average, of the retained catches of this species from the EPO. During 1994-2007 the annual retained catches of bigeye by the longline fisheries ranged from about 31,000 to 74,000 mt (average: 51,000 mt), an average of 45 percent of the total catch of bigeye in the EPO.

The preliminary estimate of the retained catch of skipjack tuna in the EPO for 2008 is 296,000t, which is 64 percent greater than the average of 181,000 mt for 1993-2007, and one percent less than the previous record-high retained catch of 311,000 mt in 2006. Small amounts of skipjack are caught with longlines and other gears. Most of the skipjack catch in the Pacific Ocean is taken in the WCPO. The majority of skipjack tuna is caught by purse seine vessels in the EPO (295,530 mt were retained in 2008), and much smaller amounts of skipjack are caught with longlines and other gears.

Roughly 80 percent of the yellowfin, skipjack, bigeye and other tunas caught by purse seine and pole and line in 2008 came from the fleets of Ecuador (36 percent), Mexico (21 percent), Panama (14 percent), and Venezuela (9 percent).

Table 3-4. Estimates of the retained catches of tunas and bonitos, by flag, gear type, and species, in metric tons, in the EPO, 2008.

Flag Country	Gear Type[4]	Yellowfin	Skipjack	Bigeye	Pacific Bluefin	Albacore	Black Skipjack	Bonitos nei[3]	Tuna nei[3]	Total
China	LL	*	*	885	*	*	*	*	*	885
Ecuador	PS	18,800	144,058	41,162	*	*	110	23	88	204,241
Japan	LL	*	*	11,938	*	66	*	*	*	12,004
Korea	LL	*	*	4,150	*	7	*	*	*	4,157
Mexico	LL	2	*	*	0	*	*	*	*	2
	LP	812	499	*	15	*	*	9	*	1,335
	PS	84,703	21,432	328	4,392	10	3,366	6,960	40	121,231
Nicaragua	PS	5,831	6,003	846	*	*	3	0	0	12,683
Panama	LL	*	*	*	*	*	*	*	933	933
	PS	27,152	42,452	11,357	*	*	47	66	4	81,078
Peru	NK	172	278	*	*	*	7	*	113	570
Taiwan	LL	*	*	1,986	*	*	*	*	*	1,986
Venezuela	PS	21,257	26,910	3,179	*	*	57	9	3	51,415
Vanuatu	LL	*	*	346	*	*	*	*	*	346
Other[1]	PS[2]	28,103	54,675	18,781	*	*	2	5	0	101,566

[1] This category is used to avoid revealing the operations of individual vessels or companies
[2] Includes Colombia, El Salvador, Guatemala, Honduras, Peru, Spain, United States and Vanuatu.
[3] Not elsewhere included (nei)
[4] LL: longline; NK: unknown; PS: purse-seine; LP: pole-and-line
Source: IATTC 2009.

3.3.2 Target and Non-target Finfish Species

HMS stock assessments are periodically carried out by scientists from Pacific-based regional fisheries management organizations (RFMOs) such as the IATTC and the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific (ISC). Stock status refers to the condition or health of the species (or stock) in the management unit. Status is usually determined by estimating the abundance (or biomass or yield) of the stock throughout its range and comparing the estimate of abundance with an adopted acceptable level of abundance (reference point).

3.3.2.1 Target Tuna Species

Detailed information and a wealth of references on the biology, taxonomy, population dynamics, and distribution of target tuna species are available in Chapter 3 of the EA prepared by NMFS PIRO in July 2009[8] (NMFS 2009b).

Table 3-5 summarizes NOAA Fisheries official status of the main fish stocks targeted by the U.S. purse seine and longline vessels fishing in the Convention Area. The table expresses overfishing and overfished status in terms of the status determination criteria specified in the relevant FMPs, as required by the MSA; they are as reported in the Report on the Status of U.S. Fisheries for 2008 (NMFS 2009; quarterly updates for certain stocks are available at www.nmfs.noaa.gov/sfa/statusoffisheries/SOSmain.htm). Under MSA, NMFS and the regional fishery management councils are required to set overfished and overfishing thresholds for individual stocks.

Table 3-5. Stock status summary of select highly migratory fish stocks in the Pacific Ocean for 2008[9].

Species	Stock	Overfishing?	Overfished?
Bigeye tuna (*Thunnus obesus)*	Pacific	**Yes**	No
Skipjack tuna *(Katsuwonus pelamis)*	western central Pacific	No	No
	eastern tropical Pacific	No	No
Yellowfin tuna (*Thunnus albacares)*	western central Pacific	No	No
	eastern Pacific	**Yes**	No
Swordfish *(Xiphias gladius)*	North Pacific	No	No

Source: NMFS 2009.

[8] Available on the following NMFS PIRO website: http://www.fpir.noaa.gov/Library/IFD/AX60%20-%20Final%20WCPFC5%20EA%20-%20July%202009.pdf.

[9] A stock that is subject to overfishing means that fishing is occurring at a rate or level that jeopardizes the capacity of a stock to produce MSY, the largest long term average catch or yield that can be taken from a stock under prevailing ecological and environmental conditions on a continuing basis. Overfishing is considered to be occurring if the fishing mortality rate is found to have been greater than the maximum fishing mortality threshold for at least one year. The maximum fishing mortality threshold can be set at a single number (a fishing mortality rate) or as a function of spawning biomass or other measure of reproductive potential. A stock that is overfished is one whose size is sufficiently small that a change in management practices is required in order to achieve an appropriate level and rate of rebuilding. The stock is considered to be overfished if the stock size falls below the minimum stock size threshold at any time. The minimum stock size threshold should equal one-half the maximum MSY stock size or the minimum stock size at which rebuilding to the MSY level would be expected to occur within ten years if the stock or stock complex were exploited at the maximum fishing mortality threshold (50 CFR § 600.310(d)).

As shown in Table 3-5 above, using the MSA stock status determination criteria, overfishing is occurring on bigeye tuna throughout the Pacific, but the bigeye tuna stock is not overfished. Langley, *et al*. (2008) concluded that biomass has been sustained due to above-average recruitment since about 1990, with exceptionally high recruitment during 1995−2005 and with peak in recruitment in 2000. In recent years, bigeye tuna recruitment is estimated to have declined to approximately the long-term average. Overfishing is taking place to the yellowfin tuna stock in the EPO; it is estimated to be near or at full exploitation.

Some of the following summaries (e.g., bigeye, yellowfin, skipjack tunas) are based on international stock assessments that do not reflect Table 3-5; however, these are the stock assessments that were used to support IATTC Resolution C-09-01, and they have undergone thorough stock assessment review panels.

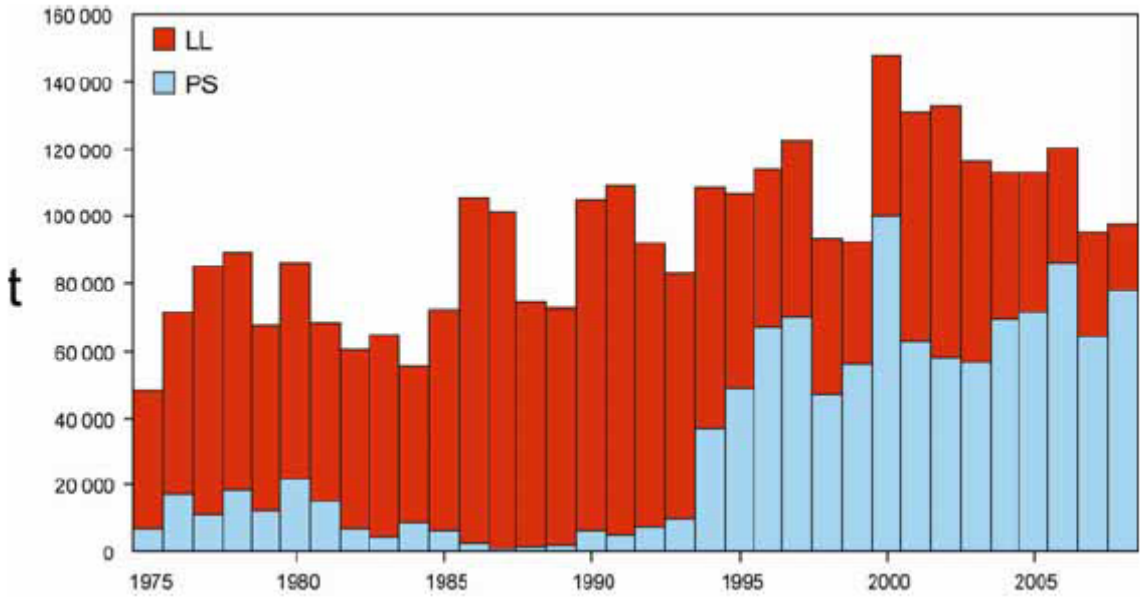
Bigeye (*Thunnus obesus*) (Aires-da-Silva and Maunder 2009)

Stock status of bigeye tuna in the EPO is assessed every 1–2 years by the IATTC. The latest assessment was conducted in May 2009 (Aires-Da-Silva and Maunder 2009). The *Stock Synthesis III* assessment model, an integrated statistical age-structured stock assessment model, was used with available data through December 2008. The assessment is based on the assumption that there is a single stock of bigeye in the EPO, and that there is limited exchange of fish between the EPO and the WCPO. Four scenarios were examined which differed by the assumption of a stock recruitment relationship, use of a Richards growth curve fit to age at length data derived from otolith data, and extending the assumed western limit of the bigeye stock distribution from 150° W. to 170° E. longitude. The base case assessment assumed no relationship between stock and recruitment and used a von Bertalanffy growth function. Furthermore, it was assumed that the western limit of the bigeye stock distribution was 150° W. longitude. Results of the base case assessment indicate that at the beginning of January 2009, the spawning biomass of bigeye tuna in the EPO was below the MSY level and near the historic low level. The spawning biomass ratio (the ratio of the spawning biomass at that time to that of the unfished stock; SBR) was about 0.17, which is about 11 percent less than the level corresponding to the MSY, thus the stock is considered overfished. Both recent catches and fishing effort have been above levels corresponding to MSY. Recent catches are estimated to have been 19 percent higher than MSY levels. If fishing mortality is proportional to fishing effort, and the current patterns of age-specific selectivity are maintained, the level of fishing effort corresponding to the MSY is about 81 percent of the current (2006-2008) level of effort, thus the stock is also considered subject to overfishing.

Analyses show that before the expansion of the floating-object fishery in 1993, the MSY was greater than the current MSY and the fishing mortality was below the fishing mortality at MSY (F_{MSY}). If bigeye were only caught in the purse-seine fishery, the MSY would be about 22 percent less than what is currently estimated for all gears combined. However, if bigeye were caught only by the longline fishery the MSY would about 111 percent greater than that estimated for all gears combined. Simulations demonstrated that without the conservation measures put in place through 2007 under IATTC resolutions C-04-09 and C-06-02, the spawning biomass ratio would have decreased to below current levels. Furthermore, continuation of those conservation measures would be insufficient to allow the population to maintain above levels corresponding to the MSY in the long term. The IATTC did not reach consensus on restrictions in EPO tuna fisheries for 2008, so unilateral conservation measures have only been put in place by some countries participating in the fisheries. Implementing the current IATTC Resolution C-09-01 is necessary to reduce the fishing mortality on bigeye.

The floating object fishery, which consists of purse seine fishermen who set nets on tuna schools associated with floating objects (either man-made fish aggregating devices known as FADs, or natural debris known as flotsam), began to increase in importance in the EPO in 1993. Purse seine sets on floating objects are known to yield catches of small fish below the critical size; however, the AMSY of

bigeye in the EPO could be maximized if the age-specific selectivity pattern of the fishery were similar to that for the longline fishery, which in general catches larger individuals. Based in part on the previous IATTC bigeye tuna stock assessment, NMFS determined that the bigeye tuna stocks are experiencing overfishing.



Source: IATTC 2009.

Figure 3-5. Total catches (retained catches plus discards) of bigeye tuna by the purse-seine fisheries, and retained catches for the longline fisheries, in the eastern Pacific Ocean, 1975-2008. The purse-seine catches are adjusted to the species composition estimate. The 2008 catch data are provisional.

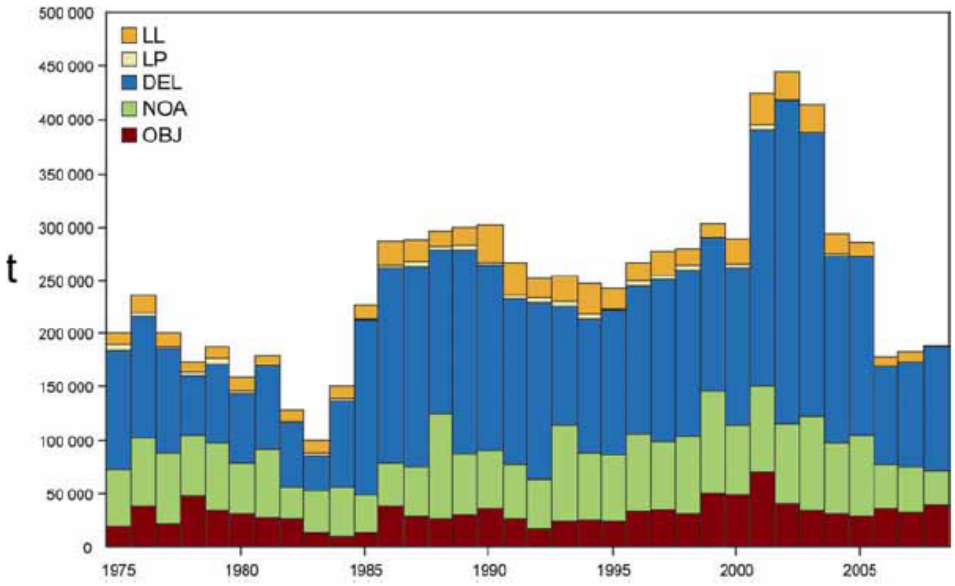
Yellowfin (*Thunnus albacares*) (Maunder and Aires-Da-Silva 2009)

Stock status of yellowfin tuna in the EPO is assessed every 1–2 years by IATTC. The IATTC conducted the latest stock assessment of eastern Pacific yellowfin tuna in May 2009 (Maunder and Aires-Da-Silva 2009). The *Stock Synthesis III* assessment model was used with available data through December 2008. The assessment is based on the assumption that there is a single stock of yellowfin in the EPO, and that there is limited exchange of fish between the EPO and the WCPO. The assessment for 2009 differs substantially from that of 2008 because it uses the Stock Synthesis program; previous assessments have used the A-SCALA program. The estimated biomass is significantly lower than estimated in the previous assessment indicating that the results are sensitive to the changes in assessment methodology. Seven sensitivity analyses were conducted to investigate other sources of uncertainty.

The 2008 base case assessment, which does not include a stock-recruitment relationship, indicates that at the beginning of 2009 the spawning biomass ratio of yellowfin in the EPO was above the level corresponding to MSY, thus the stock is not overfished, and effort levels are estimated to be less than those that would support the MSY, but recent catches are substantially below the MSY level. In addition, the recent fishing morality rate (*F)* was below the level corresponding to MSY, thus the stock is also not subject to overfishing. The MSY calculations indicate that, theoretically, at least, catches could be increased if the fishing effort were directed toward longlining and purse-seine sets on yellowfin associated with dolphins. Under current levels of fishing mortality (2006-2008), the spawning biomass is predicted to slightly decrease, but remain above the level corresponding to MSY. Fishing at F_{msy} is

predicted to reduce the spawning biomass slightly from that under current effort and produces slightly higher catches. However, if a stock-recruitment relationship is assumed, the outlook is more pessimistic, and current biomass is estimated to be below the level corresponding to the MSY.

A simulation was done in the 2008 IATTC Stock Assessment of yellowfin tuna (Maunder and Aires-Da-Silva 2008) which indicated that without the conservation measures put in place through 2007 under IATTC resolutions C-04-09 and C-06-02, including a six week purse seine closure and longline catch limits, biomass and spawning biomass ratio would have decreased to near MSY levels. The IATTC did not reach consensus on restrictions in EPO tuna fisheries for 2008, so unilateral conservation measures have only been put in place by some countries participating in the fisheries. Implementing the current IATTC Resolution C-09-01 is necessary to decrease the fishing mortality on yellowfin tuna.



Source: IATTC 2009.

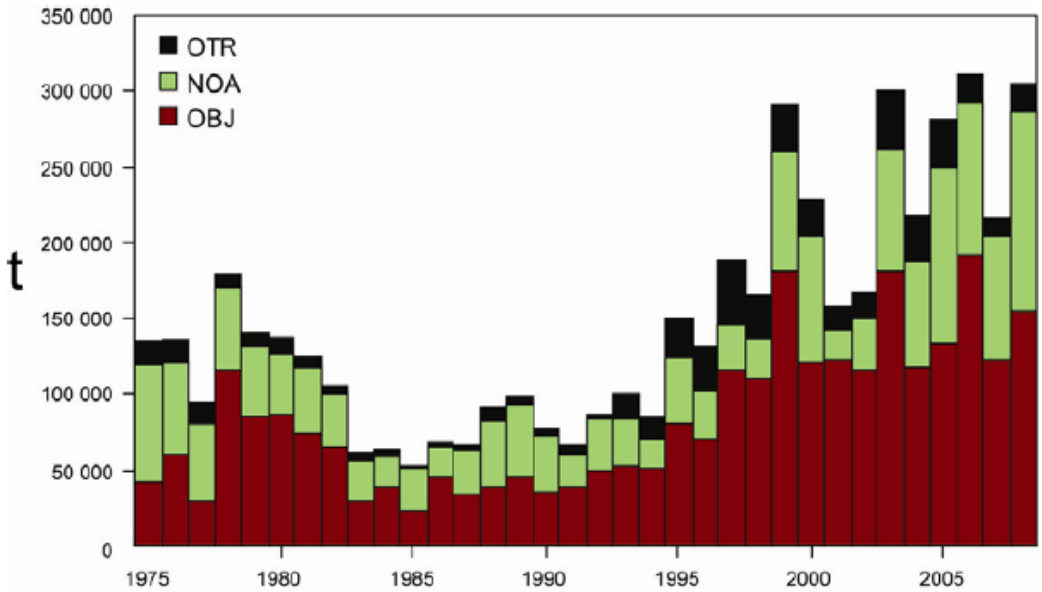
Figure 3-6. Total catches (retained catches plus discards) for the purse-seine fisheries, and retained catches for the pole-and-line and longline fisheries, of yellowfin tuna in the eastern Pacific Ocean, 1975-2008. The purse-seine catches are adjusted to the species composition estimate obtained from sampling the catches. The 2008 catch data are provisional.

Skipjack (*Katsuwonus pelamis*) (Maunder 2009)

Stock status of skipjack tuna in the eastern Pacific is assessed every 1–2 years if deemed necessary by IATTC. Skipjack tuna is a notoriously difficult species to assess due to skipjack's high and variable productivity (i.e., annual recruitment is a large proportion of total biomass). This is particularly true for the EPO stock due to the lack of age-frequency data and the limited tagging data. The most recent assessment of skipjack in the EPO (Maunder and Harley 2005) is considered preliminary because it is not known whether the catch per day fished for purse-seine fisheries is proportional to abundance. The results from that assessment are more consistent among sensitivity analyses than the earlier assessments which suggest that they may be more reliable. Neither the biomass- nor fishing mortality-based reference points, nor the indicators to which they are compared, are available for skipjack in the EPO.

Beginning in 2007, the IATTC developed a simple stock assessment model to evaluate indicators of skipjack biomass, recruitment, and exploitation rate and used simple indicators of stock status based on

relative values of fishery data, such as, CPUE, average weight of fish caught, and effort (Maunder and Deriso 2007). The latest analyses show some inconsistencies (Maunder 2009). Indicators of biomass, recruitment, and CPUE for the unassociated purse seine fishery are near the healthy reference levels; whereas, indicators for effort, exploitation rate, and average fish weight are near the unhealthy reference levels. Theoretically, average fish weight could be low due to either above average recruitment or high exploitation rates. The indicators have yet to detect any adverse consequences of relatively high exploitation rates. The results of the simple stock assessment model were similar to the 2005 assessment and there still appears to be no conservation concern for skipjack in the EPO.



Source: IATTC 2009.

Figure 3-7. Total catches (retained catches plus discards) of skipjack tuna by the purse-seine fisheries on floating objects and unassociated schools, and by other fisheries combined, in the eastern Pacific Ocean, 1975-2008. The purse-seine catches for 1975-2006 are adjusted to the species composition estimate.

Swordfish (*Xiphias gladuis*) (ISC 2009)

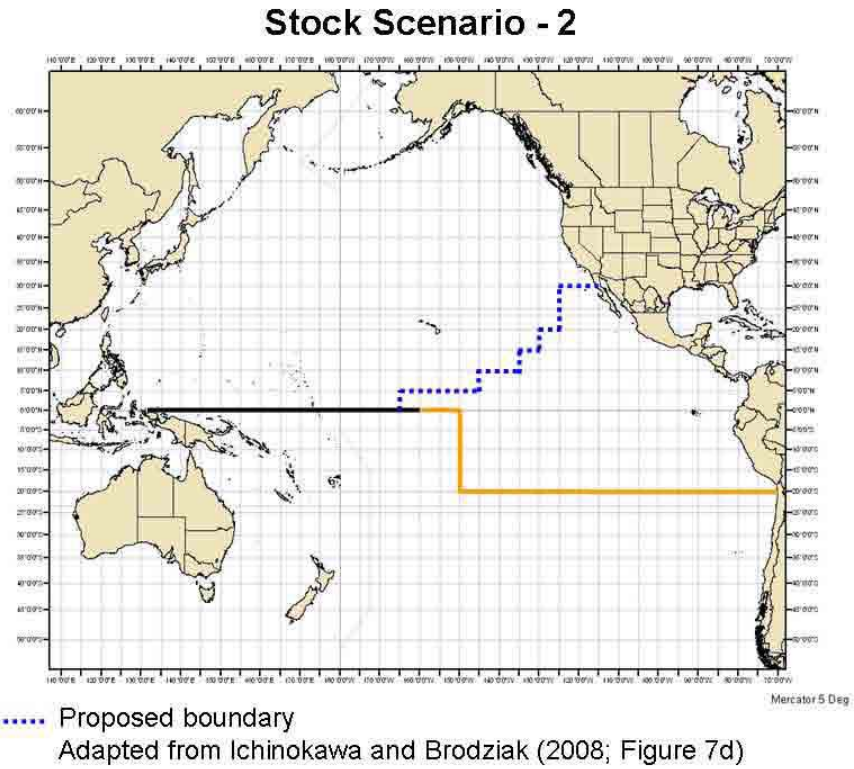
Swordfish occur throughout the Pacific Ocean between about 50° N. latitude and 50° S. latitude. They are caught mostly by the longline fisheries of Far East and Western Hemisphere nations. Lesser amounts are caught by gillnet and harpoon fisheries, and infrequently by recreational fishermen. The stock structure of swordfish is not well known in the Pacific. There are indications that there is only a limited exchange of swordfish between the EPO and the WCPO. The recent analysis conducted by the ISC indicates that there are two stocks separated by an irregular boundary extending from Mexico to the southwest and including sections of the eastern South Pacific extending to 20°S latitude (ISC 2009; Figure 3-8). Available evidence (i.e., genetic analyses) supports the two-stock hypothesis and consequently stock status and conservation advice should be based on the two-stock scenario.

The exploitation rate for the WCPO stock has fluctuated during the period 1951-2006, but has remained below the level required for MSY (ISC 2009). The probability that the exploitation rate in 2006 exceeded the exploitation rate at MSY is low at one percent. Projecting exploitable biomass through 2010 by assuming a constant 3-year (2004-2006) average exploitation rate for the fishery and fishing operations

largely remaining unchanged, results in exploitable biomass levels above BMSY and sufficient to sustain recent levels of catch.

Similarly, the exploitation rate of the EPO stock during the period 1951-2006 has remained well below the level required for MSY (ISC 2009). The probability that this rate in 2006 exceeded the exploitation rate at MSY is also low at one percent. Projecting exploitable biomass forward until 2010 by assuming a constant 3-year (2004-2006) average exploitation rate and fishing operations to those observed in 2006, results in exploitable biomass levels above BMSY which is sufficient to sustain recent levels of catch.

The WCPO and EPO stocks of swordfish are healthy and well above the level required to sustain recent catches.



Source: ISC 2009.

Figure 3-8. Stock Scenario-2. Two North Pacific swordfish stocks with boundaries according to ISC/08/BILLWG-SS/04.

3.3.2.2 Non-target Finfish Species

Overview

The purpose of this section is to discuss the stock status of non-target finfish species that make up a significant part of the overall finfish catch in U.S. longline and purse seine fisheries in the EPO. Although tuna species are the target species in these fisheries, there are also significant catches of non-target finfishes. The review of species below includes commercially important finfish species, as well as bycatch species.

Status of Major Non-target Sharks

The focus of the analysis will be on the major non-target shark species, namely blue sharks, silky sharks, oceanic whitetip, and shortfin mako sharks. For all sharks covered in the HMS FMP, there is an established OY that is set at 75 percent of the maximum sustainable yield (MSY), because these species have low productivities and are vulnerable to overfishing. Stocks of the shortfin mako shark are being managed using precautionary harvest guidelines under the HMS FMP. Basic population dynamic parameters for these shark species are poorly known, and they are considered vulnerable given their life history characteristics (slow growth, late maturing, and low fecundity). A harvest guideline is a numerical harvest level that is a general objective and is not a quota. A quota is a specified numerical harvest objective, the attainment of which triggers the closure of the fishery or fisheries for that species. If a harvest guideline is reached, NMFS initiates review of the species' status according to provisions in the HMS FMP and in consideration of the Council's recommendations.

Family Carcharhinidae (NMFS 2009b)

This is one of the largest and most important families of sharks, with many common and wide-ranging species found in all warm and temperate seas. The silky shark (*Carcharhinus falciformis)* is one of the three most abundant pelagic sharks, along with the blue (*Prionace glauca*) and oceanic whitetip sharks *(C. longimanus)* (Compagno 1984). Not surprisingly, silky and oceanic whitetip sharks are two of the most abundant species caught by the purse seine fishery (Molony 2005). Stevens (1996) estimated 84,000 metric tons of silky sharks were caught in the international Pacific Ocean high-seas fisheries (purse seine, longline, and drift-net). Oshiya (2000) conducted a stock assessment of Pacific silky sharks, with an estimated Pacific Ocean-wide standing stock of 170,000 to 240,000 metric tons, from which 15,000 and 20,000 metric tons is caught annually by longline vessels. Stevens (1996) roughly estimated 50,000 to 239,000 metric tons of oceanic whitetips were caught by the international Pacific Ocean high-seas fisheries (purse seine, longline, and drift-net) in 1994. There have been no quantitative assessments of Pacific oceanic whitetip shark populations published to date.

Blue shark *(Prionace glauca)* (Kleiber, *et al*. 2001)

Blue sharks are found world-wide in temperate and tropical pelagic waters, but have been known to frequent inshore areas around oceanic islands and locations where the continental shelf is narrow. In the eastern Pacific, blue sharks range from the Gulf of Alaska down to Chile, migrating to higher latitudes during the summer, and lower latitudes during the winter.

Within the U.S. west coast EEZ, blue sharks are entangled in pelagic drift gillnet (DGN) gear, but rarely taken by other commercial HMS gears. On the high-seas, blue sharks have been caught with longline gear in the U.S. longline fisheries. Most commercially-caught blue sharks are considered undesirable bycatch, since the meat quickly ammoniates, reducing marketability. As with several other shark species, the fins of blue sharks are sold to Asian markets for use in shark-fin soup; however, since implementation of the U.S. Shark Finning Prohibition Act which prohibits landing shark fins without accompanying carcasses, blue sharks are rarely landed or marketed when taken in U.S. commercial fisheries. Recreationally, blue sharks are considered a sport fish and larger individuals provide a challenge for fishermen using light tackle. Because most of the recreational shark trips are based out of southern California, and the average size of blue sharks taken is small (7 lb), blue sharks are often caught and released in this fishery.

For the North Pacific blue shark population, a range of examples of what might be considered "plausible" MSY were calculated in 2001 (Kleiber, *et al*. 2001). The data on which the analysis was based consisted of catch, effort, and size composition data collected during the period 1971–1998 from commercial fisheries operating in the North Pacific west of 130° W. longitude; primarily the Japan- and Hawaii-based

pelagic longline fisheries, which catch significant numbers of blue sharks. The results indicated that the blue shark stock, under the fishing regime present at that time in the North Pacific, appeared to be in no danger of collapse. An updated analysis covering the same spatial area and which included data through 2003 was recently completed and produced results similar to the previous assessment, namely that blue sharks in the North Pacific are not subject to overfishing or approaching an overfished state (Sibert, *et al*. 2006). The blue shark is currently listed as "near threatened", a lower risk status, by The World Conservation Union (IUCN) due to the impact of annual fisheries mortality (mainly of bycatch) on the world population, and the concern over the removal of such large numbers of this likely keystone predator from the oceanic ecosystem; however, monitoring data are inadequate to assess the scale of any population decline[10].

Family Lamnidae

This family of sharks is both coastal and oceanic, ranging from temperate to tropical zones of the Atlantic, Pacific, and Indian Oceans. Lamnid sharks, such as crocodile sharks *(Pseudocarcharius kamoharia*) and short-fin mako sharks *(Isurus oxyrhinchus)* are occasionally taken in pelagic fisheries.

Shortfin mako shark *(Isurus oxyrinchus)* (PFMC 2003)

The shortfin mako shark occurs throughout the tropical and temperate Pacific, but is not managed internationally. The mako is widely distributed in pelagic waters, and the population fished off the West Coast is likely part of a stock that extends considerably to the south and west. Although makos are most frequently found above the mixed layer, they have been recorded down to depths of 740 m. Tagging and fishery catch data show makos prefer water temperatures between 17–20° Celsius, and it has been hypothesized that this species migrates seasonally from the coast of California along the Baja peninsula following favorable seasonal water conditions (Cailliet and Bedford 1983). This movement pattern has been supported by tag and release studies. West coast commercial fisheries take mainly juveniles, with an average dressed weight of 34 lb (Leet, *et al*. 2001). Shortfin mako constitutes an important incidental catch whose market quality and ex-vessel value make it an important component of the landed catch of the DGN fishery (Cailliet and Bedford 1983; Holts, *et al.* 1998).

Shortfin mako is an important component of California's ocean recreational fishery. The majority are caught by anglers fishing with rod-and-reel gear from private vessels in the Southern California Bight from June through October, with a peak in August. Historically, makos have been esteemed as a prized game fish along the east coast of the United States. During the early 1980s, they increased in prominence as a popular game fish on the U.S. West Coast as well, with annual west coast recreational catches peaking in 1987 at about 21,600 fish. Since 2001, annual recreational catch estimates have ranged from 3,000–14,700 fish, with a percentage of sharks successfully released by southern California fishermen favoring catch-and-release versus harvest (PFMC 2007b; personal communication with C. Sepulveda, Pfleger Institute of Environmental Research, 2006). In 2005 it is estimated that recreational anglers fishing from private vessels in U.S. EEZ waters kept 14,000 shortfin mako sharks, and released alive 7,000; and in 2006 it is estimated that 5,000 shortfin mako sharks were kept, and 6,000 were released alive (PFMC 2007b). It is important to note that catch estimates from RecFIN must be used with caution because sampling anglers that pursue HMS is an occurrence and as such can lead to unusually high or low catch estimates with high variances.

Because basic population dynamic parameters for this species of shark are unknown, it is being managed under the HMS FMP with a precautionary harvest guideline of 150 mt. Catch statistics from the CA/OR

[10] IUCN Red List of Threatened Species: http://www.iucnredlist.org/search/details.php/39381/summ.

DGN fishery suggest that the shortfin mako was not overexploited through the 1990s; however, CPUE rates indicated a possible overall decrease (PFMC 2003). Clear effects of exploitation have not been shown, and it is tentatively assumed that overfishing of the local stock is not occurring. The IUCN currently lists the shortfin mako as "near threatened", a lower risk status, because the shortfin mako shark is subject to significant bycatch and targeted fisheries in some areas and has a relatively low reproductive capacity; however, the species is very wide-ranging and has a relatively fast growth rate.

Status of Major Non-target Billfish

Striped marlin (*Tetrapturus audax*) (ISC 2007)

Stock status of striped marlin in the EPO was assessed by IATTC in 2003. The Marlin Working Group of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) also conducted an assessment of the North Pacific striped marlin population status in 2007 (ISC 2007). The stock structure of striped marlin in the Pacific Ocean is not well known. An analysis of trends in CPUE in several sub areas suggest that the fish in the EPO constitute a single stock thus that is an assumption of IATTC assessments.

Striped marlin are found throughout the Pacific Ocean between about 45° N. and 45° S. latitude. They are caught mostly by the longline fisheries of the Far East and Western Hemisphere nations. Lesser amounts are caught by recreational, gillnet, and other fisheries. The HMS FMP prohibits commercial take of striped marlin, however there is a small seasonal recreational fishery for striped marlin in the Southern California Bight in the late summer months. Similarly, in Mexico, it is prohibited for commercial anglers to target striped marlin within 50 nm of the coast in order to provide opportunities for recreational anglers.

For the EPO assessment, standardized catch rates were obtained from a general linear model and from a statistical habitat-based standardization method. Analyses of stock status were made using two production models, taking into account the time period when billfish were targeted by longline fishing in the EPO, that were considered the most plausible. A Pella-Tomlinson model yielded estimates of the AMSY in the range of 3,700–4,100 short tons (st)[11]. The current biomass is estimated to be greater than the biomass that would produce the AMSY. An analysis, using the Deriso-Schnute delay-difference model, yielded estimates of AMSY in the range of 8,700–9,200 st, with the current biomass greater than that needed to produce the AMSY.

The catches and standardized fishing effort for striped marlin decreased in the EPO from 1990–1991 through 1998, and this decline has continued, with the annual catches during 2000–2003 between about 2,000–2,100 st, well below estimated AMSY. This may result in a continued increase in the biomass of the stock in the EPO.

The status of a hypothesized stock of striped marlin spanning the North Pacific was conducted by the ISC in 2007. The status is difficult to determine due to a range of uncertainties in the fishery data as well as biological uncertainties (e.g., maturity schedule, growth rates, stock structure, etc.). Nonetheless, the results of the two models demonstrate that biomass has declined to levels that are 6 to 16 percent of their level in 1952. In addition, landings and indices of abundance have declined markedly, and recruitment has been steadily declining with no evidence that strong year-classes have or are about to enter the fishery. There appears to be inconsistency in the indices developed for the western Pacific and the eastern Pacific, and it was recommended that future modeling efforts include spatial segregation. The ISC Plenary

[11] The IATTC uses short tons in its stock status reports. 1 short ton is equal to 0.9072 metric ton.

recognized that current levels of fishing effort across the North Pacific are not likely to be sustainable, and recommended that fishing mortality rates not be increased above current levels.

A new assessment is scheduled to be completed by the ISC in 2011. The new assessment will consider a multi-stock hypothesis, probably a two stock scenario.

Status of Major Non-target Finfish

North Pacific albacore (*Thunnus alalunga*) (ISC 2007)

Stock status of North Pacific albacore is reviewed at one- to two-year intervals by ISC Albacore Working Group (formerly the North Pacific Albacore Workshop) with participating members from the United States, Mexico, Canada, Japan, and Taiwan. The latest assessment was finalized by the working group in July 2007. Spawning stock biomass (SSB) estimates for the period 1966-2006 show fluctuations around an estimated time series average of roughly 100,000 mt. The assessment demonstrates a recent increase in SSB from 73,500 mt in 2002 to 153,300 mt in 2006 with a projected further increase to 165,800 mt in 2007. The recent increases are likely due to strong year classes in 2001 and 2003. Despite the high SSB estimates relative to the time series average, fishing mortality rates are high relative to most commonly used reference points. The population is being fished at roughly $F_{17\%}$ (i.e. at a rate resulting in a reduction of the spawning potential ratio to 17 percent of the maximum spawning potential ratio in the absence of fishing). If fishing continues at the current level, and all else being equal, then SSB is projected to decline to an equilibrium level of 92,000 mt by 2015. Considering the high fishing mortality rates, and the fact that total catch has been in decline since 2002, the ISC recommended that all nations practice precautionary-based fishing practices.

Since the mid-1970s, the U.S. component of the overall pan-Pacific Ocean catch is estimated at roughly 15 percent. Albacore troll boats account for nearly all the west coast catch. Currently there are no quotas or harvest guidelines established for North Pacific albacore catch under the HMS FMP.

Dorado (*Coryphaena hippurus*) (NMFS 2008)

Dorado are predominantly a warm water tropical species that are seasonally present in variable numbers in the SCB most likely from populations reproducing off Baja California, Mexico. Catch estimates from international fisheries are poorly documented due in part to the artisanal fishing nature of this fishery, and due to the lack of bycatch monitoring programs. West coast fishermen access the northern range of the species and there are no HMS FMP harvest guidelines recommended at this time (PFMC 2003). Between 1981 and 2007, the total U.S. west coast catch of dorado by commercial vessels was less than 45 mt, and the range was from less than 0.5 round mt to 43 round mt (PFMC 2007b). This species is more important in the recreational private sport fishery, which has accounted for an average of 5,000 fish caught annually along the Pacific coast for the years 2002-2006, and the California Commercial Passenger Fishing Vessel Fleet (CPFV), which accounts for an average of about 11,000 fish caught annually in California and Mexico water for the years 2002-2006.

Dorado are a fast-growing and highly productive species with a short life span of 2–4 years and the ability to rebound relatively quickly from exploitation. Females mature at 4–7 months and spawning can occur all year long in the tropics. The high adult mortality rates may limit the resiliency of this species (PFMC 2003). Dorado from the EPO feed during both day and night, and dominant prey species vary by location (Olson and Galvan-Magana 2002).

Pelagic stingray (*Pteroplatytrygon (Dasyatis) violacea*) (NMFS 2008)

The pelagic stingray is found worldwide in latitudes spanning tropical to temperate waters. This species is small, reaching a maximum size of 80 cm (disc width), and sexual maturity occurs at an average 37.5 cm in males and 50 cm in females. There is evidence suggesting that the eastern Pacific population migrates to the warmer waters off Central America during the winter. Females give birth in the warmer waters before migrating to higher coastal latitudes such as along the Southern California Bight. This species is commonly found within the top 100 m in deep, blue water zones and are often caught as bycatch in longline and DGN fisheries targeting HMS (Mollet 2002). The bycatch of pelagic stingray in the longline fishery is not marketable and therefore discarded.

Smith's Escolar (*Lepidocybium flavobrunneum*) (NMFS 2008)

The black escolar occurs throughout the world's oceans and are distributed between 40º N. and 40º S. latitude. Biological information is lacking for the Pacific populations. Daily catch and fishing effort data was used to determine escolar population structure for the southwestern Atlantic Ocean (SAO). In the SAO, black escolar are taken as incidental catch when longlining for tuna and swordfish. It was found that the intra-annual catch patterns for the black escolar were similar to those of the target species. This suggests that escolar have similar trophic and reproductive behavior as tuna and swordfish. Highly productive oceanic fronts that are developed in winter and spring attract pelagic species that feed on squid and anchovy. Catches are lower in the summer when presumably escolar are migrating to lower latitudes to reproduce (Milessi and Defeo 2002). In California, escolar were the third most frequently caught species in the pelagic longline fishery with 132 total fish, along with 504 swordfish, and 459 blue sharks in 2001-2002. Catches of escolar declined slightly throughout 2002–2004 (PFMC 2007). The bycatch of escolar in the longline fishery is marketable, and it is generally retained and sold.

Longnose lancetfish (*Alepisaurus ferox*) (NMFS 2008)

Longnose lancetfish range from Alaska to Chile and are considered almost worldwide in distribution ranging from temperate to tropical seas. The longnose lancetfish have been found from the surface down to 1829 m. They are prey for sharks, marlins, tunas, opahs, and other predatory fish that are commercially important. There is no commercial fishery for longnose lancetfish, but this fish is considered bycatch for other fisheries such as bottom and pelagic trawls, driftnets, longlines and other fishing gear.

Opah (*Lampris guttatus*) (NMFS 2008)

The opah is distributed worldwide and throughout the Pacific basin in temperate and tropical seas (Japan to the Gulf of Alaska to the Gulf of California). All life stages of this species are pelagic and oceanic, occurring from the sea surface to a depth of 1,680 ft. Seasonal movements are not well known in the Pacific. Although not much is known about their basic reproductive habits, anecdotal evidence suggests a spring spawning window. The size of the opah population off the coast of California, and whether local subpopulations exist, is not known at this time.

The opah is an oceanic predator that has been caught on tuna longlines in the western Pacific Ocean as well as by those fishing for albacore and salmon (Barut 1999). Between 1990 and 1999, over 660 mt of opah were landed in California, with annual landings ranging from 37 mt to 112 mt. The highest landings of the decade occurred in 1998; associated with the 1997–98 El Niño. Although the majority of opah landed in California since 1990 were landed from San Luis Obispo County and south (about 50 percent from San Diego County alone), landings were reported as far north as Crescent City. A small number of opah are caught and retained by the west-coast-based DSLL fishery.

Sport fishermen targeting albacore from British Columbia to Baja California occasionally catch opah. Within California, many sport caught opah are taken from the northern Channel Islands south to the Coronado Islands, just below the United States-Mexico border.

Wahoo (*Acanthocybium solandri*) (NMFS 2008)

Wahoo are commercially important pelagic fish that occur in both tropical and subtropical waters in the Indian, Pacific, and Atlantic Oceans. Wahoo are often taken with billfish in both commercial and recreational fisheries, and landed as incidental catch (Hyde, *et al.* 2005). Wahoo are harvested and sold as commercially important incidental catch by U.S. longline and surface troll vessels fishing in warmer waters, where this species is predominantly found (e.g., the U.S. west-coast-based DSLL fishery, and the Hawaii and American Samoa pelagic fisheries). Wahoo are a seasonally important game fish for the San Diego-based charter recreational fishery that targets them on long range trips (8-14 days) to the islands, banks, and ridges inside and adjacent to the EEZ of Mexico's Baja Peninsula.

Sickle Pomfret (*Taractichthys steindachneri*) (NMFS 2008)

The sickle pomfret is frequently caught on tuna longlines in the warm waters of the Pacific and Indian Oceans. They are commonly found at the shelf edge and considered oceanic and highly migratory. There are several species of pomfrets (Bramidae), known locally in Hawaii by the generic term "monchong", that are taken as incidental catch in the Hawaii-based longline fishery. The most common species taken in open water is the bigscale pomfret (*Taractichthys steindachneri*). In California, pomfret have been found from Point Conception and south (Itano 2004). They are retained and sold by the west-coast-based DSLL fishery.

Shortbill Spearfish (*Tetrapturus angustirostris*) (NMFS 2008)

There is no special fishery for spearfish; they are caught incidentally by longliners and occasionally by surface troll. They bycatch of shortbill spearfish is marketable, and is generally retained. There is currently no available stock assessment for shortbill spearfish. The shortbill spearfish is an Istiophorid billfish. Nakamura (1985) described the shortbill spearfish as an oceanic pelagic fish which does not generally occur in coastal or enclosed waters but is found offshore. The hypothetical habitat for this fish may be described as open ocean epipelagic and mesopelagic waters from the surface to 1,000 m in the tropics and subtropics.

Spearfish are heterosexual and no sexual dimorphism is reported. Shortbill spearfish apparently spawn in winter months in tropical and subtropical waters between 25° N. and 25° S. latitude. Kikawa (1975) noted that unlike other billfish, spawning does not take place in large groups over a very short period of time, but probably is continuous over a long period and over broad areas of the sea.

3.3.2.3 Prohibited Finfish Species

Any HMS stocks managed under the HMS FMP for which quotas have been achieved and the fishery closed are deemed prohibited species. In general, prohibited species must be released immediately if caught, unless other provisions for their disposition are established, including for scientific study. Two prohibited species have had interactions with the shallow-set longline fishery based out of Hawaii. There have been recorded interactions of great white sharks in the Hawaii-based SSLL fishery based on observer records. There has also been one recorded interaction of a basking shark in the Hawaii-based SSLL fishery based on observer records. The shark was captured December 3, 2003, and was discarded

dead. Descriptions of the stock status of great white and basking sharks are included because of the interactions observed in the Hawaii-based SSLL fishery. For a detailed description and the stock status of other prohibited species refer to the 2007 SAFE document (PFMC 2007b).

Great White Shark (*Carcharodon carcharias*) (NMFS 2008)

The great white shark is an oceanic and coastal inhabitant ranging in the eastern Pacific from the Gulf of Alaska to the Gulf of California, although it appears to prefer temperate waters (Eschmeyer, *et al*. 1983). As a large, true apex predator, this species is relatively rare. This shark commonly patrols small coastal archipelagos inhabited by pinnipeds (seal, sea lions, and walruses); offshore reefs, banks, and shoals; and rocky headlands where deepwater lies close to shore. Its low productivity and accessibility in certain localized areas make it especially vulnerable. Overall population estimates for this species are unknown and even regional and localized estimates are questionable.

Adult great whites sighted off northern California most likely originate from southern California. The northward migration may be triggered by a shift in dietary preference toward seals and sea lions as the sharks grow large (Klimley 1994). Large males and females tend to be captured along the northern coast, while juveniles as well as large females are generally found to the south. The take of this species has been prohibited by the State of California since 1995; it may not be taken except for scientific and educational purposes under permit. The HMS FMP adopted the State measures across the board. At present, the great white shark is listed as "vulnerable" by the IUCN throughout its range, and is now protected in some regions.

In 2004, the Convention on International Trade in Endangered Species (CITES) placed this shark on its Appendix II list, which demands tighter regulations and requires a series of permits that will control the trade in great white shark products.

There have been several interactions with great white sharks in the DGN fishery[12]. Most are retained as incidental catch, or discarded if dead. There have also been some instances in which live great white sharks incidentally caught by commercial fishermen were given to the Monterey Bay Aquarium for its Great White Research Project[13]. The project has two primary goals: tagging and field studies, and exhibiting a great white shark to promote public understanding and protection of white sharks.

Basking Shark (*Cetorhinus maximus*) (NMFS 2008)

The basking shark is a coastal pelagic species inhabiting the eastern Pacific from the Gulf of Alaska to the Gulf of California. The basking shark is typically seen swimming slowly at the surface, mouth agape in open water near shore. This species is known to enter bays and estuaries as well as venturing offshore. Basking sharks are often seen traveling in pairs and in larger schools of up to 100 or more. Basking sharks are highly migratory. Sightings of groups of individuals of the same size and sex suggest that there is pronounced sexual and population segregation in migrating basking sharks.

In the past, basking sharks were hunted worldwide for their oil, meat, fins, and vitamin-rich livers. Today, most fishing has ceased except in China and Japan. The fins are sold as the base ingredient for shark fin soup. A small fishery took place off Monterey Bay during the period from 1924 to the 1950s for fish meal and liver oil; it is still taken as bycatch in the area. Basking sharks occur in greatest numbers during the autumn and winter months off California, but may shift to northern latitudes in spring and summer along the coasts of Washington and British Columbia. The harvest of this species has not been

[12] Most of these interactions were in the small mesh DGN and bottom set DGN fisheries.
[13] http://www.montereybayaquarium.org/cr/whiteshark.asp.

allowed by California since 2000, and the HMS FMP adopted the same State measures. It is thought to be the least productive of shark species. The basking shark is also currently categorized as "vulnerable" throughout its range and "endangered" in the Northeast Atlantic Ocean and North Pacific Ocean regions by the IUCN. There have been two recorded captures of basking shark in the DGN fishery (December 1993, May 2002); one was released alive and one was released assumed dead.

3.4 Protected Species

This section provides information on protected species that may interact with the U.S. longline and purse seine fisheries operating in the EPO. Within the action area, all sea turtle species and some seabirds are protected under the ESA (listed as threatened or endangered). Takes of marine mammals on the high seas in U.S. fisheries is covered under the Marine Mammal Protection Act (MMPA).

3.4.1 Marine Mammals

The marine mammals that may be found in the proposed action area are listed below. The marine mammal species shown on this list were selected based on their distribution. Complete descriptions of all of these stocks can be found in the Pacific Stock Assessment Report (SARs; Carretta, *et al*. 2009) and the Alaska SARs (Angliss and Allen 2009). All marine mammals are protected under the MMPA and managed under that statute on a per stock basis.

Cetaceans

Harbor porpoise (*Phocoena phocoena*) – Morro Bay stock
Harbor porpoise (*Phocoena phocoena*) – Monterey Bay stock
Harbor porpoise (*Phocoena phocoena*) – San Francisco-Russian River stock
Harbor porpoise (*Phocoena phocoena*) – Northern California/Southern Oregon stock
Harbor porpoise (*Phocoena phocoena*) – Oregon/Washington coast stock
Harbor porpoise (*Phocoena phocoena*) – Washington inland waters stock
Dall's porpoise (*Phocoenoides dalli*) – CA/OR/WA stock
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) – North Pacific stock; CA/OR/WA stock
Risso's dolphin (*Grampus griseus*) – CA/OR/WA stock
Bottlenose dolphin (*Tursiops truncatus*) – California coastal stock
Bottlenose dolphin (*Tursiops truncatus*) – CA/OR/WA offshore stock
Short-beaked common dolphin(*Delphinus delphis)* – CA/OR/WA stock
Long-beaked common dolphin(*Delphinus capensis)* – California stock
Northern right whale dolphin (*Lissodelphis borealis*) – CA/OR/WA stock
Striped dolphin (*Stenella coeruleoalba*) – CA/OR/WA stock
Short-finned pilot whale (*Globicephala macrorhynchus*) – CA/OR/WA
Sperm whale (*Physeter macrocephalus*) – CA/OR/WA stock
Dwarf sperm whale (*Kogia sima*) - CA/OR/WA stock
Pygmy sperm whale (*Kogia breviceps*) - CA/OR/WA stock
Killer whale (*Orcinus orca*) – eastern North Pacific northern resident stock
Killer whale (*Orcinus orca*) – west coast transient stock
Mesoplodont beaked whales (*Mesoplodon* spp.) - CA/OR/WA stocks
- Hubbs' beaked whales
- Gingko-toothed whale
- Stejneger's beaked whales
- Blainville's beaked whales
- Pygmy beaked whale or Lesser beaked whale
- Perrin's beaked whale

Due to the difficulties involved with identifying different species, as well as the rarity of these species, the SAR for these species designated all Mesoplodont beaked whales as one stock in the EEZ waters off the coasts of CA/OR/WA

Cuvier's beaked whale (*Ziphius cavirostris*) - CA/OR/WA stock
Baird's beaked whale (*Berardius bairdii*) – CA/OR/WA stock
Blue whale (*Balaenoptera musculus)* – eastern North Pacific stock
Fin whale (*Balaenoptera physalus*) - CA/OR/WA stock
Humpback whale (*Megaptera novaeangliae*) – central North Pacific stock
North Pacific right whale (*Eubalaena glacialis*) – eastern North Pacific stock
Sei whale (*Balaenoptera borealis)* - eastern North Pacific stock
Minke whale (*Balaenoptera acutorostrata*) – CA/OR/WA stock

Pinnipeds

California sea lion (*Zalophus californianus californianus*) – U.S. stock
Harbor seal (*Phoca vitulina richardsi*) – California stock
Harbor seal (*Phoca vitulina richardsi*) – Oregon and Washington stock
Northern elephant seal (*Mirounga angustirostris*) – California Breeding Stock
Guadalupe fur seal (*Arctocephalus townsendi*)
Northern fur seal (*Callorhinus ursinus*): San Miguel Island stock
Steller sea lion (*Eumetopias jubatus*) – eastern U.S. stock

The ESA-listed marine mammals under NMFS's jurisdiction are listed below (Table 3-6). Under the ESA, marine mammals are generally listed based upon the global population and not by stocks (as under the MMPA), although some distinct population segments (DPS) are listed.

Table 3-6. Threatened or endangered species listed under the ESA of NMFS's jurisdiction and occurring in the EPO.

Marine Mammals	Status
Blue whale *(Balaenoptera musculus)*	Endangered
Fin whale *(Balaenoptera physalus)*	Endangered
Humpback whale *(Megaptera novaeangliae)*	Endangered
Sei whale *(Balaenoptera borealis)*	Endangered
Sperm whale *(Physeter macrocephalus)*	Endangered
Steller sea lion (*Eumetopias jubatus)*	Threatened
Guadalupe fur seal (*Arctocephalus townsendi)*	Threstened

Fishery Effects

All marine mammals are protected under the MMPA. Pursuant to the MMPA, NMFS has promulgated specific regulations that govern the incidental take of marine mammals during fishing operations (50 CFR § 229). The regulations designate three categories of fisheries, based on relative frequency of incidental serious injuries and mortalities of marine mammals in each fishery:

- Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing;
- Category II designates fisheries with occasional serious injuries and mortalities;
- Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities.

Longline Fishery

The Hawaii-based longline fishery is divided into deep-setting and shallow-setting which are classified as Category I for the deep-set portion and Category II for the shallow-set portion of the fishery[14]. The west coast-based longline fisheries and the EPO purse seine fishery are classified as Category II (73 Fed. Reg. 73032, December 1, 2008[15]).

Most of the observed interactions with marine mammals in the longline fisheries are attributed to odontocetes (toothed whales, dolphins, or porpoises) either feeding on the bait, or fish caught on the hooks, a behavior referred to as depredation; less frequently, marine mammals are entangled in gear (Gilman, *et al*. 2006). Forney and Kobayashi (2008) reviewed the Hawaii-based longline fishery (shallow- and deep-sets combined); 24,542 sets were observed, and 67 marine mammal interactions were observed. Within the tuna (deep-set) longline fishery, there were 43 observed marine mammal takes in 20,375 observed sets. Of these 43 animals, there were 6 immediate mortalities, 29 animals seriously injured, and 8 released without injury (Forney and Kobayashi 2008). In the historical California SSLL fishery only two marine mammals were observed taken in 469 sets, one Risso's dolphin and one unidentified dolphin. Table 3-7 shows the U.S. Hawaii longline deep-set and shallow-set longline interactions for 2006, 2007, and 2008.

[14] The deep-set longline fishery is categorized as a Category I fishery due to the level of takes of false killer whales.
[15] Available on the following NMFS website: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr73-73032.pdf.

Table 3-7. Marine mammal interactions with the U.S. Hawaii-based deep- and shallow-set longline fisheries for 2006-2008.

2006				
Species	**Released dead**	**Released injured**	**Released unknown**	**Fishery method**
Bottlenose dolphin		1		Deep-set
Risso's dolphin		2		
False Killer whale		4		
Short-finned Pilot whale		2		
Striped dolphin	1			
Unidentified cetacean		2		
Unidentified dolphin		2		
Bottlenose dolphin		1		Shallow-set
Humpback whale		1		
Risso's dolphin	1	1		
2007				
Species	**Released dead**	**Released injured**	**Released unknown**	**Fishery method**
Unidentified cetacean		1		Deep-set
False Killer Whale		4		
Short-finned Pilot Whale		1		
Unidentified dolphin		1		
Risso's dolphin	1			
Bottlenose dolphin		3		Shallow-set
Risso's dolphin		3		
2008				
Species	**Released dead**	**Released injured**	**Released unknown**	**Fishery method**
Unidentified cetacean		2		Deep-set
Unidentified whale		3		
Short-finned Pilot Whale		3		
False Killer Whale		2		
Risso's dolphin		1		
Spotted dolphin	1			
False Killer Whale		1		Shallow-set
Humpback Whale		1		
Risso's dolphin	1	3		
Pygmy Sperm Whale		1		
Striped dolphin		1		
Unidentified Whale		1		

The shallow-set data for 2007 covers the first three quarters only.
Source: NMFS Pacific Island Regional Observer Program.

Purse Seine Fishery

In the purse seine fishery, interactions with the large whales, including listed whales, are uncommon throughout the Pacific Ocean. The purse seine fishery in the EPO is listed in the 2009 List of Fisheries as having no marine mammal species and stocks incidentally killed or injured (73 Fed. Reg. 73032, December 1, 2008). Due to the small number of vessels with landings recorded over the past several

years, the takes of marine mammals in this fishery cannot be disclosed due to confidentiality requirements. However, as an indicator of takes of species, in the U.S. WCPO purse seine fishery, the most recent available data indicates that during 2005 there were two marine mammals (unidentified) encountered on U.S. purse seine vessels in 293 observed sets, and both were listed as dead when returned to the sea (NMFS 2009b). Based on preliminary data (88 sets) there were no observed marine mammal takes by U.S. purse seine vessels in the WCPO for 2006 (NMFS 2009b).

3.4.2 Sea Turtles

Four species of sea turtles may be found in the proposed action area (section 1.2) and are listed along with their status in Table 3-8.

Table 3-8. Sea turtles within the proposed action area.

Sea turtles	Status
Leatherback (*Dermochelys coriacea*)	Endangered
Loggerhead (*Caretta caretta*)	Threatened
Olive ridley (*Lepidochelys olivacea*)	Endangered/threatened
Green (*Chelonia mydas*)	Endangered/Threatened
Hawksbill (*Eretmochelys imbricata*)	Endangered

3.4.2.1 Species of sea turtles found in the action area

The following sections provide brief status descriptions of the sea turtle species that are found in the action area. More detailed descriptions of these species can be found in the 2004 Biological Opinion (BO) prepared for the HMS FMP. Updates of that data are provided as available for sea turtles.

Green Turtles (NMFS 2008)

Green turtles are found throughout the world, occurring primarily in tropical and, to a lesser extent, subtropical waters (NMFS and USFWS 1998a). The breeding populations of the green turtle off the coast of Florida and the Pacific coast of Mexico are listed as endangered, while all others green turtles are listed as threatened. Green turtles are generally found in warm waters, temperatures greater than 18° Celsius, which is within the temperature range of preferred tuna habitat. In the Pacific Ocean this species occurs in nesting aggregations within the eastern, central, and western regions (NMFS 2005). Using a precautionary approach, Seminoff, *et al*. (2002) estimates that the global green turtle population has declined by 34 percent to 58 percent over the last three generations (approximately 150 years); although, actual declines may be closer to 70 percent to 80 percent. Causes for this decline include harvest of eggs, harvest of subadults and adults, incidental capture by fisheries, loss of habitat, and disease. A more complete review of the most current information on green sea turtles is available in the Five Year Status Review document published in 2007 by the U.S. Fish and Wildlife Service and NMFS[16].

Eastern Pacific - Distribution and Abundance of Nesting Females

The primary green turtle nesting grounds in the eastern Pacific are located in Michoacán, Mexico, and the Galapagos Islands, Ecuador (NMFS and USFWS 1998). Here, green turtles were widespread and abundant prior to commercial exploitation and uncontrolled subsistence harvest of nesters and eggs. Sporadic nesting occurs on the Pacific coast of Costa Rica. Analysis using mitochondrial DNA (mtDNA)

[16] www.nmfs.noaa.gov/pr/pdfs/species/greenturtle_5yearreview.pdf.

sequences from three key nesting green turtle populations in the eastern Pacific indicates that they may be considered distinct management units: Michoacán, Mexico; Galapagos Islands, Ecuador, and Islas Revillagigedos, Mexico (personal communication with P. Dutton, NMFS SWFSC, 2003).

Table 3-9. Estimates of current green turtle nesting rookeries in the eastern Pacific Ocean.

Eastern Pacific Ocean	Units[1]	Years	Abundance	Trend
Revillagigedos Islands, Mexico	AN	1999-2002	90	stable
Michoacan, Mexico	AF	2000-2006	1395	increasing
Central American Coast	AN	late 1990s	184-344	uncertain
Galapagos Islands	AF	2001-2006	1650	stable

[1]AN = Annual number of nests. AF = Number of females nesting annually.
Data source: 2007 Five Year Status Review.

The most current information on the status of eastern Pacific green turtle nesting is given in Table 3-9. This indicates that three of the four known significant populations appear to be stable or increasing. Nesting along the Central American coast has not been well described or documented as of yet.

Green turtles are also known to migrate long distances from nesting areas to feeding grounds. Green turtles that were satellite tagged at the French Frigate Shoals nesting site showed an eastward migration to the main Hawaiian islands off Oahu in 26 days, traveling far from shore and over waters thousands of meters deep (Balazs, *et al*. 1994). The EPO population of green turtles has been reported to stay close to shore and have relatively small home ranges. In the Gulf of California, a group of green turtles that were tagged with radio and sonic telemetry transmitters showed a range of diving depths including dives to greater than 40 m. This population of turtles did not leave the Gulf of California throughout the summer study months (Seminoff, *et al*. 2002). In 2005, there were 1.4 estimated mortalities of green turtles in the purse seine fishery (IATTC 2006).

Central Pacific - Hawaii

Green turtles in Hawaii are considered genetically distinct and geographically isolated; although, the nesting population at Islas Revillagigedos in Mexico appears to share the mtDNA haplotype that commonly occurs in Hawaii. Since the establishment of the ESA in 1973, the nesting population of Hawaiian green turtles has shown a gradual but definite increase (Balazs 1996; Balazs and Chaloupka 2004). In three decades the number of nesting females at East Island (French Frigate Shoals) increased from 67 nesting females in 1973 to 467 nesting females in 2002. Unfortunately, the green turtle population in the Hawaiian Islands area is afflicted with a tumor disease, fibropapilloma, which is of an unknown etiology and often fatal, as well as spirochidiasis; both of these diseases are major causes of strandings of this species (personal communication with Balazs, G., NMFS, 2000).

Loggerhead Turtles (NMFS 2008)

The loggerhead turtle is listed as threatened under the ESA throughout its range, primarily due to direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. Major nesting grounds are generally located in temperate and subtropical regions, with scattered nesting in the tropics (NMFS and USFWS 1998). In the Pacific Ocean, loggerhead turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) which is comprised of separate nesting groups (Hatase, *et al.* 2002) and a smaller southwestern nesting aggregation that occurs

in Australia (Great Barrier Reef and Queensland) and New Caledonia (Limpus and Limpus 2003). Clutch size averages 110 to 130 eggs, and one to six clutches of eggs are deposited during the nesting season (Dodd 1988). The average re-migration interval is between 2.6 and 3.5 years (NMFS and USFWS 1998), and adults can breed up to 28 years (Dobbs 2002). More information can be found by reviewing the 5-Year Status Review document published in 2007 by NMFS and the USFWS[17].

For loggerheads, the transition from hatchling to young juvenile occurs in the open sea, and evidence from genetic analyses and tracking studies show that this part of the loggerhead life cycle involves trans-Pacific developmental migration (Polovina, *et al*. 2003). Large aggregations (numbering in the thousands) of mainly juveniles and subadult loggerheads are found off the southwestern coast of Baja California, over 10,000 km from the nearest significant nesting beaches (Nichols, *et al.* 2000; Pitman 1990). Genetic studies have shown these animals originate from a Japanese nesting subpopulation (Bowen, *et al.* 1995), and their presence reflects a migration pattern probably related to their feeding habits (Eckert 1993). While these loggerheads are primarily juveniles, carapace length measurements indicate that some of them are 10 years old or older.

Distribution and Abundance of loggerheads in the Pacific Ocean

Loggerhead populations can be divided in two nesting aggregations in the Pacific, a northwestern Pacific population located in Japan and a smaller southwestern population occurring in Australia and New Caledonia. The nesting populations in Japan have declined by 50-90 percent in the last 50 years (Kamezaki, *et al.* 2003).

Japan

In the western Pacific, the only major nesting beaches are in the southern part of Japan (Dodd 1988). Balazs and Wetherall (1991) speculated that 2,000 to 3,000 female loggerheads nested annually in all of Japan. From nesting data collected by the Sea Turtle Association of Japan since 1990, the latest estimates of nesting females on almost all of the rookeries are as follows: 1998 - 2,479 nests; 1999 - 2,255 nests; and 2000 - 2,589 nests. Considering multiple nesting estimates, Kamezaki, *et al*. (2003) estimated that approximately less than 1,000 female loggerheads return to Japanese beaches per nesting season. Matsuzawa (2005) has updated nesting numbers from 2001-2004 to 3,122; 4,035; 4,519; and 4,854. So over the short term, the last seven years, nesting appears to be increasing; however, these data are not sufficiently long-term to conclude a trend in the population.

In Japan, loggerheads nest on beaches across 13° of latitude (24° N. to 37° N.), from the mainland island of Honshu south to the Yaeyama Islands, which appear to be the southernmost extent of loggerhead nesting in the western North Pacific. Researchers have separated 42 beaches into five geographic areas: (1) the Nansei Shoto Archipelago (Satsunan Islands and Ryukyu Islands); (2) Kyushu; (3) Shikoku; (4) the Kii Peninsula (Honshu); and (5) east-central Honshu and nearby islands. There are nine "major nesting beaches" (defined as beaches having at least 100 nests in one season within the last decade) and six "submajor nesting beaches" (defined as beaches having 10-100 nests in at least one season within the last decade), which contain approximately 75 percent of the total clutches deposited by loggerheads in Japan (Kamezaki, *et al*. 2003).

Australia

In eastern Australia, Limpus and Reimer (1994) reported an estimated 3,500 loggerheads nesting annually during the late 1970s. Since that time, there has been a substantial decline in nesting populations at all sites. Currently, less than 500 female loggerheads nest annually in eastern Australia, representing an 86 percent reduction within less than one generation (Limpus and Limpus 2003).

[17] www.nmfs.noaa.gov/pr/pdfs/species/loggerhead_5yearreview.pdf.

New Caledonia

Loggerheads are the most common nesting sea turtle in the Île de Pins area of southern New Caledonia. Historically, there was little quantitative information available, and surveys in the late 1990s failed to locate regular nesting. However, anecdotal information from locals indicates that there may be more substantial loggerhead nesting occurring on peripheral small coral cays offshore of the main island. Limpus and Limpus (2003) estimate that the annual nesting population in the Île de Pins area may be in the "tens or the low hundreds". A recent study did identify 60-70 nests on four beaches during the 2004-2005 nesting season (Limpus, *et al*. 2006).

Recently, satellite tracking of loggerheads has provided insight into their behavior and distribution in the Pacific. Loggerheads exhibit shallow dive patterns with more than 90 percent of their dives within the top 40 m of water, which is shallower than the hook depth range of DSLL fishing gear (hook depths of 100 m or more below the water's surface) (Polovina, *et al*. 2004). Genetic analysis of loggerheads that may be exposed to the west-coast-based DSLL fishery indicate that they are likely to be those from nesting beaches in Japan (95 percent), and those foraging off Baja California and the central North Pacific (Bowen, *et al.* 1995). Satellite tracking of loggerheads indicates that they occupy a wide range of SSTs from 15–25° Celsius while in the central North Pacific, although tracks of turtles within narrowly defined temperature bounds were also observed (Polovina, *et al.* 2004). Satellite tracking indicates that loggerheads tagged and released from North Pacific fisheries and Japan travel in the North Pacific Transition Zone (NPTZ) and the Kuroshio Extension Current, perhaps spending years as juveniles feeding in these large Pacific currents (Polovina, *et al.* 2004; Polovina, *et al.* 2006). Satellite tracks of juvenile loggerheads in the NPTZ end at approximately 130° W. longitude, which is the eastern boundary of the sub-arctic and subtropical gyre in which the NPTZ is found (Polovina, *et al*. 2004). This area is within the proposed action area and on the western edge of the California Current. Researchers speculate that when the gyre meets the southbound California Current, objects in the gyre, including juvenile loggerheads, are moved into the waters off Baja (Nichols, *et al*. 2000). Many juvenile loggerheads spend years in the near shore, primarily feeding off Baja California, Mexico feeding. As adults, loggerheads head back across the Pacific to nesting beaches in Japan. Limited satellite tracking of loggerheads tagged in Baja indicate a due east movement which suggests they may be utilizing the subtropical front at 25–30° N. latitude (Nichols, *et al*. 2000).

Leatherback Turtles (NMFS 2008)

The leatherback turtle is listed as endangered under the ESA throughout its global range. Spotila, *et al*. (1996) estimated that the *global* population of female leatherback turtles in 1995 was only 34,500 nesting females (confidence interval: 26,200 to 42,900); however, this number is likely an underestimate as recent population estimates for the North Atlantic alone range from 34,000 to 90,000 adult leatherbacks. The population estimates in the Pacific are lower than the Atlantic. In the eastern Pacific, nesting counts indicate that the population has continued to decline since the mid 1990s, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (Spotila, *et al*. 1996; Spotila, *et al*. 2000). However, the status of western Pacific leatherbacks appears to be less dire. Recently published estimates of breeding females suggest that the western Pacific population is 2,700 to 4,500 adult females (Dutton, *et al*. 2007). This number is substantially higher than the population estimate of 1,775 to 1,900 western Pacific breeding females published in 2000 and used to predict possible extinction in the Pacific (Spotila, *et al*. 2000). The larger population estimate is due to adding in a number of nesting females from beaches that were not previously included in population estimates and thus is not indicative of a positive growth trend in the population. Leatherbacks are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters

(Morreale, *et al*. 1994; Eckert 1998; Eckert 1999). For a more complete review of leatherbacks, see the Five Year Status Review document published in 2007 by the U.S. Fish and Wildlife Service and NMFS[18].

Based on published estimates of nesting female abundance, leatherback populations are declining at all major Pacific basin nesting beaches, particularly in the last two decades (Spotila, *et al*. 1996; NMFS and USFWS 1998; Spotila, *et al*. 2000). Declines in nesting populations have been documented through systematic beach counts or surveys in Malaysia (Rantau Abang, Terengganu), Mexico and Costa Rica. In other leatherback nesting areas, such as Papua New Guinea, Indonesia, and the Solomon Islands, there have been no systematic consistent nesting surveys, so it is difficult to assess the status and trends of leatherback turtles at these beaches. In all areas where leatherback nesting has been documented, however, current nesting populations are reported by scientists, government officials, and local observers to be well below abundance levels of several decades ago.

Western Pacific Nesting Populations of Leatherback Turtles

Leatherbacks in the western Pacific nest at Indonesia, Papua New Guinea, the Solomon Islands, Vanuatu, with limited leatherback nesting activity in Viet Nam, Thailand, Fiji, and Australia. Malaysia was once the site of an enormous leatherback nesting population, which is now considered functionally extinct with only two to three females returning annually to nest each year. The largest extent nesting populations are in northern Indonesia at Jamursba-Medi and Wermon.

All leatherbacks in the Pacific face similar threats to their populations including poaching of eggs, killing of nesting females, human encroachment on nesting beaches, incidental capture in fishing gear, beach erosion, and egg predation by wild and domestic animals. Little is known about the status of the western Pacific leatherback nesting populations, but once major leatherback nesting assemblages have declined, some to the point of extirpation. Dutton, *et al*. (2007) report that there may be between 1,100 and 1,800 females nesting annually at 28 nesting sites in the western Pacific. Calculations using the same methods used by Spotila, *et al*. (1996) yield a minimum total estimate of nesting females in this area of approximately 2,700 to 4,500 animals taking into account an estimated re-nesting interval of 2.5 years (Spotila, *et al*. 1996). The actual re-nesting interval for western Pacific leatherbacks may vary from this estimate.

Migratory routes of leatherback turtles originating from eastern and western Pacific nesting beaches are not entirely known. However, satellite tracking of post-nesting females and foraging males and females, as well as genetic analyses of leatherback turtles caught in U.S. Pacific fisheries or stranded on the West Coast of the United States suggests that the leatherbacks found off the U.S. West Coast are from the western Pacific nesting populations. Leatherbacks forage off central California, generally at the end of the summer, when upwelling relaxes and SSTs increase. These areas are upwelling "shadows," regions where larval fish, crabs, and jellyfish are retained in the upper water column during relaxation of upwelling. Researchers estimated an average of 178 leatherbacks (CV=0.15) were present between the coast and roughly the 50 fathom isobath off California. Abundance over the study period was variable between years, ranging from an estimated 20 leatherbacks (1995) to 366 leatherbacks (1990) (Benson, *et al*. 2007). Other observed areas of summer leatherback concentration include northern California and the waters off Washington through northern Oregon, offshore from the Columbia River plume. Foraging areas of leatherbacks in the high seas is not known; although, based upon limited satellite tracking of turtles tagged off California, the animals move southwest off the coast, generally moving towards waters south of Hawaii.

[18] www.nmfs.noaa.gov/pr/pdfs/species/leatherback_5yearreview.pdf.

Eastern Pacific Nesting Populations of Leatherbacks

Leatherback nesting populations are declining at a rapid rate along the Pacific coast of Mexico and Costa Rica. Leatherbacks have been documented nesting as far north as Baja California Sur and as far south as Panama, with few areas of high nesting (personal communication with L.M. Sarti, UNAM, 2002).

Costa Rica

Since 1988, leatherback turtles have been studied at Playa Grande (in Las Baulas), the fourth largest leatherback nesting colony in the world. During the 1988-89 season (July-June), 1,367 leatherback turtles nested on this beach, and by the 1998-99 season, only 117 leatherback turtles nested (Spotila, *et al*. 2000). The last four nesting seasons have shown continued declines, with only 69 nesting females during the 2001-02 season, and 55 nesting females during the 2002-03 season. Scientists speculate that the low turnout during 2002-03 may be due to the "better than expected season in 2000-01 which temporarily depleted the reproductive pool of adult females in reproductive condition following the El Niño/La Niña transition" (personal communication with R. Reina, Drexel University, 2003). The number of females nesting in 2003-04 was 159 turtles, while during 2004-05, only 49 females nested. As of February 3, 2006, 107 individual leatherbacks had nested at Playa Grande (personal communication with P. Tomillo, Drexel University, 2006). There have also been anecdotal reports of leatherbacks nesting at Playa Caletas and Playa Coyote.

Mexico

The decline of leatherback subpopulations is even more dramatic off the Pacific coast of Mexico. Surveys indicate that the eastern Pacific Mexican population of adult female leatherback turtles has declined from 70,000[19] in 1980 (Spotila, *et al*. 1996) to approximately 60 nesting females during the 2002-03 nesting season, the lowest seen in 20 years (personal communication with L.M. Sarti, UNAM, June 2003). A summary of total leatherback nestings counted and total females estimated to have nested along the Mexican coast from 2000 through 2006 is shown in Table 3-10.

Table 3-10. Annual number of estimated leatherback nestings (# nests) from 2000-2005 on index beaches and total nesting beaches.

Index beach	2000-01	2001-02[1]	2002-03[2]	2003-04[3]	2004-05[4]	2005-06[4]
Primary Nesting Beaches (40-50% of total nesting activity)						
Mexiquillo	624	20	36	528	42	190*
Tierra Colorada	535	49	8	532	57	292*
Cahuitan	539	52	73	349	31	230*
Barra de la Cruz	146	67	3	275	28	121*
Total - primary index beaches	1,957	188	120	1,684	158	833*
Total - Mexican Pacific	4,513	658	n/a	4,045	n/a	n/a

[1]Source: Personal communication with L.M. Sarti, UNAM, 2002, index beaches and totals.
[2]Source: Personal communication with L.M. Sarti, UNAM, December 2003, index beaches and totals.
[3]Source: García, *et al*. 2004.
[4]Source: Personal communication with L.M. Sarti, UNAM, 2006 [*note that these numbers are preliminary].

[19] This estimate of 70,000 adult female leatherback turtles comes from a brief aerial survey of beaches by Pritchard, who has commented: "I probably chanced to hit an unusually good nesting year during my 1980 flight along the Mexican Pacific coast, the population estimates derived from which have possibly been used as baseline data for subsequent estimates to a greater degree than the quality of the data would justify" (Pritchard 1996).

Olive Ridley Turtle (NMFS 2008)

Although the olive ridley turtle is regarded as the most abundant sea turtle in the world, olive ridley nesting populations on the Pacific coast of Mexico are listed as endangered under the ESA; all other populations are listed as threatened. Olive ridley turtles occur throughout the world, primarily in tropical and subtropical waters. Nesting aggregations in the Pacific Ocean are found in the Mariana Islands, Australia, Indonesia, Malaysia, and Japan (western Pacific), and Mexico, Costa Rica, Guatemala, and South America (eastern Pacific). Like leatherback turtles, most olive ridley turtles lead a primarily pelagic existence (Plotkin, *et al*. 1993), migrating throughout the Pacific, from their nesting grounds in Mexico and Central America to the North Pacific. While olive ridleys generally have a tropical to subtropical range, with a distribution from Baja California, Mexico to Chile (Silva-Batiz, *et al*. 1996), individuals do occasionally venture north, some as far as the Gulf of Alaska (Hodge and Wing 2000). A more complete review of current information can be found in the Five Year Status Review document published in 2007 by the U.S. Fish and Wildlife Service and NMFS[20].

Olive ridleys are usually found in warm waters, 23-28° Celsius, often within equatorial or nearby waters (Polovina, *et al*. 2004). Sightings of olive ridley turtles from tuna purse seine vessels (1990-2002) in the EPO show turtles from 15º S. to 30º N. latitudes and spotted as far as 145º W. longitude (IATTC 2004). Shaded areas on the map (Figure 3-9) show different levels of fishing effort with darker shading representing higher effort. This map cannot be used to represent overall distribution of olive ridley turtles for this area, but in areas where there is more effort and less turtles, or less effort and more turtles, we can infer some natural distribution.

A main nesting population occurs along the north-east coast of India in the Indian Ocean. Another major nesting population exists in the eastern Pacific on the West Coast of Mexico and Central America. Both of these populations use the North Pacific as foraging grounds (Polovina, *et al*. 2004). Recent genetic information indicates that 75 percent of the Hawaii-based longline fisheries interactions with this species are from the eastern Pacific subpopulations, and 25 percent are from the Indian and western Pacific rookeries (personal communication with P. Dutton, NMFS SWFSC, 2005).

Eastern Pacific Ocean

The largest known arribadas in the eastern Pacific are off the coast of Costa Rica (~475,000 - 650,000 females estimated nesting annually) and in southern Mexico (~1,000,000+ nests/year at La Escobilla, in Oaxaca (Márquez, *et al*. 2005)).

Mexico

The nationwide ban on commercial harvest of sea turtles in Mexico, enacted in 1990, has improved the situation for the olive ridley. Surveys of important olive ridley nesting beaches in Mexico indicate increasing numbers of nesting females in recent years (Márquez, *et al*. 1995; Arenas, *et al*. 2000). In La Escobilla, Mexico, conservation measures, such as increased nesting beach protection and closure of the turtle fishery have led to a dramatic increase in the once largest nesting population in the world. The number of olive ridley nests has increased from 50,000 in 1988 to over 700,000 in 1994 to more than a million nests in 2000 (Márquez, *et al*. 2005).

Costa Rica

In Costa Rica, 25,000 to 50,000 olive ridleys nest at Playa Nancite and 450,000 to 600,000 turtles nest at Playa Ostional each year (NMFS and USFWS 1998). In an 11-year review of the nesting at Playa

[20] www.nmfs.noaa.gov/pr/pdfs/species/oliveridley_5yearreview.pdf.

Ostional, (Ballestero, *et al*. 2000) report that the data on numbers of nests deposited is too limited for a statistically valid determination of a trend; however, there does appear to be a six-year decrease in the number of nesting turtles. The greatest single cause of olive ridley egg loss comes from the nesting activity of conspecifics on *arribada* beaches, where nesting turtles destroy eggs by inadvertently digging up previously laid nests or causing them to become contaminated by bacteria and other pathogens from rotting nests nearby. In addition, some female olive ridleys nesting in Costa Rica have been found afflicted with the fibropapilloma disease (Aguirre, *et al*. 1999).

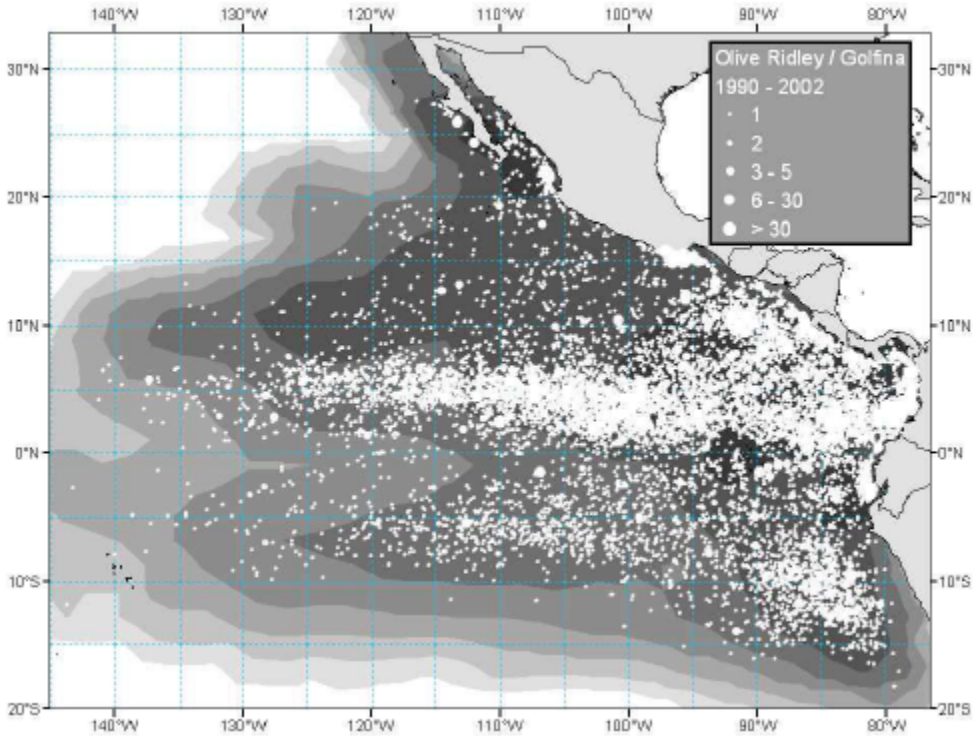
Western Pacific Ocean

In the western Pacific, olive ridleys are not as well documented as in the eastern Pacific, nor do they appear to be recovering as well. There are small documented nesting sites in Indonesia, Thailand, and Malaysia. In Indonesia, extensive hunting and egg collection, in addition to rapid rural and urban development, have reduced nesting activities, and locals report daily trading and selling of sea turtles and their eggs in the local fish markets (Putrawidjaja 2000). The main threats to turtles in Thailand include egg poaching, harvest and subsequent consumption or trade of adults or their parts (i.e., carapace), indirect capture in fishing gear, and loss of nesting beaches through development (Aureggi, *et al*. 1999).

Olive ridleys live within two distinct oceanic regions including the subtropical gyre and oceanic currents in the Pacific. The gyre contains warm surface waters and a deep thermocline preferred by olive ridleys. The currents bordering the subtropical gyre, the Kuroshio Extension Current, North Equatorial Current and the Equatorial Counter Current all provide for advantages in movement with zonal currents and location of prey species (Polovina, *et al*. 2004).

Satellite tracking of ten juvenile olive ridleys caught in Hawaii-based longline gear over a period of five years from 1997-2001, provides more insight into the movement patterns of this species. The olive ridley turtles moved between 130° W. and 150° W. longitude and south of 28° N. latitude. The overall latitudinal range for these turtles was 8º N. and 31º N. latitudes (Polovina, *et al*. 2004). In another study, two olive ridleys were equipped with a depth recorder to record diving depth. Dives to a depth of 150 m occurred approximately once a day for 20 percent of the days surveyed, and 10 percent of the time was spent at a depth greater than 100 m (Polovina, *et al*. 2002). The target depth for tuna is generally 100 to 300 m, thus olive ridleys are considered likely to encounter DSLL fishing gear due to their pattern of deep dives.

Hawaii-based DSLL data shows 38 observed takes of olive ridley turtles over the 2002 to 2006 time period. As noted above, juvenile olive ridley turtles (from western Pacific nesting grounds) are known to forage in the area surrounding and south of the Hawaiian Islands, where the majority of the Hawaii-based DSLL fishing effort is taking place (Figure 3-9). There is limited information about movements of turtles from the eastern Pacific nesting grounds. In a study from Mexico, one large male olive ridley turtle off the coast of Mexico was tagged with satellite telemetry and was followed for four months. In those four months the male traveled south from 17º N. to 7º N. latitudes and west to 120º W. longitude (Beavers and Cassano 1996).



Source: IATTC 2004.

Figure 3-9. Distribution of sightings of olive ridley turtles reported by observers aboard tuna purses-seine vessels, 1990-2002.

Hawksbill Turtle (NMFS 2009b)

Hawksbill turtles are circumtropical in distribution, generally occurring from 30° N. to 30° S. latitude within the Atlantic, Pacific, and Indian Oceans, and associated bodies of water (NMFS 2009b). Anecdotal reports from throughout the Pacific Ocean indicate that the current population is well below historical levels. In the Pacific Ocean, this species is rapidly approaching extinction primarily due to the harvesting of the species for its meat, eggs, and shell, as well as the destruction of nesting habitat by human occupation, disruption, and increased tourism (NMFS 2009b). There is limited information on the biology of hawksbills, probably because they are sparsely distributed throughout their range and they nest in very isolated locations (Eckert 1993). Hawksbills have a relatively unique diet of sponges (Meylan 1985). As a hawksbill turtle grows from a juvenile to an adult, data suggest that the turtle switches foraging behaviors from pelagic surface feeding to benthic reef feeding (Limpus 1992). As with other sea turtles, hawksbills will make long reproductive migrations between foraging and nesting areas but otherwise they remain within coastal reef habitats (Meylan and Donnelly 1999).

3.4.2.2 Other Actions Contributing to the Baseline Condition of Sea Turtles

This section discusses all of the fishery and non-fishery (anthropogenic and natural) impacts on the sea turtles that may interact with the U.S. longline and purse seine fisheries. It is important to consider all of the other effects on sea turtle populations to determine the cumulative impacts on the species.

Fishery Effects

Longline Fishery

Sea turtles are subject to take in U.S. and international fisheries. For each of the U.S. Pacific fisheries, that take sea turtles, Section 7 consultations have been conducted. In the Hawaii-based SSLL fishery, which has 100 percent observer coverage, a sea turtle cap is imposed upon the fishery which is equal to the ITS developed by NMFS (16 leatherbacks, 17 loggerheads, 5 olive ridleys, and 1 green) with a small number of mortalities. On March 20, 2006, the Hawaii-based SSLL fishery was closed after reaching the loggerhead sea turtle cap of 17 takes. Only one leatherback sea turtle was observed taken before the fishery closed. The west-coast-based DSLL fishery, which has 100 percent observer coverage, is currently undergoing analysis under Section 7 and any takes of listed species will be covered soon under an ITS. For all U.S. fisheries in the Pacific, if the take of sea turtles exceeds the ITS, re-initiation of consultation is required and if necessary, emergency rules can be implemented to close the fishery to protect ESA-listed species. Very few international fisheries have observer programs, so takes of sea turtles in most fisheries is unknown. A complete review of fisheries that are known to take, or may take, leatherback sea turtles is provided in the NMFS 2004 BO on the HMS FMP (NMFS 2004).

Purse Seine Fishery

The EPO purse seine tuna fishery has a requirement of 100 percent observer coverage on large vessels, which make up 60 percent of the fleet. In the purse seine fishery, bycatch rates vary according to set type (i.e., unassociated free-swimming tuna schools, tuna schools associated with dolphins, and tuna schools associated with floating objects). FAD sets are estimated to generate the largest amount of bycatch, about 30 times the bycatch of unassociated school sets by weight per set; school sets in turn have about 3 times the bycatch of dolphin sets (IATTC 2004). FAD (and flotsam) sets account for the largest amount of bycatch for some species, including sea turtles. One of the least sustainable bycatch species in FAD sets is believed to be sea turtles. In addition to bycatch in sets, on-board observers have reported sea turtles entangled in webbing hanging into the water column underneath some common FAD designs. IATTC data for 2003-2005 indicate that observers recorded entangled sea turtles in 1.7 percent of the FADs sighted. The number of sea turtles killed by entanglement in FADs is unknown and estimating this number is difficult for several reasons, including incomplete information about the number of FADs "fishing" at any given time and whether some dead turtles may entangle post-mortem. However, the number of turtles seen entangled, dead or alive, in recent years is between 50 and 150 annually, with the vast majority being olive ridleys. According to the IATTC, the mortality of other sea turtle species is very low, with only one leatherback observed killed during the period of 1993-2003 (IATTC 2004), and one hawksbill and two loggerhead sea turtles killed on average each during the same period (IATTC 2004).

The amended ITS prepared in 2004 for the U.S. tuna purse seine fishery in the EPO establishes take levels as follows: 30 loggerheads, 20 leatherbacks, 350 green, 20 hawksbill, and 1,330 olive ridley sea turtles every 10 years. According to the 2004 amendment to the ITS, NMFS recognized that the observed takes of listed sea turtles in the tuna purse seine fishery are in some cases orders of magnitude lower than the levels allowed in the amended ITS, and expected sea turtle take levels to remain at low levels in the future relative to the takes allowed by the ITS. Table 3-11 was created from data provided by the IATTC for the 2004 ITS amendment; it provides the number of sea turtle interactions by the U.S. tuna purse seine fleet in the EPO from 1999-2003 (the data was only collected from class size 6 vessels, or vessels with a carrying capacity greater than 363 mt, using 100 percent observer coverage.

Table 3-11. Sea turtle interactions by the U.S. tuna purse seine fleet in the EPO (1999-2003), class size 6 purse seine vessels only (100 percent observer coverage).

Species/Condition	1999	2000	2001	2002	2003
Green					
Released unharmed	5	2	3	1	6
Total	5	2	3	1	6
Hawksbill					
Released unharmed	0	0	1	1	0
Total	0	0	1	1	0
Leatherback					
Total	0	0	0	0	0
Loggerhead					
Released unharmed	1	7	0	0	0
Total	1	7	0	0	0
Olive Ridley					
Released unharmed	27	4	20	11	43
Light injuries*	6	2	1	0	7
Grave injuries**	0	0	3	0	0
Escaped/evaded net	1	2	0	0	0
Killed	0	0	3	0	1
Other***	0	0	1	0	1
Total	34	8	28	11	52
Unidentified turtle					
Released unharmed	0	3	5	1	10
Light injuries*	0	0	1	0	0
Escaped/evaded net	1	1	0	0	0
Other***	0	0	1	0	1
Total	1	4	7	1	11

* Light injuries are considered to be those that would not be lethal to the turtle.
** Grave injuries are considered to be those that would eventually cause death.
*** "Other" refers to an unknown condition.
Source: NMFS 2004b.

Foreign tuna longline fleets in the Pacific have a significant effect on sea turtles. It is difficult to quantify the impacts of the foreign tuna longline fleet in the central and western Pacific. Observer levels are very low, less than one percent, and there are no observers on Japanese, Korean, or Australian distant water fisheries (NMFS 2004). From these low observer rates, it has been estimated that 2,182 sea turtles are taken, and 500–600 turtles mortalities occur annually in the various tuna longline fisheries in the central and western Pacific (NMFS 2004). The species taken, in order of highest to lowest occurrence: olive ridley, green, leatherback, loggerhead, and hawksbill (NMFS 2004). The Japanese tuna longline fleets reported taking 166 leatherbacks in 2000 (IATTC 2004); it is unknown where in the EPO these takes occurred.

Non-Fishery Effects (NMFS 2008)

A number of anthropogenic actions may affect sea turtle populations including poaching of eggs, killing of female turtles at nesting beaches, human encroachment on nesting beaches, incidental capture in fishing gear, beach erosion, climate change and microclimate-related impacts at nesting sites (e.g., loss of

trees due to deforestation and sub-optimal incubation conditions for eggs in nests). Some natural events that could affect sea turtle populations are egg predation by animals, low hatchling production, and natural disasters (e.g., tsunamis, etc.).

The effects of climate change on sea turtles are just beginning to be studied and are still largely speculative. Nonetheless, long-term changes in climate could have a profound affect on sea turtles. Changes in temperature may affect nesting success; high temperatures while eggs are incubating in the sand may kill the offspring. In addition, the sex of turtles is temperature dependent, that is, eggs incubated at higher temperatures produce more females, while eggs incubated at lower temperatures result in more males. Increased air temperatures may result in a bias of the sex ratio of offspring and over the long-term could lead to reduced fecundity (insufficient males to fertilize eggs). Thus, while the number of nesting females may be stable or increasing, the eggs may not be viable or the hatchling output may not produce the balanced sex ratio necessary for future successful reproduction.

The climate may also affect turtle nesting habitat. Long-term climate change (e.g., rising average temperatures) will likely result in rising sea levels due to loss of glaciers and snow caps coupled with thermal expansion of warming ocean water which may lead to the loss of usable beach habitat (Baker, *et al.* 2006). Studies suggest that leatherbacks do not have the same high level of nesting site fidelity as hard shelled turtles and may be able to better adapt to the loss of habitat by seeking out new nesting areas. Similarly, short-term climate variability may cause an increase in storm or tidal activity that can inundate nesting sites, causing loss of habitat.

Oceanographic changes due to climate change may also affect sea turtle prey availability, migration and nesting. Short term variability in climate such as the ENSO may limit prey due to a reduction in upwelling brought by warm surface waters and limited or no wind. Over the longer term, climate models suggest a number of possible changes in oceanographic conditions, including slowing of the thermohaline circulation, higher precipitation storms, rising SST and rising sea levels (IPPC 2001). Also, as temperature patterns change in oceans, current foraging habitats may shift (McMahon and Hays 2006). There is already evidence to suggest that some sea turtles' re-migration periods are being affected by variations in SSTs (Chaloupka 2001; Solow, *et al.* 2002). Additional studies will be necessary to determine how climate may be affecting sea turtles and the entire marine ecosystem in the Pacific and elsewhere.

3.5 Seabirds

Due to the nature of pelagic longline and purse seine operations in the EPO, the only seabirds potentially impacted by the fisheries are the black-footed albatross (*Phoebastria nigripes*), the laysan albatross (*P.immutabilis*), the short-tailed albatross (*P. albatrus*), and Newell's shearwater (*Puffinus auricularis newelli*)

3.5.1 Current Status of Seabird Populations

Four species of albatross are known to occur within the action area where fishing has historically taken place (i.e., on the high seas in the EPO): short-tailed albatross, Newell's shearwater, black-footed albatross, and laysan albatross. Short-tailed albatross are the only species of the three listed as endangered.

Black-footed albatross (*Phoebastria nigripes) (*NMFS 2008)

The black-footed albatross is the most abundant albatross off the West Coast of Canada and the United States, ranging throughout the North Pacific between 20° N. and 58° N. latitude, but more eastern in its at-sea distribution than the laysan albatross (Cousins and Cooper 2000). The estimated number of black-footed albatross worldwide is approximately 290,000, of which 58,000 pairs (116,000 birds) bred in 2001–2002 (USFWS 2005). The conservation status for black-footed albatross under the World Conservation Union (IUCN) criteria for threatened species is "vulnerable" due to an observed 20 percent or more population decrease over three generations (~45 years).

Laysan albatross (*Phoebastria immutabilis*) (NMFS 2008)

While the laysan albatross is less common in the west coast EEZ, it is the most abundant albatross Pacific-wide, with an estimated 2,200,000 individuals (USFWS 2005), with centers of concentration in the WCPO (Cousins and Cooper 2000). Numbers of breeding laysan albatross have declined over the last five years in the two largest colonies of this species (USFWS 2005). IUCN status for the laysan albatross is "Lower Risk-Least Concern". Both the black-footed and laysan albatross nest principally in the Hawaiian Islands, mate for life, and lay only one egg in a single season. The black-footed albatross occurs off the West Coast primarily from spring through fall but can be found year round; breeding birds begin returning to the Hawaiian Island chain in October. During egg-laying, incubation, and early chick feeding, which lasts from December through March, these birds are generally more concentrated near the breeding islands, although some may still travel considerable distances. The laysan albatross also occurs uncommonly off the West Coast year round, primarily in summer during the non-breeding season.

Short-tailed albatross (*Phoebastria albatrus*) (NMFS 2008)

The short-tailed albatross has rarely been sighted off the West Coast of the United States or off Mexico in recent history, and has not been observed to interact with any west coast HMS fishery. It is nonetheless highly endangered, has historically occupied west coast EEZ waters, and will likely return to its former range as its population recovers (and may have already begun to do so). Of the 23 sightings of this species off the West Coast since 1947, 74 percent have been made in the last two decades (1983–2000) with 88 percent occurring from August–January (Roberson 2000). This temperate and subarctic species breeds only on the western Pacific islands of Torishima and Minami-Kojima in Japan. The most recent estimate of its population includes 1,712 individuals on Toroshima and 340 individuals from Minami-Kojima (USFWS 2005). In summer, the nonbreeding season, individuals appear to disperse widely throughout the historical range of the North Pacific, with observed concentrations in the northern Gulf of Alaska, Aleutian Islands, and Bering Sea. Individuals have been recorded as far south as the Baja Peninsula and south to about 20° N. latitude off the Pacific coast of Mexico (USFWS 2000). Its current distribution may also be complicated by identification problems. For the untrained observer, even though the short-tailed albatross is the largest albatross and has an extremely large pink bill, during its various plumage stages it can be confused with black-footed and laysan albatross (Mitchell and Tristram 1997). The short-tailed albatross is currently listed as endangered throughout its range under the ESA, including U.S. waters (65 FR 46643, July 31, 2000).

No short-tailed albatross have been recorded caught or killed by the Hawaii- or California-based longline fishery. However, this fleet could potentially interact with the short-tailed albatross. Specific measures to avoid interaction with seabirds are required for participants in both longline fisheries, and no take of short-tailed albatross has been reported (USFWS 2005).

Newell's shearwater (Puffinus auricularis newelli) (NMFS 2009b)

Newells's shearwater nests primarily in the Hawaiian Islands and ranges to the south and east of the islands (IUCN 2008). Based on data obtained from BirdLife International, Figure 4 shows the range of the Newell's shearwater. As indicated in Figure 4, the operations of the U.S. EPO purse seine and the Hawaii longline fisheries could overlap with the range of the Newell's shearwater.

Fishery Effects

Longline Fishery (NMFS 2009b)

NMFS observer records from 1994-2000 in the Hawaii-based longline fishery (based on four percent observer coverage) estimate an average take of 1,380 black-footed and 1,163 laysan albatross per year. There have been no takes of short-tailed albatross or Newell's shearwater reported in any U.S. pelagic longline fishery. The Hawaii-based swordfish longline fishery was closed by court order in 2001 due to concerns over incidental catch of sea turtles. Seabird incidental catch decreased significantly with the fishery closure. The swordfish fishery based in Hawaii was reopened on a limited basis in 2004, with requirements to conduct sets beginning no earlier than one hour after local sunset and ending deployment no later than one hour before local sunrise, use large 18/0 circle hooks, and carry 100 percent observer coverage. In addition, all swordfish-target sets are to use thawed and blue-dyed bait. Observers have documented 10 black-footed and 71 laysan albatross captured in this fishery since it reopened in 2004, with 2,133,096 hooks observed.

The Hawaii-based tuna, or DSLL fishing vessels are not required to use any seabird deterrents when fishing south of 23° N latitude, generally south of the southernmost short-tailed albatross observations in Hawaii. When fishing north of 23°N latitude, these vessels are required to use a line-setting machine, minimum 45 g weights on branch lines, thawed and blue-dyed bait, and strategic offal discharge. The west-coast-based DSLL fishery is also subject to these regulations; observer information cannot be disclosed due to confidentiality laws.

Purse Seine Fishery

There are no records or observer data documenting large purse seine vessels' interactions with any species of seabird in the EPO (NMFS 2003). Some species may dive into fish concentrated within or in the vicinity of purse seine nets in pursuit of bait fish, but there are no documented entanglements leading to injury or death (NMFS 2003).

Other Fisheries

Seabirds are also affected by other U.S. fisheries (e.g., the trawl fishery), and by foreign fisheries. In particular, sea birds often interact with foreign longline fisheries. However, due to limited observer coverage in foreign fleets, the number of seabird interactions with these fisheries in largely unknown.

Non-fishery Effects (NMFS 2008)

USFWS lists current non-fishing threats to short-tailed albatross as catastrophic events at breeding colonies, climate change and oceanic regime shift, contaminants, air strikes, disease/parasitism, predation and other natural factors, invasive species, and other human activities (USFWS 2005). Black-footed, Newell's shearwater, and laysan albatross experience many of the same threats as the short-tailed albatross.

3.6 Socioeconomic Environment

3.6.1 U.S. Commercial Fisheries for Tuna in the EPO

The target species of U.S. purse seine and longline (including both shallow-set and deep-set) fishing are bigeye, yellowfin, skipjack tuna, and swordfish. A variety of other commercially viable fish species are landed as well, including albacore, bluefin tuna, opah, wahoo, and dorado. The socioeconomic characteristics of the west coast commercial HMS fisheries are described in section 2.2.2, and section 2.2.5, of the HMS FMP (PFMC 2003); and section 4.1 of the HMS Stock Assessment and Fisheries Evaluation (SAFE) report (PFMC 2007b). Relevant portions of these descriptions are incorporated below as background on the socioeconomic environment.

Longline Fishery

The total number of affected vessels is approximated by the average number of U.S. longline vessels over 24 m length that have caught bigeye tuna in the EPO from 2005-2009. This includes 19 vessels, the majority of which have been based out of Hawaii. The vast majority of longline vessels in the Hawaii fishery are 24 m in length or smaller[21]. Owners and operators of U.S. longline vessels based on the U.S. West Coast would also be affected by this proposed rule; however, there is currently only one longline vessel targeting bigeye tuna with longline gear in the Convention Area.

Most of the Hawaii-based longline fleet's fishing effort has traditionally been in the WCPO, but fishing has also taken place in the EPO. The proportion of the fishery's annual bigeye tuna catches that were captured in the EPO from 2005 through 2008 ranged from 2 percent to 22 percent, and averaged 11 percent. In 2005-2007, that proportion, which ranged from 2 percent to 11 percent by weight, may have been constrained by the bigeye tuna catch limits established by NMFS to implement the past decisions of the IATTC. By far, most of the U.S. annual EPO bigeye tuna catch has typically been made in the second and third quarters of the year: in the period 2005-2008 the percentages caught in the first, second, third, and fourth quarters were 9, 25, 62, and 4 percent, respectively. As an indication of the size of businesses in the fishery, average annual fleet-wide ex-vessel revenues during 2005-2007 were about $60 million. Given the total number of vessels active during that period (127, on average), this indicates an average of about $0.5 million in annual revenue per vessel; thus all of the affected businesses would be considered small business entities. Since there is only one longline vessel participating in the west-coast-based longline fishery, NMFS cannot release landings or revenue data for confidentiality reasons.

Purse Seine Fishery

The total number of affected purse seine vessels is approximated by the current number of U.S. purse seine vessels class sizes 4-6 authorized to fish in the IATTC Convention Area. As of July 2009, there are five U.S. purse seine vessels listed on the IATTC Vessel Register; two are class size 5 (273 to 363 mt carrying capacity) and three are class size 6 (greater than 363 mt carrying capacity). From 2000-2008, there was an average of three U.S. purse seine vessels class sizes 4-6 that made catches of yellowfin, bigeye, and skipjack tunas in the EPO. As of July 2009, three U.S. purse seine vessels all class size 6 have caught tunas in the EPO and landed their catches in foreign ports. Thus it is estimated that 3-5 purse seine vessels will be affected by the proposed regulations. These larger vessels (class sizes 5 and 6) usually fish outside U.S. waters and deliver their catch to U.S. (e.g., American Samoa, California) or foreign (e.g., Ecuador, Mexico, Panama) ports. All of these large vessels are categorized as large business entities

[21] There are 164 Hawaii Longline Limited Access permits available. During the period 2005-2008, the number of vessels permitted ranged from 121 to 140. The number of vessels actually permitted as of February 2009 was 132.

(revenues in excess of $4 million per year). The majority of large purse seine vessels typically generate 4,000 to 5,000 mt of tuna valued at about $4 to $5 million per year and fish in both the EPO and WCPO. The United States also has a small purse seine fleet that opportunistically targets tunas within the U.S. west coast EEZ; however, all of these vessels would not be subject to the proposed regulations because they are all class size 3 or smaller.

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4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Estimating Change in Fishing Effort under the Alternatives

The impact analysis in this EA is based on estimates of the change in catch and fishing effort that would occur under each of the alternatives. The baseline is the current level of catch and fishing effort in the U.S. longline and purse seine fisheries in the EPO.

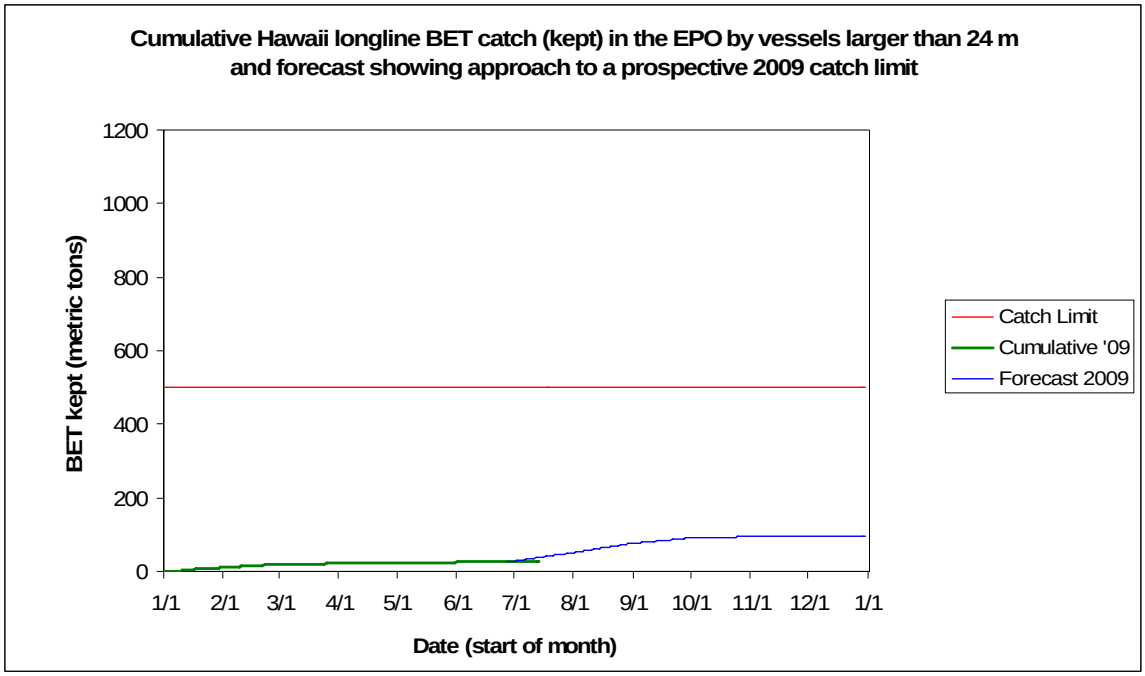
4.2 Impacts of Longline Alternatives

4.2.1 Direct and Indirect Impacts of Alternative 1

Alternative 1 would implement a quota of 500 mt of bigeye tuna in the longline fishery by prohibiting all fishing by U.S. longline vessels over 24 m in length in the Convention Area after the closure is announced. It is estimated that the 500 mt catch limit on bigeye tuna caught by longline vessels over 24 m in length would not be met in any of the years 2009, 2010, or 2011, thus it is estimated that fishing effort and related fishing mortality in the Hawaii- and west-coast-based longline fisheries would not change from the status quo. Since there is not expected to be any change in fishing effort from the current baseline, it is expected that this alternative would not likely have an effect on finfish, critical habitat, sea turtles, marine mammals, seabirds, or the socioeconomic environment. In each of the years 2005 through 2008, the number of large-scale longline vessels that caught bigeye in the EPO were 18, 8, 18, and 30, respectively, thus approximately 19 longline vessels have the potential to be affected by this proposed rule, if adopted. From 2005-2008, about 14 percent of the total bigeye tuna catch made by large-scale longline vessels was made in the EPO on average.

Figure 4 indicates the rate at which bigeye tuna catches have been made so far by U.S. longline vessels greater than 24 m in length in the EPO in 2009 and also shows a forecast of how the catch might increase for the remainder of the year. This graphic shows the logbook data submitted to NMFS so far this year; these data do not include sets for which logbooks have not yet been received. Data on fish caught were converted to metric tons using average weight. The forecast of catches is based on the past average rates of catch by month for the entire fleet, as reduced to 15 percent of the total. Approximately 15 percent of the fleet's reported catch has been by vessels larger than 24 m so far in 2009. The forecast is uncertain due to the variable amount of fishing in the EPO and a lack of separate analysis on past behavior of large-scale longline vessels. The forecast illustrates that it is very unlikely that the proposed 500 mt catch limit would be reached for 2009, and it is estimated that even with a large increase in the catch rates of bigeye tuna in the EPO, the same will be true for 2010 and 2011.

Although highly unlikely, if the 500 mt catch limit was reached in any given year, Alternative 1 would result in the highest economic costs, compared to the other longline alternatives, for the affected longline vessels due to the fact that all longline fishing operations would have to cease after the closure was announced. This would also result in the highest conservation benefit if the quota were reached, compared to the other longline alternatives impacting target, non-target, and bycatch species. However, due to the fact that it is estimated that the quota would not be reached in any applicable year, this alternative would not likely result in a change of fishing effort compared to the status quo. In addition, many of these stocks are affected by other factors that affect stock status, so implementation of the proposed rule under any of the alternatives would most likely not change the stock status of any of the affected species.



Source: NMFS Pacific Islands Fisheries Science Center; report provided on July 17, 2009.

Figure 4. Bigeye tuna catch by U.S. longline vessels larger than 24 meters, and forecast of when this catch would reach 500 mt in the EPO.

4.2.1.1 Cumulative Impacts of Alternative 1

Cumulative impacts are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions; cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

As mentioned above, the target and non-target species in the longline and purse seine fisheries have a Pacific-wide distribution and are subject to other sources of fishing mortality (e.g., other U.S. domestic fisheries, and to a greater degree, artisanal and industrial international fishing fleets). Several of the HMS species of concern being addressed in this document have a wide migratory range that cross established political and management boundaries in the Pacific. Alternative 1 is not likely to result in any changes in current U.S. fishing practices and effort, since it is unlikely that the catch limit would be reached in any year. However, the proposed rule is being promulgated in order for the United States to implement IATTC Resolution C-09-01, which was adopted by all of the High Contracting Parties to the IATTC. IATTC Resolution C-09-01 establishes bigeye tuna catch limits in the longline fisheries of all of the other High Contracting Parties, some of which have substantially higher levels of bigeye tuna catch in the EPO. The resolution also establishes closures and other measures applicable to the purse seine fishery. Thus, the cumulative impact of the resolution itself could be very beneficial for the EPO stock of bigeye tuna and could decrease the current fishing mortality rate, which could result in the stock no longer being subject to overfishing. It is estimated that the total fishing mortality of bigeye tuna would be reduced by 19 percent in 2009, 20 percent in 2010, and 24 percent in 2010 based on averages over the 1995-2003 timeframe, as a result of all High Contracting Parties implementing the resolution and establishing domestic regulations to fulfill their obligations.

In addition, the WCPFC recently adopted a Conservation and Management Measure (CMM-2008-01) which, among other things, establishes bigeye tuna catch limits in longline fisheries, purse seine effort limits, and fish aggregating device (FAD) prohibition periods in the WCPO. These measures are estimated to decrease the fishing mortality of bigeye tuna by 30 percent over the next three years (2009-2011). NMFS is currently proposing regulations to implement these measures for the United States[22].

4.2.2 Direct and Indirect Impacts of Alternative 2

Alternative 2 would implement a longline quota of 500 mt of bigeye tuna by prohibiting the retention, landing, and transshipment of bigeye tuna caught by longline vessels over 24 m in length in the Convention Area after the closure is announced. As noted in Section 4.2.1, it is highly unlikely that the 500 mt catch limit on bigeye tuna caught by longline vessels over 24 m in length would be met in any of the years 2009, 2010, or 2011, thus it is estimated that fishing effort and related fishing mortality in the Hawaii- and west-coast-based longline fisheries would remain at status quo. Since there is not expected to be any change in fishing effort from the current baseline, it is expected that this alternative would not likely have an effect on finfish, critical habitat, sea turtles, marine mammals, seabirds, or the socioeconomic environment.

Although highly unlikely, if the 500 mt catch limit was reached in any given year, Alternative 2 would result in less economic costs, compared to Alternatives 1 and 3, for the affected longline vessels due to the fact that both deep-set and shallow-set longline fishing operations could continue as long as bigeye was not retained, landed, or transshipped after the announcement was made that the bigeye catch limit had been reached. However, due to the fact that it is estimated that the quota would not be reached in any applicable year, this alternative would not likely result in a change of fishing effort compared to the status quo. In addition, many of these stocks are affected by other factors that affect stock status, so implementation of the proposed rule under any of the alternatives would most likely not change the stock status of any of the affected species

4.2.2.1 Cumulative Impacts of Alternative 2

Alternative 2 is not likely to result in any changes in current fishing practices and effort since it is highly unlikely that the catch limit would be reached in 2009, 2010, or 2011. Cumulative Impacts would be similar to those described for Alternative 1 in Section 4.2.1.1.

4.2.3 Direct and Indirect Impacts of Alternative 3

Alternative 3 would implement a longline quota of 500 mt of bigeye tuna by prohibiting all deep-set (vessels targeting yellowfin, bigeye, and skipjack tunas) longline fishing by vessels over 24 m in length in the Convention Area after the closure is announced. Shallow-set longline vessels would be continue to be permitted to fish for swordfish. As noted in Section 4.2.1, it is highly unlikely that the 500 mt catch limit on bigeye tuna caught by large-scale longline vessels would be met in any of the years 2009, 2010, or 2011, thus it is estimated that fishing effort and related fishing mortality in the Hawaii- and west-coast-based longline fisheries would remain at status quo. Since there is not expected to be any change in fishing effort from the current baseline, it is expected that this alternative would not likely have an effect on finfish, critical habitat, sea turtles, marine mammals, seabirds, or the socioeconomic environment.

Although highly unlikely, if the 500 mt catch limit was reached in any given year, Alternative 3 would probably result in more economic costs than Alternative 2, but less than Alternative 1 due to the fact that

[22] For more information on the proposed rule to implement CMM-2008-01, go to the following NMFS website: http://www.fpir.noaa.gov/IFD/ifd_documents_data.html#LLrule.

the shallow-set longline fishery would remain open and swordfish are the main target in that fishery. Bigeye tuna incidentally caught in the shallow-set longline fishery could not be retained, landed, or transshipped after the closure of the deep-set longline fishery was announced. However, due to the fact that it is estimated that the quota would not be reached in any applicable year, this alternative would not likely result in a change of fishing effort compared to the status quo. In addition, many of these stocks are affected by other factors that affect stock status, so implementation of the proposed rule under any of the alternatives would most likely not change the stock status of any of the affected species

4.2.3.1 Cumulative Impacts of Alternative 3

Alternative 3 is not likely to result in any changes in current fishing practices and effort since it is highly unlikely that the catch limit will be reached in 2009, 2010, or 2011. Cumulative Impacts would be similar to those described for Alternative 1 in Section 4.2.1.1.

4.2.4 Direct and Indirect Impacts of Alternative 4: No Action.

Under this alternative there would be no additional fishing restrictions in the Hawaii- and west-coast-based longline fisheries under this action. There is currently no bigeye quota in the U.S. longline fisheries operating in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party. This would result in no economic costs to the fishery and would not provide any additional conservation benefits to species caught in the fishery.

The Hawaii-based longline fishery currently operates under the Pelagics FMP.

4.2.4.1 Cumulative Impacts of Alternative 4

Alternative 4 would not result in any changes in current fishing practices and effort. While it is unlikely that the 500 mt catch limit would be reached in any of the action alternatives, the catch limit would provide a mechanism to ensure that the fishing mortality rate of bigeye tuna is not exacerbated by U.S. catch in the longline fishery. Without such a regulatory mechanism, the United States could not enforce the catch limit and would not meet the requirements of IATTC Resolution C-09-01. This could have political repercussions and would not set a good precedent in international fisheries management.

4.3 Impacts of Purse Seine Alternatives

IATTC Resolution C-09-01 established two specific closure period options for CPC's to choose from for each applicable year. Notwithstanding these closures, purse seine vessels of class size four (between 182 and 272 mt carrying capacity) would be able to make a single fishing trip of up to 30 days during the closed periods. In addition, Resolution C-09-01 established a 30-day closure to the west of the Galapagos Islands for 2009-2011, and a measure that requires the retention, with certain stipulations, of skipjack, yellowfin, and bigeye tuna caught in purse seine fisheries.

4.3.1 Alternatives for 2009

For 2009, NMFS does not have the discretion to choose the earlier closure period which would have started on August 1, 2009, due to the timeframe associated with the rulemaking process in the United States. Thus, for 2009, there are only two alternatives: Alternative 1a would establish a closure period for 59 days in 2009, and Alternative 1b (the no action alternative) would establish no additional measures for the purse seine fishery for 2009 as a part of this proposed rule.

4.3.1.1 Direct and Indirect Impacts of Alternative 1a

Alternative 1a would establish a purse seine closure in the EPO from 0000 hours on November 21, 2009, to 2400 hours on January 18, 2010. This 59-day closure would potentially decrease the fishing mortality of tropical tuna species and incidentally caught species. Skipjack and yellowfin tuna are the primary target species in the purse seine fishery, and bigeye tuna is incidentally targeted[23]. Juvenile bigeye and yellowfin tunas do make up a portion of the catch in the purse seine fishery, so the potential for decreased fishing pressure would benefit these stocks which are currently subject to overfishing. By prohibiting purse seine sets for 16 percent of the year in 2009, catches would be expected to be affected accordingly. However, currently there are only five U.S. purse seine vessels class size 4-6 authorized to fish in the IATTC Convention Area, and only three vessels have made landings thus far in 2009, so any decrease in effort is unlikely to have much effect on the stock status of any species. Due to the small number of vessels participating in the fishery since 2005, annual catch and revenue information cannot be released due to confidentiality laws. The affected vessels are capable of fishing outside of the closure area (i.e., in the WCPO) during the closure period and/or fishing during the remainder of the year, since the fishery continues year round, so there is a potential for the fishing effort to shift and result in no total decrease in fishing effort over the year. In addition, purse seine vessels also tend to use relatively short closures (such as these) for regular vessel maintenance. If a vessel has already undergone the necessary maintenance and repairs for 2009, the closure would result in a decrease in fishing effort and economic costs for the vessel owner.

Some potential factors inhibiting these vessels from fishing outside of the EPO are licensing availability and costs, and the recent implementation of effort limits for purse seine vessels fishing in the WCPO. Purse seine vessels fishing in the WCPO under the South Pacific Tuna Treaty (SPTT) are required to license their vessels; the maximum number of licensed vessels allowed in the U.S. purse seine fishery in the WCPO is 40 and currently there are 39 licensed vessels. The vessel registration fee costs about $3,250 per vessel. Currently the three class size 6 purse seine vessels are already registered under the SPTT. It may not be economically viable for the class size 5 purse seine vessels to register under the SPTT and fish in the WCPO because of their smaller carrying capacity and the increased costs associated with fishing far from port. At least one of the class size 5 vessels would not be able to register to fish in the WCPO because only one license is available. In addition, according to the Final Rule published in the Federal Register on August 4, 2009, fishing effort limits were established for 2009 through 2011 on the number of fishing days that may be spent by the U.S. purse seine fleet on the high seas in the WCPO and in areas under U.S. jurisdiction (i.e., the U.S. EEZ) (74 FR 38544, August 4, 2009). However, according to the Final EA prepared by NMFS analyzing the impacts of the effort limits of the purse seine fishery in the WCPO, the effort limit may not represent real change from the status quo as the effort limit is set at approximately the level expected to be exerted by 40 vessels (NMFS 2009b).

Purse seine sets on FADs, which is the primary type of set that the affected vessels use, do result in catches of non-target species such as sharks and juvenile tuna species, as well as protected resources such as sea turtles. Thus, the closure period could result in some conservation benefits to some of the species listed in Section 3.3.2.2, 3.4.1, and 3.4.2, and to the ecosystem in general. However, due to the facts that there would only be a minimal decrease in effort in the U.S. purse seine fishery from the closure period, and many of these stocks are affected by other factors, implementation of the proposed rule under this alternative is not likely to have a significant effect on finfish, critical habitat, sea turtles, marine mammals, seabirds, or the socioeconomic environment.

[23] Some FAD sets and certain sets on whale carcasses do target bigeye tuna.

4.3.1.2 Cumulative Impacts of Alternative 1a

The target and non-target species in the purse seine fisheries have a Pacific-wide distribution and are subject to other sources of fishing mortality (e.g., other U.S. domestic fisheries, and to a greater degree, international fishing fleets). Several of the HMS species of concern being addressed in this document have wide migratory ranges that cross established political and management boundaries in the Pacific. Alternative 1a is likely to result in negligible changes in current U.S. fishing practices and effort; however, the proposed rule is being promulgated in order for the United States to implement IATTC Resolution C-09-01, which was adopted by all of the High Contracting Parties to the IATTC. IATTC Resolution C-09-01 establishes the same purse seine closure periods for all of the other High Contracting Parties, some of which have substantially higher levels of effort in the purse seine fishery in the EPO. As described previously, the resolution also establishes catch limits on bigeye tuna in the longline fisheries of all High Contracting Parties. Thus, the cumulative impact of the resolution itself could be very beneficial for the EPO stocks of bigeye and yellowfin tunas, which are currently subject to overfishing according to NMFS.

In addition, the WCPFC recently adopted a Conservation and Management Measure (CMM-2008-01) which, among other things, establishes bigeye tuna catch limits in longline fisheries, purse seine effort limits, and fish aggregating device (FAD) prohibition periods in the WCPO. Thus, the cumulative impacts of this CMM and Resolution C-09-01 could have a considerable beneficial impact on affected species; in particular, bigeye tuna.

4.3.1.3 Direct and Indirect Impacts of Alternative 1b: No Action

Under this alternative there would be no additional fishing restrictions in the U.S. purse seine fishery operating in the EPO under this action. Currently there are no U.S. purse seine closure periods in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party. This would result in no economic costs to the fishery and would not provide any additional conservation benefits to species caught in the fishery.

4.3.1.4 Cumulative Impacts of Alternative 1b: No Action

Alternative 1b would not result in any changes in current fishing practices and effort. While it is likely that there would only be a minimal decrease in the fishing mortality of affected species if Alternative 1a were adopted instead of Alternative 1b, not implementing a resolution agreed upon by the IATTC, to which the United States is a Contracting Party, could have political repercussions for the United States and would not set a good precedent in international fisheries management.

4.3.2 Alternatives for 2010

There are three options for 2010. Both action alternatives (Alternatives 2a and 2b) would establish purse seine closure periods for 62 days in 2010; they would differ in when the closure periods were implemented. The third alternative is the no action alternative (Alternative 2c), which would not establish any additional purse seine measures for 2010 as part of this proposed rule.

4.3.2.1 Direct and Indirect Impacts of Alternative 2a

Alternative 2a would establish a purse seine closure in the EPO from 0000 hours on July 29, 2010, to 2400 hours on September 28, 2011. This 62-day closure would potentially decrease the fishing mortality of tropical tuna species and incidentally caught species. Skipjack and yellowfin tuna are the primary

target species in the purse seine fishery, and bigeye tuna is incidentally targeted. Juvenile bigeye and yellowfin tunas do make up a portion of the catch in the purse seine fishery, so the potential for decreased fishing pressure would benefit these stocks which are currently subject to overfishing. By prohibiting purse seine sets for 17 percent of the year in 2010, catches would be expected to be affected accordingly. However, currently there are only five U.S. purse seine vessels class size 4-6 authorized to fish in the IATTC Convention Area, and only three vessels have made landings thus far in 2009, so any decrease in effort is unlikely to have much affect on the stock status of any species. Due to the small number of vessels participating in the fishery since 2005, annual catch and revenue information cannot be released due to confidentiality laws. However, based on catch data from 2004-2009, small entities have historically made more tuna landings in the EPO during the summer closure period (July through September) compared to the winter closure period (November through January). Thus there does not appear to be much difference in the estimated impacts on target species, or the economic impact to the fishing industry when comparing the two closure period options. It is also important to note that the affected vessels are capable of fishing outside of the closure area (i.e., in the WCPO) during the closure period and/or fishing during the remainder of the year, since the fishery continues year round. In addition, purse seine vessels also tend to use relatively short closures (such as these) for regular vessel maintenance.

The factors potentially inhibiting these vessels from fishing outside of the EPO are similar to those described under Alternative 1a in Section 4.3.1.1. In addition, according to the Final Rule published in the Federal Register on August 4, 2009, it will be prohibited to set purse seine nets around FADs, deploy FADs, or service FADs in the WCPO from July 1 to September 30 in 2010 and 2011 (74 FR 38544, August 4, 2009). However, according to the Final EA prepared by NMFS PIRO, purse seine vessels would still be permitted to make purse seine sets on unassociated schools of tuna, which generally results in a different catch composition.

4.3.2.2 Cumulative Impacts of Alternative 2a

Cumulative impacts would be similar to those described under Alternative 1a in Section 4.3.1.2.

4.3.2.3 Direct and Indirect Impacts of Alternative 2b - EPO Closure November-January

Alternative 2b would establish a purse seine closure in the EPO from 0000 hours on November 18, 2010, to 2400 hours on January 18, 2011. Impacts would be very similar to those listed under Alternative 2a in Section 4.3.2.1. One distinguishing factor is that the FAD prohibition period in the WCPO ends on September 30 in 2010, so purse seine vessels would be able to make FAD sets in the WCPO during this second closure period in the EPO as long as they had all of the applicable permits and licensing. This could offset some of the potential economic costs of the closure period. However, similar to Alternative 2a, the closure period is likely to result in a negligible change in effort in the U.S. purse seine fishery in the EPO and thus is not likely to have a significant effect on finfish, critical habitat, sea turtles, marine mammals, seabirds, or the socioeconomic environment.

4.3.2.4 Cumulative Impacts of Alternative 2b

Cumulative impacts would be similar to those listed under Alternative 1a in Section 4.3.1.2.

4.3.2.5 Direct and Indirect Impacts of Alternative 2c: No Action

Under this alternative there would be no additional fishing restrictions in the U.S. purse seine fishery operating in the EPO under this action. There are currently no U.S. purse seine closures in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949

Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party. This would result in no economic costs to the fishery and would not provide any additional conservation benefits to species caught in the fishery.

4.3.2.6 Cumulative Impacts of Alternative 2c: No Action

Alternative 2c would not result in any changes in current fishing practices and effort. While it is likely that there would only be a minimal decrease in the fishing mortality of affected species if Alternatives 2a or 2b were adopted instead of Alternative 2c, not implementing a resolution agreed upon by the IATTC, to which the United States is a Contracting Party, could have political repercussions for the United States and would not set a good precedent in international fisheries management.

4.3.3 Alternatives for 2011

4.3.3.1 Direct and Indirect Impacts of Alternative 3a – EPO Closure July - September

Alternative 3a would establish a purse seine closure in the EPO from 0000 hours on July 18, 2011, to 2400 hours on September 28, 2012. This 73-day closure would potentially decrease the fishing mortality of tropical tuna species and incidentally caught species. Impacts are expected to be similar to those described under Alternative 2a in Section 4.3.2.1 except that the potential economic costs would be slightly higher and the conservation benefits would be slightly greater due to the longer closure period. By prohibiting purse seine sets for 20 percent of the year in 2011, catches would be expected to be affected accordingly. However, currently there are only five U.S. purse seine vessels class size 4-6 authorized to fish in the IATTC Convention Area, and only three vessels have made landings thus far in 2009, so any potential decrease in effort is estimated to be negligible and is not likely to have a significant effect on finfish, critical habitat, sea turtles, marine mammals, seabirds, or the socioeconomic environment.

4.3.3.2 Cumulative Impacts of Alternative 3a

Cumulative impacts would be similar to those listed under Alternative 1a in Section 4.3.1.2.

4.3.3.3 Direct and Indirect Impacts of Alternative 3b –EPO Closure November-January

Alternative 3b would establish a purse seine closure in the EPO from 0000 hours on November 7, 2011, to 2400 hours on January 18, 2012. Impacts would be very similar to those described under Alternative 3a in Section 4.3.3.1 and Alternative 2a in Section 4.3.2.1. One distinguishing factor between Alternatives 3a and 3b is that the FAD prohibition period in the WCPO ends on September 30 in 2010, so purse seine vessels would be able to make FAD sets in the WCPO during this second closure period in the EPO as long as they had all of the applicable permits and licensing. This could offset some of the potential economic costs of the closure period. However, similar to Alternative 3a, the closure period is likely to result in a negligible change in effort in the U.S. purse seine fishery in the EPO, thus it is not likely to have a significant effect on finfish, critical habitat, sea turtles, marine mammals, seabirds, or the socioeconomic environment.

4.3.3.4 Cumulative Impacts of Alternative 3b

Cumulative impacts would be similar to those listed under Alternative 1a in Section 4.3.1.2.

4.3.3.5 Direct and Indirect Impacts of Alternative 3c - No Action

Under this alternative there would be no additional fishing restrictions in the U.S. purse seine fishery operating in the EPO under this action. Currently there are no U.S. purse seine closures in the IATTC Convention Area. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party. This would result in no economic costs to the fishery and would not provide any additional conservation benefits to species caught in the fishery.

4.3.3.6 Cumulative Impacts of Alternative 3c: No Action

Alternative 3c would not result in any changes in current fishing practices and effort. While it is likely that there would only be a minimal decrease in the fishing mortality of affected species if Alternatives 3a or 3b were adopted instead of Alternative 3c, not implementing a resolution agreed upon by the IATTC, to which the United States is a Contracting Party, could have political repercussions for the United States and would not set a good precedent in international fisheries management.

4.3.4 Additional Purse Seine Closure

4.3.4.1 Direct and Indirect Impacts of Alternative 4a – Closure West of the Galapagos

Alternative 4a would establish an additional area closed to fishing by U.S. purse seine vessels class sizes 4-6 from September 29 to October 29 for 2009, 2010, and 2011. The area was chosen by the IATTC scientific staff due to the high levels of juvenile bigeye tuna catch by purse seiners in the area. The closed area is within the area of 96° and 110° W. longitude and 4° N. and 3° S. latitude from 0000 hours on September 29 to 2400 hours on October 29 for 2009, 2010, and 2011. The area is within the Convention Area and is depicted on the map in Figure 2. This closure is highly unlikely to result in changes in effort in the U.S. purse seine fleet because the rest of the IATTC Convention Area would be open for fishing, and the majority of affected vessels are capable of fishing in the WCPO. In addition, U.S. purse seine vessels seldom, if ever, fish in this area, and it is not considered vital to the economic viability of the fishery. Thus, this alternative is not likely to have a significant effect on finfish, critical habitat, sea turtles, marine mammals, seabirds, or the socioeconomic environment.

4.3.4.2 Cumulative Impacts of Alternative 4a

Cumulative impacts would be similar to those listed under Alternative 1a in Section 4.3.1.2.

4.3.4.3 Direct and Indirect Impacts of Alternative 4b: No Action

Under this alternative the 30-day purse seine closure to the west of the Galapagos would not be established. The United States would not satisfy its international obligations under the 1949 Convention for the Establishment of an Inter-American Tropical Tuna, to which it is a Contracting Party. This would result in no economic costs to the fishery and would not provide any additional conservation benefits to species caught in the fishery.

4.3.4.4 Cumulative Impacts of Alternative 4b

Alternative 4b would not result in any changes in current fishing practices and effort. While it is likely that fishing effort would not change from status quo if Alternative 4a was adopted instead of Alternative 4b, not implementing a resolution agreed upon by the IATTC, to which the United States is a Contracting

Party, could have political repercussions for the United States and would not set a good precedent in international fisheries management.

4.3.5 Tuna Retention in the Purse Seine Fishery

4.3.5.1 Direct and Indirect Impacts of Alternative 5a – Tuna Retention

Alternative 5a would continue to require that purse seine vessels retain on board and then land all skipjack, bigeye, and yellowfin tuna caught; however, there would be a minor change to the existing regulations at 50 CFR 300.24(e) and 300.25(e)(1) that would amend the exception to the tuna retention measure and make the regulations only applicable to purse seine vessels class sizes 4-6. Tuna would not need to be retained for fish considered unfit for human consumption for reasons other than size, and the single exemption of this would be the final set of a trip, when there may be insufficient well space remaining to accommodate all the tuna caught in that set. Currently the language is slightly different than this but with similar intent, so the amendment would serve to make the regulatory language consistent with IATTC Resolution C-09-01. The efficacy and impacts of the tuna retention requirement will be reviewed at the annual Commission meeting in 2010 and the Commission will decide whether to continue it. If the IATTC exercises that option, NMFS will take appropriate action to rescind. Since this alternative would only slightly modify the current regulations, it is not likely to have a significant effect on finfish, non-target species, critical habitat, protected species, marine mammals, seabirds, or the socioeconomic environment.

4.3.5.2 Cumulative Impacts of Alternative 5a

Cumulative impacts would be similar to those listed under Alternative 1a in Section 4.3.1.2.

4.3.5.3 Direct and Indirect Impacts of Alternative 5b: No Action

Under this alternative the tuna retention measures at 50 CFR 300.25(e)(1) and 300.24(e) would not be changed and would remain in effect. The United States would not be exactly implementing IATTC Resolution C-09-01 as it was adopted, and the United States would be requiring all purse seine vessels, rather than only the class size 4-6 purse seine vessels to abide by these regulations, which could be considered an undue burden.

4.3.5.4 Cumulative Impacts of Alternative 5b

Alternative 5b would not result in any changes in current fishing practices and effort. While it is likely that fishing effort would not change from the status quo if Alternative 5a was adopted instead of Alternative 5b, not implementing a resolution agreed upon by the IATTC, to which the United States is a Contracting Party, could have political repercussions for the United States and would not set a good precedent in international fisheries management.

5.0 CROSS-CUTTING MANDATES

5.1 Other Federal Laws

5.1.1 Coastal Zone Management Act (CZMA)

Section 307(c)(1) of the Coastal Zone Management Act (CZMA) as amended in 2006 requires all Federal actions that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone should be consistent with the enforceable policies of a coastal state's federally approved coastal management program to the maximum extent practicable. The preferred alternative would be implemented in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved coastal zone management programs of Washington, Oregon, and California. The recommended action is consistent and within the scope of the actions contemplated under the framework of the HMS FMP. The proposed action is not expected to affect any state's coastal management program.

5.1.2 Endangered Species Act (ESA)

A Section 7 consultation was conducted for the tuna purse seine fishery in the EPO in 1999[24]. In addition, Section 7 consultations were conducted for the Western Pacific Pelagics FMP, which analyzed the impacts of the Hawaii-based longline fishery on endangered species (i.e., BO conducted by the U.S. Fish and Wildlife Service on short-tailed albatross, and BO's conducted by NMFS PRD on the shallow-set and deep-set longline fisheries). All the consultations concluded that these fisheries would not be likely to jeopardize the continued existence of endangered or threatened species. In addition, a Section 7 consultation is currently being conducted by NMFS PRD on the west-coast-based deep-set longline fishery. The proposed action has the objective of limiting the fishing effort and fishing mortality in the purse seine and longline fisheries in the EPO, thus there may be some conservation benefits to endangered species that are affected by these fisheries.

5.1.3 High Seas Fishing Compliance Act (HSFCA)

The HSFCA requires the Secretary to license U.S. vessels fishing on the high seas. The "high seas" are defined as the waters beyond the territorial sea, EEZ, or the equivalent of any nation, to the extent that these areas are recognized by the United States. Each of the vessels that would be affected by the proposed action are in compliance with this act and have an HSFCA permit.

5.1.4 Marine Mammal Protection Act (MMPA)

The MMPA of 1972, as amended, is the principle Federal legislation that guides marine mammal species protection and conservation policy in the United States. Under the MMPA, NMFS is responsible for the management and conservation of 153 stocks of whales, dolphins, porpoise, seals, sea lions, and fur seals. The Hawaii-based longline fishery is divided into deep-setting and shallow-setting which are classified as Category I for the deep-set portion and Category II for the shallow-set portion of the fishery. The west coast-based longline fishery and the EPO purse seine fishery are classified as Category II fisheries. Since the proposed action is not likely to result in a change in fishing effort in the purse seine and longline

[24] The BO for the interim final rule for the continued authorization of the United States tuna purse seine fishery in the eastern tropical Pacific Ocean under the Marine Mammal Protection Act and the Tuna Conventions Act as revised by the International Dolphin Conservation Program Act was finalized in December 1999 and conducted by the NMFS Office of Protected Resources in the Southwest Regional Office. It was amended in January 2001 and July 2004.

fisheries in the IATTC Convention Area, there would likely not be any change in the impacts to marine mammal species.

5.1.5 Migratory Bird Treaty Act (MBTA)

The MBTA of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished the populations of many native bird species. The MBTA states that it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and implements a multilateral treaty between the United States, Canada, Japan, Mexico, and Russia to protect common migratory bird resources. The MBTA prohibits the directed take of seabirds, but the incidental take of seabirds does occur. The MBTA applies within three nautical miles of the U.S. coastline. All of the fishing that would be affected by the proposed action occurs in Federal waters (seaward of three nautical miles), or on the high seas, so the fishery would not be subject to the MBTA.

5.2 Executive Orders (EO)

5.2.1 EO 12866 Regulatory Impact Review (RIR)

EO 12866, Regulatory Planning and Review, was signed on September 30, 1993. EO 12866 requires that the economic impacts of proposed government regulations on the national economy be assessed before implementation. In most instances, the measurement of changes to gross domestic product is an accurate measure of impact. "In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory measures, including the alternative of not regulating" (EO 12866, Section 1). The emphasis of the analysis is on expected changes in net benefits that occur as a result of the proposed management measures. The government should choose only those sets of regulations that produce positive benefits while considering social and distributional effects. NMFS requires that this analysis be done through a regulatory impact review (RIR) for all regulatory actions that are of public interest. The RIR also includes analysis of distributive impacts and the costs of government administration and private compliance with the proposed measures. See the proposed rule for this action for further analysis of the expected economic effects on businesses, particularly small business entities. The proposed rule has been determined to be not significant for purposes of Executive Order 12866. The RIR is contained within the sections of this document and key elements of the RIR are cited below:

- Description of the management objections: Section 1.4, Purpose and Need and Section 1.5, Background.
- Description of the fishery: Section 3.3.1, Baseline Description of Fisheries in the Proposed Action Area.
- Statement of the problem: Section 1.4, Purpose and Need and Section 1.5, Background.
- Description of each alternative: Section 2, Alternatives.
- Economic Analysis: Section 3.3.1, Baseline Description of Fisheries in the Proposed Action Area, Section 3.6, Socioeconomic Environment and Section 4, Environmental Consequences.

5.2.2 EO 12898 (Environmental Justice)

EO 12898 obligates Federal agencies to identify and address "disproportionately high adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations in the United States" as part of any overall environmental impact analysis associated with an action. NOAA guidance, NAO 216-6, at '7.02, states that "consideration of EO 12898 should be

specifically included in the NEPA documentation for decision-making purposes." Agencies should also encourage public participationCespecially by affected communitiesCduring scoping, as part of a broader strategy to address environmental justice issues.

There would not be any significant adverse human health or environmental effects on any population in the United States, including minority and low-income groups. The proposed action would occur at sea and would not likely affect any population. There will be a notice in the Federal Register announcing when NMFS will be accepting public comments; substantive public comments will be considered in the review and revision of the draft EA. NMFS encourages public participation in these decisions, especially by communities that could experience disproportionately high and adverse impacts.

5.2.3 EO 13132 Federalism

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

This rule includes no conflicts with state law and imposes no mandates on states; the longline fishery and purse seine fisheries in the EPO are not managed by the states. This action does not contain policies with federalism implications under E.O. 13132.

5.2.4 EO 13175 Consultation and Coordination with Indian Tribal Governments

EO 13175 is intended to ensure regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes. The Secretary recognizes the sovereign status and co-manager role of Indian tribes over shared Federal and tribal fishery resources. At section 302(b)(5), the Magnuson-Stevens Act reserves a seat on the Council for a representative of an Indian tribe with federally-recognized fishing rights from California, Oregon, Washington, or Idaho. The U.S. government formally recognizes the four Washington coastal tribes (Makah, Quileute, Hoh, and Quinault) have treaty rights to marine fish. In general terms, the quantification of those rights is 50 percent of the harvestable surplus of groundfish available in the tribes' usual and accustomed fishing areas (described at 50 CFR 660.324). Each of the treaty tribes has the discretion to administer their fisheries and to establish their own policies to achieve program objectives.

There is no tribal involvement with the proposed action.

5.2.5 EO 13186 Responsibilities of Federal Agencies to Protect Migratory Birds

EO 13186 supplements the MBTA by requiring Federal agencies to work with USFWS to develop memoranda of agreement to conserve migratory birds. NMFS is in the process of implementing a memorandum of understanding. The protocols developed by this consultation will guide agency regulatory actions and policy decisions in order to address this conservation goal. The EO also directs agencies to evaluate the effects of their actions on migratory birds in environmental documents prepared pursuant to the NEPA. Since the proposed action is likely to result in a small decrease in the effort of the

purse seine and longline fisheries in the EPO, there is likely some conservation benefit to seabird species that are affected by these fisheries. Impacts to seabirds were found to be insignificant.

6.0 LIST OF PREPARERS

Name and Affiliation	Responsibility
Heidi Hermsmeyer, IATTC Coordinator, NMFS SWR	Project management

7.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE EA WERE SENT

This EA will be posted on the NMFS Southwest Regional Office website[25] and an email will be sent announcing its availability on the NMFS Southwest Region HMS list-servers. NMFS also requested public comments on this EA when the proposed rule for this action was published in the Federal Register (74 FR 53455; October 19, 2009). NMFS will also distribute copies of this final EA upon request.

[25] http://swr.nmfs.noaa.gov/.

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8.0 REFERENCES CITED[26]

Aguirre, A.A., T.R. Spraker, A. Chaves, L. Du Toit, W. Eure and G.H. Balazs. 1999. Pathology of fibropapillomatosis in olive ridley sea turtles, *Lepidochelys olivacea*, nesting in Costa Rica. Journal of Aquatic Animal Health 11: 283-289.

Aires-da-Silva, A. and M.N. Maunder. 2009. Status of Bigeye Tuna in the Eastern Pacific Ocean in 2008 and Outlook for the Future. Working Document SARM-10-06b. 10th Stock Assessment Review Meeting, May 12-15, 2009, La Jolla, CA, United States. Available on the following IATTC website: http://www.iattc.org/PDFFiles2/SARM-10-06b-BET-assessment-2008.pdf.

Angliss, R. P., and B. M. Allen. 2009. Alaska marine mammal stock assessments, 2008. U.S. Dept. Commer., NOAA Tech. Memo. NMFSAFSC-193, 258 p.

Arenas, P., L. Sarti and P. Ulloa. 2000. Conservation and management of sea turtles in Mexico, pp. 6-7. *In*: Proceedings of the 18th International Sea Turtle Symposium, March 3-7, 1998, Mazatlán, Sinaloa, Mexico.

Aureggi, M., G. Gerosa, and S. Chantrapornsyl. 1999. Marine turtle survey at Phra Thong Island, South Thailand. Marine Turtle Newsletter. No. 85: 4-5.

Baker, J.D., C.L. Littnan and D.W. Johnston. 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna in the Northwestern Hawaiian Islands. Endangered Species Research 4:1-10.

Balazs, G.H. and J.A. Wetherall. 1991. Assessing impacts of North Pacific high-seas driftnet fisheries on marine turtles: progress and problems. Unpublished paper prepared for the North Pacific Driftnet Scientific Review Meeting, Sidney, British Columbia, Canada, 11-14 June 1991.

Balazs, G.H., P. Craig, B.R. Winton and R.K. Miya. 1994. Satellite telemetry of green turtles nesting at French Frigate Shoals, Hawaii, and Rose Atoll, American Samoa. In: Bjourndal KA, Bolten AB, Johnson DA, Eliazar PJ (eds) Proc. 14th Ann. Symp. on Sea Turtle Biology and Conservation. NOAA Tech Memo NMFS-SEFSC-351: 184-187.

Balazs, G.H. 1996. Behavioral changes within the recovering Hawaiian green turtle population, pp. 16. *In*: 15th Annual Symposium on Sea Turtle Biology and Conservation, February 20-25, 1995, Hilton Head, South Carolina.

Balazs, G. Biologist, National Marine Fisheries Service. 2000. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

Balazs, G. and M. Chaloupka. 2004. Thirty year recovery trend in the ocean depleted Hawaiian green turtle stock. Biological Conservation 117 (2004) 491-498.

Ballestero, J., R.M. Arauz and R. Rojas. 2000. Management, conservation, and sustained use of olive ridley sea turtle eggs (*Lepidochelys olivacea*) in the Ostional Wildlife Refuge, Costa Rica: An 11 year review, pp. 4-5. *In*: Proceedings of the 18th International Sea Turtle Symposium, March, 3-7, 1998, Mazatlán, Sinaloa, Mexico.

Barut, N.C. 1999. Catch of experimental longline, purse seine and handline in the South China Sea, Area 3: Western Philippines Spec. Pap. Southeast Asian Fish. Dev. Cent. 41:65-75.

Beavers, S.C. and E.R. Cassano. 1996. Movements and dive behavior of a male sea turtle (*Lepidochelys olivacea*) in the Eastern Tropical Pacific. Journal of Herpetology 30(1):97-104.

Benson, S.R., K.M. Kisokau, L. Ambio, V. Rei, P.H. Dutton and D. Parker. 2007. Beach use, internesting movement, and migration of leatherback turtles, *Dermochelys coriacea,* nesting on the north coast of Papua New Guinea 6(1):7-14

Bertrand, A., E. Josse, B. Pascal, G. Philippe, and L. Dagorn. 2002. Hydrological and trophic characteristics of tuna habitat: consequences on tuna distribution and longline catchability. Can J Fish Aquat Sci 59:1002-1013

[26] The references cited list also includes those references which have been cited in the original sources used for this report.

Bigelow, K.A., C.H. Boggs and X. He. 1999. Environmental effects on swordfish and blue shark catch rates in the US North Pacific longline fishery. Fish Oceanogr. 8(3):178-198

Bowen, B.W., F.A. Abreu-Grobois, G.H. Balazs, N. Kamezaki, C.J. Limpus and R.J. Ferl. 1995. Trans-Pacific migration of the loggerhead turtle (*Caretta caretta*) demonstrated with mitochondrial DNA markers. Proc. Natl. Acad. Sci. 92:3731-3734.

Cailliet, G.M., D.W. Bedford. 1983. The biology of three pelagic sharks from California waters, and their emerging fisheries: a review. CalCOFI Rep. 24:57-69.

Carretta, J.V., K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, D. Johnston, B. Hanson, M.M. Muto, D. Lynch, and L. Carswell. 2009. U.S. Pacific Marine Mammal Stock Assessments: 2008. NOAA Technical Memorandum-NMFS-SWFSC-434. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. Available on the SWFSC website: http://swfsc.noaa.gov/uploadedFiles/Divisions/PRD/Programs/Coastal_Marine_Mammal/Pacific%20SARs%202008%20Final(1).pdf.

Chaloupka, M. 2001. Historical trends, seasonality and spatial synchrony in green sea turtle egg production. Biological Conservation 101 (2001) 263-279

Compagno, L.J.V. 1984. *Sharks of the world an annotated and illustrated catalogue of shark species known to date*. Rome: United Nations Development Programme.

Cousins, K. and J. Cooper. 2000. The population biology of the Black-footed Albatross in relation to mortality caused by longline fishing. Western Pacific Mgt. Council. Report of a Workshop Held in Honolulu, Hawaii, October 1998. Western Pacific Regional Fishery Management Council. 120pp

Dagorn, L., P. Bach and E. Josse. 2000. Movement patterns of large bigeye tuna (Thunnus obesus) in the open ocean, determined using ultrasonic telemetry. Marine Biology 136: 361-371.

Dobbs, K. 2002. Marine turtle conservation in the Great Barrier Reef, World Heritage Area, Queensland, Australia, pp. 79-83. *In*: Kinan, I. (ed.), Proceedings of the Western Pacific Sea Turtle Cooperative Research and Management Workshop, February 5-8, 2002, Honolulu, Hawaii.

Dodd, C. K., Jr. 1988. Synopsis of the biological data on the loggerhead sea turtle Caretta caretta (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report. 88(14).

Dutton, P. Biologist and lead of the Marine Turtle Research Program, Southwest Fisheries Science Center, La Jolla, CA. 2003. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

Dutton, P. Biologist and lead of the Marine Turtle Research Program, Southwest Fisheries Science Center, La Jolla, CA. 2005. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

Dutton, P.H., C. Hitipeuw, M. Zein, G. Petro, J. Pita, V. Rei, and coauthors. 2007. Status and genetic structure of nesting stocks of leatherback turtles (*Dermochelys coriacea*) in the western Pacific. Chelonian Conservation and Biology 6(1):47-53.

Eckert, K.L. 1993. The biology and population status of marine turtles in the North Pacific Ocean. Final Report to SWFSC, NMFS, NOAA Honolulu, HI.
Eckert S. 1999a. Global distribution of juvenile leatherback turtles. Hubbs Sea World Research Institute: San Diego.

Eckert S. 1998. Perspectives on the use of satellite telemetry and other electronic technologies for the study of marine turtles, with reference to the first year long tracking of leatherback sea turtles. In S. Epperly. J. Braum, ed. Seventeenth Annual Sea Turtle Symposium, vol. NOAA Tech Memo NMFS-SEFSC-415. U.S. Department of Commerce, NOAA-NMFS, NOAA Tech Memeo NMFS-SEFSC-415. Orlando, Florida. 294 pp.

Eckert, S.A. 1999. Habitats and migratory pathways of the Pacific leatherback sea turtle. Hubbs Sea World Research Institute Technical Report 99-290.

Eschmeyer, W.N., E.S. Herald, and H. Hamman. 1983. A field guide to Pacific coast fishes of North America from the Gulf of Alaska to Baja California. Houghton Mifflin, Boston, 336 pp.

Etnoyer, P., D. Canny, B. Mate and L. Morgan. 2004. Persistent pelagic habitats in the Baja California to Bering Sea (B2B) ecoregion. Oceanography, 17(1):90-101

Field, J.C. and S.R. Ralston. 2005. Spatial distribution of California Current fish. In: Boldt JL (ed) Fisheries and the environment: Ecosystem indicators for the North Pacific and their implications for stock assessment. Proceedings of the first annual meeting of the National Marine Fisheries Service's Ecological Indicators Research Program. AFSC Processed Report 2005-04, 45-48

Forney, K.A. and J. Barlow. 1998. Seasonal patterns in the abundance and distribution of California cetaceans, 1991-92. Mar. Mamm. Sci. 14:460-489

Francis, R.C., S.R. Hare, A.B. Hollowed and W.S. Wooster. 1998. Effects of interdecadal climate variability on the oceanic ecosystems of the NE Pacific. Fish. Oceanogr. 7:1-21

Garcia, M.D., A.R., Barragan, L. Sarti, and P. Dutton. 2004. Informe final de investigacion distribucion de la anidacion y estimacion del numero de hembras de tortuga laud, *Dermochelys coriacea* en el Pacifico Mexicano durande la temporada 2003-2004. in Sarti and Barragan, editors. Conservacion y evaluacion de la poblacion de tortuga laud *Dermochelys coriacea* en el Pacifico Mexicano temporada de anadacion 2003-2004. DGVS-SEMARNAT.

Gilman, E., N. Brothers, G. McPherson and P. Dalzell. 2006. A review of cetacean interactions with longline gear. J. Cetacea Res. Manage. 8(2):215-223.

Gillet, R., M.A. McCoy, and D.G. Itano. 2002. Status of the United States Western Pacific Tuna Purse Seine Fleet and Factors Affecting Its Future. SOEST 02-01, JIMAR Contribution 02-344. Available on the following website: http://www.soest.hawaii.edu/PFRP/soest_jimar_rpts/gpa_amer_samoa.pdf.

Hare, S.R., N.J. Mantua and R.C. Francis. 1999. Inverse production regimes: Alaskan and West Coast Salmon. Fisheries 24(1):6-14

Hatase, H, M. Kinoshita, T. Bando, N. Kamezaki, K. Sato, Y. Matsuzawa, K. Goto, K. Omuta, Y. Nakashima, H. Takeshita, and W. Sakamoto. 2002. Population structure of loggerhead turtles, Caretta caretta, nesting in Japan: bottlenecks on the Pacific population. Marine Biology 141:299-305.

Hodge, R. and B.L. Wing. 2000. Occurrence of marine turtles in Alaska Waters: 1960-1998. Herpetological Review 31: 148-151.

Holland, K.N., R.W. Brill, R.K.C. Chang, J.R. Sibert and D.A. Fournier. 1992. Physiological and behavioural thermoregulation in bigeye tuna (*Thunnus obesus*). Nature (London) 358:410-412

Holland, K.N. and J.R. Sibert. 1994. Physiological thermoregulation in bigeye tuna, *Thunnus obesus*. Envir Biol Bish 40:319-327

Holts, D.B., A. Julian, Sosa-Nishizaki, and N.B. Bartoo. 1998. Pelagic shark fisheries along the west coast of the United States and Baja California, Mexico. Fish. Res. 39:115-125

Hyde, J.R., E. Lynn, R. Humphreys Jr., M. Musy, A.P. West and R. Vetter. 2005. Shipboard identification of fish eggs and larvae by multiplex PCR, and description of fertilized eggs of blue marlin, shortbill spearfish, and wahoo. Marine Ecology Progress Series 286:269–277.

Inter-American Tropical Tuna Commission (IATTC). 2004. IATTC Working Group on Bycatch, 4th Meeting, Kobe, Japan; January 14-16, 2004; Document BYC-4-04. Review of the status of sea turtle stocks in the eastern Pacific.

IATTC. 2006. Fishery Status Report No. 4: Tunas and Billfishes in the Eastern Pacific Ocean in 2005. La Jolla, CA.

IATTC. 2007. The Fishery for Tunas and Billfishes in the Eastern Pacific Ocean in 2006. Document IATTC-75-06. Cancun, Mexico, June 25-29, 2007.

IATTC. 2009. The Fishery for Tunas and Billfishes in the Eastern Pacific Ocean in 2008. Document IATTC-80-05. La Jolla, California, June 8-12, 2009.

Intergovernmental Panel on Climate Change (IPCC). 2007a. Climate Change 2007: Synthesis Report. An assessment of the Intergovernmental Panel on Climate Change, IPCC Plenary Session XXVII, Valencia, Spain.

IPCC. 2007b. Climate Change 2007: The Physical Science Basis: Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. This Summary for Policymakers was formally approved at the 10th Session of Working Group I of the IPCC, Paris, February 2007. Available at: http://hosted.ap.org/specials/interactives/_documents/climate_report.pdf

International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC). 2007. Report of the Seventh Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean, Plenary Session, July 25-30, 2007, Busan, Korea.

ISC. 2009. Report of the Eighth Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean, Plenary Session, July 15-20, 2009, Kaohsiung, Taiwan.

International Union for the Conservation of Nature (IUCN). 2008. The IUCN Red List of Threatened Species: *Puffinus Newelli*. Accessed on December 5, 2008. Available at the following website: http://www.iucnredlist.org/details/144888.

Itano, D. 2004. Hawaiian-style small-scale deep-setting longline technique used on seamounts Pelagic Fisheries Program, University of Hawai'I, SPC Fisheries Newsletter 111.

Kamezaki, N., K. Matsuzawa, O. Abe, H. Asakawa, T. Fujii, K. Goto. 2003. Loggerhead turtles nesting in Japan. In: Bolten AB,Witherington BE (eds) Loggerhead Sea Turtles. Smithsonian Institution Press, Washington, DC, 210–217.

Kikawa, S. 1975. Synopsis on the biology of the shortbill spearfish, *Tetrapturus angustirostris* Tanaka, 1914 in the Indo-Pacific areas. NOAA Techn. Rep. NMFS SSRF-675, Part 2:39-54.

Klimley, A.P. 1994. The predatory behavior of the white shark. Am. Sci. 82:122-132.

Kleiber, P., Y. Takeuchi and H. Nakano. 2001. Calculation of plausible maximum sustainable yield (MSY) for blue shark (*Prionace glauca*) in the north Pacific, SWFSC Admin. Rep. H-01-02 and Dept. of Commerce 2001.

Langley, A.D., W.J. Hampton, P.M. Kleiber, and S.D. Hoyle. 2008. Stock assessment of bigeye tuna in the western and central Pacific ocean, including an analysis of management options. WCPFC Report SC4-2008/SA-WP-1. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Leet, W.S., C.M. Lewes, R. Klingdeil and E.J. Larson (eds). 2001. California's Living Marine Resources: A Status Report. California Department of Fish and Game: Resources Agency.

Limpus, C. 1992. The hawksbill turtle, *Eretmochelys imbricata*, in Queensland: Population structure within a southern Great Barrier Reef feeding ground. *Wildlife Research* 19(4):489-506.

Limpus, C.J. and D. Reimer. 1994. The loggerhead turtle, *Caretta caretta*, in Queensland: a population in decline, pp. 39-59. *In*: James, R. (compiler), Proceedings of the Australian Marine Turtle Conservation Workshop: Sea World Nara Resort, Gold Coast, November 14-17, 1990. Australian Nature Conservation Agency, Australia.

Limpus, C.J. and D.J. Limpus. 2003. Loggerhead Turtles in the Equatorial Pacific and Southern Pacific Ocean: A Species in Decline. *In*: Bolten, A.B. and B.E. Witherington (eds.), Loggerhead Sea Turtles. Smithsonian Institution.

Limpus, C.J., M. Boyle, and T. Sunderland. 2006. New Caledonian loggerhead turtle population assessment: 2005 pilot study. Pages 77-92 *in* Kinan, I. (compiler). Proceedings of the second Western Pacific Sea Turtle Cooperative Research and Management Workshop. Volume II: North Pacific Loggerhead Sea Turtles. Western Pacific Regional Fishery Management Council, Honolulu, Hawaii.

MacCall, A. 2005. Appendix 2: Recent ecosystem changes in the California Current System. In: King J (ed.) Report of the study group on fisheries and ecosystem responses to recent regime shifts. PICES Scientific Report No. 28. January 2005, 65-68

Márquez, M.R., C.S. Peñaflores, A.O. Villanueva, and J.F. Diaz. 1995. A model for diagnosis of populations of olive ridleys and green turtles of west Pacific tropical coasts. In Biology and Conservation of Sea Turtles (revised edition). Edited by K. A. Bjorndal.

Márquez, M.R., M.A. Carrasco, M.C. Jimenez, S.C. Peñaflores, and G.R. Bravo. 2005. Kemp's and olive ridley sea turtles population status. Pages 237-239 *in* Coyne, M.S. and R.D. Clark (compilers). Proceedings of the 21st Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-528. 368 pp.

Matsuzawa, Y. March 2005. Nesting and beach management of eggs and pre-emergent hatchlings of pacific loggerhead sea turtles on Yakushima Island, Japan: April to September 2004. Final Report to the Western Pacific Regional Fishery Management Council: Contract No. 04-WPC-011.su

Maunder, M.N. and A. Aires-Da-Silva. Evaluation of the Effect of Resolutions C-04-09 and C-06-02, Document SARM-9-06c. Inter-American Tropical Tuna Commission 9th Stock Assessment Review Meeting, La Jolla, California, May 12-16, 2008.

Maunder, M.N. and A. Aires-Da-Silva. 2009. Status of Yellowfin Tuna in the Eastern Pacific Ocean in 2008 and Outlook for the Future, Document SARM-10-06a. Inter-American Tropical Tuna Commission 10th Stock Assessment Review Meeting, La Jolla, California, May 12-15, 2009. Available on the following IATTC website: http://www.iattc.org/PDFFiles2/SARM-10-06a-YFT-assessment-2008.pdf.

Maunder, M.N. and R.B. Deriso. 2007. Using indicators of stock status when traditional reference points are not available: evaluation and application to skipjack tuna in the eastern Pacific Ocean. Inter-Amer. Trop. Tuna Comm., Stock Assessment Report, 8: 229-248.

Maunder, M.N. and S.J. Harley. 2005. Status of Skipjack Tuna in the Eastern Pacific Ocean in 2003 and Outlook for 2004, Inter-American Tropical Tuna Commission, 5th Meeting of the Scientific Working Group, May 11-13, La Jolla, CA, IATTC SAR-5-05 SKJ, 5: 109-167.

Maunder, M.N. 2009. Updated Indicators of Stock Status for Skipjack Tuna in the Eastern Pacific Ocean. Document SARM-10-07. Inter-American Tropical Tuna Commission 10th Stock Assessment Review Meeting, La Jolla, California, May 12-15, 2009. Available on the following IATTC website: http://www.iattc.org/PDFFiles2/SARM-10-07-SKJ-assessment-2008.pdf.

McFarlane, G.A., J.R. King and R.J. Beamish. 2000. Have there been recent changes in climate? Ask the fish. Prog.Oceanogr. 47(2-4):147–169

McMahon, C.R. and G.C. Hays. 2006. Thermal niche, large-scale movements and implications of climate change for a critically endangered marine vertebrate. Global Change Biology 12(7): 1330-1338.

Meylan, A. 1985. The role of sponge collagens in the diet of the hawksbill turtle (*Eretmochelys imbricata*). 1499. *In* Vairati, A. and R. Garrone (eds.) Biology of Inverterbrate and Lower Verterbrate Collagens, 191-196. New York, World Wildlife Fund Project, Plenum Press.

Meylan, A.B. and M. Donnelly. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata*) as critically endangered on the 1996 IUCN Red List of Threatened Animals. *Chelonian Conservation and Biology* 3(2):200-224.

Milessi, A.C. and O. Defeo. 2002. Long-term impact of incidental catches by tuna longlines: the black escolar (*Lepidocybium flavobrunneum*) of the southwestern Atlantic Ocean. Fisheries Research 59: 203-213.

Mitchell, E. and G. Tristram. 1997. North Pacific albatrosses identification guide. Alaska Sea Grant Publication M-04 (laminated card).

Mollet, H.F. 2002. Distribution of the pelagic stingray, *Dasyatis violacea* (Bonaparte, 1832), off California, Central America, and worldwide. Mar. Freshwater Res. 53:525-530.

Molony, B. 2005. Estimates of the mortality of non-target species with an initial focus on seabirds, turtles, and sharks. WCPFC Report SC1 EB WP-1. Pohnpei, Federated States of Micronesia, Western and Central Pacific Fisheries Commission.

Morreale, S., E. Standora, F. Paladino and J. Spotila. 1994. Leatherback migrations along deepwater bathymetric contours. Pg.109, 13th Ann. Symp. Sea Turtle Biol. and Conserv, Feb. 23-27, 1993, Jekyll Island, Georgia.

Nakamura, I. 1985. FAO species catalog: billfishes of the world; an annotated and illustrated catalogue of marlins, sailfishes, spearfishes and swordfishes known to date. FAO Fish Synopsis 5(125).

Nichols, W.J., A. Resendez, J.A. Seminoff and B. Resendez. 2000. Transpacific migration of a loggerhead turtle monitored by satellite telemetry. Bulletin of Marine Science, 67(3):937-947.

National Marine Fisheries Service (NMFS). 2003. Fishery Management Plan and Environmental Impact Statement for U.S. West Coast Fisheries for Highly Migratory Species. Pacific Fishery Management Council.

NMFS. 2004. Biological Opinion on the authorization of fisheries under the Fishery Management Plan for Pelagic Fisheries in the Western Pacific Region. NMFS Pacific Islands Region, Honolulu, HI. February 23, 2004.

NMFS. 2004b. Memo from James H. Lecky, Assistant Regional Administrator for Protected Resources, for the record dated July 7, 2004 with the subject "Annual Observed Sea Turtle Mortality in the U.S. Tuna Purse Seine Fishery in the Eastern Tropical Pacific Ocean".

NMFS. 2005. Biological Opinion on the Hawaii-based pelagic, deep-set longline fishery. National Marine Fisheries Service, Pacific Islands Region.

NMFS. 2008. Characterization of the West Coast Deep-set Longline Fishery Operating Outside of the U.S. Exclusive Economic Zone Draft Environmental Assessment. September 2008. Available on the following NMFS website: http://swr.nmfs.noaa.gov/pdf/DRAFT_DSLL_%20EA.pdf.

NMFS. 2009. 2008 Status of U.S. Fisheries. Silver Spring, Maryland, United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

NMFS. 2009b. Environmental Assessment for the Implementation of the Decisions of the Fifth Regular Annual Session of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean: Fishing Restrictions and Observer Requirements in Purse Seine Fisheries for 2009-2011 and Turtle Mitigation Requirements in Purse Seine Fisheries and Bigeye Tuna Catch Limits in Longline Fisheries in 2009, 2010, and 2011. July 2009. Available on the following NMFS website: http://www.fpir.noaa.gov/Library/IFD/AX60%20-%20Final%20WCPFC5%20EA%20-%20July%202009.pdf.

NMFS and USFWS (U.S. Fish and Wildlife Service). 1998. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

Olson, R.J. and F. Galvan-Magana. 2002. Food habits and consumption rates of common dolphinfish (*Coryphaena hippurus*) in the eastern Pacific Ocean. Fish. Bull. 100 (2): 279-298.

Oshiya, S. 2000. Biological Study and Stock Assessment of Silky Shark ("Kurotogarizame") Carcharhinus falciformis in the Tropical and Subtropical Pacific Ocean. Tokyo, Tokai University, School of Marine Science and Technology.

Pacific Fishery Management Council (PFMC). 2003. Fishery management plan and environmental impact statement for U.S. West Coast fisheries for highly migratory species. Pacific Fishery Management Council, Portland, OR.

PFMC. 2007a. Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species, as Amended by Amendment 1. Pacific Fishery Management Council, Portland, OR.

PFMC. 2007b. Status of the U.S. West Coast fisheries for highly migratory species through 2005, Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, Portland, OR.

PFMC. 2008. Status of the U.S. west coast highly migratory species through 2007: Stock assessment and fishery evaluation. Portland, Oregon, Pacific Fishery Management Council.

Perry, A.L., P.J. Low, J.R. Ellis, and J.D. Reynolds. 2005. Climate change and distribution shifts in marine fishes. *Science* 308(5730):1912-1915.

Pitman R. 1990. Pelagic distribution and biology of sea turtles in the eastern tropical Pacific. In T. Richarson, J. Richardson M. Donnelly, eds. Proceedings from the Tenth Annual Workshop on Sea Turtle Biology and Conservation. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-SEFC-278. 143-148.

Plotkin, P.T., R.A. Bales, and D.C. Owens. 1993. Migratory and reproductive behavior of *Lepidochelys olivacea* in the eastern Pacific Ocean. Schroeder, B.A. and B.E. Witherington (Compilers). Proc.

of the Thirteenth Annual Symp. on Sea Turtle Biology and Conservation. NOAA, Natl. Mar. Fish. Serv., Southeast Fish. Sci. Cent. NOAA Tech. Mem. NMFS-SEFSC-31.

Polovina, J.J., E. Howell, D.M. Parker, and G.H. Balazs. 2002. Dive depth distribution of loggerhead (*Caretta caretta*) and olive ridley (*Lepidochelys olivacea*) sea turtles in the central North Pacific: Might deep longline sets catch fewer turtles? Fish Bull 101(1):189-193.

Polovina, J.J., E. Howell, D.M. Parker, G.H. Balazs. 2003. Dive-depth distribution of loggerhead (*Caretta caretta*) and olive ridley (*Lepidochelys olivacea*) sea turtles in the central North Pacific: Might deep longline sets catch fewer turtles? Fishery Bulletin 101(1): 189-193.

Polovina, J.J., G.H. Balazs, E.A. Howell, D.M. Parker, M.P. Seki and P.H. Dutton. 2004. Forage and migration habitat of loggerhead (*Caretta caretta*) and olive ridley (*Lepidochelys olivacea*) sea turtles in the central North Pacific Ocean. Fish Oceanogr. 13(1):36-51.

Polovina, J., I. Uchida, G. Balazs, E.A. Howell, D. Parker and P.H. Dutton. 2006. The Kuroshio Extension Bifurcation Region: A pelagic hotspot for juvenile loggerhead sea turtles. Deep-Sea Research II 53: 326-339.

Pritchard, P. 1996. Evolution, phylogeny, and current status. In P. L. Lutz and J. A. Musick, Editors. The Biology of Sea Turtles, CRC Press, Boca Raton, FL. Pp 1-28.

Putrawidjaja, M. 2000. Marine turtles in Irian Jaya, Indonesia. Marine Turtle Newsletter 90:8-10.

Reina, R. Drexel University. September 2003. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

Richardson, T.L., G.A. Jackson, H.W. Ducklow, and M.R. Roman. 2004. Planktonic fowebs of the equatorial Pacific at 0°, 140° W: a synthesis of EqPac time-series carbon flux data. *Deep-Sea Research* I 51(9): 1245-1274.

Roberson, D. 2000. California Short-tailed Albatross: A summary at the turn of the century. (http://montereybay.com/creac~us/CAS TAL.htrnl)

Roessig, J.M., C.M. Woodley, J.J. Cech, and L.J. Hansen. 2004. Effects of global climate change on marine and estuarine fishes and fisheries. *Reviews in Fish Biology and Fisheries* 14(2):251-275.

Sarti, L.M., S.A. Eckert, N.T. Garcia and A.R. Barragan. 1996. Decline of the world's largest nesting assemblage of leatherback turtles. Marine Turtle Newsletter (74)

Sarti, L.M. Biologist, UNAM. March 2002. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

Sarti, L.M. Biologist, UNAM. June 2003. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

Sarti, L.M. Biologist, UNAM. December 2003. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

Sarti, L.M. Biologist, UNAM. May 2006. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeier, V. Burkett, D.R. Cayan, M. Fogarty et al. 2002. Climate change impacts on U.S. coastal and marine ecosystems, *Estuaries* 25(2):149-164.

Schwing, F. 2005. Decadal-scale climate events. In: King J (ed) Report of the study group on fisheries and ecosystem responses to recent regime shifts. PICES Scientific Report No. 28, 9-36

Seki, M.P., J.J. Polovina, D.R. Kobayashi, R.R. Bidigare and G.T. Mitchum. 2002. An oceanographic characterization of swordfish (*Xiphias gladius*) longline fishing grounds in the springtime subtropical North Pacific. Fish. Oceanogr. 11(5):251-25).

Seminoff, J.A., A. Resendiz and W.J. Nichols. 2002. Home range of green turtles Chelonia mydas at a coastal foraging area in the Gulf of California, Mexico. Marine Ecology Progress Series 242:253-265.

Sepulveda, Chugey. Senior Research Biologist and USCG-Licensed Captain, Pfleger Institute of Environmental Research, Oceanside, CA. 2006. Personal communication with Craig Heberer, National Marine Fisheries Service.

Sibert, J., J. Hampton, P. Kleiber, and M. Maunder. 2006. Biomass, size, and trophic status of top predators in the Pacific Ocean. Science 314(5806).

Sibert, J.R., M.K. Musyl and R.W. Brill. 2003. Horizontal movements of bigeye tuna (*Thunnus obesus*) near Hawaii determined by Kalman filter analysis of archival tagging data. Fish Oceanogr 12(3):141-151

Silva-Batiz, F.A., E. Godinez-Dominguez, J.A. Trejo-Robles. 1996. Status of the olive ridley nesting population in Playon de Mismaloya, Mexico: 13 years of data. Pg.302, 15th Annual Symposium, Sea Turtle Biology and Conservation, Feb. 20-25, 1995, Hilton Head, South Carolina.

Solow, A.R., K.A. Bjorndal and A.B. Bolten. 2002. Annual variation in nesting numbers of marine turtles: The effect of sea surface temperature on re-migration intervals. Ecology Letters 5:742-746.

Spotila J., A. Dunham, A. Leslie, A.Steyermark, P. Plotkin, and F. Paladino. 1996. Worldwide population decline of Dermochelys coriacea: are leatherback turtles going extinct? Chel. Cons. Biol. 2 (2). 209-222.

Spotila, J.R., R.D. Reina, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. Nature. Vol. 45. June 1, 2000.

Stevens, J. 1996. The population status of highly migratory oceanic sharks in the Pacific Ocean. Symposium on Managing Highly Migratory Fish of the Pacific Ocean. Monterey, California.

Tomillo, P. Drexel University. 2006. Personal communication with Elizabeth Petras, National Marine Fisheries Service.

U.S. Fish and Wildlife Service (USFWS). 2000. Biological Opinion of the U.S. Fish and Wildlife Service of the effects of the Hawaii-based domestic longline fleet on the Short-tailed Albatross (*Phoebastria albatrus*). USFWS, 96 pp.

USFWS. 2005. Short-tailed Albatross Draft Recovery Plan. Anchorage, AK, United States Department of the Interior, U.S. Fish and Wildlife Serve, Region 7. 62 pp.

Western Pacific Fishery Management Council (WPFMC). 2009. Pelagic fisheries of the western Pacific region: 2007 annual report (updated April 6, 2009). Honolulu, Western Pacific Fishery Management Council.