November 2014

NOAA FISHERIES
Pacific Islands Regional Office

Supplemental Environmental Assessment for a Rule to Implement Decisions of the Western and Central Pacific Fisheries Commission for:

Restrictions on the Use of Fish Aggregating Devices in Purse Seine Fisheries for 2015

RIN 0648-BE36

Prepared by:

National Marine Fisheries Service
Pacific Islands Regional Office

Contact Information:

Dr. Charles Karnella,
International Fisheries Administrator
National Marine Fisheries Service,
Pacific Islands Regional Office
NOAA Inouye Regional Center
1845 Wasp Boulevard, Building 176
Honolulu, HI 96818

Tel: (808) 725-5000
Fax: (808) 725-5215
E-mail: *Charles.Karnella@noaa.gov*

LIST OF ABBREVIATIONS AND ACRONYMS

CCM	Commission Members, Cooperating Non-Members, and Participating Territories
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMM	Conservation and Management Measures
Convention	Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
Convention Area	Area of Application of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
CPUE	Catch per Unit of Effort
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ENSO	El Niño Southern Oscillation
EPO	Eastern Pacific Ocean
ESA	Endangered Species Act
FAD	Fish Aggregating Device
FEP	Fishery Ecosystem Plan
FFA	Forum Fisheries Agency
FMP	Fishery Management Plan
FR	*Federal Register*
HAPC	Habitat Areas of Particular Concern
HMS	Highly Migratory Species
HSFCA	High Seas Fishing Compliance Act of 1995
IATTC	Inter-American Tropical Tuna Commission
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	maximum sustainable yield
mt	Metric Tons
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWR	National Wildlife Refuge

RIR	Regulatory Impact Review
SPC	Secretariat of the Pacific Community
SPTA	South Pacific Tuna Act of 1988
SPTT	South Pacific Tuna Treaty (formally, the Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America)
USFWS	United States Fish and Wildlife Service
VMS	Vessel Monitoring System
WCPFC	Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, also known as the Western and Central Pacific Fisheries Commission
WCPFCIA	Western and Central Pacific Fisheries Convention Implementation Act
WCPO	Western and Central Pacific Ocean

Table of Contents

Table of Contents 5
List of Figures 7
List of Tables 8
Chapter 1 Introduction and Purpose and Need 10
1.1. Background 10
1.2. Prior Environmental Analysis 13
1.3. Purpose and Need 13
1.4. Organization of This Document 14
Chapter 2 Proposed Action and Alternatives 16
2.1. Proposed Action 16
2.2. Development of Alternatives for FAD Restrictions 16
2.3. Alternatives for the 2015 FAD Restrictions Rule Considered in Detail 17
2.3.1. Alternative 1: The No-Action Alternative 17
2.3.2. Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit 18
2.3.3. Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit 18
Chapter 3 Affected Environment 20
3.1. Physical Environment and Climate Change 20
3.1.1 Oceanography 20
3.1.2 Climate Change 24
3.2. U.S. WCPO Purse Seine Fishery 26
3.2.1 Fleet Characteristics 26
3.2.2 Management of the U.S. Purse Seine Fleet in the WCPO 27
3.2.3 Participation, Effort, and Catch 29
3.3. FADs 33
3.4. Bigeye Tuna, Skipjack Tuna, and Yellowfin Tuna 36
3.4.1 Bigeye Tuna (*Thunnus obesus*) 36
3.4.3 Yellowfin Tuna (*Thunnus albacares*) 41
3.5. Biological Environment 43
3.5.1 Biodiversity and Ecosystem Function 43
3.5.2 Other Non-Target Fish Species 46
3.6. Protected Resources 48
3.6.1. Threatened and Endangered Species 48
3.6.2. Marine Mammals 51
3.6.3. Essential Fish Habitat (EFH) 52
3.6.4. National Wildlife Refuges (NWRs) and Monuments 53
Chapter 4 Environmental Consequences: Direct and Indirect Effects 56
4.1. The U.S. WCPO Purse Seine Fleet 56
4.1.1 Alternative 1: No-Action Alternative 56
4.1.2 Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit 58

4.1.3 Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit........ 60
4.2. Physical Environment and Climate Change 61
4.3. Bigeye Tuna, Skipjack Tuna, and Yellowfin Tuna........ 61
4.3.1 Alternative 1: No-Action Alternative 62
4.3.2 Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit........ 63
4.3.3 Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit........ 63
4.4. Other Non-target Fish Species........ 64
4.4.1 Alternative 1: No-Action Alternative 64
4.4.2 Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit........ 65
4.4.3 Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit........ 65
4.5. Protected Resources........ 66
4.5.1 Alternative 1: No-Action Alternative 66
4.5.2 Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit........ 67
4.5.3 Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit........ 68
4.6. Environmental Justice........ 68
Chapter 5 Cumulative Impacts 70
5.1. Affected Environment........ 70
5.2. Past, Present, and Reasonably Foreseeable Future Actions........ 71
5.2.1 Past Actions 71
5.2.2 Other Present Actions 72
5.2.3 Reasonably Foreseeable Future Actions........ 73
5.3. 5.3 Discussion of Cumulative Impacts 74
5.3.1 Cumulative Impacts to Physical Resources and Climate Change 74
5.3.2 Cumulative Impacts to Bigeye, Skipjack, and Yellowfin Tuna in the WCPO 75
5.3.3 Cumulative Impacts to Other Non-target Fish Species in the WCPO........ 76
5.3.4 Cumulative Impacts to Protected Resources in the WCPO........ 76
5.3.5 Cumulative Impacts to Environmental Justice 76
Consultation........ 78
Literature Cited........ 79
Appendix 1........Separate Attachment

List of Figures

Figure 1: The Convention Area 11
Figure 2: Sea Surface Temperature Indices of ENSO Patterns from 1995 to July 2014.. 24
Figure 3: The general operational area of the U.S. WCPO purse seine fishery 26
Figure 4: Proportion of the WCPO U.S. purse seine fleet that fished, by month, 1997-2012... 31
Figure 5: Distribution of U.S. purse seine effort during 2001 and 2002 32
Figure 6: Spatial distribution of reported logbook fishing effort (vessel-days fished) by the U.S. purse seine fleet in the western and central Pacific Ocean in 2011 32
Figure 7: Associated sets as proportion of all sets by U.S. WCPO purse seine fleet, 1988-2011... 34
Figure 8: FAD sets as proportion of all sets by U.S. WCPO purse seine fleet, by month, 1997-2008, 2009 and 2010-2011 averages. 35
Figure 9: Convention Area bigeye tuna catch (mt) by gear 1960-2013 39
Figure 10: Convention Area skipjack tuna catch (mt) by gear 1960-2013....................... 41
Figure 11: Convention Area yellowfin tuna catch (mt) by gear 1960-2013..................... 43
Figure 12: Trophic levels in the central North Pacific Ocean 44

List of Tables

Table 1: Tuna landings by U.S. WCPO purse seine vessels by species and port, 2011 and preliminary landings for 2012 30
Table 2: Annual U.S. WCPO purse seine retained catch estimates in metric tons by set type (unassociated and associated), 2008-2012 33
Table 3: FAD sets made by U.S. WCPO purse seine fleet in 2010 and 2011 35
Table 4: Stock status summary of primary HMS caught by the U.S. WCPO Purse Seine fleet 36
Table 5: Observed Estimates of Catch and Rate of Discards of “Other” Fish Species in 2010 by the U.S. WCPO Purse Seine Fleet. 46
Table 6: Listing Status of Species in the WCPO Listed as Endangered or Threatened Under the ESA. 49
Table 7: Non-Listed Marine Mammals that Occur in the WCPO. 51
Table 8: EFH and HAPC for Management Unit Species for the Western and Pacific Region 53
Table 9: List of agencies and offices contacted 78

Chapter 1

Chapter 1 Introduction and Purpose and Need

This document has been prepared pursuant to the provisions of the National Environmental Policy Act (NEPA; 42 U.S.C. § 4321, *et seq*.) and related authorities, such as the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations (CFR) Parts 1500-1508) and the National Oceanic and Atmospheric Administration's (NOAA) Environmental Review Procedures for Implementing NEPA (NOAA Administrative Order (NAO) 216-6).

At its Tenth Regular Session, in December 2013, the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Commission or WCPFC) adopted Conservation and Management Measure (CMM) 2013-01, "Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean." CMM 2013-01 went into effect February 4, 2014, and is generally applicable for the 2014-2017 period. The CMM includes provisions for purse seine vessels, longline vessels, and other types of vessels that fish for highly migratory species. The CMM's provisions for purse seine vessels include limits on fishing capacity, limits on the allowable level of fishing effort, restrictions on the use of fish aggregating devices (FADs), a requirement to retain all bigeye tuna, yellowfin tuna, and skipjack tuna except in specific circumstances, and a requirement to carry observers. This document analyzes a proposed rule to implement the FAD restrictions for 2015. The CMM's FAD restrictions for subsequent years, as well as other provisions of the CMM, would be implemented through separate rules. The National Marine Fisheries Service (NMFS) is implementing CMM 2013-01 through multiple rules primarily for timing reasons – different provisions of the CMM need to go into effect at different times.

1.1. Background

The United States ratified the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Convention) in 2007.[1] The area of application of the Convention (Convention Area) is shown in Figure 1.

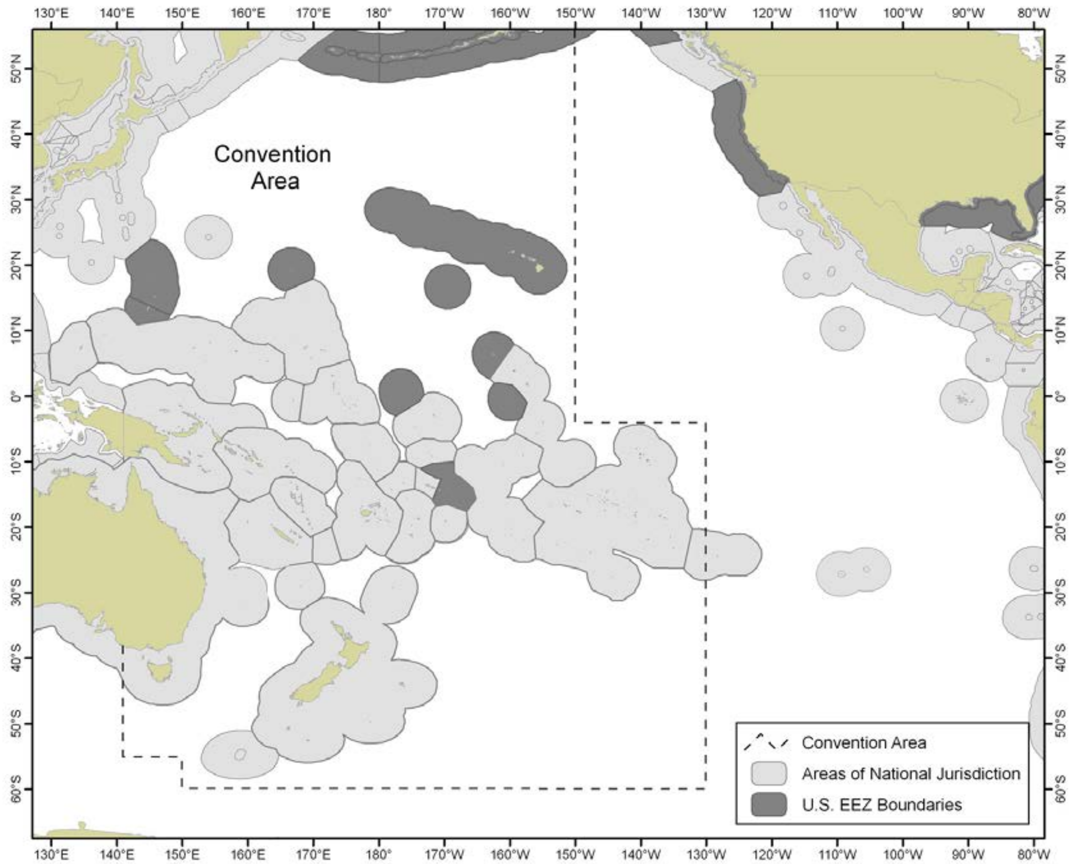
The Convention text indicates that the agreement is focused on highly migratory fish species (HMS) and stocks thereof within the Convention Area (see the Convention text for the specific HMS covered).[2] The Convention provides for the conservation and

[1] The Convention was opened for signature in Honolulu on September 5, 2000, and entered into force in June 2004; the Convention entered into force for the United States in 2007. The full text of the Convention is available at: *http://www.wcpfc.int/key-documents/convention-text*.

[2] Though not stated in the Convention text, it has also been agreed that southern bluefin tuna (*Thunnus maccoyii*) that are found in the Convention Area will continue to be solely managed by the Commission for the Conservation of Southern Bluefin tuna.

management of target stocks, non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks.

Figure 1: The Convention Area - high seas (in white); U.S. Exclusive Economic Zone (EEZ) (in dark gray); and foreign jurisdictions ("claimed maritime jurisdictions," in light gray).



Source: NMFS.

The WCPFC – among other things – adopts CMMs for Commission Members, Cooperating Non-Members, and Participating Territories (collectively referred to as CCMs) of the WCPFC to implement through their respective national laws and procedures. The Western and Central Pacific Fisheries Convention Implementation Act (WCPFCIA; 16 USC 6901 *et seq*.), authorizes the Secretary of Commerce, in consultation with the Secretary of State and the Secretary of the Department in which the Coast Guard is operating, to develop such regulations as are needed to carry out the obligations of the United States under the Convention. The authority to promulgate regulations to implement the provisions of the Convention and WCPFC decisions, such as regulations to implement CMMs, has been delegated by the Secretary of Commerce to NMFS.

As stated above, the rule analyzed in this document would implement the 2015 FAD provisions for the U.S. purse seine fishery in the western and central Pacific Ocean (WCPO).

The stated general objective of CMM 2013-01 is to ensure that compatible measures for the high seas and EEZs are implemented so that the stocks of bigeye, yellowfin and skipjack tuna in the WCPO are, at a minimum, maintained at levels capable of producing their maximum sustainable yield as qualified by relevant environmental and economic factors. The CMM includes specific objectives for each of the three stocks: for each, the fishing mortality rate is to be reduced to or maintained at levels no greater than the fishing mortality rate associated with maximum sustainable yield. CMM 2013-01 is the most recent in a series of WCPFC CMMs for the management of the principal tuna stocks in the WCPO.

Earlier WCPFC CMMs for tropical tuna management, which contained provisions for FAD restrictions in purse seine fisheries and which NMFS implemented via rulemaking, include CMM 2008-01, "Conservation and Management Measure for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean," CMM 2011-01, "Conservation and Management Measure for temporary extension of CMM 2008-01," and CMM 2012-01, "Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean." CMM 2008-01 set forth specific provisions for purse seine fisheries for the years 2009, 2010, and 2011, which NMFS implemented in 2009 (see final rule published August 4, 2009, in 74 *Federal Register* (FR) 38544; hereafter 2009 rule). Due to a change in meeting schedule, in December 2011, the WCPFC adopted an intersessional decision to extend the provisions of CMM 2008-01 until the WCPFC met in March 2012. NMFS implemented that intersessional decision for the U.S. purse seine fleet operating in the WCPO through an interim rule in 2011 (see interim rule published December 30, 2011 in 76 FR 82180; hereafter 2011 rule). Adopted in March 2012, CMM 2011-01 extended the majority of the provisions of CMM 2008-01 through the end of 2012. Given that the 2011 rule extended the applicable provisions of CMM 2011-01 for the U.S. purse seine fleet through 2012, there was no need for NMFS to take additional regulatory action to put into place the measures of CMM 2011-01 for purse seine fisheries. NMFS implemented the purse seine provisions of CMM 2012-01 for 2013 and 2014 in 2013 (see final rule published May 23, 2013 in 78 FR 30773; hereafter 2013 rule).

CMM 2013-01 has provisions for FAD restrictions that are similar to the previous CMMs, with some modifications to those provisions that are specified in detail in Chapter 2 of this document. This rulemaking (hereafter 2015 FAD restrictions rule) implements the FAD restrictions for 2015. As stated above, the CMM's FAD restrictions for subsequent years, as well as other provisions of the CMM, would be implemented through separate rules.

1.2. Prior Environmental Analysis

NMFS prepared an Environmental Assessment (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 Restriction 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" (hereafter 2009 EA), which analyzed the impacts of the 2009 rule on the human environment.[3]

In the 2009 EA, NMFS analyzed four action alternatives for the 2009 rule, as well as the No-Action Alternative. NMFS concluded that all of the alternatives would have similar effects. NMFS determined that all of the action alternatives analyzed in the 2009 EA would have minor beneficial effects or no effects on resources in the affected environment.

NMFS prepared an EA, "Environmental Assessment for a Rule to Implement Decisions of the Western and Central Pacific Fisheries Commission for: Fishing Restrictions and Observer Requirements in Purse Seine Fisheries for 2013 and 2014" (hereafter 2013 EA), which analyzed the impacts of the 2013 rule on the human environment and incorporated the 2009 EA by reference.[4] The 2013 EA included detailed analysis of three action alternatives, as well as the No-Action Alternative. Similar to the 2009 EA, NMFS concluded that all of the alternatives would have similar effects. NMFS determined that all of the action alternatives analyzed in the 2013 EA would have minor beneficial effects or no effects on resources in the affected environment.

Pursuant to 40 CFR 1502.9(c)(1)(i), this document supplements the 2013 EA to account for changes to FAD restrictions as part of the implementation of WCPFC decisions on tropical tunas. As a supplement, this document is meant to be read in conjunction with the 2013 EA and refers to specific sections in the 2013 EA where appropriate. Appendix 1 of this document contains the 2013 EA.

1.3. Purpose and Need

The purpose of the 2015 FAD restrictions rule is to implement the FAD restriction provisions of CMM 2013-01 for the U.S. WCPO purse seine fleet that are necessary prior to January 1, 2015, in order to contribute to the underlying objectives of CMM 2013-01 regarding WCPO bigeye tuna, yellowfin tuna and skipjack tuna, which are to reduce or

[3] The 2009 EA (combined with the Finding of No Significant Impact) is available at http://www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2009-0108.

[4] The 2013 EA (combined with the Finding of No Significant Impact) is available at http://www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2013-0043.

maintain their respective fishing mortality rates at levels no greater than the fishing mortality rates associated with maximum sustainable yield. The need for the rule is to satisfy the obligations of the United States as a Contracting Party to the Convention, pursuant to the authority of the WCPFCIA.

1.4. Organization of This Document

The following is a brief description of the remaining chapters of this supplemental EA:

Chapter 2 provides detailed discussion of the proposed action and the development of action alternatives for detailed analysis. The chapter also discusses the No-Action Alternative.

Chapter 3 describes the U.S. purse seine fishery in the WCPO and the physical environment and biological resources that could be affected by the implementation of the proposed action under any of the action alternatives.

Chapter 4 analyzes the direct and indirect environmental effects that could be caused by the implementation of the proposed action under any of the action alternatives analyzed in depth, as well as the direct and indirect effects of the No-Action Alternative, and compares the effects of the alternatives.

Chapter 5 analyzes the potential cumulative impacts that could result from the implementation of the proposed action under any of the action alternatives analyzed in depth, as well as the No-Action Alternative.

This supplemental EA is being issued in conjunction with the proposed rule, which will be subject to a public review and comment period.

Chapter 2

Chapter 2 Proposed Action and Alternatives

In an environmental review document, agencies must assess the environmental impacts of a proposal and the reasonable and feasible alternatives to the proposal in comparative form. The purpose of this comparison of alternatives is to provide the decisionmaker and the public with a clear basis for choosing among the alternatives.[5]

This chapter provides a description of the proposed action analyzed in this supplemental EA and the alternative means of implementing the proposed action. The chapter also includes a description of the No-Action Alternative (i.e., the existing conditions and the conditions that would result if the proposed action were not implemented under any of the action alternatives).

2.1. Proposed Action

The proposed action is the promulgation of the 2015 FAD restrictions rule to implement the 2015 FAD restrictions for U.S. purse seine vessels operating in the WCPO.

The proposed action would include implementation of prohibition periods for the use of FADs and a numerical limit on the number of FAD sets that would be allowed in 2015.

Section 2.2 discusses the development of alternatives for FAD restrictions. Section 2.3 describes the alternatives analyzed in depth in this supplemental EA, including two action alternatives and the No-Action Alternative.

2.2. Development of Alternatives for FAD Restrictions

In the 2009 EA, NMFS identified one alternative for implementing the FAD restrictions for the 2009 rule, which was the same for each of the action alternatives analyzed (Alternative B, Alternative C, Alternative D, and Alternative E). This alternative was a two-month period in 2009 (from August 1 through September 30) and a three-month period in 2010 and 2011 (from July 1 through September 30), during which FAD restrictions were in effect.

NMFS identified two alternatives for implementation of the FAD restrictions for the 2013 rule that were analyzed in depth in the 2013 EA. One alternative was a four-month period from July 1 through October 31 in 2013 and 2014 during which FAD restrictions would be in effect. The second alternative was a four-month period from July 1 through October 31 in 2013 and 2014 during which FAD restrictions would be in effect, as well as restrictions during the same period on setting on fish that had aggregated in association with a vessel. This second alternative was developed to address the fish aggregating

[5] See the CEQ's Regulations for Implementing the Procedural Provisions of NEPA at 40 CFR §1502.14.

properties of fishing vessels. As indicated in the 2013 EA, NMFS concluded that the two different action alternatives for FAD restrictions would be unlikely to have different effects on resources in the human environment. The 2013 rule implemented the FAD restrictions alternative that included restrictions on setting on fish that have aggregated in association with a vessel. Thus, the alternative of setting only on FADs and not setting on fish that have aggregated in association with a vessel is not discussed further in this supplemental EA.

CMM 2013-01 includes the prohibition on setting on FADs in the Convention Area between the latitudes of 20° North and 20° South from July 1 through September 30, 2015. In addition, CCMs are required to either: (1) prohibit their purse seine vessels from setting on FADs in January and February in combination with limiting the number of FAD sets by their purse seine vessels to specified levels (for U.S. purse seine vessels, the specified level is 3,061 FAD sets per year); or (2) limit the number of FAD sets by their purse seine vessels to specified levels (for U.S. purse seine vessels, the specified level is 2,202 per year). In other words, for each calendar year, the United States has the option of a five-month FAD closure in combination with a 3,061 FAD set limit, or a three-month FAD closure in combination with a 2,202 FAD set limit.

2.3. Alternatives for the 2015 FAD Restrictions Rule Considered in Detail

The alternatives for the 2015 FAD restrictions rule analyzed in depth in this supplemental EA are designated by number and are described in detail below.

2.3.1. Alternative 1: The No-Action Alternative

Alternative 1, the No-Action Alternative, would cause no changes to "the status quo" and would result in conditions that are treated as the baseline for the purposes of assessing the impacts of the other alternatives. The inclusion of the No-Action Alternative serves the important function of facilitating comparison of the effects of the action alternatives and is a required part of a NEPA document. Under Alternative 1, the U.S. WCPO purse seine fishery would continue to be managed under existing laws and regulations, which are described in Chapter 3, Section 3.2. In effect, up to 40 vessels licensed by Pacific Islands Forum Fisheries Agency (FFA)[6] under the Treaty on Fisheries between the Governments of certain Pacific Islands States and the Government of the United States of America (SPTT or Treaty) would continue to fish in the manner in which operations have occurred for the past 25 years, though certain SPTT instruments are currently being renegotiated and it is foreseeable that there may be substantive changes to the management of the U.S. WCPO purse seine fleet in 2015. In addition, the fleet would be subject to certain NMFS

[6] An additional five vessel licenses are available for joint venture operations with Pacific Island Parties to the SPTT.

regulations that implement decisions of the WCPFC, including permit endorsement requirements, specific reporting requirements, prohibitions on at-sea transshipments, sea turtle take mitigation requirements, catch retention requirements and observer requirements. Vessels in the U.S. WCPO purse seine fleet are also currently required to carry WCPFC observers on all trips in the WCPFC Convention Area. The fleet is also subject to observer coverage requirements under the SPTT. The fleet would also be subject to permitting requirements under NMFS regulations implementing the High Seas Fishing Compliance Act (HSFCA; 16 U.S.C. § 5501, *et seq*.) as well as NMFS regulations implementing the Fishery Ecosystem Plan (FEP) for Pacific Pelagic Fisheries of the Western Pacific Region (Pelagics FEP), pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. § 1801 *et seq*.). All of these regulations are discussed in more detail in Section 3.2 of this supplemental EA.

2.3.2. Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit

Under Alternative 2, there would be a prohibition on setting on FADs and on fish that have aggregated in association with a fishing vessel, in the Convention Area between the latitudes of 20° North and 20° South, from July 1 through September 30, 2015. There would also be a specified 2,202 limit on the number of FAD sets that could be made in 2015. In order to estimate FAD sets with respect to reaching the limit, vessel owners and operators would be required to submit information on FAD sets to NMFS at the end of each fishing day.

2.3.3. Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit

Under Alternative 3, there would be a prohibition on setting on FADs and on fish that have aggregated in association with a fishing vessel, in the Convention Area between the latitudes of 20° North and 20° South, during the months of January, February, July, August and September in 2015. There would also be a specified 3,061 limit on the number of FAD sets that could be made in 2015. In order to estimate FAD sets with respect to reaching the limit, vessel owners and operators would be required to submit information on FAD sets to NMFS at the end of each fishing day.

Chapter 3

Chapter 3 Affected Environment

This chapter describes the physical and biological environment in which the U.S. purse seine fishery operates in the WCPO, focusing on the resources that could be affected by the implementation of 2015 FAD restrictions rule. The chapter follows the format of the 2013 EA and is divided as follows: (1) physical environment and climate change; (2) description of the U.S. WCPO purse seine fleet; (3) bigeye tuna, skipjack tuna, and yellowfin tuna – the principal stocks associated with the U.S. purse seine fishery in the WCPO; (4) other biological resources; and (5) protected resources. The information presented includes some information from the 2013 EA, as well as updates to the corresponding sections in the 2013 EA.

3.1. Physical Environment and Climate Change

The physical reach of the Convention Area (as shown in Chapter 1), comprises all waters of the Pacific Ocean bounded to the south and to the east by the following line: from the south coast of Australia due south along the 141° meridian of east longitude to its intersection with the 55° parallel of south latitude; thence due east along the 55° parallel of south latitude to its intersection with the 150° meridian of east longitude; thence due south along the 150° meridian of east longitude to its intersection with the 60° parallel of south latitude; thence due east along the 60° parallel of south latitude to its intersection with the 130° meridian of west longitude; thence due north along the 130° meridian of west longitude to its intersection with the 4° parallel of south latitude; thence due west along the 4° parallel of south latitude to its intersection with the 150° meridian of west longitude; thence due north along the 150° meridian of west longitude.

Below is a description of the specific physical environment in which the WCPO U.S. purse seine fishery occurs and how physical features of the pelagic environment, as well as the distribution of HMS, influence the fishery.

3.1.1 Oceanography

There are two main subtropical gyres (the North Pacific subtropical gyre in the northern hemisphere and the South Pacific subtropical gyre in the southern hemisphere) in the Pacific Ocean, as well as 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 forces. Due to this, the central Pacific Ocean (~20° N -20° S latitude) 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. Embedded in the mean flow are numerous mesoscale eddies (turbulent or spinning flows on scales of a few hundred kilometers (Stewart 2005) created from wind and current interactions with the ocean's bathymetry. These eddies, which can rotate either clockwise or counter clockwise, typically have important biological impacts, such as creating areas of high biological productivity.

Ocean 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, where the mixing is greatest, are often targeted by fishermen as these are areas of high biological productivity.

The subtropical frontal zones, consisting of several convergent fronts, lie between latitudes 25°- 40° N and S, and are often referred to as the Transition Zones. Transition zones are areas of ocean water bounded to the north and south by large-scale surface currents originating from subartic and subtropical locations (Polovina et al. 2001). The bulk of marine life is found near divergences and convergences that concentrate forage species, and also near upwelling zones along ocean current boundaries, and temperature, oxygen, salinity, light, and depth gradients (Niller and Reynolds 1984; Roden 1980; Seki et al. 2002). Biologically, these convergent fronts appear to represent zones of enhanced trophic transfer (Bakun 1996; Olson et al. 1994). The dense cooler phytoplankton-rich water sinks below the warmer water creating a convergence of phytoplankton (Polovina et al. 2000; Roden 1980). Buoyant organisms, such as jellyfish as well as vertically swimming zooplankton, can maintain their vertical position in the weak down-welling, and aggregate in the front to graze on the down-welled phytoplankton (Bakun 1996; Olson et al. 1994). The increased level of biological productivity in these zones attracts higher trophic level prey and their predators such as sharks. These zones also provide important habitat for pelagic fish and thus, are targeted by fishers.

Variability within the ocean–atmosphere system results in changes in winds, rainfall, currents, water column mixing, and sea-level heights, which can have profound effects on regional climates as well as on the abundance and distribution of marine organisms. In the tropical Pacific there is a limited seasonal variation, yet there is a strong interannual variability which in turn affects the entire Pacific Ocean (Langley et al. 2004). These events affect the habitat range and movements of pelagic species. Geographic distribution of all species, especially HMS, varies with seasonal changes in the physical and chemical ocean environment. Suitable physical environment for these species depends on gradients in temperature, oxygen, or salinity, all of which are influenced by oceanic conditions on various scales. In the pelagic environment, physical conditions such as isotherm and isohaline boundaries often determine whether or not the surrounding water mass is suitable for pelagic fish. Additionally, areas of high trophic transfer as found in fronts and eddies are important habitat for foraging, migration, and reproduction for many species (Bakun 1996).

The scientific community has become increasingly aware of the occurrence and importance of long-term (decadal-scale) oceanographic cycles and of their relationship to cycles in the population sizes of some species of fish (Chavez et al. 2003). These naturally occurring cycles can either mitigate or accentuate the impact of fishing mortality on all species, especially those targeted in HMS fisheries. El Niño Southern Oscillation (ENSO)[7] events, including mesoscale events, such as El Niño and La Niña, and shorter term phenomena such as cyclonic eddies near the Hawaiian Islands (Seki et al. 2002), impact the recruitment and fishing vulnerability of HMS. ENSO events can cause considerable interannual physical and biological variation. During an El Niño, the normal easterly trade winds weaken, resulting in a weakening of the westward equatorial surface current and a deepening of the thermocline in the central and eastern equatorial Pacific. In turn, the eastward-flowing countercurrent tends to dominate circulation, bringing warm, low-salinity, and low-nutrient water to the eastern margins of the Pacific Ocean. As the easterly trade winds are reduced, the normal nutrient-rich upwelling system does not occur, leaving warm surface water pooled in the eastern Pacific Ocean (EPO).

El Niño affects the ecosystem dynamics in the equatorial and subtropical Pacific by considerable warming of the upper ocean layer, rising of the thermocline in the western Pacific and lowering in the east, strong variations in the intensity of ocean currents, low trade winds with frequent westerlies, high precipitation at the dateline, and drought in the western Pacific (Sturman and McGowan 1999). El Niño events have the ability to exercise a strong influence on the abundance and distribution of organisms within marine ecosystems. The deepening of the mixed layer depth that occurs with an El Niño may be manifested by a discernible increase in purse seine catch per unit of effort (CPUE) of yellowfin tuna in the central/western regions of the Pacific. This is normally seen after a 2-3 month delay and occurs in the eastern portion of the WCPO in the vicinity of Kiribati and the U.S. EEZ of the central Pacific (Howland, Baker, Jarvis etc.). During a strong El Niño, the purse seine fishery for skipjack tuna shifts over thousands of kilometers from the western to the central equatorial Pacific in response to physical and biological impacts (Lehodey et al. 1997).

A La Niña event exhibits the opposite conditions: cooler than normal sea-surface temperatures in the central and eastern tropical Pacific Ocean. These may have larger impacts on global weather patterns. For the purse seine fishery the contraction of the warm pool tends to shift fishing to the western portion of the WCPO in the vicinity of Papua New Guinea and Federated States of Micronesia, or away from the U.S. EEZ and

[7] ENSO events include the full range of variation observed between El Niño and La Niña events. El Niño is characterized by a large-scale weakening of the tradewinds and warming of the surface layers in the eastern and central equatorial Pacific. El Niño events occur irregularly at intervals of 2–7 years, although the average is about once every 3–4 years. These events typically last 12–18 months, and are accompanied by swings in the Southern Oscillation, an interannual "see-saw" in tropical sea level pressure between the eastern and western hemispheres. During El Niño, unusually high atmospheric sea level pressures develop in the western tropical Pacific and Indian Ocean regions, and unusually low sea level pressures develop in the southeastern tropical Pacific. During La Niña, the opposite effects are seen (NMFS 2004).

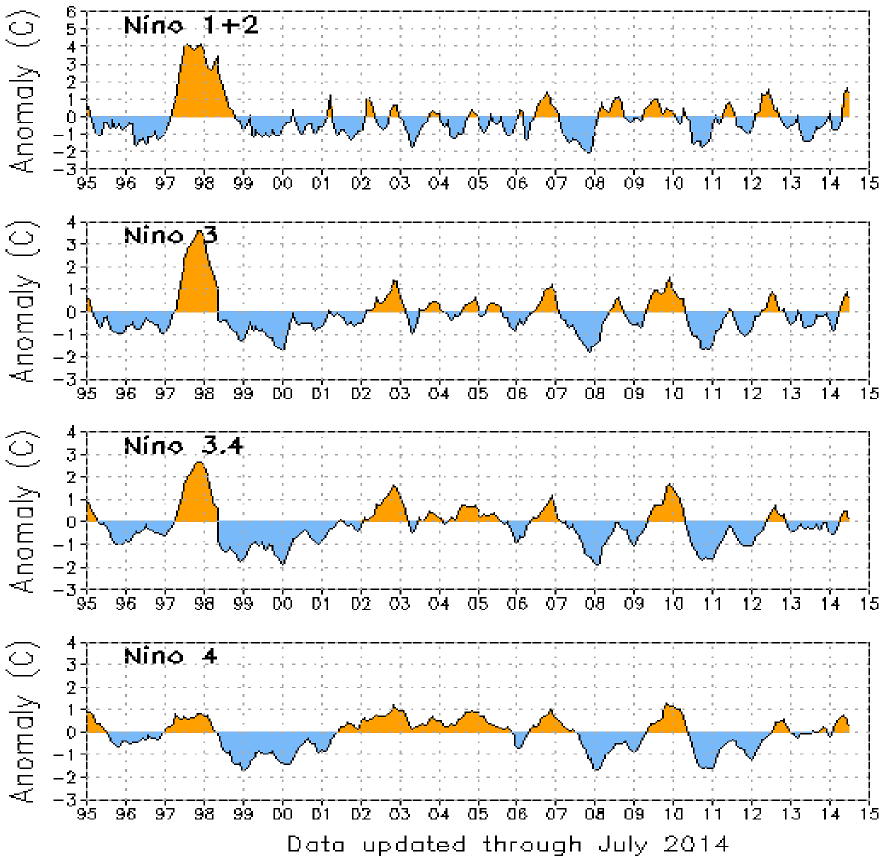
those areas to the north of American Samoa. The major change is a horizontal extension or contraction of the skipjack tuna habitat during El Niño and La Niña phases respectively.

Physical and biological oceanographic changes have also been observed on decadal time scales. These low frequency changes, termed regime shifts, can impact the entire ocean basin. These impacts can lead to potential impacts on the tropical Pacific fisheries for tunas such as the extension of present fisheries to higher latitudes, a decrease in productivity, mainly in the eastern Pacific, increasing variability in the catches, changes in species composition of the catch, and increasing fishing pressure, particularly on bigeye and yellowfin tuna (The World Bank 2000).

Figure 2 below shows sea surface temperature anomalies for different regions of the Pacific Ocean for the years 1995 through July 2014. The regions are as follows: (1) Nino 1+2 is the extreme eastern equatorial Pacific between 0° to 10°S latitude and 90° to 80°W longitude; (2) Nino 3 is the eastern equatorial Pacific between 5°N to 5°S latitude and 150°W to 90°W longitude; (3) Nino 3.4 is the east-central equatorial Pacific between 5°N to 5°S latitude and 170°W to 120°W longitude; and (4) Nino 4 covers the international date line and is from 5°N to 5°S latitude and 160°E to 150°W longitude. Anomalies refer to variations from the monthly mean sea surface temperatures during the base period (1981-2010).[8]

[8] Information and Figure 2 taken from the National Weather Service Web site at: http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt5.shtml.

Figure 2: Sea Surface Temperature Indices of ENSO Patterns from 1995 to July 2014.



3.1.2 Climate Change

Climate change can affect the marine environment by impacting the established hydrologic cycle (e.g., a change in precipitation and evaporation rates) (Bala et al. 2010). This in turn may cause a shift in food web dynamics, such as a reduction in primary productivity, which affects HMS migration and distribution (Dambacher et al. 2010, Loukos et al. 2003). Climate change has been associated with other effects to the marine environment, including rising oceanic temperatures, changes in ice cover, salinity, oxygen levels, and circulation (Intergovernmental Panel on Climate Change 2007). These effects are leading to shifts in the range, abundance, and behaviors of algae, plankton, fish and other sea life (Solomon et al. 2007). Coral reefs are also being damaged through ocean acidification and sea level rise (Carpenter et al. 2008, Mayfield et al. 2012, Munday et al. 2012). There are many predictions pertaining to the rate of change and potential maximums of sea level rise but studies indicate the change is caused by rising global temperatures and ice melt (Rahmstorf 2007). Sea level changes could potentially damage the nesting, breeding, foraging, and migratory sites of coastal marine sea birds

(Galbraith et al. 2002) and other vertebrate megafauna such as pinnipeds and chelonioidea (Baker et al. 2006).

Climate change is also increasing the incidence of disease in aquatic organisms (Roessig et al. 2004, Hoegh-Guldberg and Bruno 2010, Woesik et al. 2012) as well as the spread of invasive species (Hoegh-Guldberg and Bruno 2010). Studies on planktonic ecosystems demonstrate that climate change is affecting phytoplankton abundance and distribution, which in turn affects consumers ranging from zooplankton to megafauna (Hays et al. 2005). Changes in plankton affect ecosystem services such as oxygen production, carbon sequestration, and biogeochemical cycling (Edwards et al. 2010). All of these studies concluded that fish, seabirds, and marine mammals will need to adapt to shifts in spatial distribution of primary and secondary production within pelagic marine ecosystems (Hoegh-Guldberg and Bruno 2010; Dambacher et al. 2010).

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).

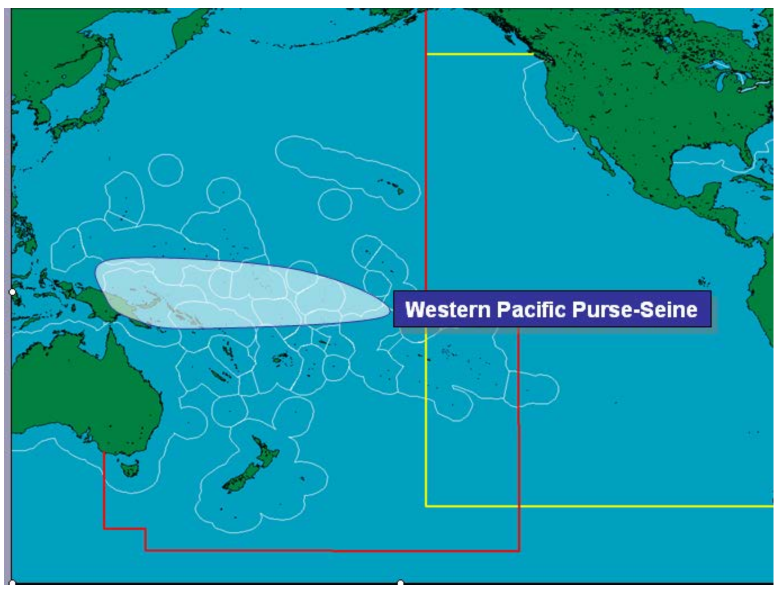
Ainsworth et al. (2011) also investigate potential climate change impacts on commercially valuable species of fish, stimulating changes in (1) primary productivity; (2) species range shifts; (3) zooplankton community size structure; (4) ocean acidification; and (5) ocean deoxygenation. Climate change may also impact marine carrying capacity and relative suitable habitats for fish stocks, theoretically either positively or negatively affecting the levels of growth and survival of certain fish populations (Kaeriyama et al. 2012).

Ocean habitat can be affected by changes in pH associated with climate change. The global average pH has risen 0.1 units (Farby et al. 2008) since the beginning of the Industrial Revolution, due to increased levels of CO_2 both anthropogenically and naturally released. Any creature that produces a carbonate shell is vulnerable to the carbonic acid (it dissolves carbonate) that is produced by the reaction between atmospheric CO_2 and seawater. Most of these creatures are small phytoplankton and zooplankton, but larger crustaceans and mollusks are vulnerable to dissolution as well, especially in juvenile stages (Farby et al. 2008). Coral reefs are also damaged by increasing acidity levels (Hoegh-Guldberg et al. 2007). As these organisms form, feed, or support many levels of the food chain, as well as provide many other important ecosystem services, any major loss of diversity or productivity could impact higher trophic levels and the environment as a whole.

3.2. U.S. WCPO Purse Seine Fishery

U.S. purse seine vessels typically engage in targeting skipjack tuna and to a lesser extent yellowfin tuna throughout the equatorial regions of the Convention Area. The U.S. WCPO purse seine fleet operates mostly in the EEZs of Pacific Island countries between the latitudes of 10° N. and 10° S. within the Convention Area (Figure 3).

Figure 3: The general operational area of the U.S. WCPO purse seine fishery (indicative only) in light blue. The red line demarks the Convention Area and the yellow line depicts the boundary of the Inter American Tropical Tuna Commission (IATTC), which generally exercises competence over tuna and tuna-like species in the EPO.



Source: NMFS unpublished data.

3.2.1 Fleet Characteristics

Gillett et al. (2002) provide a detailed description of the historical development and expansion of the U.S. WCPO purse seine fleet from its bases in the EPO. The U.S. fleet developed a year-round fishery along the Equator, generally within a rectangular area bounded by 10° N-10° S latitude and 135° E-170° E longitude, and encompassing the EEZs of Palau, Federated States of Micronesia, Papua New Guinea, Solomon Islands, Nauru, Marshall Islands, and the Gilbert Islands group of Kiribati. Fishing grounds continued to expand eastward throughout the 1980s, eventually encompassing the Phoenix and Line Islands (Kiribati); the U.S. possessions of Howland, Baker, and Jarvis; Tokelau; and the high seas among these EEZ areas. U.S. purse seiners target skipjack and yellowfin tuna found in association with drifting logs/flotsam or FADs and unassociated free-swimming schools of tuna ("school sets"). The relative proportion of the different set types has varied considerably over time as oceanographic and economic conditions and technology have changed.

Large modern purse seiners are one of the most complex fishing vessels in terms of both technology and machinery. Hydraulic systems on large "super seiners," require more than 1,600 meters of piping, and are equipped with at least four auxiliary engines in addition to the main propulsion engine (or engines). 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 1,500 meters or more in length and 150 meters in depth. 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. The catch is removed from the sack onto the vessel with large "scoops" holding several metric tons (mt), and then is placed in brine tanks for freezing and later storage. Joseph (2002) and NMFS (2004) provide a detailed description of tuna purse seining and the fleets involved in the Pacific Ocean fisheries.

3.2.2 Management of the U.S. Purse Seine Fleet in the WCPO

The fishing activities of U.S. WCPO purse seine vessels are governed in large part by the SPTT. The SPTT manages access of U.S. purse seine vessels to the EEZs of Pacific Islands parties to the SPTT and provides for technical assistance in the area of Pacific Island country fisheries development. The SPTT is implemented domestically by regulations (50 CFR 300 Subpart D) issued under authority of the South Pacific Tuna Act of 1988 (SPTA; 16 U.S.C. 973-973r). As of this writing, certain SPTT instruments are being renegotiated, which may result in changes to the current management regime. The HSFCA and implementing regulations (50 CFR 300 Subpart B), the WCPFCIA and implementing regulations (50 CFR 300 Subpart O), and regulations implementing the Pelagics FEP pursuant to MSA (50 CFR Part 665) also regulate this fishery. The main fishery management regulations established under the SPTA, HSFCA, WCPFCIA, and Pelagics FEP are:

- All U.S. vessels that fish (as defined under 50 CFR § 300.2) on the high seas are required to have a permit in accordance with the HSFCA and, if fishing on the high seas in the Convention Area, a WCPFC Area Endorsement;

- A U.S. purse seine vessel operating in the WCPO must have a license issued by the FFA as Treaty Administrator on behalf of the Pacific Island parties to the SPTT. The SPTT and implementing regulations provide for the availability of 45 licenses, five of which are available only to fishing vessels engaged in joint venture arrangements with the Pacific Island parties. No joint venture licenses have ever been issued.

- Within the SPTT Area there are several types of designated geographical areas, as described below:

    1. The **Treaty Area** which is about 10 million square miles in size.

    2. The **Licensing Area** where a license is required in order to fish.

    3. **Closed Areas** are those in which U.S. purse seine vessels are not allowed to fish.

- U.S. purse seine vessels are prohibited from transshipping fish at sea in the Convention Area and from transshipping fish caught in the Convention Area anywhere else;

- A U.S. purse seine vessel cannot be used for directed fishing for southern bluefin tuna *(Thunnus maccoyii)* or for fishing for any kinds of fish other than tunas, except fish that may be caught incidentally;

- Holders of vessel licenses are required to submit both written and electronic reports on their fishing activities in the Treaty Area to NMFS, the FFA or the local marine resource authority in which the vessel is operating;

- U.S. purse seine vessels are required to carry and operate mobile transmitting units to provide automated position information as part of a vessel monitoring system (VMS) administered by NMFS and by the FFA;

- U.S. purse seine vessels are required to be identified in accordance with the 1989 United Nations Food and Agriculture Organization standard specifications for the marking and identification of fishing vessels, which requires that the vessel's international radio call sign be marked on the hull and deck;

- U.S. purse seine vessels operating in the Convention Area must submit specific reports on transhipments, discards, and entries into and exits from a certain area of the high seas (i.e., Eastern High Seas Special Management Area; 50 CFR 300.225);

- U.S. purse seine vessels fishing in the Convention Area must follow certain sea turtle interaction mitigation measures;

- U.S. purse seine vessels must retain all catch of bigeye, yellowfin, and skipjack tuna, subject to certain exceptions; and

- U.S. purse seine vessels equal to or greater than 50 feet (15.2 meters) in length overall generally cannot fish in a certain portion of the U.S. EEZ around American Samoa.

- Pursuant to the terms of the SPTT, U.S. purse seine vessels must carry observers on at least twenty percent of their trips (see SPTT, Annex I, Part 7). Beginning in 2010, purse seine vessels have been required to carry WCPFC observers on all trips (CFR 50 300.223), with certain exceptions.

Observers provide useful information that is independent of vessel operators and is obtained during actual fishing operations. Data typically collected by observers include catch composition by species, effort, location, environmental conditions, gear type, and information on bycatch. Observers deployed by FFA on U.S. WCPO purse seine vessels collect detailed information on bycatch and discards in the WCPO purse seine fishery and these data are routinely used to provide estimates of total bycatch and discards and the extent of interaction with species of special interest (e.g., marine mammals and turtles) (Secretariat of the Pacific Community (SPC) 2012b) and are employed for regional tuna stock assessments.

3.2.3 Participation, Effort, and Catch

Participation in the U.S. WCPO purse seine fishery increased from the late 1980s to the mid-1990s, and gradually decreased until a low was reached in 2006. The fleet has since increased to about the levels of the mid 1990s, and has been relatively stable for the past five years. As of August 2014, the U.S. WCPO purse seine fleet included 40 vessels.

Effective June 15, 2013, while certain SPTT instruments are being renegotiated, there is an interim arrangement in place between U.S. purse seine vessel owners and the members of the FFA that stipulates that from June 15, 2013, through December 31, 2014 (18.5 months), the fleet may collectively conduct activities considered to be fishing for no more than 12,000 days in the EEZs of the Parties to the Nauru Agreement (PNA, a subset of eight FFA members in whose waters most WCPO tropical purse seine fishing occurs), and no more than 450 fishing days in the EEZs of the other (non-PNA) FFA members. A separate agreement is in place with the Cook Islands for an additional 300 fishing days over the majority of the year, which would amount to approximately 315 fishing days for a full calendar year.

NMFS is implementing the fishing effort restrictions of CMM 2013-01 for purse seine fisheries for 2014 in a separate rulemaking (see proposed rule at 79 FR 43373; July 25, 2013), which would set limits on the number of purse seine fishing days for the U.S. fleet at 1,828 for the high seas and U.S. EEZ within the Convention Area.

Skipjack tuna accounts for a large majority of purse seine catch, followed by yellowfin tuna and bigeye tuna. Table 1 shows the 2011 and 2012 tuna landings of the fleet by species and port. Historically, most of the U.S. WCPO purse seine fleet operated out of

Pago, Pago, American Samoa. However, recently some of the vessels that have entered the fleet operate under a different business model, and transship most of their catch in Pacific Island ports in the region. In recent years, about 25 percent of the catch has been landed in Pago Pago.

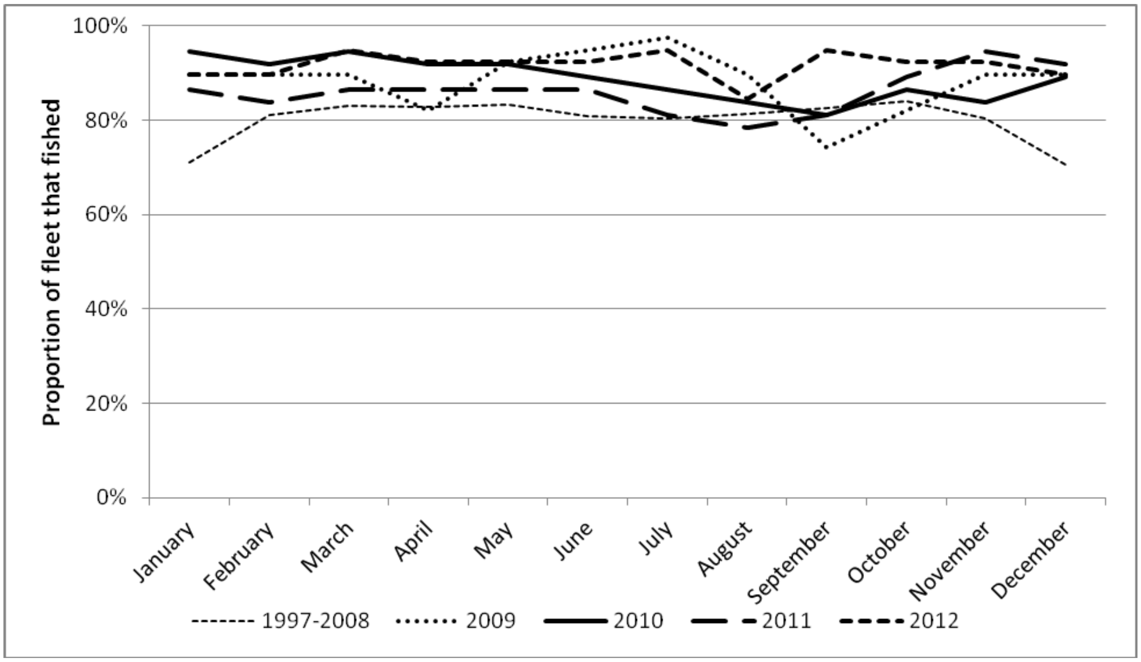
Table 1: Tuna landings by U.S. WCPO purse seine vessels by species and port, 2011 and preliminary landings for 2012

2011	**Tuna Landings (mt)**			
PORT	**Skipjack**	**Yellowfin and Bigeye**	**Total**	**%**
United States Ports				
Pago Pago, American Samoa	35,464	3,449	38,913	19%
Pago Pago, Transshipments	15,932	3,032	18,964	9%
Foreign Ports				
Pohnpei, Federated States of Micronesia	22,596	4,024	26,620	13%
Tarawa, Kiribati	5,045	532	5,577	3%
Rabaul, Papua New Guinea	10,285	1,516	11,801	6%
Majuro, Republic of the Marshall Islands	72,657	6,005	78,662	38%
Honiara, Solomon Islands	20,213	1,455	21,668	11%
Other	2,573	369	2,942	1%
TOTAL	**184,765**	**20,382**	**205,147**	**100%**
2012 (Preliminary)	**Tuna Landings (mt)**			
PORT	**Skipjack**	**Yellowfin and Bigeye**	**Total**	**%**
United States Ports				
Pago Pago, American Samoa	51,315	7,316	58,631	23%
Pago Pago, Transshipments	29,688	3,763	33,451	13%
Foreign Ports				
Pohnpei, Federated States of Micronesia	20,945	2,329	23,274	9%
Christmas Island, Kiribati	5,340	2,537	7,877	3%
Tarawa, Kiribati	7,282	3,365	10,647	4%
Rabaul, Papua New Guinea	11,373	1,055	12,428	5%
Majuro, Republic of the Marshall Islands	91,894	14,926	106,820	41%
Other	4,969	245	5,214	2%
TOTAL	**222,805**	**35,536**	**258,342**	**100%**

Source: United States Coast Guard and NMFS 2013.

Purse seine fishing effort in the WCPO cannot be characterized by any marked or documented seasonal patterns. As shown in Figure 4 below, over 70 percent of the U.S. purse seine fleet in the WCPO fished throughout the entire year from 1997 through 2008 and at least that in each of the years from 2009 through 2012. The percent of licensed vessels that fished in the years when the 2009 rule and 2011 rule were in effect was generally constant throughout the year.

Figure 4: Proportion of the WCPO U.S. purse seine fleet that fished, by month, 1997-2012.

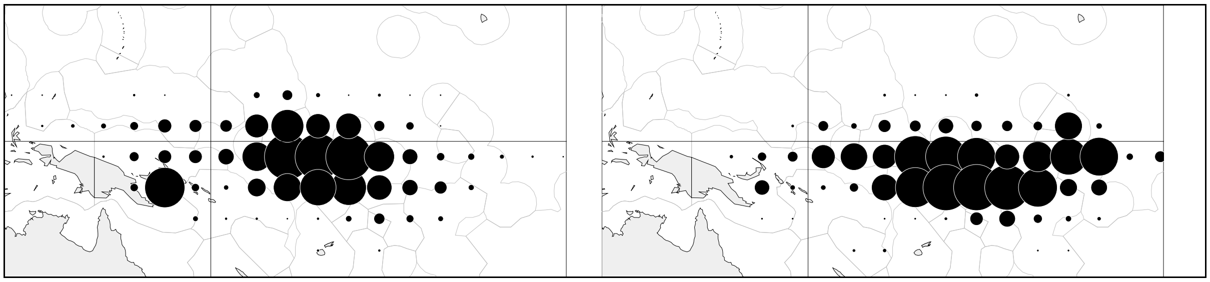


Source: NMFS unpublished data.

As stated in Section 3.1 above, the spatial distribution of fishing effort is influenced by the (irregular) cycles associated with ENSO events, revealing strong temporal variation on the scale of years and decades. The distribution of catch by the WCPO purse seine fishery is also strongly influenced by ENSO events. Lehodey et al. (1997) and Lehodey et al. (1998) suggested that skipjack abundance is linked to east–west movements of warm water. El Niño conditions also produce unusual westerly winds and surface drift in the WCPO that transport drifting debris further eastward than usual. During these El Niño events, purse seine effort increases in the eastern portion of the fishery to take advantage of sets on debris, such as logs (Williams 2003).

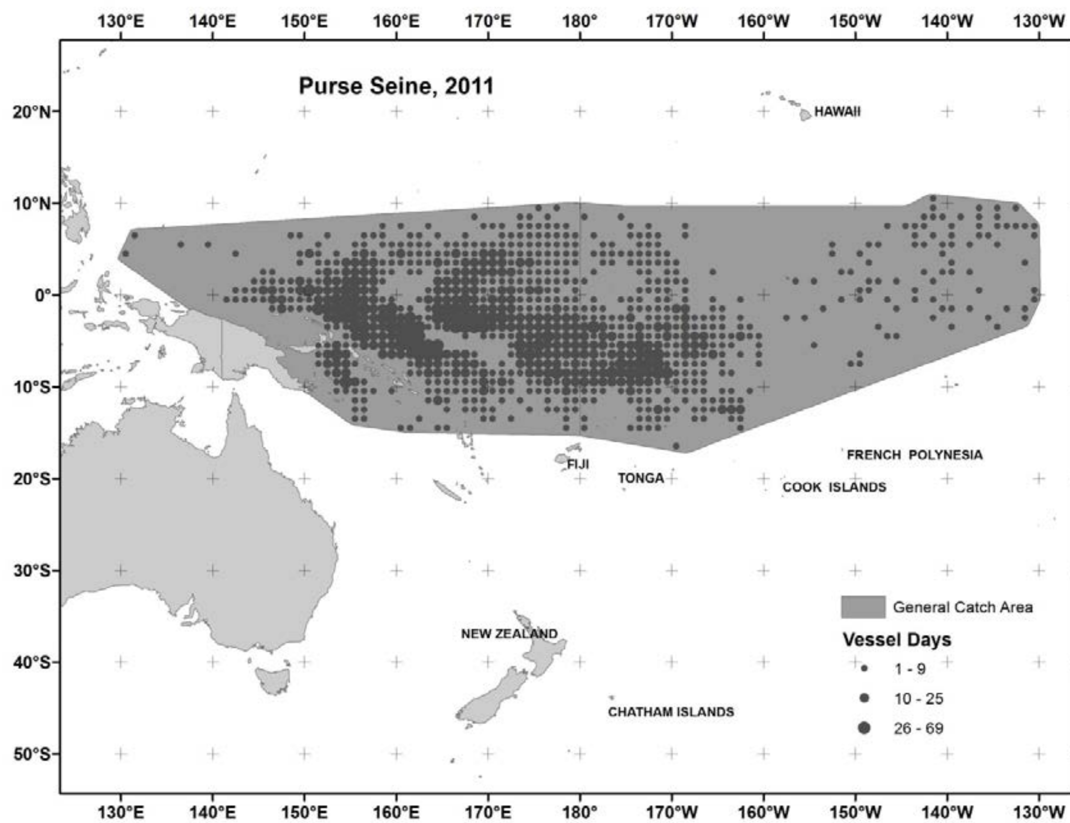
Figure 5 depicts a good example of the U.S. purse seine effort during a transitional year between an El Niño and La Niña period (2001) and an El Niño period (2002). Effort in strong La Niña conditions normally shifts west of the vertical line indicating 160° E longitude. Figure 6 shows the spatial distribution of effort in the WCPO in 2011.

Figure 5: Distribution of U.S. purse seine effort during 2001 and 2002. Lines for the Equator (0° latitude) and 160° E longitude included. The left-hand side of the figure shows effort during 2001 and the right-hand side shows effort during 2002.



Source: Williams 2003.

Figure 6: Spatial distribution of reported logbook fishing effort (vessel-days fished) by the U.S. purse seine fleet in the western and central Pacific Ocean in 2011



Source: U.S. Annual Report Part 1 to the WCPFC 2013. Area of circles is proportional to effort. Effort in some areas is not shown in order to preserve data confidentiality.

3.3. FADs

Fish aggregating devices, or FADs, are man-made devices or natural floating objects, anchored or not, capable of aggregating fish. FAD sets by purse seine fleets are generally composed of adult skipjack tuna, juvenile bigeye tuna, and juvenile yellowfin tuna (Dagorn, L. et al. 2012). Fishing on drifting FADs has also shown decreases in average size of target catch, increases in catches of bigeye, and increases in bycatch (Gillett et al. 2002) when compared to unassociated sets. FAD sets also show a more varied composition of catch.

As shown in Table 2, the WCPO purse seine fleet catches mostly skipjack and yellowfin tuna. Based on data compiled by SPC (SPC 2012a), FAD sets generally yield higher catch rates (mt/day) for skipjack tuna than unassociated sets. Data from SPC also indicates that unassociated sets generally yield a higher catch rate for yellowfin tuna than FAD sets. This may be explained from the occurrence of unassociated sets in the more eastern areas of the Convention Area containing “pure” schools of large, adult yellowfin, which account for a larger catch (by weight) than the (mostly) juvenile yellowfin encountered in FAD sets (SPC 2012a). As indicated in Table 2, almost all the WCPO purse seine catch of bigeye is from FAD sets. Table 3 shows the breakdown of catch by set type for the U.S. purse seine fleet for the years 2008-2012.

Table 2: Annual U.S. WCPO purse seine retained catch estimates in metric tons by set type (unassociated and associated), 2008-2012

Year	Skipjack		Yellowfin		Bigeye		Totals
	Unass.	Ass.	Unass.	Ass.	Unass.	Ass.	
2008	69,170	89,935	20,058	23,491	466	6,203	209,323
2009	96,975	138,645	9,005	26,975	777	9,212	281,589
2010	112,738	86,504	18,993	19,878	1,111	6,302	245,526
2011	54,424	113,328	4,093	21,328	328	9,714	203,215
2012	69,523	96,851	10,923	20,852	556	6,973	205,678
5 year average	80,566	105,053	12,614	22,505	648	9,609	229,066

Source: SPC 2013.

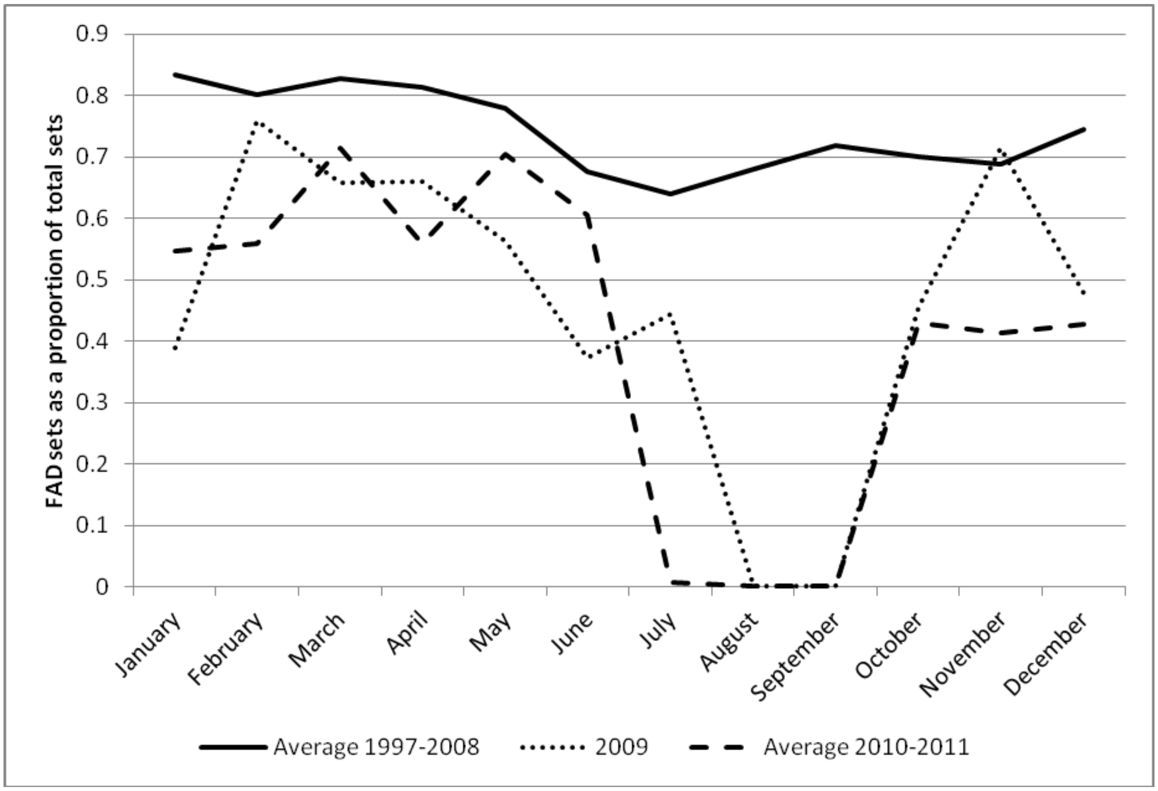
As indicated in Figure 7 below, from 1998 through 2011, FAD sets have at times accounted for more than 90 percent of all sets made by the fleet, and less than 30 percent of the sets in other years. There are likely many factors that cause this variability, all of which are not fully understood. However, some general determinates can be postulated: FADs provide a guaranteed location of fish (assuming they are marked with the appropriate electronic equipment) although the magnitude (in mt) of the schools associated with FADs can vary considerably. Therefore in times of high relative fuel prices FADs provide a risk-adverse option for vessel operators. FAD sets that yield no tuna are limited while free unassociated sets have a much higher likelihood of sets with little or no catch. FADs provide a source of fish that may or may not be economic to operators – especially those that offload to canneries. Small skipjack along with juvenile yellowfin and bigeye tuna are very often associated with FADs or floating objects – however, not all fleets or operators can find markets for "small fish," especially when ex-vessel price is low or fish demand is reduced. But in times of high fish demand when canneries are not rejecting fish based on size, FAD fishing presents an attractive scenario for many operators. On the other hand, although skipjack is the main target of the WCPO fishery, yellowfin tuna can provide an important component to vessel profitability given there is typically a premium paid for larger yellowfin, which are typically found in unassociated schools. Operators may be willing to search for these unassociated schools if fuel price is reasonable and fish can be found.

Figure 7: Associated sets as proportion of all sets by U.S. WCPO purse seine fleet, 1988-2011

Source: NMFS unpublished data.

Figure 8 below shows FAD sets as a proportion of all sets by the U.S. WCPO purse seine fleet, by month, for the periods 1997-2008, 2009, and 2010-2011 – the FAD restrictions pursuant to CMM 2008-01 were in effect for two months in 2009 (August and September) and for three months in 2010 and 2011 (July, August, and September).

Figure 8: FAD sets as proportion of all sets by U.S. WCPO purse seine fleet, by month, 1997-2008, 2009 and 2010-2011 averages.



Source: NMFS unpublished data.

Table 3 below shows FAD sets as a proportion of all sets made by the fleet in 2010 and 2011, as well as the proportion of FAD sets per fishing day in the months when FAD sets were allowed.

Table 3: FAD sets made by U.S. WCPO purse seine fleet in 2010 and 2011

	Total Sets	FAD Sets	FAD Set Ratio	Fishing Days	Sets/Fishing Day	% FAD Sets Per Year when FAD Sets Allowed
2010	8,628	2,344	27%	8,110	1.06	36
2011	6,212	3,360	54%	7,770	0.80	72
2010-2011 Average	7,420	2,852	38%	7,940	0.93	51

Source: NMFS unpublished data.

3.4. Bigeye Tuna, Skipjack Tuna, and Yellowfin Tuna

Table 4 summarizes the current status of bigeye tuna, yellowfin tuna, and skipjack tuna stocks in the Pacific Ocean, as determined by NMFS. The table expresses overfishing and overfished status in terms of the status determination criteria specified in the relevant Fisheries Management Plans (FMPs) or FEPs, as required by the MSA. Stock status with respect to these two criteria is presented as reported in the NMFS quarterly stock status updates.

Table 4: Stock status summary of primary HMS caught by the U.S. WCPO Purse Seine fleet[9]

Species	Stock	Overfishing?	Overfished?
Bigeye tuna (*Thunnus obesus)*	Pacific	**Yes**	No
Skipjack tuna *(Katsuwonus pelamis)*	Central western Pacific	No	No
Yellowfin tuna (*Thunnus albacares)*	Central western Pacific	No	No
	Eastern tropical Pacific	No	No

Source: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/

As shown in Table 4 above, using the MSA stock status determination criteria, overfishing is occurring on Pacific bigeye tuna but the bigeye tuna stock is not overfished (for the purpose of these status determinations bigeye tuna is considered a single pan-Pacific stock; however, most of the assessments upon which the determinations are based consider bigeye tuna as two stocks, one to the west of 150° W longitude and one to the east). Neither skipjack tuna nor yellowfin tuna in the WCPO or EPO are subject to overfishing or determined to be overfished.

3.4.1 Bigeye Tuna (*Thunnus obesus*)

Several studies on the taxonomy, biology, population dynamics, and exploitation of bigeye tuna have been carried out, including comprehensive reviews by Collette and Nauen (1983), and Whitelaw and Unithan (1997). Miyabe (1994) and Miyabe and Bayliff (1998) reviewed the biology and fisheries for bigeye tuna in the Pacific Ocean. Information from these studies are presented here – but may not be specifically referenced.

The species is a mixture between a tropical and temperate water tuna, characterized by equatorial spawning, high fecundity, and rapid growth during the juvenile stage with

[9] As discussed in more detail below, the stock structure of bigeye tuna in the Pacific Ocean is not well known. The WCPFC has to date treated bigeye tuna in the WCPO as a single and entire stock, both in terms of stock assessments and management decisions. The WCPFC decisions manage bigeye tuna in the WCPO. The WCPFC decisions also manage yellowfin tuna and skipjack tuna in the WCPO and when the terms WCPO bigeye tuna, WCPO yellowfin tuna, or WCPO skipjack tuna are used in this document, they refer to the stocks of these species as defined and managed by the WCPFC.

movements between temperate and tropical waters during its life cycle. Bigeye tuna are trans-Pacific in distribution, occupying epipelagic and mesopelagic waters of the Indian, Pacific, and Atlantic Oceans. The distribution of the species within the Pacific stretches between northern Japan and the north island of New Zealand in the western Pacific and from 40° N to 30° S in the eastern Pacific (Calkins 1980). Molecular analyses (Grewe et al. 1998) and tagging projects executed by the SPC (Langley et al. 2008) indicate that a single stock exists for Pacific bigeye tuna, however a tagging study done by Schaefer and Fuller (2009) revealed a low degree of mixing between EPO and WPO groups demonstrating relatively strong regional fidelity. Matsumoto et al. (2013) conducted a tagging study that showed bigeye also observed some degree of school fidelity. Large, mature-sized bigeye tuna are sought by sub-surface fisheries, primarily longline fleets. Smaller, juvenile fish are taken in many surface fisheries, either as a targeted catch or as a bycatch with other tuna species (Miyabe and Bayliff 1998). Large numbers are taken by purse seiners fishing on drifting objects in equatorial waters, however these fish tend to be of a smaller size as larger bigeye are less likely to associate with FADs (Schaefer and Fuller 2009). Basic environmental conditions favorable for survival include clean, clear oceanic waters between 13° C and 29° C. Hanamoto (1987) estimated optimum bigeye habitat to exist in water temperatures between 10° to 15° C at salinities ranging between 34.5 parts per thousand to 35.5 parts per thousand where dissolved oxygen concentrations remain above 1 milliliter/liter. He further suggested that bigeye range from the surface layers to depths of 600 meters. However, evidence from archival tagging studies indicates that greater depths and much lower ambient temperatures can be tolerated by the species. Bigeye do display some diel vertical migration tendencies. They have been observed to stay above the 20° C isotherm all the time when associated with a FAD, but free swimming schools tend to go below the 20° C isotherm during the day and come above it at night (Matsumoto et al. 2013). Juvenile bigeye occupy an ecological niche similar to juvenile yellowfin of a similar size.

There have been far fewer bigeye tuna tagged in the Pacific in comparison to skipjack and yellowfin tunas. Miyabe and Bayliff (1998) present summary information of some long distance movements of tagged bigeye tuna in the Pacific. Hampton et al. (1998) describe 8,000 bigeye tuna releases made in the western Pacific during 1990-1992. Most of the fish were recaptured close to the point of release; approximately 25 percent had moved more than 200 nautical miles, and more than 5 percent had moved more than 1,000 nautical miles. These migration patterns generally cause stock assessment in the WCPO and EPO to be conducted separately (Langley et al. 2008).

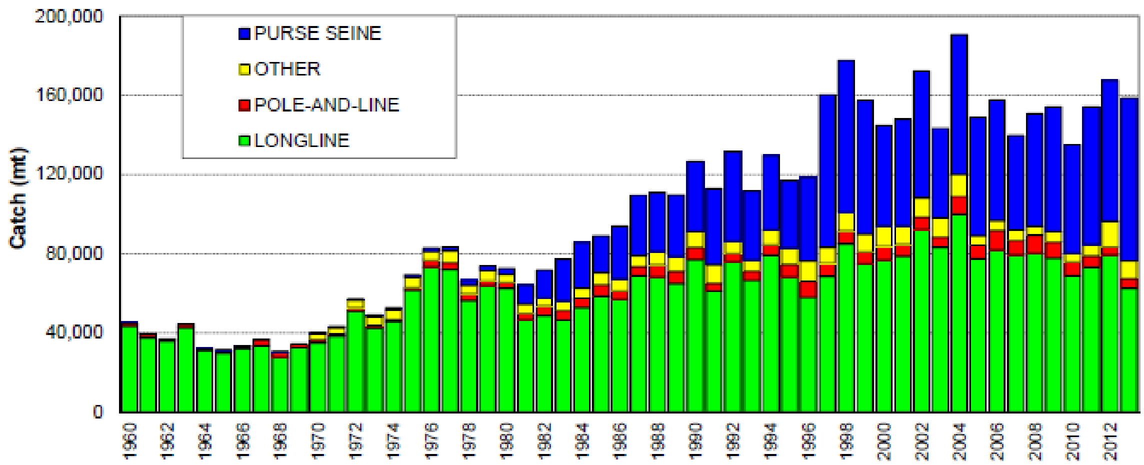
Feeding is opportunistic at all life stages, with prey items consisting primarily of crustaceans, cephalopods, and fish (Calkins 1980). There is significant evidence that bigeye feed at greater depths than yellowfin tuna, utilizing higher proportions of cephalopods and mesopelagic fishes in their diet thus reducing niche competition (Whitelaw and Unithan 1997). Spawning spans broad areas of the Pacific and occurs throughout the year in tropical waters and seasonally at higher latitudes at water temperatures above 23° or 24° C (Kume 1967). Bigeye are serial spawners, capable of repeated spawning at near daily intervals with batch fecundities of millions of ova per spawning event (Nikaido et al. 1991). Sex ratio is commonly accepted to be essentially 1:1 until a length greater than 150 centimeters after which the proportion of males increases. Alverson and Peterson (1963) state that juvenile bigeye less than 100 centimeters generally feed at the surface during daylight, usually near continental land masses, islands, seamounts, banks, or floating objects. Bigeye tuna are moderately fast growing, reaching maturity between the ages of two and a half and six years. A larger proportion of bigeye reach the age of eight, with some living as long as eighteen years (Langley et al. 2008).

Bigeye tuna, especially during the juvenile stages, aggregate strongly to drifting or anchored objects, large marine animals, and regions of elevated productivity, such as near seamounts and areas of upwelling (Calkins 1980; Hampton and Bailey 1993; Holland et al. 1999). Major fisheries for bigeye tuna exploit aggregation effects either by targeting biologically productive areas (deep and shallow seamount and ridge features) or by utilizing artificial fish aggregation devices to aggregate commercial concentrations of bigeye tuna. Juvenile and pre-adult bigeye of 35 centimeters to approximately 99 centimeters are regularly taken as a bycatch in the eastern and western Pacific purse-seine fisheries, usually on sets made in association with floating objects (Hampton and Bailey 1993). Juvenile bigeye tuna form mono-specific schools at or near the surface with similar-sized fish or may be mixed with skipjack and/or juvenile yellowfin tuna (Calkins 1980; Holland et al. 1999). Juvenile and adult bigeye tuna are also known to aggregate near seamounts and submarine ridge features where they are exploited by pole-and-line, handline, and purse seine fisheries (Fonteneau 1991; Holland et al. 1999).

Small bigeye are caught near the surface by purse seines, while larger fish are caught deeper using longline gear (Gillett and Langley 2007). In the western Pacific, the purse seine fishery is diverse, occurring in the waters of a number of island nations as well as the high seas and carried out by both small domestic fleets and distant water fleets from developed nations.

In 2012, the estimated total bigeye catch in the WCPO was 161,561 mt, the highest catch since 2006 (WCPFC 2013). Figure 9 below shows the catch of bigeye tuna in the Convention Area from 1960-2013 by gear type. The WCPFC Scientific Committee reviewed a new stock assessment of bigeye tuna in 2014, which concluded that current catches exceed maximum sustainable yield (MSY), recent levels of fishing mortality exceed the MSY-associated level, and the latest spawning biomass size was about 16% of the unfished size (Harley et al. 2014).

Figure 9: Convention Area bigeye tuna catch (mt) by gear 1960-2013



Source: Williams and Terawasi 2014.

3.4.2 Skipjack Tuna (*Katsuwonus pelamis*)

Skipjack tuna are concentrated mostly in tropical waters; though they also seasonally expand into subtropical waters in both the north and south Pacific. They can tolerate a temperature range of 15° C to 33° C (Dizon et al. 1977), but they are more commonly found in waters above 20° C (Dizon et al. 1978). The main characteristics of skipjack tuna are fast growth, early maturity (ten months to one year), high fecundity, year-round spawning (Hunter et al. 1986) over broad tropical regions, a relatively short life span compared to bigeye, albacore, and bluefin tunas, high and variable recruitment and few age classes on which the fishery depends. In describing the attributes of the species, Joseph (2002) states:

> These characteristics, together with their wide distribution, results in a huge biomass of fish, and very high levels of potential production. Ever since the beginning of heavy commercial exploitation in the early 1970s, the consensus among scientists had been that the populations of skipjack in all oceans of the world were lightly exploited and capable of sustaining much higher catches. This has been borne out by the fact that annual (global) catches increased from approximately 400,000 tons in 1970 to approximately 1.9 million tons in 1998. They remained near that level during 1999 and 2000.

In the western Pacific skipjack catches have continued to grow from that early 2002 quote.

CPUE trends for purse seiners dramatically rose between 2004 and 2007 before fluctuating until 2009. Post 2009 trends have been generally downward through 2011, but have not dipped much below 2005 levels (Harley et al. 2012).

In 2012, the estimated total skipjack catch in the WCPO exceeded 1.64 million mt, a slight decline from a record setting year in 2009 of 1.77 million mt, and a similarly high catch in 2010 of 1.68 million mt. The purse seine fishery was responsible for the bulk of this catch (WCPFC 2013).

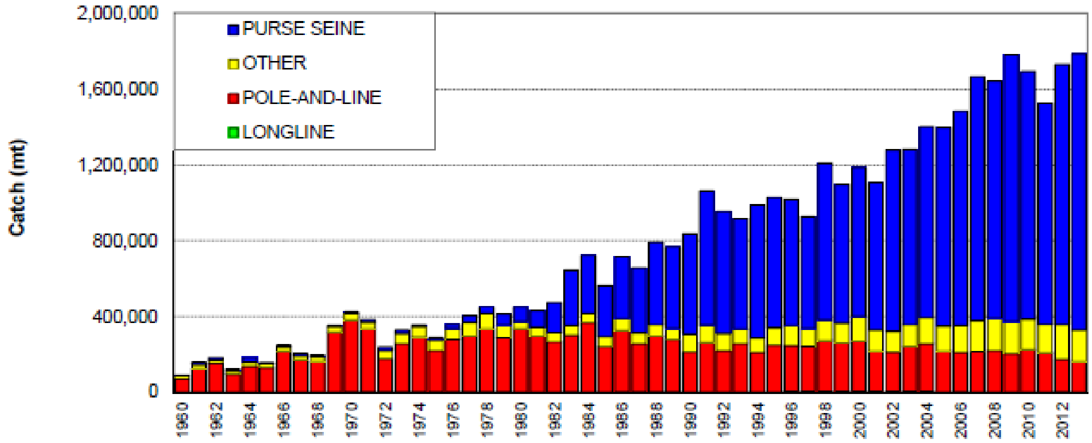
Historically, bait boats (pole-and-line) were the main gear used in catching skipjack tuna but since the 1950s, purse seiners have come to dominate the fishery. Some skipjack tuna are also caught incidentally by longliners, particularly those using shallow gear (typically hooked when retrieving the gear). In the WCPO, fishing for skipjack tuna occurs in the waters of a number of island nations and is carried out by both small domestic fleets and distant water fleets from developed nations.

Genetic studies of the Pacific population of skipjack suggest that some mixing of fish occurs across the Pacific Ocean, but for management purposes, the stocks in the western Pacific have been considered by most scientists to be independent of those in the eastern Pacific. Tagging data showing limited movement of skipjack from the eastern Pacific to the western Pacific support the same conclusion (Joseph 2002). Recent research suggests that fast-growing, short-lived species like skipjack and yellowfin may have median lifetime displacements on the order of 644–805 kilometers, supporting the idea of “regional fidelity” (Sibert and Hampton 2003). Remote sensing has corroborated this data. Like bigeye, skipjacks also display diel vertical migrations especially in relation to FADs. A tagging study done by Matsumoto et al. (2014) showed that skipjacks’ swimming depth was deeper during the day than at night, a pattern that was more obvious when they were not associated with a FAD. Those swimming with a FAD still showed some vertical migration patterns, but they were not as pronounced.

Skipjack in the North Pacific only demonstrated north-south migrations, seeming to primarily follow sea surface temperature, with some influence from sea surface chlorophyll, and physical ocean features like currents, fronts and eddies (Mugo et al. 2010). The possibility of restricted movements of skipjack in the WCPO suggests the possibility for local depletion despite the large total biomass. There is some evidence that skipjack tuna have migrations tied to ENSO events however this migration can be interrupted if they encounter FADs along the way. FAD placement could retain skipjack tuna in areas they would not normally colonize and change how they interact with their environment (Wang et al. 2014).

Figure 10 below shows the Convention Area skipjack tuna catch by gear type.

Figure 10: Convention Area skipjack tuna catch (mt) by gear 1960-2013



Source: Williams and Terawasi 2014.

3.4.3 Yellowfin Tuna (*Thunnus albacares*)

Several studies on the taxonomy, biology, population dynamics, and exploitation of yellowfin tuna exist, including comprehensive reviews by Collette and Nauen (1983) and Suzuki (1994).

This is a tropical tuna characterized by a rapid growth rate and fast development to maturity. Estimates of length at maturity for central and western Pacific yellowfin tuna vary widely with some studies supporting an advanced maturity schedule for yellowfin tuna in coastal or archipelagic waters (Cole 1980). However, most estimates suggest that the majority of yellowfin tuna reach maturity between two and three years of age on the basis of length-age estimates for the species. Longevity for the species may not be explicitly defined, but a maximum age of six to seven years is commonly used in stock assessment. Itano (2000) notes from a large data set from the western tropical Pacific that 50% of yellowfin tuna sampled from purse seine and longline gear at 105 centimeters were histologically classified as mature and predicts a length at 50% maturity of 104.6 centimeters. Under appropriate conditions, yellowfin tuna exhibit high spawning frequency and fecundity (Cole 1980). Spawning occurs in broad areas of the Pacific. Spawning fish require surface salinity and temperature that remain above 24° C (Itano 2000). This means that spawning can occur throughout the year in tropical waters and seasonally at higher latitudes in areas such as Hawaii (Suzuki 1994).

Yellowfin tuna are trans-Pacific in distribution, occupying the surface waters of all warm oceans, and form the basis of large surface and sub-surface fisheries. The adult distribution in the Pacific lies roughly within latitudes 40° N to 40° S as indicated by catch records of the Japanese purse seine and longline fishery (Suzuki et al. 1978). Blackburn (1965) suggests the range of yellowfin tuna distribution is bounded by water temperatures between 18° C and 31° C with commercial concentrations occurring between 20° C and 30° C. Although the species preferentially occupies the surface mixed layer above the thermocline, archival tagging has revealed dives to depths in excess of 1,000 meters with water temperature of 5.8° C (Dagorn et al. 2006). Yellowfin are apex predators that rely on a wide diverse food base, but most heavily prey upon small teleost fish and crustaceans. As juveniles they prey mostly on zooplankton (Graham et al. 2007).

Although tag and recapture programs have documented that yellowfin tuna are clearly capable of large-scale movements, most recaptures occur within a short distance of release. Sibert and Hampton (2003) applied an advection-diffusion model to yellowfin tuna tagging data and determined a median lifetime displacement of 375 miles. Adult yellowfin tuna aggregate in regions of elevated productivity, high zooplankton density (e.g., seamounts), and regions of upwelling and convergence. This association has presumably evolved to capitalize on the elevated forage available (Cole 1980; Suzuki 1994). Yellowfin tuna are also known to aggregate around drifting flotsam, anchored buoys, and large marine animals (Hampton and Bailey 1993). A 2013 study (Weng et al.) observed juvenile yellowfin behavior around a subsurface FAD. They found that yellowfin tuna displayed vertical migrations that included staying at depth during the day and swimming to shallower water at night. Their initial conclusions suggested that variations in these migration patterns may be based on a combination of weather, moon phase, prey movement, and predator avoidance. Major fisheries for yellowfin tuna exploit aggregation effects either by utilizing artificial FADs or by targeting areas with vulnerable concentrations of tuna.

A recent study of the relative impacts of associated and unassociated purse seine sets on yellowfin tuna indicates that unassociated sets yield slightly better stock status, in terms of higher spawning biomass and lower fishing mortality, than associated sets (Hampton and Pilling 2014).

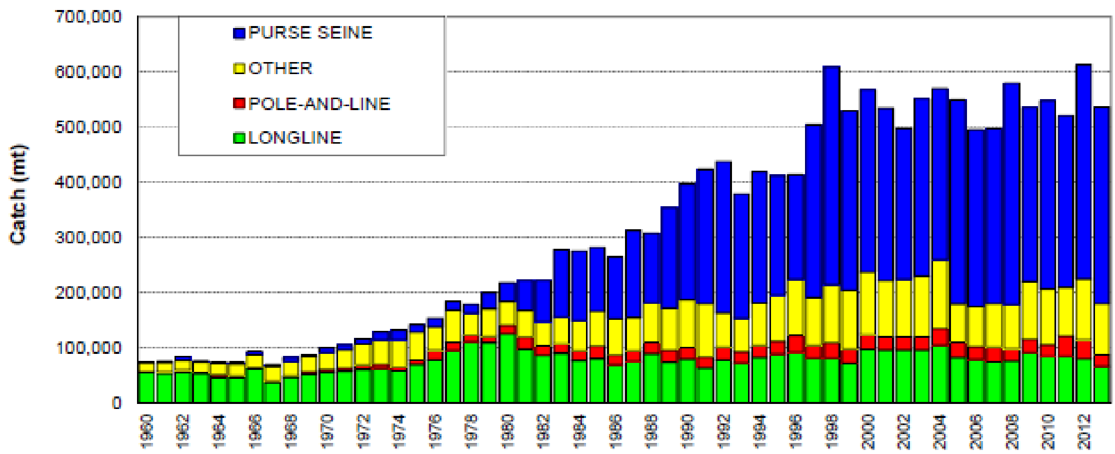
Some genetic analyses suggest that there may be several semi-independent yellowfin tuna stocks in the Pacific Ocean including possible eastern and western stocks, which may diverge around 150° W (Grewe and Hampton 1998; Itano 2000). Other analyses have failed to distinguish the presence of geographically distinct populations (Appleyard et al. 2001). Tagging studies have shown individual animals are capable of large east-west movements that would suggest considerable pan-Pacific mixing of the stock.

Purse seining and longlining are the main gear employed in catching yellowfin tuna. Small yellowfin tuna may be caught on the surface by purse seine vessels, while larger fish are typically caught deeper using longline gear (Gillet et al. 2007). In the western Pacific, the fishery is diverse, occurring in the waters of a number of island nations and on the high seas and carried out by both small domestic fleets and distant water fleets from developed nations.

In 2012, the estimated total yellowfin catch in the WCPO was 646,165 mt, the largest catch year to date. The purse seine fishery was responsible for the bulk of this catch

(WCPFC 2013). Figure 11 below shows the catch of yellowfin tuna in the Convention Area from 1960-2013 by gear type.

Figure 11: Convention Area yellowfin tuna catch (mt) by gear 1960-2013



Source: Williams and Terawasi 2014.

3.5. Biological Environment

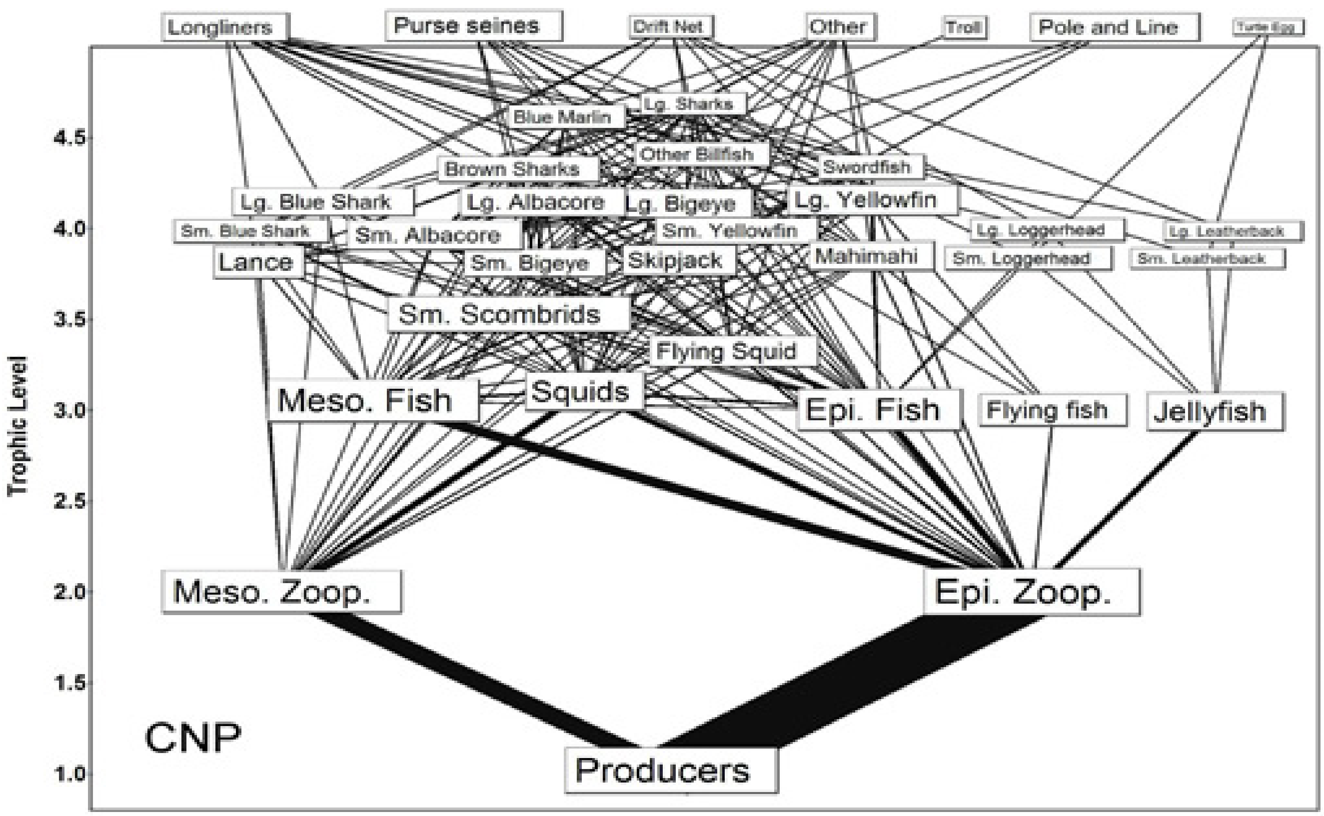
This section describes the other primary biological resources in the Convention Area as well as ecological interactions between the species.

3.5.1 Biodiversity and Ecosystem Function

The following description of a marine fisheries food web is taken from Begon et al. 2006, and Nybakken 1997. Primary producers such as diatoms, dinoflagellates, coccolithophores, cyanobacteria, and phytoplankton (plant planktonic forms) are organisms that utilize solar energy to convert carbon dioxide into oxygen. Primary producers are considered the first trophic (or eating) level. The next trophic level includes the zooplankton; animal planktonic forms such as copepods and larval stages of fish. These microorganisms drift through the water column grazing on phytoplankton and are referred to as “grazers.” Copepods are the most abundant zooplankton and make up most of the animal biomass in the ocean. The third trophic level is made up of the molluscan bivalves, amphipods, and larval forms of fish and crustaceans. Small bait fish make up the next trophic level. These include small fish such as sardines which in turn are eaten by big fish, the next trophic level. This level is made up of dominant predators, species that tend to migrate from coastal to deep ocean waters. They are also prey to the apex predators, species at the top trophic level. Species at this trophic level include tunas, billfish, and sharks. Dominant predators as well as apex predators feed opportunistically, eating anything they encounter. Digested or dead organic matter drifts towards the ocean bottom where both suspended decomposers and bottom feeders utilize the dead matter's energy completing the food web cycle. Both biotic and abiotic factors interact with each other to create this cycle. Figure 12 depicts a food chain from the central North Pacific Ocean.

Organisms at the top of the food web tend to be larger and less abundant. This is mainly due to the amount of energy it takes to get to the top of a food web. Marine food webs are highly connected because of the openness of marine ecosystems, general lack of specialists, potential for long life-spans, and significant size changes across the life histories of many species (Link 2002). Few fully charted examples of open water marine food webs exist. Those that do demonstrate limitations such as low species diversity, high species aggregation, limited spatiotemporal studies, and low chances of detecting important factors such as species richness, interactions or links (Link 2002).

Figure 12: Trophic levels in the central North Pacific Ocean



Source: Hinke et al. 2004.

Understanding an ecosystem depends on the identification of its food web and the exchanges between the different trophic levels in the food chain. Food webs show the dynamics of biomass production, sinks, and partitioning. Even minor changes in abiotic factors can cause far reaching changes in the spatial distribution of primary and secondary pelagic production (Richardson et al. 2004). For example, increases in sea surface temperatures may lead to increases or decreases in phytoplankton abundance depending on the *in situ* water temperature (Richardson et al. 2004). Tuna removal by commercial fisheries or other changes in biotic balances could have lasting effects lower down the food chain. Models done by Hinke et al. (2004), and observations by Halpern et al. (2006) demonstrate that by removing top predators, mid and low trophic level species may expand due to the elimination of competition and predation, and that top down food web control may be more important to ecosystem balance than previously thought. As apex predators, bigeye, skipjack and yellowfin tuna are in the top trophic level with distinct energy pathways supporting each species (Hinke et al. 2004). They are opportunistic feeders, a quality that complicates trophic impact analysis (Cox et al. 2002).

When there is an overlap in the primary forage trophic level, as when multiple fisheries act on top predator tunas, there are indirect effects seen within their own forage groups. Hinke et al. (2004) concluded that the primary food webs for individual fisheries were relatively simple (Figure 12). Ecosystem analysis, however, is difficult because the interactions among a broad group of species are not always apparent or recognized. Each stock has a unique recruitment history so the variability in biomass over time and among stocks cannot all be attributed to fishing (Sibert et al. 2006). Cox et al. (2002) also found that declines in top predators could result in an increase in smaller tunas that serve as prey to larger tunas. Predation as a component of natural mortality is still unclear, as are the effects of fishing mortality on these predation rates and abundance (Cox et al. 2002).

Purse seining directly affects higher trophic levels but may also affect the lower trophic levels. Hinke et al. (2004) found that the aggregate effect of purse seine fishing in the central north Pacific Ocean showed a shift in the highest distributions of biomass from upper level predators to their prey. They also observed that similar changes in the overall structure of food webs can be seen in pelagic purse seine tuna fisheries in the EPO. Fishing a species at maximum sustainable yield may lead to the erosion of their trophic structure and have negative effects on recruitment (Sibert et al. 2006). Reducing population biomass too dramatically could lead to the outright collapse of the food chain (Sibert et al. 2006).

In 2010, SPC reported some of its findings on an ongoing study of the WCPO tuna ecosystem that attempts to model and understand species relationships, with an end goal of assessing future environmental and fishery impacts on tuna stock health. In the analysis of stomach contents, yellowfin, bigeye and skipjack tuna were split into three size categories (baby, small and large) to account for growth-related diet shifts as well as whether they filled a predominantly predator or prey role. All three were found to primarily eat smaller fish, followed by mollusks and crustaceans (Allain 2010).

3.5.2 Other Non-Target Fish Species[10]

As depicted in Table 5 below, the U.S. Purse Seine fleet operating in the WCPO catches a small amount of various non-target fish species, some of which is retained.

Table 5: Observed Estimates of Catch and Rate of Discards of “Other” Fish Species in 2010 by the U.S. WCPO Purse Seine Fleet.

	Catch (MT)	% Discarded
Black Marlin	52.51	44
Blue Marlin	89.12	58
Marlins - Sailfishes-Spearfishes (UnID)	<.005	100
Sailfish	4.15	25
Shortbilled Spearfish	0.25	72
Striped Marlin	18.12	67
Swordfish	0.49	10
Bigeye Thresher	<.005	100
Blacktip Shark	0.21	99
Blue Shark	0.3	100
Bull Shark	0.06	100
Giant Manta	4.73	99
Manta Rays (UnID)	11.43	100
Mobula (aka Devil Ray)	3.07	99
Oceanic Whitetip Shark	1.68	97
Pelagic Stingray	0.12	98
Rays, Skates and Mantas	0.02	100
Silky Shark	85.15	99
Thresher Sharks	<.005	100
Albacore	0.88	1
Bullet Tuna	0.59	74
Frigate and Bullet Tunas	2.5	58
Frigate Tuna	1.73	74
Kawakawa	1.29	93
Mackerel (UnID)	0.01	100
Wahoo	12.5	38
Amberjack (Longfin Yellowtail)	0.01	0
Amberjack/Giant Yellowtail	62.27	77
Amberjacks	2.72	100
Barracudas	1.07	55

[10] This terminology is used throughout the supplemental EA to differentiate between bigeye tuna, a non-target species of the U.S. WCPO purse seine fleet, and other non-target fish species.

Batfishes	0.3	24
Bigeye Scad	94.72	1
Bigeye Trevally	3.2	40
Black Triggerfish	1.55	96
Brilliant Pomfret	6.35	2
Crestfish/Unicornfish	<.005	100
Drift Fish	<.005	100
Drummer (Blue Chub)	9.5	68
Filfish (Scribbled Leatherjacket)	<.005	100
Filefish (Unicorn Leatherjacket)	<.005	100
Filefishes	0.27	4
Golden Trevally	0.89	0
Great Barracuda	1.63	28
Greater Amberjack	10.6	100
Longfin Batfish	0.06	2
Mackerel Scad/Saba	146.01	97
Mahi Mahi/Dolphinfish/Dorado	44.66	73
Ocean Sunfish	0.98	17
Ocean Triggerfish (Spotted)	23.41	95
Oceanic Triggerfish (UnID)	106.37	95
Opah	0.02	100
Pelagic Puffer	<.005	100
Pilot Fish	<.005	100
Pomfrets and Ocean Breams	2.38	58
Rainbow Runner	510.71	94
Ray's Bream/Atlantic Pomfret	0.04	100
Sargent Major	<.005	100
Saury (Sanma)	0.01	20
Sickle Pomfret	0.01	0
Slender Sunfish	0.39	96
Snake Mackerel	0	100
Spanish Mackerel (Narrow-Barred)	0.04	80
Squids	0.02	75
Trevallies (Unidentified - Jacks)	1.74	58
Triple-Tail	0.25	5
Unspecified	19.21	85
Total	1342.3	

Source: SPC 2012b.

3.6. Protected Resources

This section provides information on protected resources in the WCPO.

3.6.1. Threatened and Endangered Species

Table 6 includes species listed under the U.S. Endangered Species Act (ESA; 16 USC 1531 *et seq*.) that could be affected by any changes to fishing patterns and practices in the Convention Area. NMFS has jurisdiction over all the species listed except for the dugong (*Dugong dugon)*, Short-tailed Albatross (*Phoebastria albatrus*), Newell's Shearwater (*Puffinus auricularis newelli*), Hawaiian Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*), Chatham Petrel (*Pterodroma axillaris*), Fiji Petrel (*Pseudobulweria macgillivrayi*), and Magenta Petrel (*Pterodroma magentae*). The U.S. Fish and Wildlife Service (USFWS) has jurisdiction over these seven species.

NMFS recently published a final rule to list 15 species of coral in the Indo-Pacific as endangered (see http://www.fpir.noaa.gov/Library/PRD/Coral/Final_Coral_Rule.pdf).

Table 6: Listing Status of Species in the WCPO Listed as Endangered or Threatened Under the ESA.

Scientific name	Common name	ESA Status
Balaenoptera musculus	Blue whale	Endangered
Balaenoptera physalus	Fin whale	Endangered
Megaptera novaeangliae	Humpback whale	Endangered
Eubalaena japonica	North Pacific right whale	Endangered
Balaenoptera borealis	Sei whale	Endangered
Physeter macrocephalus	Sperm whale	Endangered
Eubalaena australis	Southern right whale	Endangered
Sphyrna lewini	Scalloped hammerhead shark Indo-Pacific distinct population segment[11]	Threatened
Monachus schauinslandi	Hawaiian monk seal	Endangered
Dugong dugon	Dugong	Endangered
Phoebastria albatrus	Short-tailed Albatross	Endangered
Pseudorca crassidens	Main Hawaiian Islands insular false killer whale[12]	Endangered
Puffinus auricularis newelli	Newell’s Shearwater	Threatened
Pterodroma phaeopygia sandwichensis	Hawaiian Dark-rumped Petrel	Endangered
Pterodroma axillaris	Chatham Petrel	Endangered
Pseudobulweria macgillivrayi	Fiji Petrel	Endangered
Pterodroma magentae	Magenta Petrel	Endangered
Dermochelys coriacea	Leatherback turtle	Endangered
Caretta caretta	Loggerhead turtle North Pacific and South Pacific distinct population segments[13]	Endangered[1]

[11] NMFS issued a final determination on July 3, 2014 (79 FR 38214; effective September 2, 2014) to list the Central and Southwest Atlantic Distinct Population Segment and the Indo-West Pacific Distinct Population Segment of scalloped hammerhead shark as threatened species under the ESA and a final determination to list the Eastern Atlantic Distinct Population Segment and Eastern Pacific Distinct Population Segment of scalloped hammerhead shark as endangered species under the ESA.

[12] NMFS issued a final determination to list the Main Hawaiian Islands insular false killer whale distinct population segment as endangered (see 77 FR 70915; November 28, 2012).

[13] In September 2011, NMFS and USFWS listed nine distinct population segments of loggerhead turtles. Five of the distinct population segments were listed as endangered and four were listed as threatened. The two distinct population segments in the Pacific Ocean (North Pacific and South Pacific) are listed as endangered. See 76 FR 58868.

Scientific name	Common name	ESA Status
Chelonia mydas	Green turtle	Threatened
Lepidochelys olivacea	Olive Ridley turtle	Threatened
Eretmochelys imbricata	Hawksbill turtle	Endangered

Source: http://www.nmfs.noaa.gov/pr/; http://www.fws.gov/pacificislands/teslist.html.

The Final Biological Opinion and Incidental Take Statement for the U.S. purse seine fishery for effects to ESA-listed sea turtles and marine mammals was issued on November 1, 2006, concluding formal Section 7 ESA consultation for species under the jurisdiction of NMFS. In addition to the coral species mentioned above, two species under the jurisdiction of NMFS have been ESA-listed since that time: the main Hawaiian Islands insular false killer whale and the scalloped hammerhead shark. The range of the main Hawaiian Islands insular false killer whale does not overlap with the area in which the U.S. WCPO purse seine fleet operates.[14] The U.S. purse seine fishery, as described in Section 3.2 of this supplemental EA, does not involve contact with the seafloor or benthic habitats and operations take place far from coastlines, so the fishery would not spatially overlap with the listed coral species.

By letter dated January 28, 2009, the USFWS concurred with NMFS' determination that a proposed regulation that would not alter U.S. purse fishing practices or fishing effort would not be likely to adversely affect ESA-listed species under the jurisdiction of USFWS, which at the time included the dugong, Newell's Shearwater, and Short-tailed Albatross. This determination was based on the fact that there was minimal spatial overlap between the U.S. purse seine fishery and the range of the dugong, no spatial overlap between the U.S. purse seine fishery and range of the Short-tailed albatross, and no recorded interactions between the U.S. purse seine fleet and seabirds or dugongs, based on observer data from August 1994 to January 2007. Four species under the jurisdiction of USFWS (the Hawaiian Dark-rumped Petrel, Chatham Petrel, Fiji Petrel, and Magenta Petrel) have been ESA-listed since that time. Based on observer data available to NMFS, the U.S. WCPO purse seine fleet has not been reported to interact with seabirds.

[14] The range of the main Hawaiian Islands insular false killer whale includes the waters around the main Hawaiian islands from Ni'ihau to Hawai'i, and offshore as far as 140 kilometers. The U.S. WCPO purse seine fleet generally operates much further south, between 10° N and 10° S latitude.

3.6.2. Marine Mammals

All marine mammals receive protection under the Marine Mammal Protection Act (MMPA; 16 USC 1361, *et seq*.). The marine mammals found in the WCPO but not listed under the ESA as threatened or endangered (i.e., not included in Table 6 above) are listed in Table 7 below.

Table 7: Non-Listed Marine Mammals that Occur in the WCPO.

Species name	Common name
Balaenoptera acutorostrata	Minke whale
Balaenoptera bonaerensis	Antarctic minke whale
Balaenoptera edeni	Bryde's whale
Berardius arnuxii	Arnoux's beaked whale
Callorhinus ursinus	Northern Fur Seal
Caperea marginata	Pygme right whale
Delphinus delphis	Short-beaked common dolphin
Eschrichtius robustus	Gray whale
Feresa attenuata	Pygmy killer whale
Globicephala macrorhynchus	Short-finned pilot whale
Globicephala melas	Long-finned pilot whale
Grampus griseus	Risso's dolphin
Hyperoodon planifrons	Southern bottlenose whale
Indopacetus pacificus	Longman's beaked whale
Kogia breviceps	Pygme sperm whale
Kogia sima	Dwarf sperm whale
Lagenodelphis hosei	Fraser's dolphin
Lagenorhynchus cruciger	Hourglass dolphin
Lagenorhynchus obliquidens	Pacific white sided dolphin
Lagenorhynchus obscurus	Dusky dolphin
Lissodelphis peronii	Southern right whale dolphin
Mesoplodon bowdoini	Andrew's beaked whale
Mesoplodon densirostris	Blainville’s Beaked Whale
Mesoplodon ginkgodens	Ginkgo-toothed whale
Mesoplodon grayi	Gray's beaked whale
Mesoplodon hectori	Hector's beaked whale
Mesoplodon layardii	Strap-toothed whale
Mesoplodon stejnegeri	Stejneger's beaked whale
Mesoplodon traversii	Spade-toothed whale
Mirounga angustirostris	Northern Elephant Seal

Species name	Common name
Orcinus orca	Killer whale
Peponocephala electra	Melon headed whale
Phocoena dioptrica	Spectacled porpoise
Phocoena phocoena	Harbor porpoise
Phocoenoides dalli	Dall's porpoise
Pseudorca crassidens	False killer whale[15]
Stenella attenuata	Pantropical spotted dolphin
Stenella coeruleoalba	Striped dolphin
Stenella longirostris	Spinner dolphin
Steno bredanensis	Rough toothed dolphin
Tursiops truncatus	Bottlenose dolphin
Ziphius cavirostris	Cuvier's beaked whale

Source: http://www.wpcouncil.org/species-protection/marine-mammals/; http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/.

3.6.3. Essential Fish Habitat (EFH)

The EFH provisions (50 CFR Part 600 Subpart J) of the MSA are intended to maintain sustainable fisheries. NMFS and the Fishery Management Councils must identify and describe EFH and Habitat Areas of Particular Concern (HAPC) for each managed species using the best available scientific data and must ensure that fishing activities being conducted in such areas do not have adverse effects to the extent practicable. This process consists of identifying specific areas and the habitat features within them that provide essential functions to a particular species for each of its life stages. Both the EFH and the HAPC are documented in the FEPs established under the MSA.[16]

EFH and HAPC have been designated in the WCPO for pelagic, bottomfish and seamount groundfish, precious corals, crustaceans, and coral reef species. Table 8 lists the EFH and HAPC for species managed under the various western Pacific FEPs.

[15] As stated in Table 3 above, the Main Hawaiian Islands insular false killer whale distinct population segment has been listed as endangered.

[16] The FEPs being the FEP for the American Samoa Archipelago, the FEP for the Mariana Archipelago; the FEP for the Pacific Remote Island Areas; the FEP for the Hawaii Archipelago; and the FEP for Pacific Pelagic Fisheries of the Western Pacific Region.

Table 8: EFH and HAPC for Management Unit Species for the Western and Pacific Region.[1]

Species Group	EFH (juveniles and adults)	EFH (eggs and larvae)	HAPC
Pelagics	Water column down to 1,000 meters	Water column down to 200 meters	Water column down to 1,000 meters that lies above seamounts and banks
Bottomfish	Water column and bottom habitat down to 400 meters	Water column down to 400 meters	All escarpments and slopes between 40-280 meters, and three known areas of juvenile opakapaka habitat
Seamount Groundfish	(adults only): water column and bottom from 80 to 600 meters, bounded by 29°-35°N and 171°E-179°W	(including juveniles): epipelagic zone (0-200 meters) bounded by 29°-35°N and 171°E-179°W	Not identified
Precious Corals	Keahole, Makapuu, Kaena, Wespac, Brooks, and 180 Fathom gold/red coral beds, and Milolii, S. Kauai and Auau Channel black coral beds	Not applicable	Makapuu, Wespac, and Brooks Bank beds, and the Auau Channel
Crustaceans	Lobsters: Bottom habitat from shoreline to a depth of 100 meters Deepwater shrimp: The outer reef slopes at depths between 300-700 meters	Water column down to 150 meters Water column and associated outer reef slopes between 550 and 700 meters	All banks with summits less than 30 meters No HAPC designated for deepwater shrimp
Coral Reef Ecosystems	Water column and benthic substrate to a depth of 100 meters	Water column and benthic substrate to a depth of 100 meters	All Marine Protected Areas identified in FEP, all PRIAs,[2] many specific areas of coral reef habitat

Source: FEP for the American Samoa Archipelago, Table 20 (WPRFMC 2009).
[1] All areas bounded by the shoreline and the outward boundary of the U.S. EEZ, unless otherwise indicated.
[2] Pacific Remote Island Areas.

3.6.4. National Wildlife Refuges (NWRs) and Monuments

Pursuant to the National Wildlife System Administration Act of 1966 (16 USC 668dd, *et seq*.), USFWS carries out the mission of NWRs, which is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." National Monuments are designated by the President using the authority of the Antiquities Act of 1906 (16 U.S.C. 431). This act allows the President to protect areas of "historic or scientific significance." There are 10 NWRs and four National Monuments in the

Convention Area: Guam NWR; Baker Island NWR; Howland Island NWR; Jarvis Island NWR; Johnston Island NWR; Kingman Reef NWR; Palmyra Atoll NWR; Rose Atoll NWR; Hawaiian Islands NWR; Midway Atoll NWR; Papahanaumokuakea Marine National Monument; the Marianas Trench Marine National Monument; the Pacific Remote Islands Marine National Monument; and the Rose Atoll Marine National Monument.

NMFS published a final rule that prohibits commercial fishing in the Pacific Remote Islands and Rose Atoll Monuments, and in the Islands Units of the Marianas Trench Monument; establishes management measures for non-commercial and recreational charter fishing in the Monuments; and prohibits the conduct of commercial fishing outside the Monuments and non-commercial fishing inside the Monuments during the same trip (78 FR 32996; June 3, 2013).

Chapter 4

Chapter 4 Environmental Consequences: Direct and Indirect Effects

This chapter provides an analysis of the direct and indirect environmental effects that could be caused by the implementation of the 2015 FAD restrictions rule under either of the action alternatives, as well as the No-Action Alternative and compares the alternatives; cumulative effects are addressed in Chapter 5.[17]

This chapter begins with a discussion of the potential impacts[18] from each of the alternatives to the U.S. WCPO purse seine fleet. Then, Sections 4.2 through 4.6 analyze the potential environmental impacts these changes to the fleet could cause to the resources in the affected environment.

4.1. The U.S. WCPO Purse Seine Fleet

The direct and indirect effects to the U.S. WCPO purse seine fleet would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The Regulatory Impact Review (RIR) for the 2015 FAD restrictions rule (NMFS 2014), prepared under Executive Order 12866, provides an analysis of the potential economic impacts of the rule to the fleet and to the nation and is incorporated here by reference, pursuant to 40 CFR §1502.23. The general information regarding economic impacts in the discussion below is provided to help compare the alternatives and to determine whether the economic impacts are interrelated with environmental impacts. Thus, the discussion in this section focuses on potential changes to the fishing patterns and practices of the fleet from each of the alternatives.

4.1.1 Alternative 1: No-Action Alternative

Under Alternative 1, the No-Action Alternative, the 2015 FAD restrictions rule under either of the action alternatives would not go into effect, and the fleet would continue to be managed under existing regulatory requirements, including SPTT-related requirements, and any changed or new requirements as the result of a renegotiated Treaty and its associated economic assistance agreement, as described in more detail in Section 3.2 of this document. Given that FAD restrictions have been in place since 2009, there would be some changes to the fishing patterns and practices of the fleet relative to patterns and practices in recent years. Overall, since the opportunity to fish on FADs is

[17] According to the CEQ regulations implementing the Procedural Provisions of NEPA at 40 CFR §1508.7 and §1508.8, direct effects are caused by the action and occur at the same time and place; indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable; and cumulative effects are the impacts on the environment that result from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

[18] The terms effects and impacts are used interchangeably throughout this document. See 40 CFR 1508.8.

just one component of the fishery, there would be no substantial direct changes to the fishing patterns and practices of the fleet.

As described in Chapter 3, Section 3.3, the U.S purse seine fleet operating in the WCPO has used FADs to varying degrees for its fishing operations. As indicated in Table 2 of this supplemental EA, FAD sets tend to yield more skipjack and small bigeye tuna than yellowfin tuna. Unassociated sets tend to yield more yellowfin tuna than skipjack tuna and very little bigeye tuna. Sections 3.2 and 3.3 of this supplemental EA provides information on the current fishing opportunities available to the fleet, as well as information on the ratio of FADs sets per year relative to total sets per year, based on data from 2010-2011, when 100% observer coverage was in effect. Should the same fishing opportunities be present in 2015 as they are in 2014, an upper bound estimate of fishing days for the U.S. purse seine fleet in 2015 is 10,252 days. Given the number of sets per day in that same period (0.93 as shown in Table 3 of this supplemental EA), the upper bound estimate of sets for 2015 would be approximately 9,581 sets. Should fishing opportunities outside the U.S. EEZ and high seas be restricted, a lower bound estimate of fishing days for the U.S. purse seine fleet in 2015 is 1,828 days. Given the number of set per day in that same period (0.93 as shown in Table 3 of this supplemental EA), the lower bound estimate of sets for 2015 would be approximately 1,708 sets. As indicated in Table 3 of this EA, about 51% of sets per year when FAD sets are allowed are FAD sets. Thus, the upper bound estimate of FAD sets per month for the U.S. purse seine fleet in 2015 under the No-Action Alternative can be projected to be 407 FAD sets per month and the lower bound estimate of FAD sets per month for the U.S. purse seine fleet in 2015 can be projected to be 73 FAD sets per month.

CMM 2013-01 includes specific objectives for the WCPO stocks of bigeye tuna, skipjack tuna, and yellowfin tuna: for each, the fishing mortality rate is to be reduced to or maintained at levels no greater than the fishing mortality rate associated with maximum sustainable yield. As stated in Section 3.4 of this supplemental EA, Pacific bigeye tuna is currently subject to overfishing but not overfished, while the stocks of yellowfin tuna and skipjack tuna in the WCPO and EPO are neither experiencing overfishing nor overfished. As shown in Table 1 and Table 2 in Chapter 3 of this supplemental EA, skipjack tuna accounts for the majority of the fleet’s catch, with the proportion of catch of each of the three tropical tuna species being approximately 81 percent skipjack tuna, 15 percent yellowfin tuna, and four percent bigeye tuna for the period 2008-2012. It is conceivable that the indirect effects (or long-term effects), of this alternative on the fleet would be negative, in that the No-Action Alternative would be less likely to achieve the objectives of CMM 2013-01. However, the 2015 FAD restrictions rule would implement only one component of CMM 2013-01, and as discussed in Section 3.4 of this supplemental EA, many factors other than purse seine fishing, especially the contribution of the U.S. fleet, affect the stock status of bigeye tuna, yellowfin tuna, and skipjack tuna in the WCPO.

Also, as described further below, aside from impacts to the number of FAD sets and when in the year they occur, implementation of the 2015 FAD restrictions rule under any of the action alternatives are not expected to substantially change the fishing practices and patterns of the fleet as a whole, since the fleet would continue to be able to fish during the time periods when FAD restrictions would be in effect, and the number of FAD sets per year experiences considerable variability, as described in Section 3.3 of this supplemental EA. Thus, the fishing patterns and practices of the fleet under the No-Action Alternative would be similar to the fishing patterns and practices of the fleet under any of the action alternatives analyzed in this supplemental EA.

4.1.2 Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit

Under Alternative 2, there would be a prohibition on setting on FADs and on fish that have aggregated in association with a fishing vessel, in the Convention Area between the latitudes of 20° North and 20° South, from July 1 through September 30, 2015. There would also be a specified 2,202 limit on the number of FAD sets that could be made in 2015. In order to estimate FAD sets with respect to reaching the limit, vessel owners and operators would be required to submit information on FAD sets to NMFS at the end of each fishing day, but this new administrative burden is not anticipated to affect the fishing patterns and practices of the fleet.

During the three months in which no fishing on FADs would be allowed, no fishing on or near schools associated with FADs, and no deploying or servicing FADs, would be permitted in the Convention Area in the area between 20° N. and 20° S. latitude. These prohibitions would also apply if the FAD sets limit of 2,202 is reached in 2015. The specific prohibitions, which include details for enforcement purposes, would be the following:

- No setting of a purse seine around a FAD or within one nautical mile of a FAD;
- No setting of a purse seine in a manner intended to capture fish that have aggregated in association with a FAD or a vessel, such as by setting the purse seine in an area from which a FAD has been moved or removed within the previous eight hours, or setting the purse seine in an area in which a FAD has been inspected or handled within the previous eight hours, or setting the purse seine in an area into which fish were drawn by a vessel from the vicinity of a FAD;
- No deployment of a FAD into the water;
- No repairing, cleaning, maintaining, or otherwise servicing a FAD, including any electronic equipment used in association with a FAD, in the water or on a vessel while at sea, except that: a FAD may be inspected and handled as needed to identify the owner of the FAD, identify and release incidentally captured animals, un-foul fishing gear, or prevent damage to property or risk to human safety; and a FAD may be removed from the water and if removed may be cleaned, provided that it is not returned to the water.
- No submerging lights under water, suspending or hanging lights over the side of the purse seine vessel or any associated skiffs, other watercraft or equipment, or directing or using lights in a manner other than as needed to illuminate the deck of

> the purse seine vessel or associated skiffs, watercraft or equipment, except as needed to comply with navigational requirements, to ensure the health and safety of the crew, and in emergencies and as needed to prevent human injury or the loss of human life, the loss of the purse seine vessel, skiffs, watercraft or aircraft, or environmental damage.

As discussed in Section 3.3 of this supplemental EA, FAD sets tend to yield smaller fish, including smaller adult skipjack tuna, and juvenile bigeye and yellowfin tuna, while unassociated sets tend to yield larger fish – primarily adult skipjack tuna and yellowfin tuna.

The overall composition of the catch made by the fleet would likely be affected by the FAD restrictions (as intended by CMM 2013-01). It is expected that there would be a transfer of effort to fishing on unassociated sets during the prohibition period (i.e., the period of time during which the prohibitions would be in effect – three months of the year and/or when the FAD set limit is reached) (see Figure 8 in Chapter 3) – given that represents the only viable fishing option if vessels continue to operate – so the composition of the catch during those periods would likely consist of more larger yellowfin and skipjack tuna and less bigeye tuna. As shown in Table 2 in Chapter 3, bigeye tuna accounts for only a very small percentage of the catch of the U.S. purse seine fleet operating in the WCPO. FAD sets contribute a substantial percentage of skipjack. By putting restrictions on FAD fishing for three months of the year or more in 2015, skipjack tuna catches would expect to be impacted accordingly.

Should the upper bound estimate of fishing opportunities be available to the U.S. purse seine fleet in 2015, the limit on FAD sets would restrict fishing on FADs and would reduce the number of FAD sets to less than half of the upper bound estimate of FAD sets per year. This could mean that the limit would be reached earlier in the year than when July 1, 2015, when the prohibition period would otherwise start. As indicated in Figure 7 in Chapter 3 of this supplemental EA, the number of FAD sets is distributed fairly evenly throughout the year. Using the estimate of 407 FAD sets per month, as indicated in 4.1.1 of this supplemental EA, the 2,202 FAD set limit would be anticipated to be reached in May or June. Thus, Alternative 2 could result in essentially a six to seven month prohibition period for fishing on FADs in 2015. However, should the lower bound estimate of fishing opportunities be available to the U.S. purse seine fleet in 2015, the limit on FAD sets would not further restrict fishing on FADs, since the lower bound estimate of 73 FAD sets per month is much below the annual 2,202 FAD set limit.

When the FAD prohibitions are effect, vessel operators would be able to set only on unassociated schools. This constraint on the type of set that may be made at any given time would be expected to adversely affect vessels' profitability. Vessel operators might be able to mitigate those impacts by choosing to schedule their routine vessel and equipment maintenance during time when FAD setting is prohibited. Nonetheless, it is conceivable that the FAD restrictions could lead to less fishing effort by the U.S. WCPO purse seine fleet in 2015 than would occur without the restrictions. However, as shown in Figure 4 of this supplemental EA, during the FAD restrictions in 2009-2012 (August 1 through September 30 in 2009, and July 1 through September 30 in 2010, 2011, and 2012), there was no substantial change in the proportion of the fleet that fished during those months in each of those years when compared to the proportion that fished during those months in 1997-2008 when no FAD restrictions were in place. Thus, little effect on overall fishing effort is expected under this alternative.

The FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the three months that FAD sets would be prohibited and should the 2,202 FAD set limit be reached, as compared to the No-Action Alternative.

4.1.3 Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit

Under Alternative 3, there would be a prohibition on setting on FADs and on fish that have aggregated in associated with a fishing vessel, in the Convention Area between the latitudes of 20° North and 20° South, during the months of January, February, July, August and September in 2015. There would also be a specified 3,061 limit on the number of FAD sets that could be made in 2015. In order to estimate FAD sets with respect to reaching the limit, vessel owners and operators would be required to submit information on FAD sets to NMFS at the end of each fishing day, but this new administrative burden is not anticipated to affect the fishing patterns and practices of the fleet.

During the five months no fishing on FADs would be allowed, no fishing on or near schools associated with FADs or vessels, and no deploying or servicing FADs, would be permitted in the Convention Area in the area between 20° N. and 20° S. latitude. These same prohibitions would apply if the 3,061 FAD set limit is reached in 2015. The specific prohibitions, which include details for enforcement purposes, would be the following:

- No setting of a purse seine around a FAD or within one nautical mile of a FAD;
- No setting of a purse seine in a manner intended to capture fish that have aggregated in association with a FAD or a vessel, such as by setting the purse seine in an area from which a FAD or a vessel has been moved or removed within the previous eight hours, or setting the purse seine in an area in which a FAD has been inspected or handled within the previous eight hours, or setting the purse seine in an area into which fish were drawn by a vessel from the vicinity of a FAD;
- No deployment of a FAD into the water;
- No repairing, cleaning, maintaining, or otherwise servicing a FAD, including any electronic equipment used in association with a FAD, in the water or on a vessel while at sea, except that: a FAD may be inspected and handled as needed to identify the owner of the FAD, identify and release incidentally captured animals, un-foul fishing gear, or prevent damage to property or risk to human safety; and

a FAD may be removed from the water and if removed may be cleaned, provided that it is not returned to the water.

- No submerging lights under water, suspending or hanging lights over the side of the purse seine vessel or any associated skiffs, other watercraft or equipment, or directing or using lights in a manner other than as needed to illuminate the deck of the purse seine vessel or associated skiffs, watercraft or equipment, except as needed to comply with navigational requirements, to ensure the health and safety of the crew, and in emergencies and as needed to prevent human injury or the loss of human life, the loss of the purse seine vessel, skiffs, watercraft or aircraft, or environmental damage.

The FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the five months the restrictions would be in effect and should the 3,061 FAD set limit be reached, and possibly reducing the amount of fishing effort during the prohibition periods relative to other periods of the year.

The FAD restrictions would be in effect for January and February and July-September, so using the estimate of 407 FAD sets per month for the upper bound estimate of fishing opportunities and 73 FAD sets per month for the lower bound estimate of fishing opportunities, the FAD set limit of 3,061 would not be expected to be reached under either the upper bound or lower bound estimates.

4.2. Physical Environment and Climate Change

None of the alternatives (No-Action Alternative or any of the action alternatives) would be expected to cause direct or indirect effects to the physical environment of the WCPO. In addition, none of the alternatives would be expected to contribute to climate change. Under the action alternatives, the FAD restrictions could increase search time and thus, fuel use, if vessels in the fleet shift to fishing on unassociated sets. However, the overall fuel use of the fleet would be expected to depend more on other factors (market conditions, fishing opportunities (e.g., number of fishing days available and in which locations, oceanographic changes affecting the location of the target tunas, etc.)), and the action alternatives would not be expected to lead to increased emissions of greenhouse gases affecting climate change.

4.3. Bigeye Tuna, Skipjack Tuna, and Yellowfin Tuna

This section presents the analysis of the potential impacts that could be caused by the No-Action Alternative and each of the action alternatives for the 2015 FAD restrictions rule to bigeye tuna, skipjack tuna, and yellowfin tuna in the WCPO – the three stocks on which CMM 2013-01 focuses.

4.3.1 Alternative 1: No-Action Alternative

Under Alternative 1, the U.S. purse seine fleet would continue to be managed through existing requirements, and the 2015 FAD restrictions would not be implemented. Thus, there would be no direct changes to the fishing patterns or practices of the fleet and thus, no resulting direct effects to bigeye tuna, yellowfin tuna, or skipjack tuna.

As shown in Table 4 of this supplemental EA, the stock of Pacific bigeye tuna in the Pacific is currently experiencing overfishing, but the stocks of skipjack tuna and yellowfin tuna in the WCPO and EPO are neither experiencing overfishing nor are they overfished. CMM 2013-01 includes specific objectives for the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna: for each, the fishing mortality rate is to be reduced to or maintained at levels no greater than the fishing mortality rate associated with maximum sustainable yield. Because Alternative 1 would not implement the provisions of CMM 2013-01 for the U.S. purse seine fleet, the objectives of the CMM would be less likely to be met under this alternative than under any of the action alternatives. It is conceivable that the indirect effects (or long-term effects), of this alternative on bigeye tuna, yellowfin tuna, and skipjack tuna would be increased fishing pressure on stocks, leading to a decline to sizes smaller than that which is capable of producing MSY.

On the other hand, as stated above, many other factors affect the status of these stocks, and implementation of 2015 FAD restrictions is just one component of CMM 2013-01. Moreover, the action alternatives would not substantially change the fishing practices and patterns of the fleet, since the fleet would continue to fish on unassociated sets during the time periods when the FAD restrictions would be in effect, and the number of FAD sets varies from year to year based on other factors. Thus, the status of the stocks under the No-Action Alternative would not differ substantially from any of the action alternatives. Under this alternative, however, any decreased impacts from fishing that the stocks could experience from implementation of the 2015 FAD restrictions under the action alternatives would not occur. Thus, there could be some increased potential for long-term negative effects to the stocks over the action alternatives, although such effects cannot be predicted with certainty.

4.3.2 Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit

Overall, the direct effects of Alternative 2 would be to decrease the impacts from fishing on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna by reducing the fishing mortality on predominantly juvenile tunas and adult skipjack tuna. The FAD restrictions could also have some potentially adverse effects on the WCPO stock of yellowfin tuna by an increase in the overall fishing mortality on the stock as a result of the fleet targeting large unassociated tunas during the FAD restrictions. However, any potential adverse effects would be ameliorated by reduced catches of juvenile yellowfin tuna during the FAD restrictions, which may have a chance to move or recruit to a deeper, non-predominantly FAD associated life cycle that would provide benefits in terms of additional adult yellowfin tuna available to unassociated fishing. Indeed, as indicated by the recent study conducted in 2014, unassociated sets yield slightly better stock status for yellowfin tuna, in terms of higher spawning biomass and lower fishing mortality, than associated sets (Hampton and Pilling 2014).

The indirect effects of Alternative 2 on bigeye, skipjack, and yellowfin tuna stocks would be similar, since this alternative would be expected to result in some decreased fishing mortality on the stocks, particularly decreased fishing mortality on juvenile tunas, which could lead to long-term positive effects on the stocks. However, these effects would be relatively small, because numerous other factors contribute to the status of the stocks.

As discussed in Chapter 3, Section 3.4, adult bigeye tuna, skipjack tuna, and yellowfin tuna are considered among the top predators of the tropical or warm pool marine ecosystem. Changes to the stocks of these species could lead to trophic interactive effects, including increased competition for prey species with other top predators. Larval and juvenile tunas are also sources of food for other marine species, such as fish, seabirds, porpoises, marine mammals, and sharks. Thus, increases in larval and juvenile tuna could increase the food available for these other species. It is unlikely that the effects of Alternative 2 to the stocks of bigeye, skipjack and yellowfin tuna, which would be short-lived, would be large enough to impact the marine ecosystem. Overall, Alternative 2 would not cause substantial effects on biodiversity and ecosystem function.

4.3.3 Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit

Under Alternative 3, the impacts to the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna would be similar to the impacts under Alternative 2. However, if the upper bound estimate of fishing opportunities is available to the fleet in 2015, as discussed above in 4.1.1 of this supplemental EA, it is much less likely that the 3,061 FAD set limit would be reached under Alternative 3 than the 2,202 FAD set limit under Alternative 2. Thus, the duration of the FAD prohibitions could be longer under Alternative 2 than under Alternative 3, if the upper bound estimate of fishing opportunities is available to the fleet in 2015. Accordingly, any effects on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna would be less than under Alternative 2.

If the lower bound estimate of fishing opportunities is available to the fleet in 2015, the duration of the FAD prohibition periods would be longer under Alternative 3 than under Alternative 2, since the FAD set limits would not be reached under either alternative, so the fleet would experience a three month FAD prohibition period under Alternative 2 and a five month FAD prohibition period under Alternative 3. Accordingly, any effects to the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna would be more than under Alternative 2.

4.4. Other Non-target Fish Species[19]

This section discusses the potential impacts from the No-Action Alternative or from implementation of the action alternatives for the 2015 FAD restrictions rule on non-target fish species caught by the U.S.WCPO purse seine fleet.

4.4.1 Alternative 1: No-Action Alternative

Under Alternative 1, the No-Action Alternative, there would be no direct changes to the existing fishing patterns of the U.S. WCPO purse seine fleet, and thus, no direct effects to non-target fish species. As discussed above in Section 4.1.4 of this EA, it is conceivable that the indirect, or long-term, effects of the No-Action Alternative on bigeye tuna, skipjack tuna, and yellowfin tuna would be negative, should this alternative lead to increased fishing pressure on the stocks. Any such increased fishing pressure could also lead to long-term negative effects on other non-target fish species that are caught by the U.S. WCPO purse seine fleet. Given that many other factors influence the status of non-target fish species (e.g., fisheries that target those species, oceanic conditions), it is likely that the indirect effects to non-target species under the No-Action Alternative stemming from lack of implementation of the 2015 FAD restrictions rule would be negligible. In addition, as discussed above, none of the action alternatives would substantially change the fishing patterns and practices of the fleet as a whole. Thus, the fishing patterns and practices of the fleet under the No-Action Alternative would be similar to the fishing patterns and practices of the fleet under any of the action alternatives analyzed in this supplemental EA. So the effects to other non-target species from the No-Action Alternative would not be substantially different from the effects to other non-target species under any of the action alternatives.

[19] This terminology is used throughout the supplemental EA to differentiate between bigeye tuna, a non-target species of the U.S. WCPO purse seine fleet, and other non-target fish species.

4.4.2 Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit

Under Alternative 2, there could be some change in the amount and type of non-target fish species caught by the U.S. WCPO purse seine fleet. As discussed above, during the periods when the FAD prohibitions would be in effect, the fleet may fish in different areas than fished historically (i.e., make unassociated rather than FAD sets), which would affect the composition of the catch, including both target stocks and non-target species. Direct impacts to other non-target fish species would include a potential increase in the catch of some species and a decrease in the catch of other species, due to the changes in fishing patterns and practices of the fleet. Indirect or long-term effects would include the greater potential for adverse effects to the stocks of other non-target fish species that experience increased fishing mortality and reduced potential for adverse effects to the stocks of non-target fish species that experience decreased fishing mortality. However, these effects would be relatively small, because numerous other factors contribute to the status of the stocks. As shown in Table 5 of this supplemental EA, the U.S. WCPO purse seine fleet is only a small contributor of fishing pressure on these other non-target fish species. Thus, the overall direct and indirect effect on other non-target fish species would be negligible.

4.4.3 Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit

Under Alternative 3, similar to Alternative 2 there could be some change in the amount and type of other non-target fish species caught by the U.S. WCPO purse seine fleet. The nature of the potential direct and indirect impacts to other non-target fish species would be identical to those identified under Alternative 2. However, if the upper bound estimate of fishing opportunities is available to the fleet in 2015, as discussed above in 4.1.1 of this supplemental EA, it is much less likely that the 3,061 FAD set limit would be reached under Alternative 3 than the 2,202 FAD set limit under Alternative 2. Thus, the duration of the FAD prohibitions could be longer under Alternative 2 than under Alternative 3, if the upper bound estimate of fishing opportunities is available to the fleet in 2015.

If the lower bound estimate of fishing opportunities is available to the fleet in 2015, the duration of the FAD prohibition periods would be longer under Alternative 3 than under Alternative 2, since the FAD set limits would not be reached under either alternatives, so the fleet would experience a three month FAD prohibition period under Alternative 2 and a five month FAD prohibition period under Alternative 3.

However, the overall effects to other non-target fish species would be negligible for the reasons discussed above for Alternative 2.

4.5. Protected Resources

This section discusses the potential impacts from each of the alternatives to protected resources in the affected environment.

4.5.1 Alternative 1: No-Action Alternative

Under Alternative 1, the No-Action Alternative to the purse seine rule, there would be no direct changes to the existing fishing patterns of the U.S. WCPO purse seine fleet, and thus, no direct effects to protected resources. As discussed above in Section 4.1.1 of this supplemental EA, it is conceivable that the indirect, or long-term, effects of the No-Action Alternative on bigeye tuna, skipjack tuna, and yellowfin tuna would be negative, should this alternative lead to increased fishing pressure on the stocks. Any such increased fishing pressure could also lead to long-term negative effects on protected resources with which the U.S. WCPO purse seine fleet interacts. However, given that many other factors influence the status of those species (e.g., other fisheries, oceanic conditions), it is unlikely that there would be any substantive indirect effects to protected resources stemming from lack of implementation of the 2015 FAD restrictions rule under the No-Action Alternative.

4.5.2 Alternative 2: Three-month FAD Prohibition Period in Combination with a 2,202 FAD set limit

Based on incomplete and unverified observer data from FFA, the U.S. purse seine fishery may have had limited interactions with marine mammals in recent years. The number of these interactions and whether the marine mammals were ESA-listed species is unknown at this time. Data also indicates that the U.S. purse seine fleet has had some interaction with sea turtles in the WCPO, but the U.S. WCPO purse seine fleet has not been known to interact with seabirds. The direct and indirect effects to marine mammals and sea turtles from the implementation of Alternative 2 would likely be negligible, although it is possible there would be slight reduction in interactions with protected species. To the extent that there is a shift in fishing patterns and practices, any effects in terms of interactions with protected resources would be little compared to typical year-to-year variations in interactions with species driven by changing oceanic and economic conditions. As indicated in Figure 7 of the EA, the proportion of FAD versus unassociated sets varies from year to year, so the overall shifts in fishing patterns and practices of the fleet in a given year depend mostly on oceanographic and economic factors, which would not be affected by this alternative. Thus, for these reasons, it is likely that there would be little, or no net change in interactions stemming from implementation of Alternative 2.

Of the newly ESA-listed species described in Section 3.6 of this supplemental EA, only the boundaries of the Indo-Pacific DPS of the scalloped hammerhead overlap with the area of operation of the purse seine fishery. NMFS is in the process of addressing ESA requirements for the U.S. purse seine fishery on this DPS. In the past, the U.S. purse seine fishery has caught hammerhead sharks as bycatch at insignificant levels. Based on the best available data, in the years when 100% observer coverage has been in effect, no hammerhead sharks of any species were caught in 2010; 4 sets that caught hammerhead sharks unidentified as to species were made in 2011; 1 hammerhead shark unidentified to species was caught in 2012; and three hammerhead sharks (1 unidentified to species, 1 smooth hammerhead shark (*Sphyrna zygaena*), and 1 great hammerhead shark (*Sphyrna mokarran*)) were caught in 2013. To date, in the years when 100% observer coverage was in effect, there is no data reporting U.S. purse seine catch of the scalloped hammerhead shark.

The changes in fishing patterns and practices of the fleet would not affect the following areas designated as EFH or HAPC: ocean or coastal habitats; historic properties listed in or eligible for listing in the National Register of Historic Places; or NWRs or National Monuments. Such resources would not be affected because the potential changes in fishing patterns and practices of the fleet would take place in areas of the ocean far from shorelines and would not affect the seafloor or benthic habitats since purse seine fishing does not involve contact with the seafloor (see Section 3.2 of this supplemental EA for a description of purse seine fishing). Also, because any effects to fish stocks would be minor or negligible, as discussed above, any pelagic fish habitat designated as EFH, including the water column, or HAPC, would not be expected to experience any effects –

either beneficial or adverse – from implementation of this alternative. In addition, as discussed in Section 3.6 of this supplemental EA, commercial fishing is already prohibited in the Monuments.

4.5.3 Alternative 3: Five-month FAD Prohibition Period in Combination with a 3,061 FAD set limit

The effects to protected resources under Alternative 3 would be essentially the same as under Alternative 2. However, if the upper bound estimate of fishing opportunities is available to the fleet in 2015, as discussed above in 4.1.1 of this supplemental EA, it is much less likely that the 3,061 FAD set limit would be reached under Alternative 3 than the 2,202 FAD set limit under Alternative 2. Thus, the duration of the FAD prohibitions could be longer under Alternative 2 than under Alternative 3, if the upper bound estimate of fishing opportunities is available to the fleet in 2015. Thus, any shifts in fishing patterns and practices would be less under Alternative 3, and consequently, any potential changes in interactions with protected resources would also be less.

If the lower bound estimate of fishing opportunities is available to the fleet in 2015, the duration of the FAD prohibition periods would be longer under Alternative 3 than under Alternative 2, since the FAD set limits would not be reached under either alternatives, so the fleet would experience a three month FAD prohibition period under Alternative 2 and a five month FAD prohibition period under Alternative 3.

However, similar to Alternative 2, the implementation of the FAD restrictions rule under Alternative 3 would not be expected to affect interactions to protected resources.

4.6. Environmental Justice

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” states that “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” As discussed above, the overall environmental effects from under any of the alternatives would be minor and generally would be distributed evenly among the affected vessels in the fleet. Thus, none of the alternatives considered would result in significant and adverse effects on minority or low-income populations.

Chapter 5

Chapter 5 Cumulative Impacts

This chapter presents the cumulative impacts analysis for the 2015 FAD restrictions rule and supplements Chapter 5 of the 2013 EA.

The cumulative impacts analysis in Chapter 5 of the 2013 EA defined the geographic area of the analysis as the Pacific Ocean area as described in Chapter 3 and in Section 5.1 of the 2013 EA. The time frame for this analysis was from 2009 – when the United States first implemented a WCPFC decision for the management of tropical tunas through rulemakings with effects on the environment similar to the effects that would be caused by implementation of the 2013 U.S. Purse Seine Rule – to 2017, the reasonably foreseeable end date of the new multi-year CMM for tropical tunas that the WCPFC was anticipated to adopt at the end of 2013.

The geographic area and time frame for the cumulative impacts analysis for the 2015 FAD restrictions rule is the same as in the 2013 EA. Moreover, the 2015 FAD restrictions rule would implement just one component of CMM 2013-01, and thus, the cumulative impacts analysis presented in the 2013 EA, which considered the effects of the implementation of all the purse seine components of CMM 2012-01 in combination with past, present and reasonably foreseeable future actions, is relevant to the analysis of cumulative impacts on the stocks of bigeye, skipjack, and yellowfin tuna in the WCPO. The provisions of CMM 2013-01 are similar to or in some cases identical to the provisions in CMM 2012-01.

Section 5.1provides some additional information on the affected environment, Section 5.2 describes the identified past, present, and reasonably foreseeable future actions during the 2009-2017 time period, and Section 5.3 presents the cumulative impacts analysis.

5.1. Affected Environment

Chapter 3 describes the affected environment that could be affected by the proposed action under any of the alternatives studied in depth. Chapter 3 sets forth the baseline for assessing the direct and indirect impacts of the proposed action, as presented in Chapter 4. This section supplements the information in Chapter 3 in order to establish the baseline for studying the other actions that are part of the cumulative impacts analysis. The section provides information on the fisheries that are active in the area of application of the Convention.

The dominant HMS fisheries in the Convention Area are tuna fisheries that target skipjack tuna, yellowfin tuna, bigeye tuna, and albacore tuna. Many distant-water fishing nations and coastal states participate in the fisheries and operations vary from small-scale, subsistence, and artisanal operations in the coastal waters of Pacific Island States, to industrial scale operations both in the EEZs of Pacific Island States and on the high seas.

HMS fisheries in the Convention Area are individually managed under a number of international agreements and associated domestic authorities. Catch and effort information is compiled by the Oceanic Fisheries Programme (OFP) at the Secretariat of the Pacific Community (SPC) as the scientific and data support provider to the WCPFC for most fisheries. The WCPFC Tuna Yearbook, produced by the OFP at SPC, summarizes this information and is available to the public.[20]

Williams and Terawasi (2012) summarized the Convention Area HMS fishery in the following terms, "Annual total catches of the four main tuna species (skipjack, yellowfin, bigeye and albacore) in the [Convention Area] increased steadily during the 1980s as the purse seine fleet expanded and remained relatively stable during most of the 1990s until the sharp increase in catch during 1998. From 2004 until 2009, there had been a clear increasing trend in total tuna catch, primarily due to increases in purse-seine fishery catches."

The provisional total Convention Area tuna catch for 2012 was estimated to be 2,588,011 mt, the second highest on record, and about 15,000 mt lower than the record in 2009.

5.2. Past, Present, and Reasonably Foreseeable Future Actions

This section describes the other actions in the period 2009-2017 that have the potential to affect the same resources in the affected environment as would be affected by the 2015 FAD restrictions rule. The analysis of cumulative impacts is presented in the following section.

5.2.1 Past Actions

Past actions include:

- U.S. implementation of the purse seine provisions of CMM 2008-01, 2011-01, and 2012-01 though the 2009 rule, the 2011 rule, and the 2013 rule, as discussed in Chapter 1 of this supplemental EA.
- U.S. implementation of the longline provision of CMM 2008-01, CMM 2011-01, and CMM 2012-01, which was essentially implementation of a 3,763 catch limit for bigeye tuna for the U.S. longline fleets operating in the Convention Area for the years 2009-2014 (see final rule published December 7, 2009, at 74 FR 63999; final rule published August 27, 2012 at 77 FR 51709; and final rule published September 23, 2013, at 78 FR 58240).

[20] See http://www.wcpfc.int/statistical-bulletins. The Tuna Fishery Yearbook 2012 is referenced in this document and cited as WCPFC 2013.

- U.S implementation of the IATTC decisions for tropical tunas in the EPO in 2009, 2011, and 2013, which include bigeye tuna catch limits for longline fisheries and closed areas and periods for purse seine fishing for the years 2009 through 2016 (see final rule published November 23, 2009, at 74 FR 61046; final rule published November 4, 2011, at 76 FR 68332; and final rule published April 9, 2014, at 79 FR 19487).
- NMFS issued a final rule that prohibits commercial fishing in the Pacific Remote Islands and Rose Atoll Monuments, and in the Islands Units of the Marianas Trench Monument; establishes management measure for non-commercial and recreational charter fishing in the Monuments; and prohibits the conduct of commercial fishing outside the Monuments and non-commercial fishing inside the Monuments during the same trip (78 FR 32996; June 3, 2013).
- NMFS issued a final rule to implement provisions of several WCPFC CMMs on December 3, 2012 (77 FR 71501). The final rule, effective January 2, 2013, establishes notice, reporting, and observer coverage requirements for transshipments, requirements regarding notification of entry into or exit from a particular area of the high seas, and requirements regarding discards from purse seine vessels.
- Based on a Western Pacific Fishery Management Council (WPFMC) recommendation, NMFS issued a final rule on June 11, 2012 (77 FR 34260), that modifies the boundaries of the American Samoa large vessel prohibited area to align with the boundaries of the Rose Atoll Marine National Monument, effective July 11, 2012.
- NMFS issued a final rule to implement for U.S. fishing vessels IATTC Resolution C-11-10, “Resolution on the Conservation of Oceanic Whitetip Sharks Caught in Association with Fisheries in the Antigua Convention Area” (76 FR 68332; November 4, 2011). Under this rule, oceanic whitetip shark may not be retained by U.S. HMS fishing vessels in the EPO.
- NMFS issued a final rule to implement for U.S. fishing vessels IATTC Resolution C-11-03, “Resolution Prohibiting Fishing on Data Buoys” (76 FR 68332; November 4, 2011).

5.2.2 Other Present Actions

Present actions include:

- NMFS issued a proposed rule to implement WCPFC decisions to establish fishing restrictions related to the oceanic whitetip shark, silky shark, and whale shark in the Convention Area (79 FR 49745; August 22, 2014). If finalized, this rule would prohibit U.S. HMS fishing vessels from retaining either of the two first species, and would prohibit U.S. purse seine vessels from setting on whale sharks.

- NMFS issued a proposed rule to revise the 2014 purse seine fishing effort limit in all areas of high seas and U.S. EEZ within the Convention Area (79 FR 43373; July 25, 2014), as set forth in CMM 2013-01. If finalized, this rule would reduce the number of fishing days available to the U.S. WCPO purse seine fleet in 2014 from 2,588 to 1,828.
- Amendment 7 to the Pelagics FEP, which would be implemented via rulemaking (the proposed rule was published January 8, 2014; 79 FR 1354), would establish a framework for setting annual fishing effort and catch limits in the pelagic fisheries of American Samoa, the Commonwealth of the Northern Mariana Islands, and Guam. For 2014, it would set bigeye tuna catch limits of 2,000 mt in each of the three territories' longline fisheries. The amendment, if implemented, would also provide for the territories to allocate portions of their respective fishing effort and catch limits to U.S. fishing vessels in the context of WCPFC-mandated fishing effort and catch limits that are implemented by NMFS. For 2014, any such allocations for bigeye tuna in longline fisheries would be limited to 1,000 mt.

5.2.3 Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions include:

- WCPFC CMM 2013-01 includes provisions for purse seine and longline fisheries that are applicable through 2017. Although some of the CMM's provisions are contingent on further decisions of the WCPFC, it appears that if fully implemented by the United States and other WCPFC members, there would likely be slightly less purse seine fishing effort in 2015-2017 than in the last few years. And if the FAD-related provisions are implemented for 2016-2017, effects similar to those associated with the 2015 FAD restrictions rule would be extended through 2017.
- As discussed in earlier sections of this supplemental EA, provisions of the SPTT, which governs the operations of U.S. purse seine vessels in much of the WCPO, are being renegotiated. It is not possible to foresee the regulatory regime that will emerge from the negotiations, but based on the interim arrangement currently in place, overall fishing patterns and practices of the U.S. fleet under the new SPTT regime are unlikely to be substantially different than those in the last few years.
- Other future fishery management actions could include actions taken by the United States and other nations to manage their fisheries in the Convention Area, and to some extent, Pacific Ocean as a whole, particularly HMS fisheries. In the United States, such actions will be driven by a variety of factors, including a number of different statutes with different mandates (e.g., the MSA for federal fisheries generally, the ESA with respect to threatened and endangered marine species, the SPTA to implement SPTT, the WCPFCIA to implement the decisions of the WCPFC, and the Tuna Conventions Act or other appropriate authority to implement the decisions of the IATTC). Internationally and as a whole, such actions would be driven largely by, in addition to local issues and mandates, internationally agreed measures, including those adopted by the WCPFC and the

IATTC. Although specific conservation and management measures by other nations and the United States can be difficult to predict, given the fishing pressure on target stocks of HMS in the Pacific Ocean, it is likely that internationally agreed upon management measures will further constrict fishing capacity, effort, and/or catch. The consequences of such measures being implemented in the fisheries in the WCPO and the Pacific Ocean would be, generally, to improve the status of affected biological resources.

5.3. 5.3 Discussion of Cumulative Impacts

This section discusses cumulative impacts to the resources in the affected environment analyzed in Chapter 4 of this supplemental EA.

5.3.1 Cumulative Impacts to Physical Resources and Climate Change

As discussed in Section 4.2 of this supplemental EA, the 2015 FAD restrictions rule under either of the action alternatives or the No-Action Alternative would not be expected to substantially impact physical resources in the WCPO or contribute to climate change. The other past, present, and reasonably foreseeable future actions identified in this chapter would similarly not be expected to substantially impact physical resources in the WCPO, since they are fishery management actions that would not be expected to impact physical resources. Based on all information to date, the other actions are also not expected to lead to a large increase in greenhouse gas emissions that would affect climate change. Thus, the cumulative impacts to physical resources and climate change from implementation of either action alternatives or the No-Action Alternative would not be expected to be substantial.

5.3.2 Cumulative Impacts to Bigeye, Skipjack, and Yellowfin Tuna in the WCPO

The analysis of cumulative impacts to bigeye, skipjack, and yellowfin tuna in the WCPO for the 2015 FAD restrictions rule is essentially the same as the analysis presented in Chapter 5 of the 2013 EA. As discussed in Chapter 4, the direct and indirect effects from any of the action alternatives to bigeye, skipjack, and yellowfin tuna stocks in the WCPO would likely decrease impact to the resources. Alternative 2 would have more potential to decrease impacts on the stocks, given that the period of time during which fishing on FAD would be restricted would likely be longer. Alternative 3 would have less potential to decrease impacts on the stocks than Alternative 2, since the limit on FAD sets would be reached later in the year, if at all. However, which alternative would have more impacts on the stocks would depend on whether the upper bound or lower bound estimate of fishing opportunities (as described in Section 4.1.1 of this supplemental EA) is available to the fleet. As for the No-Action Alternative, there would be no direct effects to bigeye, skipjack, and yellowfin tuna stocks, and the potential indirect effects would be minor and perhaps negative, because the decreased fishing pressure on the stocks would not be experienced under the No-Action Alternative, so over the long-term, this could result in possible negative effects to the stock, though this cannot be predicted with certainty.

As stated in the 2013 EA, the status of the stocks of bigeye, skipjack, and yellowfin tuna using the MSA stock status determination criteria has not changed since 2009, thus, it is evident that the past management actions, which were intended to help to conserve the stocks, have not had substantial effects on the status of the stocks with respect to the MSA criteria. The other identified present and reasonably foreseeable future actions would also be expected to have minor effects on these stocks.

Thus, the cumulative impacts from the identified past, present, and reasonably foreseeable future actions on the stocks of bigeye tuna, yellowfin tuna, and skipjack tuna in the WCPO would likely decrease the overall impacts to these stocks. However, as stated in the 2013 EA, it is unlikely that the current status of the stocks will change as a collective result of all of these actions, and though additional details of some of the actions described in the 2013 EA are known at this time (e.g., CMM 2013-01), details of other actions remain unknown (e.g., the details of a renegotiated SPTT), making it difficult to predict the overall cumulative impacts to the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna in the WCPO. However, similar to the analysis in the 2013 EA, based on all information available to date, it is reasonable to conclude that the cumulative impacts from implementation of the 2015 FAD restrictions rule under any of the action alternatives or lack of implementation under the No-Action Alternative would not be expected to lead to substantial cumulative impacts on the status of the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna in the WCPO.

5.3.3 Cumulative Impacts to Other Non-target Fish Species in the WCPO

As stated in Section 4.4 of this supplemental EA, the 2015 FAD restrictions rule under either action alternative or the No-Action Alternative would have negligible effects on other non-target fish species. Given that the other past, present and reasonably foreseeable future actions are fishery management actions, they would similarly be expected to have negligible effects or effects that would decrease fishing pressure on other non-target fish species, and thus, the cumulative effects on other non-target fish species would not be expected to be substantial.

5.3.4 Cumulative Impacts to Protected Resources in the WCPO

As discussed in Section 4.5 of this supplemental EA, the action alternatives or No-Action Alternative would not be expected to increase or decrease interactions with protected resources, although it is possible there would be slight reduction in interactions with protected species under the action alternatives. Based on all information to date, the other identified past, present, and reasonably foreseeable future action are not expected to have substantial effects on protected resources, since they are all fishery management actions geared toward overall marine conservation management. Thus, the cumulative effects on protected resources would not be expected to be substantial.

5.3.5 Cumulative Impacts to Environmental Justice

As stated in Section 4.6 of this supplemental EA, the 2015 FAD restrictions rule under either action alternative or the No-Action Alternative would not substantially affect minority or low-income populations. Based on all information to date, the other past, present, and reasonably foreseeable future action identified in this chapter are not expected to affect minority of low-income populations. Thus, the cumulative effects on minority or low-income populations would not be expected to be substantial.

Consultation

NAO 216-6 requires a listing of the agencies and persons who were consulted while preparing this EA. Table 9 lists the agencies, NOAA units, and entities that were contacted for information.

Table 9: List of agencies and offices contacted

NMFS – Headquarters – Office of International Affairs
NMFS – Pacific Islands Regional Office – Observer Program
NMFS – Pacific Islands Regional Office – Sustainable Fisheries Division
NMFS – Pacific Islands Fisheries Science Center
NMFS – West Coast Regional Office – Sustainable Fisheries Division
NMFS – Southwest Science Center
NOAA Office of Law Enforcement
North Pacific Fishery Management Council
Pacific Fishery Management Council
Department of State – Office of Marine Conservation
U.S. Coast Guard – 14th Coast Guard District
Western Pacific Fishery Management Council

Literature Cited

Ainsworth, C. H., J.F. Samhouri, D.S. Busch, W.W.L. Cheung, J. Dunne, J. and T.A. Okey. 2011. Potential impacts of climate change on Northeast Pacific marine foodwebs and fisheries. *Ices Journal of Marine Science* 68(6): 1217-1229.

Allain, V. 2010. Trophic structure of the pelagic ecosystems of the western and central Pacific Ocean. WCPFC Report SC6-2010/EB- IP10. Nukualofa, Tonga, Western and Central Pacific Fisheries Commission.

Alverson, F.G. and C.L. Peterson. 1963. Synopsis of the biological data on bigeye tuna *Parathunnus sibi* (Temminck and Schlegel) 1844. FAO Fisheries Report 6(2):482-514. Rome, Food and Agriculture Organization for the United Nations.

Appleyard, S., P. Grewe, B. Innes, and R. Ward. 2001. Population structure of yellowfin tuna (*Thunnus albacares*) in the western Pacific Ocean, inferred from microsatellite loci. *Marine Biology* 139(2):383-393.

Baker, J.D., C.L. Littnan, 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* 2: 21-30.

Bakun, A.1996. *Patterns in the ocean: Ocean processes and marine population dynamics*. La Jolla, California: California Sea Grant College System.

Bala, G., K. Caldeira, R. Nemani. 2010. Fast versus slow response in climate change: implications for the global hydrological cycle. *Climate Dynamics* 35: 423–434.

Begon, M., C.A. Townsend, and J.L. Harper. 2006. *Ecology: From Individuals to Ecosystems*. Hoboken, New Jersey: Wiley-Blackwell.

Blackburn, M. 1965. Oceanography and ecology of tunas. *Oceanography and Marine Bioloby: An Annual Review* 3:299-322.

Calkins, T.P. 1980. Synopsis of biological data on the bigeye tuna, *Thunnus obesus* (Lowe, 1839), in the Pacific Ocean. *In* Bayliff, W.H. (ed.) Synopses of Biological Data on Eight Species of Scombrids. IATTC Special Report 2. La Jolla, California, Inter-American Tropical Tuna Commission.

Carpenter, K.E., M. Abrar, G. Aeby, R. B. Aronson, S. Banks, A. Bruckner, A. Chiriboga, J. Cortés, J.C. Delbeek, L. DeVantier, et al. 2008. One-Third of Reef-Building Corals Face Elevated Extinction Risk from Climate Change and Local Impacts. *Science* 321: 560-563.

Chavez, F.P., J. Ryan, S.E. Lluch-Cota, and C.M. Niquen. 2003. From anchovies to sardines and back: Multidecadal change in the Pacific Ocean. *Science* 299(5604):217-221.

Coan Jr., A.L, G.T. Sakagawa and G. Yamasaki. 2002. The 2001 U.S. purse seine fishery for tropical tunas in the central-western Pacific. Fifteenth Meeting of the Standing Committee on Tuna and Billfish, 22-27 July 2002. Working Paper FTWG-1. Honolulu, Hawaii. Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Cole, J.S. 1980. Synopsis of biological data on the yellowfin tuna *(Thunnus albacares)* (Bonnaterre 1788) in the Pacific Ocean. IATTC Special Report 2:75-150. La Jolla, California, Inter-American Tropical Tuna Commission.

Collette, B.B. and C.E. Nauen. 1983. *Scombrids of the world: An annotated and illustrated catalogue of tunas, mackerels, bonitos, and related species known to date*. Rome: Food and Agriculture Organization for the United Nations.

Cox, S.P., T.E. Essington, J.F. Kitchell, S.J.D. Martell, C.J. Walters, C. Boggs, and I. Kaplan. 2002. Reconstructing ecosystem dynamics in the central Pacific Ocean, 1952-1998. II. A preliminary assessment of the trophic impacts of fishing and effects on tuna dynamics. *Canadian Journal of Fisheries and Aquatic Sciences* 59:1736-1747.

Dagorn, L., K.N. Holland, J.P. Hallier, M. Taquet, G. Moreno, G. Sancho, D.G. Itano et al. 2006. Deep diving behavior observed in yellowfin tuna (*Thunnus albacares*). *Aquatic Living Resources* 19:85-88.

Dagorn, L., K.N. Holland, V. Restrepo, and G. Moreno. 2012. Is it good or bad to fish with FADs? What are the real impacts of the use of drifting FADs on pelagic marine ecosystems? *Fish and Fisheries*.

Dambacher, J.M., J.W. Young, R.J. Olson, V. Allain, F. Galván-Magaña, M. J. Lansdell, N. Bocanegra-Castillo, V. Alatorre-Ramírez, S. P. Cooper, L.M. Duffy. 2010. Analyzing pelagic food webs leading to top predators in the Pacific Ocean: A graph-theoretic approach. *Progress in Oceanography* 86(1-2):152-165.

Dizon, A.E., R.W. Brill, and H.S. Yuen. 1978. Correlations between environment, physiology and activity and the effects on thermoregulation in skipjack tuna. In: Sharp, G.D. and A.E. Dizon (Eds.), *The Physiological Ecology of Tunas*. Academic Press, New York, pp. 233–259.

Dizon, A.E., W.H. Neill, and J.J. Magnuson. 1977. Rapid temperature compensation of volitional swimming speeds and lethal temperatures in tropical tunas (*Scombridae*). *Environmental Biology of Fishes* 2: 83–92.

Edwards, M., M. Heath, and A. McQuatters-Gollop. 2010. Plankton *in* MCCIP Annual Report Card 2010-11, MCCIP Science Review:10.

Farby, V.J., B.A. Seibel, R.A. Feely, and J.C. Orr. 2008. Impacts of ocean acidification on marine fauna and ecosystem processes. *ICES Journal of Marine Science* 65: 414–432.

Fonteneau, A. 1991. Seamounts and tuna in the tropical eastern Atlantic. *Aquatic Living Resources* 4(1):13-25.

Galbraith, H., R. Jones, R. Park, J. Clough, S. Herrod-Julius, B. Harrington and G.Page. 2002. Global Climate Change and Sea Level Rise: Potential Losses of Intertidal Habitat for Shorebirds. *The International Journal of Waterbird Biology* 25(2):173-183.

Gillett, R.D., M. McCoy, and D.G. Itano. 2002. Status of the United States western Pacific tuna purse seine fleet and factors affecting its future. SOEST/JIMAR Report SOEST contribution 00-02 and JIMAR contribution 00-01. Honolulu, Joint Institute for Marine and Atmospheric Research and School of Ocean and Earth Science and Technology, University of Hawaii.

Gillet, R. and A. Langley. 2007. Tuna for tomorrow? Some of the science behind an important fishery in the Pacific Islands. Noumea, New Caledonia, Asian Development Bank and Secretariat of the Pacific Community.

Graham, B.S., D. Grubbs, K. Holland, and B. N. Popp. 2007. A rapid ontogenetic shift in the diet of juvenile yellowfin tuna from Hawaii. *Marine Biology*, 150(4): 647-658.

Grewe, P.M. and J. Hampton. 1998. An assessment of bigeye (*Thunnus obesus*) population structure in the Pacific Ocean based on mitochondrial DNA and DNA microsatellite analysis. Hobart, Australia, Australian Commonwealth Scientific and Research Organization.

Halpern, B.S., K. Cottenie, and B.R. Broitman. 2006. Strong top-down control in southern California kelp forest ecosystems. *Science* 312:1230-1232.

Hampton, J. and K. Bailey. 1993. Fishing for tunas associated with floating objects: A review of the western Pacific fishery. SPC Report 31. Noumea, New Caledonia, South Pacific Commission, Tuna and Billfish Assessment Programme, South Pacific Commission.

Hampton, J., K. Bigelow, and M. Labelle. 1998. A summary of current information on the biology, fisheries, and stock assessment of bigeye tuna (*Thunnus obesus*) in the Pacific Ocean, with recommendations for data requirements and future research. SPC Report 36. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Hampton, J. and G. Pilling. 2014. Relative impacts of FAD and free-school purse seine fishing on yellowfin tuna stock status. WCPFC Report SC10-2014/MI-WP-05. Majuro, Republic of the Marshall Islands. Western and Central Pacific Fisheries Commission.

Hanamoto, E. 1987. Effect of oceanographic environment on bigeye tuna distribution. *Bulletin of the Japanese Society of Fisheries Oceanography* 51:203-216.

Harley, S., P. Williams, and J. Hampton. 2012. A compendium of fisheries indicators for bigeye, skipjack, yellowfin, and south Pacific albacore tunas and south Pacific swordfish. WCPFC Report SC8-2012/SA-WP-02. Busan, Republic of Korea, Western and Central Pacific Fisheries Commission.

Harely, S. N. Davies, J. Jampton, and S. McKechnie. 2014. Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean. WCPFC Report SC10-2014/SA-WP-01. Majuro, Republic of the Marshall Islands. Western and Central Pacific Fisheries Commission.

Hays, G.C., A.J. Richardson, and C. Robinson. 2005. Climate change and marine plankton. *Trends in Ecology and Evolution* 20(6):337-344.

Hinke, J.T., I.C. Kaplan, K. Aydin, G.M. Watters, R.J. Olson, and J.F. Kitchell. 2004. Visualizing the food-web effects of fishing for tunas in the Pacific Ocean. *Ecology and Society* 9(1) Article 10.

Hoegh-Guldberg, O., and J. Bruno. 2010. The Impact of Climate Change on the World's Marine Ecosystems. *Science* 328: 1523-1528.

Hoegh-Guldberg, O., P.J. Mumby, A.J. Hooten, R.S. Steneck, P. Greenfield, E. Gomez, et al. 2007. Coral reefs under rapid climate change and ocean acidification. *Science*, *318*(5857): 1737-1742.

Holland, K., P. Kleiber, and S. Kajiura. 1999. Different residence times of bigeye and yellowfin tuna occurring in mixed aggregations over a seamount. *Fisheries Bulletin* 97:392-395.

Hunter, J.S., B. J. Macewicz, And J.R. Sibert. 1986. The Spawning Frequency of Skipjack Tuna, *Katsuwonus Pelamis,* from the South Pacific. *Fishery Bulletin*, 84(4): 895-903.

Intergovernmental Panel on Climate Change. 2007. Climate change 2007: Synthesis report. An assessment of the Intergovernmental Panel on Climate Change, IPCC Plenary Session XXVII, Valencia, Spain.

Itano, D.G. 2000. The reproductive biology of yellowfin tuna (*Thunnus Albacares*) in Hawaiian waters and the western tropical Pacific Ocean: Project summary. SOEST/Jimar

Report SOEST contribution 00-01 JIMAR Contribution 00-328. Honolulu, Joint Institute for Marine and Atmospheric Research and the School for Ocean and Earth Science and Technology, University of Hawaii.

Joseph, J. 2002. Managing fishing capacity of the world tuna fleet. FAO Fisheries Circular Number 982. Rome, Food and Agriculture Organization of the United Nations.

Kaeriyama, M., H. Seo, H. Kudo, M. Nagata. 2012. Perspectives on wild and hatchery salmon interactions at sea, potential climate effects on Japanese chum salmon, and the need for sustainable salmon fishery management reform in Japan. *Environmental Biology of Fishes* 94(1, SI): 165-177.

Kume, S. 1967. Distribution and migration of bigeye tuna in the Pacific Ocean. *Report of the Nankai Regional Fisheries Research Laboratory* 25:75-80.

Langley, A., P. Williams, P. Lehodey, and J. Hampton. 2004. The western and central Pacific tuna fishery 2003: Overview and status of tuna stocks. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Langley, A., J. Hampton, P. Kleiber, and S. Hoyle. 2008. Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean, Including an Analysis of Management Options. WCPFC-SC4-2008/SA-WP-1 Rev.1. Port Moresby, Papua New Guinea, Western and Central Pacific Fisheries Commission.

Lehodey, P., M. Bertignac, J. Hampton, A. Lewis, and J. Picaut. 1997. El Niño Southern Oscillation and tuna in the western Pacific. *Nature* 389(6652):715-718.

Lehodey P., JM. Andre, M. Bertignac, J. Hampton, A. Stoens, C. Menkes, L. Memery, and N. Grima. 1998. Predicting skipjack tuna forage distributions in the equatorial Pacific using a coupled dynamical bio-geochemical model. *Fisheries Oceanography* (special issue of GLOBEC Open Science Meeting) 7(3 and 4):317–32.

Link, J. 2002. Does food web theory work for marine ecosystems? *Marine Ecology Progress Series* 230:1-9.

Loukos, H., P. Monfray, L. Bopp, and P. Lehodey. 2003. Potential changes in skipjack tuna (Katsuwonus pelamis) habitat from a global warming scenario: modelling approach and preliminary results. *Fisheries Oceanography* 12(4-5):474-482.

Matsumoto, T., T. Kitagawa, and S. Kimura. 2013. Vertical behavior of bigeye tuna (*Thunnus obesus*) in the northwestern Pacific Ocean based on archival tag data. *Fisheries Oceanography* 22(3): 234-246.

Matsumoto, T., K. Satoh, and M. Toyonaga. 2014. Behavior of skipjack tuna (*Katsuwonus pelamis*) associated with a drifting FAD monitored with ultrasonic transmitters in the equatorial central Pacific Ocean. *Fisheries Research* 157: 78-85.

Mayfield A.B., Chan P., H.M. Putnam, C. Chen, T. Yung Fan. 2012. The effects of a variable temperature regime on the physiology of 10 the reef-building coral *Seriatopora hystrix*: results from a laboratory-based reciprocal transplant. *The Journal of experimental Biology* 215(23): 4183-95.

Miyabe, N. 1994. A review of the biology and fisheries for bigeye tuna, *Thunnus obesus*, in the Pacific Ocean. FAO Fisheries Report T336 Volume 2. Rome, Food and Agriculture Organization for the United Nations.

Miyabe, N. and W.H. Bayliff. 1998. A review of information on the biology, fisheries, and stock assessment of bigeye tuna, *Thunnus obesus,* in the Pacific Ocean. *In* Deriso, R.B., W.H. Bayliff, and N.J. Webb (eds.) Proceedings of the First World Meeting on Bigeye Tuna, 129-170. La Jolla, California: Inter-American Tropical Tuna Commission.

Mugo, R., S. Saitoh, A. Nihira, and T. Kuroyama. 2010. Habitat characteristics of skipjack tuna (Katsuwonus pelamis) in the western North Pacific: a remote sensing perspective. *Fisheries Oceanography* 19(5): 382–396.

Munday, P.L., M. I. McCormick, and G.E. Nilsson. 2012. Impact of global warming and rising CO2 levels on coral reef fishes: what hope for the future? *Journal Of Experimental Biology* 215(22): 3865-3873.

National Marine Fisheries Service. 2004. Environmental assessment for the third extension of the South Pacific Tuna Treaty. Honolulu, United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Regional Office.

National Marine Fisheries Service. 2014. *Regulatory Impact Review for a Rule to Implement Decisions of the Western and Central Pacific Fisheries Commission for: Restrictions on the Use of Fish Aggregating Devices in Purse Seine Fisheries for 2015*. RIN 0648-BE36. Honolulu, United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Regional Office.

Nikaido, H., N. Miyabe, and S. Ueyanagi. 1991. Spawning time frequency of bigeye tuna, *Thunnus obesus*. *Bulletin of Natural Resources: Institute of the Far Seas Fisheries* 28:47-73.

Niller, P.P. and R.W. Reynolds. 1984. The three-dimensional circulation near the eastern North Pacific subtropical front. *Journal of Physical Oceanography* 14(2): 217-230.

Nybakken, J.W. 1997. *Marine biology: An ecological approach*. New York: Addison-Wesley.

Olson, D.B., G.L. Hitchcock, A.J. Mariano, C.J. Ashjian, G. Peng, R.W. Nero, and G.P. Podesta. 1994. Life on the edge: Marine life and fronts. *Oceanography* 7(2): 52-60.

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.

Polovina, J.J., R.D. Kobayashi, M.D. Parker, P.M. Seki, and H.G. Balazs. 2000. Turtles on the edge: Movement of loggerhead turtles (*Caretta caretta*) along oceanic fronts, spanning longline fishing grounds in the central North Pacific, 1997-1998. *Fisheries Oceanography* 9(1): 71-82.

Polovina, J.J., E. Howell, D.R. Kobayashi, and M.P. Seki. 2001. The transition zone chlorophyll front, a dynamic global feature defining migration and forage habitat for marine resources. Beyond El Niño conference: Climate variability and marine ecosystem impacts from the tropics to the Arctic, 49(1-4):469-483. La Jolla, California, United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Rahmstorf, S. 2007. A Semi-Empirical Approach to Projecting Future Sea-Level Rise. *Science* 315:368-370.

Richardson, T.L., G.A. Jackson, H.W. Ducklow, and M.R. Roman. 2004. Planktonic food webs 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.

Roden, G.I. 1980. On the subtropical frontal zone north of Hawaii during winter. *Journal of Physical Oceanography* 10(3): 342-362.

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.

Schaefer, K.M., and D.W. Fuller. 2009. Horizontal Movements of Bigeye Tuna (*Thunnus Obesus*) in the Eastern Pacific Ocean, as Determined from Conventional and Archival Tagging Experiments Initiated During 2000-2005. Inter-American Tropical Tuna Commission, La Jolla, California. Bulletin 24(2).

Secretariat of the Pacific Community. 2012a. Status of the Purse Seine Fishery for 2011. A paper prepared for the Internal Meeting of the Pacific Island Parties for the U.S. Treaty Consultation 24th Annual Meeting February 25-27, 2012 Honolulu, Hawaii. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Secretariat of the Pacific Community. 2012b. Observer Scientific Data for 23rd LP (2010/2011). A paper prepared for the Internal Meeting of Pacific Island Parties for the U.S. Treaty Consultation 24th Annual Meeting March 25-27, 2012 Honolulu, Hawaii. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Secretariat of the Pacific Community. 2013. Preliminary Review of the Western and Central Pacific Ocean Purse Seine Fishery 2012. A paper prepared for the Internal Meeting of the Pacific Island Parties to the South Pacific Regional US Multilateral Treaty. May 3-7, 2013 Honiara, Solomon Islands. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Seki, M.P., R. Lumpkin, and P. Flament. 2002. Hawaii cyclonic eddies and blue marlin catches: The case study of the 1995 Hawaiian International Billfish Tournament. *Journal of Oceanography* 58(5):739-745.

Sibert, J. and J. Hampton. 2003. Mobility of tropical tunas and the implications for fisheries management. *Marine Policy* 27(1):87-95.

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):1773-1776.

Solomon, S., D. Quin, M. Manning, Z. Chen, M. Marquis, K.B. Avryt, M. Tignor et al. 2007. Summary for policy makers. *In* Climate Change 2007: The Physical Science Basis. WGI-IPCC Report 4. Cambridge and New York, Cambridge University Press.

Stewart. R.H. 2005. *Introduction to physical oceanography*. September 2005 Edition. Galveston, Texas: Department of Oceanography, Texas A&M University.

Sturman, A.P. and H.A. McGowan. 1999. Mesoscale and local climates in New Zealand. *Progress Physical Geography* 23(4):611-635.

Suzuki, Z., P.K. Tomlinson, and M. Honma. 1978. Population structure of Pacific yellowfin tuna. *Inter-American Tropical Tuna Commission Bulletin* 17(5):227-446.

Suzuki, Z. 1994. A review of the biology and fisheries for yellowfin tuna (*Thunnus albacares*) in the western and central Pacific Ocean. *In* Shomura, R. S., J. Majkowski, and S. Langi (eds.) Interactions of Pacific Tuna Fisheries. Volume 2: Papers on biology and fisheries, 108-137. Rome, Food and Agriculture Organization for the United Nations.

The World Bank. 2000. *Cities, seas, and storms: managing change in Pacific Islands economies.* Volume IV: Adapting to climate change. Washington D.C.: The World Bank.

United States Coast Guard and National Marine Fisheries Service. 2013.Distant water tuna fleet (aka U.S. purse seine fleet). Annual report to Congress. United States Coast

Guard, Homeland Security and United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Regional Office.

Wang, X., Y. Chen, S. Truesdell, L. Xu, J. Cao, and W. Guan. 2014. The Large-Scale Deployment of Fish Aggregation Devices Alters Environmentally-Based Migratory Behavior of Skipjack Tuna in the Western Pacific Ocean. *PLOS ONE* 9(5): e98226.

Weng, J.S., M.K. Hung, C.C. Lai, L.J. Wu, M.A. Lee, and K.M. Liu. 2013. Fine-scale vertical and horizontal movements of juvenile yellowfin tuna (*Thunnus albacares*) associated with a subsurface fish aggregating device (FAD) off southwestern Taiwan. *Applied Ichthyology* 29: 990-1000.

Western and Central Pacific Fisheries Commission. 2012. Tuna Fishery Yearbook 2011. Secretariat of the Pacific Community, Noumea, New Caledonia, 151 pp.

Western and Central Pacific Fisheries Commission. 2013. Tuna Fishery Yearbook 2012. Secretariat of the Pacific Community, Noumea, New Caledonia, 154 pp.

Western Pacific Regional Fishery Management Council. 2009. Fishery Ecosystem Plan for the American Samoa Archipelago. Honolulu, Western Pacific Fishery Management Council.

Whitelaw, A.W. and V.K. Unithan. 1997. Synopsis on the distribution, biology, and fisheries of the bigeye tuna (*Thunnus obesus*) with a bibliography. Hobart, Australia, Australian Commonwealth Scientific and Research Organization.

Williams, P. 2003. Overview of the western and central Pacific Ocean tuna fisheries – 2002. Sixteenth Meeting of the Standing Committee on Tuna and Billfish 9–16 July. Working Paper GEN-1. Mooloolaba, Australia.

Williams, P. and P. Terawasi. 2012. Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions -2011. WCPFC Report SC8-2012/GN WP-1. Busan, Scientific Committee, Western and Central Pacific Fisheries Commission.

Williams, P. and P. Terawasi. 2014. Overview of the western and central Pacific Ocean tuna fisheries, including economic conditions – 2013. WCPFC-SC10-2014/GN WP-1. Majuro, Republic of the Marshall Islands, Western and Central Pacific Fisheries Commission.

Woesik, R., P. Houk, A.L. Isechal, J.W. Idechong, S. Victor, and Y. Golbuu. 2012. Climate-change refugia in the sheltered bays of Palau: analogs of future reefs. *Ecology and Evolution* 2(10): 2474–2484.

Appendix 1

2013 EA

February 2013

NOAA FISHERIES
Pacific Islands Region

Environmental Assessment

For a Rule to Implement Decisions of the Western and Central Pacific Fisheries Commission for:

Fishing Restrictions and Observer Requirements in Purse Seine Fisheries for 2013 and 2014

RIN 0648-BC87

Contact Information:
Dr. Charles Karnella,
International Fisheries Coordinator
Pacific Islands Regional Office,
National Marine Fisheries Service
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814
Tel: (808) 944-2200
Fax: (808) 973-2941
E-mail: Charles.Karnella@noaa.gov

U.S. Department of Commerce | National Oceanic and Atmospheric Administration
National Marine Fisheries Service

LIST OF ABBREVIATIONS AND ACRONYMS

CCM	Commission Members, Cooperating Non-Members, and Participating Territories
CEQ	Council on Environmental Quality
CMM	Conservation and Management Measures
Convention	Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
Convention Area	Area of Application of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
CPUE	Catch per Unit of Effort
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ENSO	El Niño Southern Oscillation
EPO	Eastern Pacific Ocean
ESA	Endangered Species Act
FAD	Fish Aggregating Device
FEP	Fishery Ecosystem Plan
FFA	Forum Fisheries Agency
FMP	Fishery Management Plan
HAPC	Habitat Areas of Particular Concern
HMS	Highly Migratory Species
HSFCA	High Seas Fishing Compliance Act of 1995
IATTC	Inter-American Tropical Tuna Commission
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
mt	Metric Tons
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWR	National Wildlife Refuge
PIC	Pacific Island Countries
RIR	Regulatory Impact Review
ROP	Regional Observer Programme
SPC	Secretariat of the Pacific Community

SPTA	South Pacific Tuna Act of 1988
SPTT	South Pacific Tuna Treaty (formally, the Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America)
USFWS	United States Fish and Wildlife Service
VMS	Vessel Monitoring System
WCPFC	Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, also known as the Western and Central Pacific Fisheries Commission
WCPFCIA	Western and Central Pacific Fisheries Convention Implementation Act
WCPO	Western and Central Pacific Ocean
WPFMC	Western Pacific Fishery Management Council

Table of Contents

Table of Contents 5
List of Figures 8
List of Tables 9
Chapter 1 Introduction and Purpose and Need 11
1.1 Background 11
1.2. Purpose and Need 14
1.3 Organization of This Document 15
Chapter 2 Proposed Action and Alternatives 17
2.1 Proposed Action 17
2.2 Development of Fishing Effort Limit Alternatives 18
2.2.1 Lowest Levels from Years in which Data are Available with Separate Limits for the High Seas and U.S. EEZ (Most Restrictive Alternative) 19
2.2.2 Past Regulatory Precedent Alternative 20
2.2.3 Highest Levels from Years for which Data are Available with Combined Limit for the High Seas and U.S. EEZ (Least Restrictive Alternative) 20
2.3 Development of Alternatives for FAD Restrictions 20
2.4 Development of Observer Coverage Provision Alternatives 21
2.5 Alternatives for the U.S. Purse Seine Rule Considered in Detail 22
2.5.1 Alternative 1: The No-Action Alternative to the 2013 U.S. Purse Seine Rule 22
2.5.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs 23
2.5.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel 24
2.5.4 Alternative 4: Least Restrictive Fishing Effort Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs 24
2.6 Alternatives Initially Considered But Excluded From Detailed Analysis 25
2.6.1 Excluded Alternatives for Fishing Effort Limits 25
2.6.2 Excluded Alternatives for FAD Restrictions 26
Chapter 3 Affected Environment 29
3.1 Physical Environment and Climate Change 29
3.1.1 Oceanography 29
3.1.2 Climate Change 32
3.2 U.S. WCPO Purse Seine Fishery 33
3.2.1 Fleet Characteristics 34
3.2.2 Management of the U.S. Purse Seine Fleet in the WCPO 35
3.2.3 Participation, Effort, and Catch 37
3.2.4 FADs 43
3.3 Bigeye Tuna, Skipjack Tuna, and Yellowfin Tuna 46
3.3.1 Bigeye Tuna (*Thunnus obesus*) 47
3.3.2 Yellowfin Tuna (*Thunnus albacares*) 51
3.4 Biological Environment 52

3.4.1 Biodiversity and Ecosystem Function 52
3.4.2 Other Non-Target Fish Species.. 55
3.5 Protected Resources 58
3.5.1 Threatened and Endangered Species 58
3.5.2 Marine Mammals 61
3.5.3 Essential Fish Habitat (EFH) 62
3.5.4 National Wildlife Refuges (NWRs) and Monuments..................................... 63
Chapter 4 Environmental Consequences: Direct and Indirect Effects 66
4.1 The U.S. WCPO Purse Seine Fleet.. 66
4.1.1 Alternative 1: No-Action Alternative 66
4.1.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs............................... 67
4.1.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel 72
4.1.4 Alternative 4: Least Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs............................... 75
4.2 Physical Environment and Climate Change 77
4.3 Bigeye Tuna, Skipjack Tuna, and Yellowfin Tuna.. 78
4.3.1 Alternative 1: No-Action Alternative 79
4.3.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs............................... 79
4.3.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel 80
4.3.4 Alternative 4: Least Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs............................... 81
4.4 Other Non-target Fish Species 81
4.4.1 Alternative 1: No-Action Alternative 81
4.4.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs............................... 82
4.4.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel 83
4.4.4 Alternative 4: Least Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs............................... 83
4.5 Protected Resources 83
4.5.1 Alternative 1: No-Action Alternative 83
4.5.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs............................... 84
4.5.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel 85
4.5.4 Alternative 4: Least Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs............................... 85

4.6 Environmental Justice ... 85
Chapter 5 Cumulative Impacts ... 88
5.1 Affected Environment ... 88
5.1.1 Convention Area HMS Fisheries ... 89
5.2 Past, Present, and Reasonably Foreseeable Future Actions ... 92
5.2.1 Past Actions ... 92
5.2.2 Other Present Actions ... 93
5.2.3 Reasonably Foreseeable Future Actions ... 93
5.3 Discussion of Cumulative Impacts to Bigeye, Skipjack, and Yellowfin Tuna in the WCPO ... 94
Consultation ... 96
List of Preparers ... 97
Literature Cited ... 98

List of Figures

Figure 1: The Convention Area - high seas (in white); U.S. EEZ (in dark gray); and foreign jurisdictions ("claimed maritime jurisdictions," in light gray)............................ 12
Figure 2: Sea Surface Temperature Indices of ENSO Patterns from 1993 to 2012. 32
Figure 3: The general operational area of the U.S. WCPO purse seine fishery (indicative only) in light blue. The red line demarks the Convention Area with the yellow line depicting the boundary of the Inter American Tropical Tuna Commission (IATTC), which generally exercises competence over HMS Fisheries in the EPO. 34
Figure 4: U.S. WCPO purse seine fleet fishing effort, 1997-2010 38
Figure 5: Number of U.S.-flagged purse seine vessels licensed and vessels fished under the SPTT from 1988 to 2012 40
Figure 6: Proportion of the WCPO U.S. purse seine fleet that fished, by month, 1997-2012... 42
Figure 7: Distribution of U.S. purse seine effort during 2001 and 2002. Lines for the Equator (0° latitude) and 160° E longitude included. The left-hand side of the figure shows effort during 2001 and the right-hand side shows effort during 2002. 43
Figure 8: FAD sets as proportion of all sets by U.S. WCPO purse seine fleet, 1997-2010. 45
Figure 9: FAD sets as proportion of all sets by U.S. WCPO purse seine fleet, by month, 1997-2008 and 2009-2010 averages. 46
Figure 10: Convention Area bigeye tuna catch (mt) by gear... 49
Figure 11: Trophic levels in the central North Pacific Ocean 53

List of Tables

Table 1: U.S. WCPO purse seine fleet fishing effort (1997-2010). Updated from Table 3 in the 2009 EA to include 2008-2010 data and best available data. 39
Table 2: Tuna landings by U.S. WCPO purse seine vessels by species and port, 2010... 41
Table 3: Annual U.S. WCPO purse seine catch estimates in mt by set type (unassociated and FAD), 2006-2010 (data for 2010 are preliminary)... 44
Table 4: Stock status summary of select highly migratory fish stocks in the Pacific Ocean for 2008 47
Table 5: Observed Estimates of Catch and Rate of Discards of "Other" Fish Species in 2010 by the U.S. WCPO Purse Seine Fleet. 56
Table 6: Listing Status of Species in the WCPO Listed as Endangered or Threatened Under the ESA. 59
Table 7: Non-Listed Marine Mammals that Occur in the WCPO. 61
Table 8: EFH and HAPC for Management Unit Species for the Western and Pacific Region.[1] 63
Table 9: Tuna catches in WCPFC Statistical Area by species (in mt).............................. 90
Table 10: Tuna catches in WCPFC Statistical Area by gear (albacore, bigeye, skipjack, and yellowfin tuna, in mt). 91
Table 11: 2007 Tuna catches in WCPFC Statistical Area by nation/territory/fishing entitiy (albacore, bigeye, skipjack, and yellowfin tuna, in mt). 91
Table 12: Number of vessels active in WCPFC Statistical Area...................................... 92
Table 13: List of agencies and offices contacted 96

Chapter 1

Chapter 1 Introduction and Purpose and Need

This Environmental Assessment (EA) has been prepared pursuant to the provisions of the National Environmental Policy Act (NEPA; 42 U.S.C. § 4321, *et seq*.) and related authorities, such as the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508) and the National Oceanic and Atmospheric Administration's (NOAA) Environmental Review Procedures for Implementing NEPA (NAO 216-6).

At its Ninth Regular Session, in December 2012, the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Commission or WCPFC) adopted Conservation and Management Measure (CMM) 2012-01, "Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean." Among other provisions, CMM 2012-01 includes provisions for the management of purse seine fisheries operating in the western and central Pacific Ocean (WCPO). The National Marine Fisheries Service (NMFS) is promulgating a rule to implement the provisions of CMM 2012-01 for the U.S. purse seine fleet operating in the WCPO that need to be implemented via regulations at this time. These provisions include the following: (1) limits on fishing effort by U.S. purse seine vessels in the U.S. exclusive economic zone (EEZ) and on the high seas; (2) restrictions on the use of fish aggregating devices (FADs); and (3) requirements for U.S. purse seine vessels to carry observers.

1.1 Background

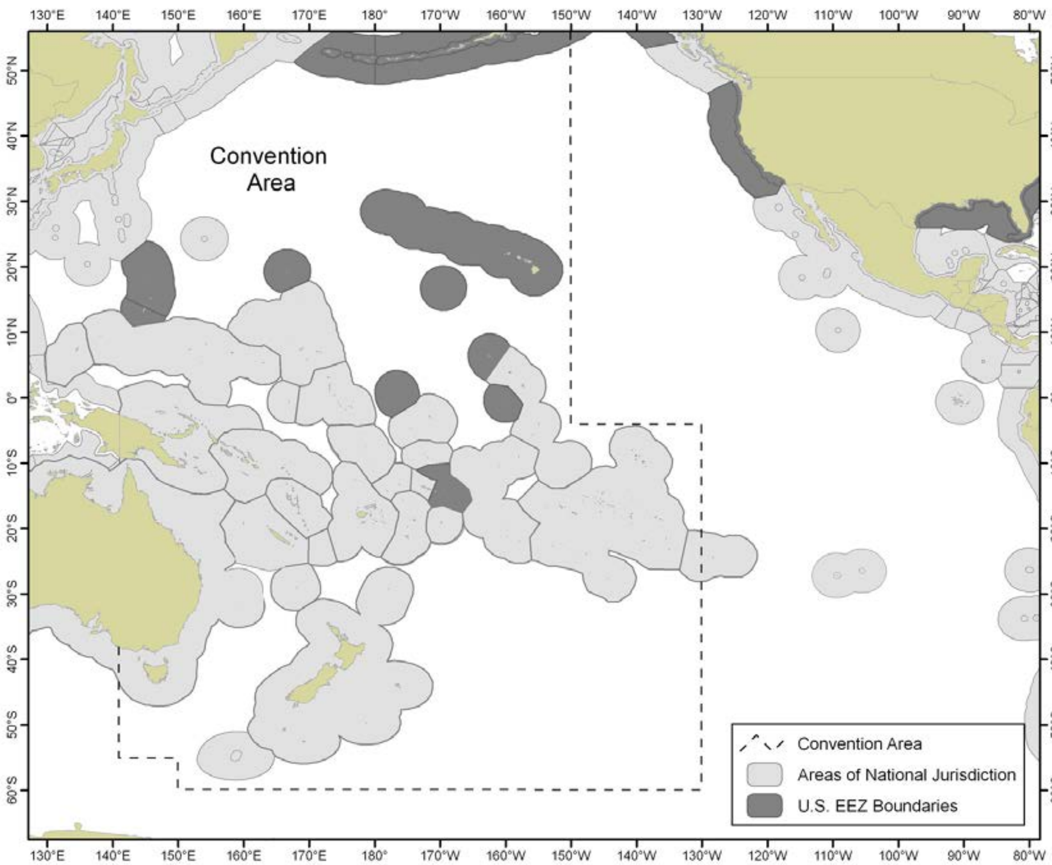
The United States ratified the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Convention) in 2007.[1] The area of application of the Convention (Convention Area) is shown in Figure 1.

The Convention text indicates that the agreement is focused on highly migratory fish species (HMS) and stocks thereof within the Convention Area (see the Convention text for the specific HMS covered).[2] The Convention provides for the conservation and management of target stocks, non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks.

[1] The Convention was opened for signature in Honolulu on September 5, 2000, and entered into force in June 2004; the Convention entered into force for the United States in 2007. The full text of the Convention is available at: *http://www.wcpfc.int/key-documents/convention-text*.

[2] Though not stated in the Convention text, it has also been agreed that southern bluefin tuna (*Thunnus maccoyii*) that are found in the Convention Area will continue to be solely managed by the Commission for the Conservation of Southern Bluefin tuna.

Figure 1: The Convention Area - high seas (in white); U.S. EEZ (in dark gray); and foreign jurisdictions ("claimed maritime jurisdictions," in light gray).



Source: NMFS.

The WCPFC – among other things – adopts Conservation and Management Measures (CMMs) for Commission Members, Cooperating Non-Members, and Participating Territories (collectively referred to as CCMs) of the WCPFC to implement through their respective national laws and procedures. The Western and Central Pacific Fisheries Convention Implementation Act (WCPFCIA; 16 USC 6901 *et seq*.), authorizes the Secretary of Commerce, in consultation with the Secretary of State and the Secretary of the Department in which the Coast Guard is operating, to develop such regulations as are needed to carry out the obligations of the United States under the Convention. The authority to promulgate regulations to implement the provisions of the Convention and WCPFC decisions, such as regulations to implement CMMs, has been delegated by the Secretary of Commerce to NMFS.

CMM 2012-01 contains specific provisions, identified as interim measures, for purse seine, longline, and other commercial fisheries for calendar year 2013. The rule analyzed in this EA would implement the applicable provisions for the U.S. purse seine fishery in the WCPO. NMFS is implementing the applicable provisions for U.S. longline fisheries in a separate rulemaking, consistent with the approach NMFS has used to implement similar CMMs, which are discussed in more detail below. NMFS has determined that the provisions for other commercial fisheries do not apply to U.S. fleets.

The stated general objective of CMM 2012-01 is to ensure that compatible measures for the high seas and EEZs are implemented so that the stocks of bigeye, yellowfin and skipjack tuna in the WCPO are, at a minimum, maintained at levels capable of producing their maximum sustainable yield as qualified by relevant environmental and economic factors. The CMM includes specific objectives for each of the three stocks: for each, the fishing mortality rate is to be reduced to or maintained at levels no greater than the fishing mortality rate associated with maximum sustainable yield. CMM 2012-01 is the most recent in a series of WCPFC CMMs for the management of the principal tuna stocks in the WCPO.

Earlier WCPFC CMMs for tropical tuna management, which contained provisions for purse seine fisheries and which NMFS implemented via rulemaking, include CMM 2008-01, "Conservation and Management Measure for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean," and CMM 2011-01, "Conservation and Management Measure for temporary extension of CMM 2008-01." CMM 2008-01 set forth specific provisions for purse seine fisheries for the years 2009, 2010, and 2011, which NMFS implemented in 2009 (see final rule published August 4, 2009, in 74 FR 38544; hereafter 2009 rule). Due to a change in meeting schedule, in December 2011, the WCPFC adopted an intersessional decision to extend the provisions of CMM 2008-01 until the WCPFC met in March 2012. NMFS implemented that intersessional decision for the U.S. purse seine fleet operating in the WCPO through an interim rule in 2011 (see interim rule published December 30, 2011 in 76 FR 82180; hereafter 2011 rule). Adopted in March 2012, CMM 2011-01 extended the majority of the provisions of CMM 2008-01 through the end of 2012. Given that the 2011 rule extended the applicable provisions of CMM 2011-01 for the U.S. purse seine fleet through 2012, there was no need for NMFS to take additional regulatory action to put into place the measures of CMM 2011-01 for purse seine fisheries. The provisions of CMM 2008-01 for U.S. longline fisheries were implemented in a separate rulemaking in 2009 and the provisions of CMM 2011-01 for U.S. longline fisheries were implemented in a separate rulemaking in 2012.

The specific NMFS regulations to implement the WCPFC CMMs described above for the U.S. WPCO purse seine fleet expired on December 31, 2012, and included the following:

- specific limits on the number of fishing days that may be spent by the U.S. purse seine fleet on the high seas and in areas under U.S. jurisdiction (including the U.S. EEZ);
- specific FAD restrictions;
- closure of specific areas of the high seas to U.S. purse seine fishing;
- a requirement that U.S. purse seine vessels retain on board all bigeye tuna, yellowfin tuna, and skipjack tuna up to the point of first landing or transshipment, with certain exceptions; and
- observer requirements for U.S. purse seine vessels.

CMM 2012-01 has provisions that are similar to the previous CMMs, with some modifications to those provisions. This 2013 rulemaking (hereafter 2013 U.S. purse seine rule) includes implementation of three of the five provisions listed above: (1) limits on fishing effort by U.S. purse seine vessels in the U.S. EEZ and on the high seas; (2) restrictions on the use of FADs; and (3) requirements for U.S. purse seine vessels to carry observers. The other two provisions listed above are not being implemented in the 2013 U.S. purse seine rule because CMM 2012-01 does not contain provisions for the closure of specific areas of the high seas to U.S. purse seine fishing, and because the catch retention provisions are already in effect. In a separate final rule, issued in December 2012 and effective on January 2, 2013, NMFS removed the December 31, 2012, termination date of the catch retention requirements (see final rule published December 3, 2012, in 77 FR 71501).

Prior Environmental Analysis

NMFS prepared an 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 Restriction 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" (hereafter 2009 EA), which analyzed the impacts of the 2009 rule on the human environment. This EA incorporates the 2009 EA by reference.[3]

In the 2009 EA, NMFS analyzed four action alternatives,[4] as well as the No-Action Alternative. NMFS concluded that all of the alternatives would have similar effects, with the main distinction between the action alternatives being the manner of application of the fishing effort limit. NMFS determined that all of the action alternatives analyzed in the 2009 EA would have minor beneficial effects or no effects on resources in the affected environment.

1.2. Purpose and Need

The purpose of the 2013 U.S. purse seine rule is to implement the provisions of CMM 2012-01 for the U.S. WCPO purse seine fleet that are necessary to implement via regulations in 2013 in a timely and practical manner, in order to contribute to the underlying objectives of CMM 2012-01 regarding WCPO bigeye tuna, yellowfin tuna and skipjack tuna, which are to reduce or maintain their respective fishing mortality rates at levels no greater than the fishing mortality rates associated with maximum sustainable

---

[3] The 2009 EA (combined with the Finding of No Significant Impact) is available at http://www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2009-0108.

[4] These alternatives are described in more detail in Chapter 2 of this EA.

yield. The need for the rule is to satisfy the international obligations of the United States as a Contracting Party to the Convention, pursuant to the authority of the WCPFCIA.

1.3 Organization of This Document

The following is a brief description of the remaining chapters of this EA:

Chapter 2 provides detailed discussion of the proposed action and the development of action alternatives for detailed analysis. The chapter also discusses the No-Action Alternative and the alternatives initially considered but excluded from detailed analysis.

Chapter 3 describes the U.S. purse seine fishery in the WCPO and the physical environment and biological resources that could be affected by the implementation of the proposed action under any of the action alternatives.

Chapter 4 analyzes the direct and indirect environmental effects that could be caused by the implementation of the proposed action under any of the action alternatives analyzed in depth, as well as the direct and indirect effects of the No-Action Alternative, and compares the effects of the alternatives.

Chapter 5 analyzes the potential cumulative impacts that could result from the implementation of the proposed action under any of the action alternatives analyzed in depth, as well as the No-Action Alternative.

This EA is being issued in conjunction with the proposed 2013 U.S. Purse Seine Rule, which will be subject to a public review and comment period. Although comments are not being solicited on the EA, any comments received that pertain to matters in the EA will be considered, as appropriate.

Chapter 2

Chapter 2 Proposed Action and Alternatives

In an environmental review document, agencies must assess the environmental impacts of a proposal and the reasonable and feasible alternatives to the proposal in comparative form. The purpose of this comparison of alternatives is to provide the decisionmaker and the public with a clear basis for choosing among the alternatives.[5]

This chapter provides a description of the proposed action analyzed in this EA and the alternative means of implementing the proposed action. The chapter also includes a description of the No-Action Alternative (i.e., the existing conditions and the conditions that would result if the proposed action were not implemented under any of the action alternatives).

2.1 Proposed Action

The proposed action is the promulgation of the 2013 U.S. purse seine rule to implement certain provisions of CMM 2012-01 for U.S. purse seine vessels operating in the WCPO.

The proposed action would include three elements, all applicable within the Convention Area between 20° N. and 20° S. latitude for the 2013 and 2014 calendar years: (1) limits on fishing effort, measured in terms of fishing days, on the high seas and in the U.S. EEZ for the 2013 and 2014 calendar years; (2) FAD restrictions on the high seas and in the U.S. EEZ in 2013 and 2014; and (3) a requirement to carry observers on all trips in 2013 and 2014, with certain exceptions.

Sections 2.2 to 2.4 include a description of each of these elements and alternative ways to implement each element. Section 2.5 combines the various identified alternatives for each of the elements to develop three action alternatives that are analyzed in detail, along with the No-Action Alternative, in this EA. Section 2.6 provides a discussion of the alternatives initially considered but excluded from detailed analysis.

Duration of the Rule

The “interim” measures of CMM 2012-01 are applicable for 2013. The CMM also calls for the WCPFC to adopt a new CMM for bigeye, yellowfin, and skipjack tuna during its next regular annual session, in December 2013. The new CMM would be a multi-year management program for 2014-2017 that is designed to achieve the management objectives for the three stocks that are set out in CMM 2012-01. Under section 505(a) of the WCPFC Implementation Act, NMFS is authorized to promulgate such regulations as may be necessary to carry out the Unites States’ international obligations under the Convention. It is foreseeable that the new CMM would include some of the same provisions for purse seine vessels as those included in CMM 2012-01. Thus, NMFS is

[5] See the CEQ’s Regulations for Implementing the Procedural Provisions of NEPA at 40 CFR §1502.14.

proposing to implement the 2013 U.S. Purse Seine Rule for 2014 as well as 2013, as it believes this is the most effective way to ensure that the United States satisfies its international obligations under the Convention for 2014. Implementing the rule for both 2013 and 2014 would also serve to provide early public notice that the regulations would remain the same in 2014 unless the purse seine provisions of the new CMM differ from those in CMM 2012-01. Once the WCPFC adopts a new CMM, NMFS would take any steps necessary to implement the WCPFC's decision(s).

2.2 Development of Fishing Effort Limit Alternatives

In the 2009 EA, NMFS identified various methods for implementing the fishing effort limits for the U.S. WCPO purse seine fleet. First, the effort limits could be applied by: (1) allocating the effort limits among vessels (i.e., each vessel would be allocated a specific portion of the overall effort limit based on some established criteria); or (2) having no allocation of the effort limits, so all vessels would compete for the available fishing days under a single fleet-wide – competitive – limit. Second, the effort limits could be applied by: (1) having a single combined effort limit that applies to both of the applicable areas (high seas and U.S. EEZ); or (2) separate effort limits for the high seas and U.S. EEZ. Third, given that the rule was for the period 2009-2011, the effort limits also could be set in several alternative temporal terms so that days could be borrowed from the limits of past and future years, or they could be fixed so that no borrowing could take place: (1) on an annual basis, and/or (2) a multiple-year basis. In either case, but particularly the former, they could be set for the calendar year or be put on some other "limit-year" schedule – given the fleet is managed on licensing periods that run from June 15th to June 14th of the following year. NMFS analyzed four different variations of the fishing effort limits in the 2009 EA that represented a reasonable range of alternatives. These alternatives included the following:

(1) Combined effort limits for the high seas and the U.S. EEZ, effort limits not allocated within the fleet (meaning a competitive scheme whereby fishing days are available to all vessels until the fleet-wide cap is reached), and different time scales for the limits (separate but overlapping three-year, two-year, and one-year limits) (analyzed as part of Alternative B).
(2) Combined effort limits for the high seas and the U.S. EEZ, effort limits allocated to individual vessels in some manner, and different time scales for the limits (separate three-year, two-year, and one-year limits) (analyzed as part of Alternative C).
(3) Separate effort limits for the high seas and for the U.S. EEZ, effort limits not allocated within the fleet, meaning on a competitive basis, and limits applied on a single-year basis (analyzed as part of Alternative D).
(4) Combined effort limit for the high seas and the U.S. EEZ, effort limit allocated on a competitive basis, and one limit implemented for the entire three-year period, rather than having separate one-year limits or different time scales for the limits (analyzed as part of Alternative E).

The provisions of CMM 2012-01 pertaining to the purse seine fishing effort limits differ in some respects from those in CMM 2008-01. CMM 2008-01 specified that the effort limits for the high seas must be the number of days fished in 2004 or the average number of days fished in the period from 2001-2004, and that the effort limit in the U.S. EEZ should be compatible with the effort limits on the high seas. CMM 2012-01 specifies that each CCM shall take measures not to increase fishing days on the high seas and to establish effort limits or equivalent catch limits in its EEZ that reflect the geographical distributions of skipjack tuna, yellowfin tuna, and bigeye tuna, and that are consistent with the WCPFC's management objectives for those species. In addition, the purse seine effort limit provisions in CMM 2012-01 are specified only for the year 2013, and the purse seine effort limit provisions in CMM 2008-01 for a three-year period (2009-2011).

NMFS has developed three alternatives to implement the purse seine fishing effort provisions of CMM 2012-01 for detailed consideration in this EA. They are as follows:

2.2.1 Lowest Levels from Years in which Data are Available with Separate Limits for the High Seas and U.S. EEZ (Most Restrictive Alternative)

NMFS examined available logbook data on fishing effort of the U.S. WCPO purse seine fleet from 1997-2010. The 2009 EA relied on logbook data from 1997-2007 to show the recent fishing effort of the fleet. For consistency with the approach used in the 2009 EA, NMFS is using the logbook data, updated through 2010, to formulate the fishing effort limits (see Table 1 in Chapter 3 of this EA). [6] During the 1997-2010 period, the year with the least amount of fishing effort in both the U.S. EEZ and on the high seas was 2010. In that year, the fleet of 37 vessels fished for a total of 25 days in the U.S. EEZ and 400 days on the high seas, or an average of 0.7 fishing days[7] per vessel in the U.S. EEZ and 10.8 fishing days per vessel on the high seas. These per-vessel levels of fishing effort were extrapolated to account for the number of fishing opportunities available under the South Pacific Tuna Treaty,[8] or 40 vessels (the same as the baseline number of vessels

[6] These data are for the same period and from the same source as used in the 2009 EA to calculate the fishing effort limits, with numbers included for 2008, 2009, and 2010. Although data for 2011 and 2012 are available to NMFS, the source of such data is different, and thus, NMFS believes data for the years 2011 and 2012 would not be appropriate to use for the analysis in this EA at this time.

[7] For the purposes of the 2009 rule and this 2013 U.S. purse seine rule, a fishing day is defined as any day in which a fishing vessel of the United States equipped with purse seine gear searches for fish, deploys a FAD, services a FAD, or sets a purse seine, with the exception of setting a purse seine solely for the purpose of testing or cleaning the gear and resulting in no catch.

[8] As discussed in more detail in Chapter 3 of this EA, the U.S. purse seine fleet operating in the WCPO is, for the most part, managed by the United States under the authority of the Treaty on Fisheries between the Governments of Certain Pacific Islands States and the Government of the United States of America (South Pacific Tuna Treaty or SPTT; 16 U.S.C. 973-973r).

used to derive the proposed fishing effort limits for the United States, established in the 2009 rule, as set forth in the 2009 EA). This results in 27 fishing days in the U.S. EEZ and 433 fishing days on the high seas. Thus, this alternative would include an effort limit of 27 fishing days for the U.S. EEZ and an effort limit of 433 fishing days for the high seas for each of the calendar years 2013 and 2014.

2.2.2 Past Regulatory Precedent Alternative

This alternative would include a combined total limit of 2,588 fishing days for the high seas and U.S. EEZ for each of the calendar years 2013 and 2014. This is the same baseline effort limit for a one-year period that NMFS implemented in 2009 for the years 2009-2011 (and as extended by the 2011 rule for the year 2012), and thus, this alternative would maintain the effort limits established by NMFS for the preceding four years for one-year periods. The limits in 2009-2012 were implemented as overlapping multi-year limits, so the limit for any given year was 3,882 fishing days, for a two-year period was 6,470 fishing days, and for a three-year period was 7,764 fishing days. The one and two year limits were aimed at avoiding unduly long closed periods, while ensuring that the overall limit of 7,764 fishing days (three times the base limit of 2,588 fishing days), would not be exceeded in any three-year period.

2.2.3 Highest Levels from Years for which Data are Available with Combined Limit for the High Seas and U.S. EEZ (Least Restrictive Alternative)

As stated above, NMFS examined logbook data on fishing effort of the U.S. WCPO purse seine fleet from 1997-2010. The highest annual level of effort in the U.S. EEZ on an average per-vessel basis was 41.4 days in 1997 and the highest annual level of effort on the high seas on a per vessel basis was 57.2 days in 2005. Extrapolating for the number of fishing opportunities available under the SPTT, or 40 vessels (the same as the baseline number of vessels used to derive the proposed fishing effort limits established in the 2009 rule, as set forth in the 2009 EA), the number would be 1,655 fishing days in the U.S. EEZ and 2,288 fishing days on the high seas, or a total of 3,943 fishing days combined for the U.S. EEZ and high seas for each of the calendar years 2013 and 2014.

2.3 Development of Alternatives for FAD Restrictions

In the 2009 EA, NMFS identified one alternative for implementing the FAD restrictions, which was the same for each of the action alternatives analyzed (Alternative B, Alternative C, Alternative D, and Alternative E). This alternative was a two-month period in 2009 (from August 1 through September 30) and a three-month period in 2010 and 2011 (from July 1 through September 30), as set forth in CMM 2008-01, during which FAD restrictions were in effect.

NMFS has identified two alternatives for implementation of the FAD restrictions for the 2013 U.S. purse seine rule. One alternative would be a four-month period from July 1 through October 31 in 2013 and 2014 during which FAD restrictions would be in effect. The second alternative would be a four-month period from July 1 through October 31 in 2013 and 2014 during which FAD restrictions would be in effect, as well as restrictions during the same period on setting on fish that have aggregated in association with a vessel. This second alternative has been developed to address the fish aggregating properties of fishing vessels.

2.4 Development of Observer Coverage Provision Alternatives

In the 2009 EA, NMFS identified one alternative for implementing the observer coverage provisions, which was the same for each of the action alternatives analyzed (Alternative B, Alternative C, Alternative D, and Alternative E). That alternative required U.S. purse seine vessels to carry observers deployed as part of the WCPFC's Regional Observer Programme (ROP) on all trips in the Convention Area during the 2009 period of FAD restrictions (August 1 through September 30, 2009) and on all trips in the Convention Area in 2010 and 2011, unless the trip took place exclusively within areas under the jurisdiction of the United States or any other single nation, as set forth in CMM 2008-01.[9] NMFS has identified one alternative for implementation of the purse seine observer coverage provisions that is similar to the alternative analyzed in 2009. The main difference is that observer coverage also would be required for trips that take place exclusively in the U.S. EEZ.

CMM 2012-01 includes a provision requiring each coastal CCM to require that all purse seine vessels – that is, purse seine vessels of any flag – fishing in the Convention Area between the latitudes of 20° N. and 20° S. latitude solely within the jurisdiction of the coastal CCM carry an observer (not necessarily a WCPFC-approved observer). Currently, no foreign purse seine fishing vessels are authorized to fish in the U.S. EEZ in the Convention Area, and no such authorizations are foreseeable during the duration of 2013 U.S. Purse Seine Rule. Therefore, NMFS does not see any need to include a requirement in the rule that foreign purse seine vessels that fish in the U.S. EEZ must carry observers. However, the rule would require U.S. purse seine vessels to carry observer when fishing exclusively in the U.S. EEZ.

Under the 2013 U.S. Purse Seine Rule, U.S. purse seine vessels would be required to carry observers deployed as part of the ROP on all trips in the Convention Area in 2013

[9] Although the limitation of the observer requirements to the area between 20° N. and 20° S. latitude was not specifically discussed in the 2009 EA, this limitation was included in the 2009 rule, as specified in CMM 2008-01.

and 2014.[10] These observer requirements would not apply to trips that take place in areas outside the area between 20° N. and 20° S. latitude.[11]

2.5 Alternatives for the U.S. Purse Seine Rule Considered in Detail

The alternatives for the 2013 U.S. purse seine rule analyzed in depth in the EA are designated by number and are described in detail below. The alternatives represent a reasonable range of alternatives that combine the alternative methods of implementing the three elements of the rule (fishing effort limits, periods during which restrictions on fishing on FADs would be in effect, and observer coverage provisions), as set forth above.

2.5.1 Alternative 1: The No-Action Alternative to the 2013 U.S. Purse Seine Rule

Alternative 1, the No-Action Alternative to the U.S. Purse Seine Rule, would cause no changes to "the status quo" and would result in conditions that are treated as the baseline for the purposes of assessing the impacts of the other alternatives. The inclusion of the No-Action Alternative serves the important function of facilitating comparison of the effects of the action alternatives and is a required part of a NEPA document. Under Alternative 1, the U.S. WCPO purse seine fishery would continue to be managed under existing laws and regulations, which are described in Chapter 3, Section 2.1. In effect up to 40 vessels licensed by FFA[12] under the SPTT would continue to fish in the manner in which operations have occurred for the past 25 years, though the SPTT is currently subject to renegotiation and it is foreseeable that there will be substantive changes to the management of the U.S. WCPO purse seine fleet in 2013 or 2014. In addition, the fleet would be subject to certain NMFS regulations that implement decisions of the WCPFC,

[10] Although the provisions of CMM 2012-01 do not specify that the observers carried on trips within a single EEZ must be WCPFC observers, NMFS has identified only two observer programs that would be used as sources of observers to satisfy this requirement – the Pacific Islands Forum Fisheries Agency (FFA) observer program and the NMFS observer program. Currently, both these programs are authorized by the WCPFC as part of the ROP, so observers deployed by these two programs are considered WCPFC observers.

[11] The 2013 U.S. Purse Seine Rule also would not require U.S. purse seine vessels to carry observers when fishing exclusively in water under the jurisdiction of a single foreign nation. However, in that situation, the foreign nation might have its own observer requirements that apply to the U.S. vessel. Furthermore, U.S. regulations at 50 CFR 300.214 require that if a U.S. fishing vessel with a WCPFC Area Endorsement or for which a WCPFC Area Endorsement is required is used for fishing for HMS in the Convention Areas in areas under the jurisdiction of a CCM other than the United States, the owner and operator of the vessel must ensure that the vessel is operated in compliance with the applicable laws of such CCM, including any laws related to carrying observers.

[12] An additional five vessel licenses are available for joint venture operations with Pacific Island Parties to the SPTT.

including permit endorsement requirements, specific reporting requirements, prohibitions on at-sea transshipments, sea turtle take mitigation requirements, catch retention requirements and observer requirements. Vessels in the U.S. WCPO purse seine fleet are also currently required to carry WCPFC observers on all trips in the WCPFC Convention Area pursuant to the general WCPFC observer requirements at 50 CFR 300.215, even though the regulations implementing CMM 2008-01 and CMM 2011-01's observer requirements for purse seine fisheries expired on December 31, 2012. The fleet is also subject to observer coverage requirements under the SPTT. The fleet would also be subject to permitting requirements under NMFS regulations implementing the High Seas Fishing Compliance Act (HSFCA; 16 U.S.C. § 5501, *et seq*.) as well as NMFS regulations implementing the Fishery Ecosystem Plan (FEP) for Pacific Pelagic Fisheries of the Western Pacific Region (Pelagics FEP), pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. § 1801 *et seq*.). All of these regulations are discussed in more detail in Section 3.2 of this EA.

2.5.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Under Alternative 2, the U.S. WCPO purse seine fleet would be subject to the following requirements, as detailed below.

Fishing Effort Limit

Under Alternative 2, in the Convention Area between 20° N. and 20° S. latitude, there would be a limit of 27 fishing days in the U.S. EEZ and a separate limit of 433 fishing days on the high seas for each of the calendar years 2013 and 2014 for the U.S. purse seine fleet.

Use of FADs

Under Alternative 2, in the Convention Area between 20° N. and 20° S. latitude, the FAD restrictions would be in effect from July 1 through October 31 (four months) in each of the years 2013 and 2014.

Observer Requirements

Under Alternative 2, U.S. purse seine vessels would be required carry WCPFC observers on all trips in the Convention Area in 2013 and 2014 in the areas between 20° N. and 20° S. latitude.

2.5.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel

Under Alternative 3, the U.S. WCPO purse seine fleet would be subject to the following requirements, as detailed below. Alternative 3 is the agency's preferred alternative at this time, for reasons discussed in the preamble to the proposed rule.

Fishing Effort Limit

Under Alternative 3, in the Convention Area between 20° N. and 20° S. latitude, there would be a combined limit of 2,588 fishing days for the high seas and U.S. EEZ for each of the calendar years 2013 and 2014.

Use of FADs

Under Alternative 3, in the Convention Area between 20° N. and 20° S. latitude, FAD restrictions would be in effect from July 1 through October 31 (four months) in each of the years 2013 and 2014 as well as restrictions on setting on fish that have aggregated in association with a vessel.

Observer Requirements

Under Alternative 3, the observer coverage requirements would be identical to those under Alternative 2.

2.5.4 Alternative 4: Least Restrictive Fishing Effort Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Under Alternative 4, the U.S. WCPO purse seine fleet would be subject to the following requirements, as detailed below.

Fishing Effort Limit

Under Alternative 4, in the Convention Area between 20° N. and 20° S. latitude, there would be a combined limit of 3,943 fishing days for the high seas and U.S. EEZ for each of the years 2013 and 2014.

Use of FADs

Under Alternative 4, the FAD restrictions would be identical to those under Alternative 2.

Observer Requirements

Under Alternative 4, the observer coverage requirements would be identical to those under Alternative 2.

2.6 Alternatives Initially Considered But Excluded From Detailed Analysis

NMFS initially considered additional alternatives for the fishing effort limit provisions and the FAD restrictions that have been excluded from detailed analysis in this EA. These alternatives are discussed below.

2.6.1 Excluded Alternatives for Fishing Effort Limits

As stated above, CMM 2012-01 specifies that each CCM shall take measures not to increase fishing days on the high seas and to establish effort limits or equivalent catch limits in its EEZ that reflect the geographical distributions of skipjack tuna, yellowfin tuna, and bigeye tuna, and that are consistent with the WCPFC's management objectives for those species. The management regime for the tuna purse seine fisheries in the WCPO has focused on a system of fishing effort limits (vessel-fishing day limits) or input-based control, rather than catch limits or output-based control, and it is unclear how such effort limits could be converted to "equivalent catch limits" for the U.S. purse seine fleet. Thus, absent more specific guidance or requirements adopted by the WCPFC on implementation of catch limits for purse seine vessels, NMFS believes the only reasonable approach is to continue management of the U.S. purse seine fleet via effort limits at this time, and has excluded consideration of catch limits for the U.S. purse seine fleet from detailed analysis in this EA.

In the 2009 EA, NMFS considered an alternative for the allocation of the effort limits among individual purse seine vessel in some manner. As indicated in the 2009 EA, this alternative would have no real difference from other fishing effort limit alternatives that could cause impacts on resources in the affected environment, other than perhaps decreasing the likelihood of a race to fish that could be caused by competitive, fleet-wide limits. Given the complexity of setting up such an allocation scheme (which would require consideration of such things as which entities are to receive allocations, the criteria for making allocations, and whether and how the allocations would be transferable, as well as developing a mechanism to reliably monitor the fishing effort of the individual entities), NMFS believes it is not feasible to develop such an allocation scheme for this rulemaking in 2013. Because this alternative would not be feasible to implement in 2013, NMFS is excluding detailed consideration of this alternative in this EA. Moreover, NMFS believes that it is not practical to conduct detailed analysis of this alternative at this time for 2014, given that any potential management changes to the fleet under the SPTT are not known in any detail at the current time due to the status of the ongoing renegotiation proceedings. The SPTT and the related economic assistance agreement between the United States and certain Pacific Islands is currently subject to renegotiation and it is foreseeable that there will be substantive changes to the management of the U.S. WCPO purse seine fleet in 2013 or 2014. However, the nature and details of any such changes are unknown at this time. Should NMFS decide to consider implementation of such an alternative in 2014 or beyond, NMFS would conduct any needed analysis of this alternative at the appropriate time. As set forth in Chapter 1 of this EA, the purpose of the 2013 U.S. purse seine rule is to implement the provisions of CMM 2012-01 for the U.S. WCPO purse seine fleet that are necessary to implement via regulations in 2013 in a timely and practical manner, in order to contribute to the underlying objectives of CMM 2012-01 regarding WCPO bigeye tuna, yellowfin tuna and skipjack tuna, which are to reduce or maintain their respective fishing mortality rates at levels no greater than the fishing mortality rates associated with maximum sustainable yield. The need for the rule is to satisfy the international obligations of the United States as a Contracting Party to the Convention, pursuant to the authority of the WCPFCIA. The alternative of allocating fishing effort limits among individual vessels does not meet the purpose of and need for the 2013 U.S. purse seine rule and is a complex matter that does not lend itself to a timely assessment for this regulatory effort.

2.6.2 Excluded Alternatives for FAD Restrictions

CMM 2012-01 requires CCMs to prohibit their purse seine vessels from setting on FADs in EEZs and on the high seas in the Convention area between 20° N. and 20° S. latitude from July 1 through September 30. The CMM further requires CCMs to either prohibit setting on FADs in October or limit the total number of FAD sets in the calendar year by the CCM's purse seine fleet to two-thirds of the fleet's average annual number in the 2001-2011 period, as specified in Attachment A of CMM 2012-01 (for a CCM that is a Small Island Developing State, the total annual limit on FAD sets would be eight-ninths of its fleet's 2009-2012 annual average). For the U.S. purse seine fleet, the calendar-year limit would be 1,464 FAD sets. Assuming that fishing patterns in 2013 would be similar to those in recent years, and because the limit-year would start January 1, the 2013 limit of 1,464 FAD sets would be expected to be reached as early as April 2013. It is infeasible for NMFS to complete the rulemaking process that would be necessary to establish the limit and the legal mechanism to prohibit further FAD sets once the limit is reached before April, the date the fleet would likely reach the FAD set limit. Furthermore, NMFS finds that it would not be feasible to establish by that time the mechanism needed to monitor FAD sets with respect to the limit and to reliably project when the limit is likely to be reached so that further FAD sets can be prohibited in a timely manner. For example, a system would have to be established for rapidly processing data collected from vessel observers and/or masters and for using those data to project future levels of FAD sets in advance of actually reaching the limit. Thus, the option of limiting the annual number of FAD sets would likely result in the mandated limit for 2013 being exceeded, and the United States would have failed to satisfy its international obligations with respect to the purse seine provisions of CMM 2012-01. Because the option of limiting the number of annual FAD sets would be infeasible to implement for 2013, and the United States would consequently fail to satisfy its international obligations under the Convention, this option is not considered in detail

NMFS believes that implementing a limit on the total annual number of FAD sets for the U.S. WCPO purse seine fleet may be a viable option in the future, should the WCPFC adopt similar provisions that would be effective after 2013. However, NMFS believes that it is not practical to conduct detailed analysis of this alternative at this time for 2014, given the potential for significant management changes to the fleet from the ongoing renegotiations of the SPTT. As stated above, the SPTT and the related economic assistance agreement between the United States and certain Pacific Islands is currently subject to renegotiation and it is foreseeable that there will be substantive changes to the management of the U.S. WCPO purse seine fleet in 2013 or 2014. However, the nature and details of any such changes are unknown at this time. It is likely that implementation of a limit on FAD sets for the U.S. fleet for 2014 and beyond would need to take into consideration any new provisions of the SPTT (e.g., limits on fishing days, license numbers, areas of fishing allowed). Thus, should the WCPFC adopt similar provisions for limiting FAD sets that would be effective in 2014 and beyond, NMFS would conduct the analysis of this alternative at the appropriate time. As set forth in Chapter 1 of this EA, the purpose of the 2013 U.S. purse seine rule is to implement the provisions of CMM 2012-01 for the U.S. WCPO purse seine fleet that are necessary to implement via regulations in 2013 in a timely and practical manner, in order to contribute to the underlying objectives of CMM 2012-01 regarding WCPO bigeye tuna, yellowfin tuna and skipjack tuna, which are to reduce or maintain their respective fishing mortality rates at levels no greater than the fishing mortality rates associated with maximum sustainable yield. The need for the rule is to satisfy the international obligations of the United States as a Contracting Party to the Convention, pursuant to the authority of the WCPFCIA. The alternative for the limit on FAD sets for 2013 does not meet the purpose of and need for the 2013 U.S. purse seine rule.

Chapter 3

Chapter 3 Affected Environment

This chapter describes the physical and biological environment in which the U.S. purse seine fishery operates in the WCPO, focusing on the resources that could be affected by the implementation of 2013 U.S. purse seine rule. The chapter is divided as follows: (1) physical environment and climate change; (2) description of the U.S. WCPO purse seine fleet; (3) bigeye tuna, skipjack tuna, and yellowfin tuna – the principal stocks associated with the U.S. purse seine fishery in the WCPO; (4) other biological resources; and (5) protected resources.

3.1 Physical Environment and Climate Change

The physical reach of the Convention Area (as shown in Chapter 1), comprises all waters of the Pacific Ocean bounded to the south and to the east by the following line: from the south coast of Australia due south along the 141° meridian of east longitude to its intersection with the 55° parallel of south latitude; thence due east along the 55° parallel of south latitude to its intersection with the 150° meridian of east longitude; thence due south along the 150° meridian of east longitude to its intersection with the 60° parallel of south latitude; thence due east along the 60° parallel of south latitude to its intersection with the 130° meridian of west longitude; thence due north along the 130° meridian of west longitude to its intersection with the 4° parallel of south latitude; thence due west along the 4° parallel of south latitude to its intersection with the 150° meridian of west longitude; thence due north along the 150° meridian of west longitude.

Below is a description of the specific physical environment in which the WCPO U.S. purse seine fishery occurs and how physical features of the pelagic environment, as well as the distribution of HMS, influence the fishery.

3.1.1 Oceanography

There are two main subtropical gyres (the North Pacific subtropical gyre in the northern hemisphere and the South Pacific subtropical gyre in the southern hemisphere) in the Pacific Ocean, as well as 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 forces. Due to this, the central Pacific Ocean (~20° N. -20° S. latitude) 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. Embedded in the mean flow are numerous mesoscale eddies (turbulent or spinning flows on scales of a few hundred kilometers (Stewart 2005)) created from wind and current interactions with the ocean's bathymetry. These eddies, which can rotate either clockwise or counter clockwise, typically have important biological impacts, such as creating areas of high biological productivity.

Ocean 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, where the mixing is greatest, are often targeted by fishermen as these are areas of high biological productivity.

The subtropical frontal zones, consisting of several convergent fronts, lie between latitudes 25°- 40° N and S, and are often referred to as the Transition Zones. Transition zones are areas of ocean water bounded to the north and south by large-scale surface currents originating from subartic and subtropical locations (Polovina et al. 2001). These zones also provide important habitat for pelagic fish and thus, are targeted by fishers.

Variability within the ocean–atmosphere system results in changes in winds, rainfall, currents, water column mixing, and sea-level heights, which can have profound effects on regional climates as well as on the abundance and distribution of marine organisms. In the tropical Pacific there is a limited seasonal variation, yet there is a strong interannual variability which in turn affects the entire Pacific Ocean (Langley et al. 2004).

The scientific community has become increasingly aware of the occurrence and importance of long-term (decadal-scale) oceanographic cycles and of their relationship to cycles in the population sizes of some species of fish (Chavez et al. 2003). These naturally occurring cycles can either mitigate or accentuate the impact of fishing mortality on all species, especially those targeted in HMS fisheries. El Niño Southern Oscillation (ENSO)[13] events, including meso-scale events, such as El Niño and La Niña, and shorter term phenomena such as cyclonic eddies near the Hawaiian Islands (Seki et al. 2002), impact the recruitment and fishing vulnerability of HMS. ENSO events can cause considerable interannual physical and biological variation. During an El Niño, the normal easterly trade winds weaken, resulting in a weakening of the westward equatorial surface current and a deepening of the thermocline in the central and eastern equatorial Pacific. In turn, the eastward-flowing countercurrent tends to dominate circulation, bringing warm, low-salinity, and low-nutrient water to the eastern margins of the Pacific Ocean. As the easterly trade winds are reduced, the normal nutrient-rich upwelling system does not occur, leaving warm surface water pooled in the eastern Pacific Ocean (EPO).

[13] ENSO events include the full range of variation observed between El Niño and La Niña events. El Niño is characterized by a large-scale weakening of the tradewinds and warming of the surface layers in the eastern and central equatorial Pacific. El Niño events occur irregularly at intervals of 2–7 years, although the average is about once every 3–4 years. These events typically last 12–18 months, and are accompanied by swings in the Southern Oscillation, an interannual “see-saw” in tropical sea level pressure between the eastern and western hemispheres. During El Niño, unusually high atmospheric sea level pressures develop in the western tropical Pacific and Indian Ocean regions, and unusually low sea level pressures develop in the southeastern tropical Pacific. During La Niña, the opposite effects are seen (NMFS 2004).

El Niño affects the ecosystem dynamics in the equatorial and subtropical Pacific by considerable warming of the upper ocean layer, rising of the thermocline in the western Pacific and lowering in the east, strong variations in the intensity of ocean currents, low trade winds with frequent westerlies, high precipitation at the dateline, and drought in the western Pacific (Sturman and McGowan 1999). El Niño events have the ability to exercise a strong influence on the abundance and distribution of organisms within marine ecosystems. The deepening of the mixed layer depth that occurs with an El Niño may be manifested by a discernable increase in purse seine catch per unit of effort (CPUE) of yellowfin tuna in the central/western regions of the Pacific. This is normally seen after a 2-3 month delay and occurs in the eastern portion of the WCPO in the vicinity of Kiribati and the U.S. EEZ of the central Pacific (Howland, Baker, Jarvis etc.). During a strong El Niño, the purse seine fishery for skipjack tuna shifts over thousands of kilometers from the western to the central equatorial Pacific in response to physical and biological impacts (Lehodey et al. 1997).

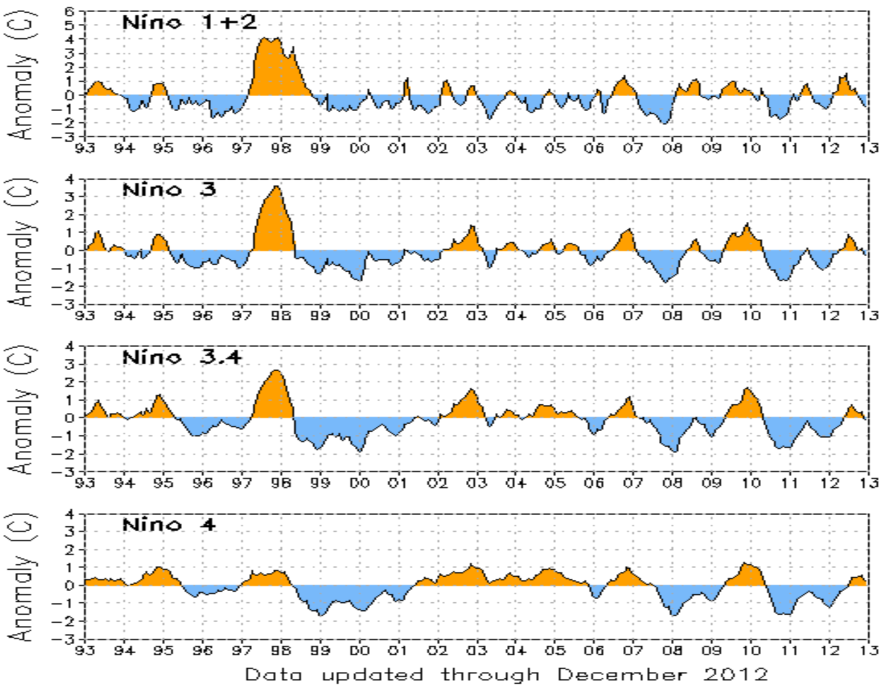
A La Niña event exhibits the opposite conditions: cooler than normal sea-surface temperatures in the central and eastern tropical Pacific Ocean. These may have larger impacts on global weather patterns. For the purse seine fishery the contraction of the warm pool tends to shift fishing to the western portion of the WCPO in the vicinity of Papua New Guinea and Federated States of Micronesia, or away from the U.S. EEZ and those areas to the north of American Samoa. The major change is a horizontal extension or contraction of the skipjack tuna habitat during El Niño and La Niña phases respectively.

Physical and biological oceanographic changes have also been observed on decadal time scales. These low frequency changes, termed regime shifts, can impact the entire ocean basin. These impacts can lead to potential impacts on the tropical Pacific fisheries for tunas such as the extension of present fisheries to higher latitudes, a decrease in productivity, mainly in the eastern Pacific, increasing variability in the catches, changes in species composition of the catch, and increasing fishing pressure, particularly on bigeye and yellowfin tuna (The World Bank 2000).

Figure 2 below shows sea surface temperature anomalies for different regions of the Pacific Ocean for the years 1993-2012. The regions are as follows: (1) Nino 1+2 is the extreme eastern equatorial Pacific between 0° to 10°S latitude and 90° to 80°W longitude; (2) Nino 3 is the eastern equatorial Pacific between 5°N to 5°S latitude and 150°W to 90°W longitude; (3) Nino 3.4 is the east-central equatorial Pacific between 5°N to 5°S latitude and 170°W to 120°W longitude; and (4) Nino 4 covers the international date line and is from 5°N to 5°S latitude and 160°E to 150°W longitude. Anomalies refer to variations from the monthly mean sea surface temperatures during the base period (1981-2010).[14]

[14] Information and Figure 2 taken from the National Weather Service Web site at: http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt5.shtml.

Figure 2: Sea Surface Temperature Indices of ENSO Patterns from 1993 to 2012.



3.1.2 Climate Change

Climate change can affect the marine environment by impacting the established hydrologic cycle (a change in precipitation and evaporation rates) (Bala et al. 2010). This in turn may cause a shift in food web dynamics, such as a reduction in primary productivity, which affects HMS migration and distribution (Dambacher et al. 2010, Loukos et al. 2003). Climate change has been associated with other effects to the marine environment, including rising oceanic temperatures, changes in ice cover, salinity, oxygen levels, and circulation (Intergovernmental Panel on Climate Change 2007). These effects are leading to shifts in the range, abundance, and behaviors of algae, plankton, fish and other sea life (Solomon et al. 2007). Coral reefs are also being damaged through ocean acidification and sea level rise (Carpenter et al. 2008, Mayfield et al. 2012, Munday et al. 2012). There are many predictions pertaining to the rate of change and potential maximums of sea level rise but studies indicate the change is caused by rising global temperatures and ice melt (Rahmstorf 2007). Sea level changes could potentially damage the nesting, breeding, foraging, and migratory sites of coastal marine sea birds (Galbraith et al. 2002) and other vertebrate megafauna such as pinnipeds and chelonioidea (Baker et al. 2006).

Climate change is also increasing the incidence of disease in aquatic organisms (Roessig et al. 2004, Hoegh-Guldberg and Bruno 2010, Woesik et al. 2012) as well as the spread of invasive species (Hoegh-Guldberg and Bruno 2010). Studies on planktonic ecosystems demonstrate that climate change is affecting phytoplankton abundance and distribution, which in turn affects consumers ranging from zooplankton to megafauna (Hays et al. 2005). Changes in plankton affect ecosystem services such as oxygen production, carbon sequestration, and biogeochemical cycling (Edwards et al. 2010). All of these studies concluded that fish, seabirds, and marine mammals will need to adapt to shifts in spatial distribution of primary and secondary production within pelagic marine ecosystems (Hoegh-Guldberg and Bruno 2010, Dambacher et al. 2010).

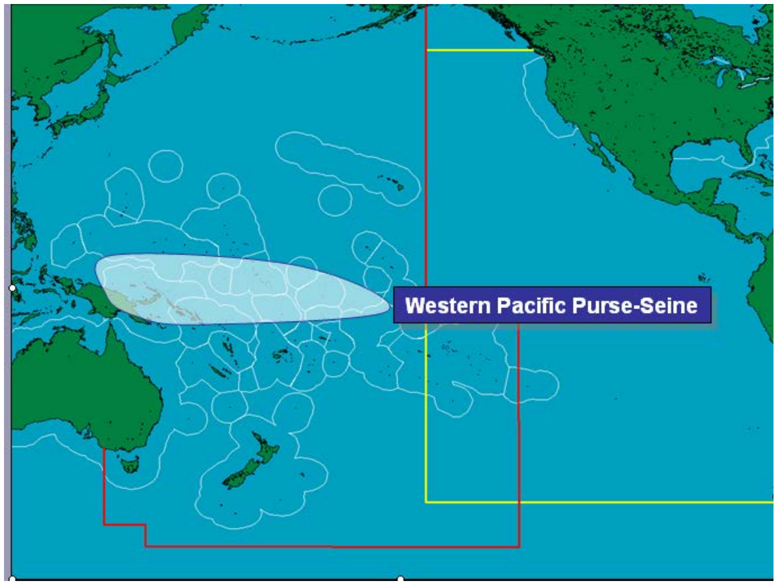
Studies conducted by Perry et al. (2005) indicate that climate change is impacting marine fish distributions, which in turn may have important ecological impacts on fish as well as important impacts on commercial fisheries. How climate change can impact commercial fisheries include: (1) increases in 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).

Ainsworth et al. (2011) also investigate potential climate change impacts on commercially valuable species of fish, stimulating changes in (1) primary productivity; (2) species range shifts; (3) zooplankton community size structure; (4) ocean acidification; and (5) ocean deoxygenation. Climate change may also impact marine carrying capacity and relative suitable habitats for fish stocks, theoretically either positively or negatively affecting the levels of growth and survival of certain fish populations (Kaeriyama et al. 2012).

3.2 U.S. WCPO Purse Seine Fishery

U.S. purse seine vessels typcially engage in targeting skipjack and to a lesser extent yellowfin tuna throughout the equatorial regions of the Convention Area. The U.S. WCPO purse seine fleet operates mostly in the EEZs of Pacific Island Countries (PIC) between 10° N and 10° S within the Convention Area (Figure 3).

Figure 3: The general operational area of the U.S. WCPO purse seine fishery (indicative only) in light blue. The red line demarks the Convention Area with the yellow line depicting the boundary of the Inter American Tropical Tuna Commission (IATTC), which generally exercises competence over HMS Fisheries in the EPO.



Source: NMFS unpublished data.

3.2.1 Fleet Characteristics

Gillett et al. (2002) provide a detailed description of the historical development and expansion of the U.S. WCPO purse seine fleet from its bases in the EPO. The U.S. fleet developed a year-round fishery along the Equator, generally within a rectangular area bounded by 10° N-10° S latitude and 135° E-170° E longitude, and encompassing the EEZs of Palau, Federated States of Micronesia, Papua New Guinea, Solomon Islands, Nauru, Marshall Islands, and the Gilbert Islands group of Kiribati. Fishing grounds continued to expand eastward throughout the 1980s, eventually encompassing the Phoenix and Line Islands (Kiribati); the U.S. possessions of Howland, Baker, and Jarvis; Tokelau; and the high seas between these EEZ areas. U.S. purse seiners typically target skipjack and yellowfin tuna found in association with drifting logs/flotsam or FADs and also unassociated free-swimming schools of tuna (“school sets”). The relative proportion of the different set types has varied considerably over time as oceanographic conditions and technology have changed.

Large modern purse seiners are one of the most complex fishing vessels in terms of both technology and machinery. Hydraulic systems on large “super seiners,” require more than 1,600 meters of piping, and are equipped with at least four auxiliary engines in addition to the main propulsion engine (or engines). 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 meters or more in length and 150 meters in depth. 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. The catch is removed from the sack onto the vessel with large "scoops" holding several metric tons (mt), and then is placed in brine tanks for freezing and later storage. Joseph (2002) and NMFS (2004) provide a detailed description of tuna purse seining and the fleets involved in the Pacific Ocean fisheries.

3.2.2 Management of the U.S. Purse Seine Fleet in the WCPO

The fishing activities of U.S. WCPO purse seine vessels are governed in large part by the SPTT. The SPTT manages access of U.S. purse seine vessels to the EEZs of Pacific Islands Parties to the SPTT and provides for technical assistance in the area of Pacific Island Country fisheries development. The SPTT is implemented domestically by regulations (50 CFR 300 Subpart D) issued under authority of the South Pacific Tuna Act of 1988 (SPTA; 16 U.S.C. 973-973r). As stated in Chapter 2 of this EA, the SPTT is being renegotiated, which very likely will result in changes to the current management regime. The HSFCA and implementing regulations (50 CFR 300 Subpart B), the WCPFCIA and implementing regulations (50 CFR 300 Subpart O), and regulations implementing the Pelagics FEP pursuant to MSA (50 CFR Part 665) also regulate this fishery. The main fishery management regulations established under the SPTA, HSFCA, WCPFCIA, and Pelagics FEP are:

- All U.S. vessels that fish (as defined under 50 CFR § 300.2) on the high seas are required to have a permit in accordance with the HSFCA and a WCPFC Area Endorsement, if fishing on the high seas in the Convention Area;

- A U.S. purse seine vessels operating in the WCPO must have a license issued by the FFA as Treaty Administrator on behalf of the Pacific Island Parties to the SPTT. The SPTT and implementing regulations provide for the availability of 45 licenses, five of which are only available to fishing vessels engaged in joint venture arrangements with the Pacific Islands Parties. No joint venture licenses have ever been issued.

- Within the SPTT Area there are several types of designated geographical areas, as described below:

    1. The **Treaty Area** which is about 10 million square miles in size.

2. The **Licensing Area** where a license is required in order to fish.

3. **Closed Areas** are those in which U.S. purse seine vessels are not allowed to fish.

- U.S. purse seine vessels are prohibited from transshipping fish at sea in the Convention Area and from transshipping fish caught in the Convention Area anywhere else;

- A U.S. purse seine vessel cannot be used for directed fishing for southern bluefin tuna *(Thunnus maccoyii)* or for fishing for any kinds of fish other than tunas, except fish that may be caught incidentally;

- Holders of vessel licenses are required to submit both written and electronic reports on their fishing activities in the Treaty Area to NMFS, the FFA or the local marine resource authority in which the vessel is operating;

- U.S. purse seine vessels must carry observers and comply with provisions for accommodating observers;

- U.S. purse seine vessels are required to carry and operate mobile transmitting units to provide position information and comply with Vessel Monitoring System (VMS) reporting requirements;

- U.S. purse seine vessels are required to be identified in accordance with the 1989 United Nations Food and Agriculture Organization standard specifications for the marking and identification of fishing vessels, which requires that the vessel's international radio call sign be marked on the hull and deck;

- U.S. purse seine vessels operating in the Convention Area must submit specific reports on transhipments, discards, and entries into and exit from a certain area of the high seas (i.e., Eastern High Seas Special Management Area; 50 CFR 300.225);

- U.S. purse seine vessels fishing in the Convention Area must follow certain sea turtle interaction mitigation measures;

- U.S. purse seine vessels must retain all catch of bigeye, yellowfin, and skipjack tuna, subject to certain exceptions; and

- U.S. purse seine vessels equal to or greater than 50 feet (15.2 meters) in length overall generally cannot fish in a certain portion of the U.S. EEZ around American Samoa.

Pursuant to the terms of the SPTT, at least twenty percent of trips by the U.S. WCPO purse seine fleet must carry observers (see SPTT, Annex I, Part 7). Beginning in 2010, purse seine vessels were required to carry WCPFC observers on all trips under regulations implementing WCPFC CMM 2008-01(CFR 50 300.223), with certain exceptions. Those exceptions included: fishing trips that took place entirely within areas under U.S. jurisdiction or entirely within areas under the jurisdiction of a single nation other than the United States; fishing trips in the Convention Area not between 20°N. and 20°S. latitude; or when NMFS has determined that an observer is not available for the fishing trip and a written copy of the determination is on board the vessel.[15] Although those specific observer coverage provisions implementing CMM 2008-01 expired at the end of 2012, pursuant to the regulations at 50 CFR 300.215, NMFS has directed vessels in the U.S. purse seine fleet operating in the Convention Area to carry observers on all trips.

Observers provide useful information that is independent of vessel operators and is obtained during actual fishing operations. Data typically collected by observers include catch composition by species, effort, location, environmental conditions, gear type, and information on bycatch. Observers deployed by FFA on U.S. WCPO purse seine vessels collect detailed information on bycatch and discards in the WCPO purse seine fishery and these data are routinely used to provide estimates of total bycatch and discards and the extent of interaction with species of special interest (e.g., marine mammals and turtles) (Secretariat of the Pacific Community (SPC) 2012b) and are employed for regional tuna stock assessments.

3.2.3 Participation, Effort, and Catch

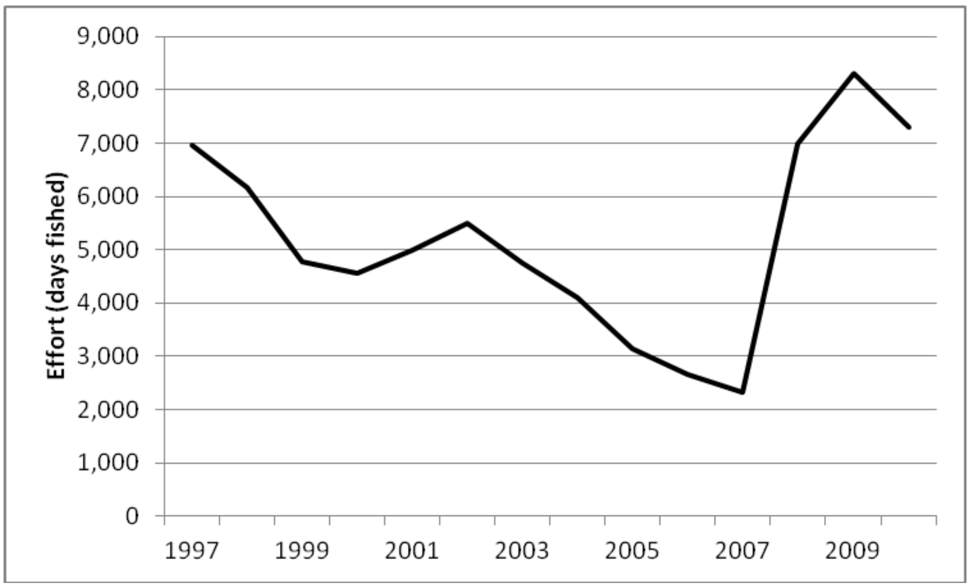
As stated in Section 2.2 of this EA, the 2009 EA relied on logbook data from 1997-2007 to show the recent fishing effort of the fleet. For consistency with the approach used in the 2009 EA, NMFS is using the logbook data, updated through 2010, for the analysis in this EA.[16] As shown in Table 1 below, the U.S. WCPO purse seine fleet spent, from

[15] CMM 2012-01 includes provisions to require that all purse seine vessels – that is, purse seine vessels of any flag – fishing in the Convention Area between 20° N. and 20° S. latitude solely within the jurisdiction of the coastal CCM carry an observer. As explained in Chapter 2 of this EA, NMFS is implementing this provision for U.S. purse seine vessels when those vessels take trips solely within the U.S. EEZ. In addition, although the 2009 rule included an exception for fishing trips for which the NMFS Pacific Islands Regional Administrator had determined that a WCPFC observer is not available, provided that written documentation of such determination was carried on board the vessel during the entirely of the fishing trip, NMFS no longer believes that this exception is needed, and it is not included in the 2013 U.S. Purse Seine Rule. This exception was included in the 2009 rule because at that time it was not clear whether the observer providers in the region would be able to provide observers on all the required fishing trips made by U.S. purse seine vessels. The FFA observer program has now deployed observers on all fishing trips by the U.S. WCPO purse seine fleet for more than three years.

[16] These data are for the same period and from the same source as used in the 2009 EA to calculate the fishing effort limits, with numbers included for 2008, 2009, and 2010. Although data for 2011 and 2012 are available to NMFS, the source of such data is different, and thus, NMFS believes data for the years 2011 and 2012 would not be appropriate to use for the analysis in this EA at this time.

1997 through 2010, about 6 percent of its effort in the U.S. EEZ, 22 percent on the high seas, and the remainder in the EEZs of Pacific Island Parties to the SPTT (unpublished NMFS data). The percentages for any given year during that period ranged from 1 percent to 21 percent for the U.S. EEZ, 5 percent to 30 percent for the high seas, and 60 percent to 94 percent for the EEZs of Pacific Island Parties to the SPTT. Figure 4 shows approximate effort data from 1997 through 2010 for the U.S. WCPO purse seine fleet (unpublished NMFS data) and Table 1 shows the effort data for the high seas, U.S. EEZ, and PIC EEZ regions for each of those years (unpublished NMFS data).

Figure 4: U.S. WCPO purse seine fleet fishing effort, 1997-2010



Source: NMS unpublished data.

Table 1: U.S. WCPO purse seine fleet fishing effort (1997-2010). [17] **Updated from Table 3 in the 2009 EA to include 2008-2010 data and best available data.**

Year	U.S. EEZ Effort	U.S. % days	High seas Effort	High Seas % days	PIC Effort	PIC % days	Total Effort	Number of Vessels[18]
1997	1,448	21	1,351	19	4,166	60	6,965	35
1998	466	8	1,604	26	4,103	66	6,173	39
1999	225	5	1,214	25	3,347	70	4,786	36
2000	120	3	894	20	3,553	78	4,567	33
2001	343	7	955	19	3,691	74	4,989	32
2002	434	8	1,323	24	3,737	68	5,494	29
2003	219	5	871	18	3,663	77	4,753	26
2004	278	7	1,056	26	2,775	68	4,108	21
2005	127	4	858	27	2,157	69	3,142	15
2006	176	7	568	21	1,918	72	2,662	13
2007	88	4	697	30	1,548	66	2,333	21
2008	69	1	1,567	22	5,349	77	6,985	36
2009	100	1	1,758	21	6,460	78	8,318	39
2010	25	<0.5	400	5	6,883	94	7,307	37
Total							72,581	
AVG.	294	6	1,078	22	3,811	73	5,184	

Source: NMFS unpublished data.

Participation in the U.S. WCPO purse seine fishery increased from the late 1980s to the mid-1990s, and gradually decreased until a low was reached in 2006. The fleet has since increased to about the levels of the mid 1990s, and has been relatively stable for the past five years. As of December 2012, the U.S. WCPO purse seine fleet included 39 vessels.

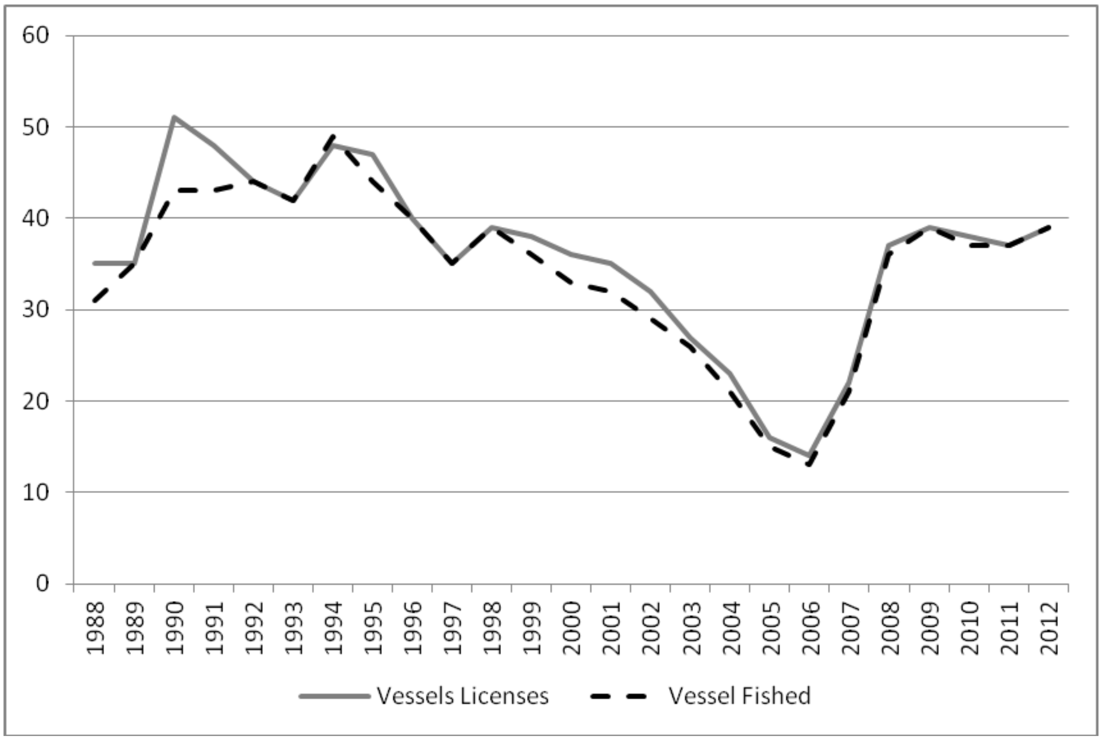
---

[17] For the purposes of the 2009 rule and this 2013 U.S. purse seine rule, a fishing day is defined as any day in which a fishing vessel of the United States equipped with purse seine gear searches for fish, deploys a FAD, services a FAD, or sets a purse seine, with the exception of setting a purse seine solely for the purpose of testing or cleaning the gear and resulting in no catch.

[18] Number of vessels indicates the total number of unique vessels contributing to the data for a given year.

The fleet is likely to operate at of near the 40 vessel level for the next two years. Figure 5 below shows the number of licensed vessels and the number of vessels that fished in the fleet from 1988 to 2012.

Figure 5: Number of U.S.-flagged purse seine vessels licensed and vessels fished under the SPTT from 1988 to 2012



Sources: Coan et al 2002; United States Coast Guard and NMFS 2013; and NMFS, unpublished data.

Skipjack tuna generally account for 70–77 percent of the purse seine catch, yellowfin tuna for about 19-22 percent, and bigeye tuna for a small proportion (<5 percent) (SPC 2012a). Table 2 shows the 2010 tuna landings of the fleet by species and port. Historically, most of the U.S. WCPO purse seine fleet operated out of Pago, Pago, American Samoa. However, recently some of the vessels that have entered the fleet operate under a different business model, and transship most of their catch in Pacific Island ports in the region. In recent years, about 25 percent of the catch has been landed in Pago Pago.

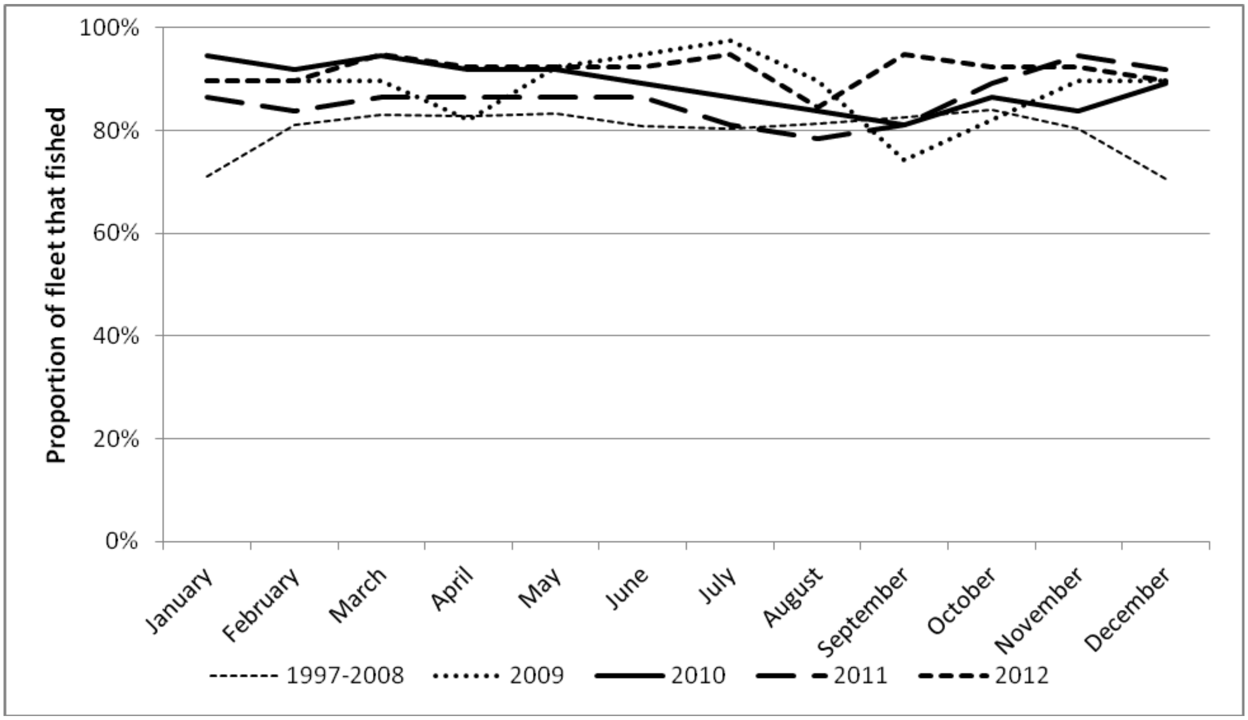
Table 2: Tuna landings by U.S. WCPO purse seine vessels by species and port, 2010

2010	**Tuna Landings (mt)**			
PORT	**Skipjack**	**Yellowfin and Bigeye**	**Total**	**%**
United States Ports				
Pago Pago, American Samoa	52,168	4,265	56,432	23%
Foreign Ports				
Pohnpei, Federated States of Micronesia	52,459	7,322	59,781	24%
Tarawa, Kiribati	7,817	318	8,135	3%
Rabaul, Papua New Guinea	10,041	4,408	14,449	6%
Majuro, Republic of the Marshall Islands	69,491	9,447	78,939	32%
Honiara, Solomon Islands	19,298	3,059	22,356	9%
Other	3,731	970	4,701	2%
TOTAL	**215,005**	**29,788**	**244,793**	**100%**

Source: United States Coast Guard and NMFS 2012.

Purse seine fishing effort in the WCPO cannot be characterized by any marked or documented seasonal patterns. As shown in Figure 6 below, over 70 percent of the U.S. purse seine fleet in the WCPO fished throughout the entire year from 1997 through 2008 and at least that in each of the years from 2009 through 2012. The percent of licensed vessels that fished in the years when the 2009 rule and 2011 rule were in effect was generally constant throughout the year.

Figure 6: Proportion of the WCPO U.S. purse seine fleet that fished, by month, 1997-2012.

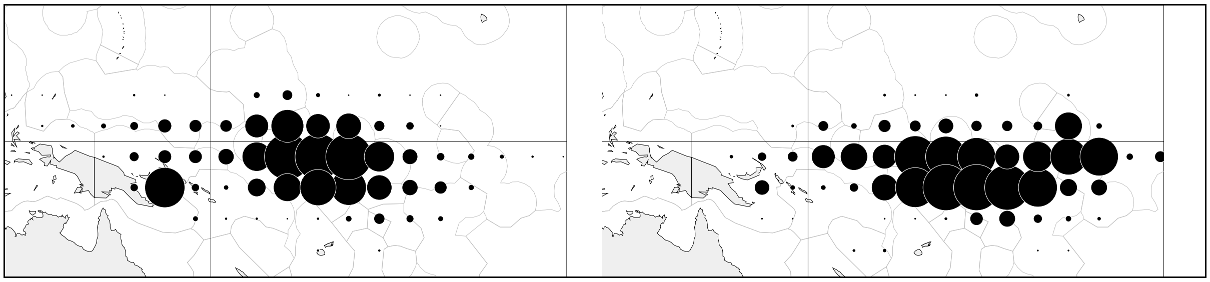


Source: NMFS unpublished data.

As stated in Section 3.1 above, the spatial distribution of fishing effort is influenced by the (irregular) cycles associated with ENSO events, revealing strong temporal variation on the scale of years and decades. The distribution of catch by the WCPO purse seine fishery is also strongly influenced by ENSO events. Lehodey et al. (1997) and Lehodey et al. (1998) suggested that skipjack abundance is linked to east–west movements of warm water. El Niño conditions also produce unusual westerly winds and surface drift in the WCPO that transport drifting debris further eastward than usual. During these El Niño events, purse seine effort increases in the eastern portion of the fishery to take advantage of sets on debris, such as logs (Williams 2003).

Figure 7 depicts a good example of the U.S. purse seine effort during a transitional year between an El Niño and La Niña period (2001) and an El Niño period (2002). Effort in strong La Niña conditions normally shifts west of the vertical line indicating 160° E longitude.

Figure 7: Distribution of U.S. purse seine effort during 2001 and 2002. Lines for the Equator (0° latitude) and 160° E longitude included. The left-hand side of the figure shows effort during 2001 and the right-hand side shows effort during 2002.



Source: Williams 2003.

3.2.4 FADs

Fish aggregating devices, or FADs, are man-made devices or natural floating objects, anchored or not, capable of aggregating fish. FAD sets by purse seine fleets are generally composed of adult skipjack tuna, juvenile bigeye tuna, and juvenile yellowfin tuna (Dagorn, L. et al. 2012). Fishing on drifting FADs has also shown decreases in average size of target catch, increases in catches of bigeye, and increases in bycatch (Gillett et al. 2002) when compared to unassociated sets. FAD sets also show a more varied composition of catch.

As shown in Table 3, the WCPO purse seine fleet catches mostly skipjack and yellowfin tuna. Based on data compiled by SPC (SPC 2012a), FAD sets generally yield higher catch rates (mt/day) for skipjack tuna than unassociated sets. Data from SPC also indicates that unassociated sets generally yield a higher catch rate for yellowfin tuna than FAD sets. This may be explained from the occurrence of unassociated sets in the more eastern areas of the Convention Area containing “pure” schools of large, adult yellowfin, which account for a larger catch (by weight) than the (mostly) juvenile yellowfin encountered in FAD sets (SPC 2012a). As indicated in Table 3, almost all the WCPO purse seine catch of bigeye is from FAD sets. Table 3 shows the breakdown of catch by set type for the U.S. purse seine fleet for the years 2006-2010.

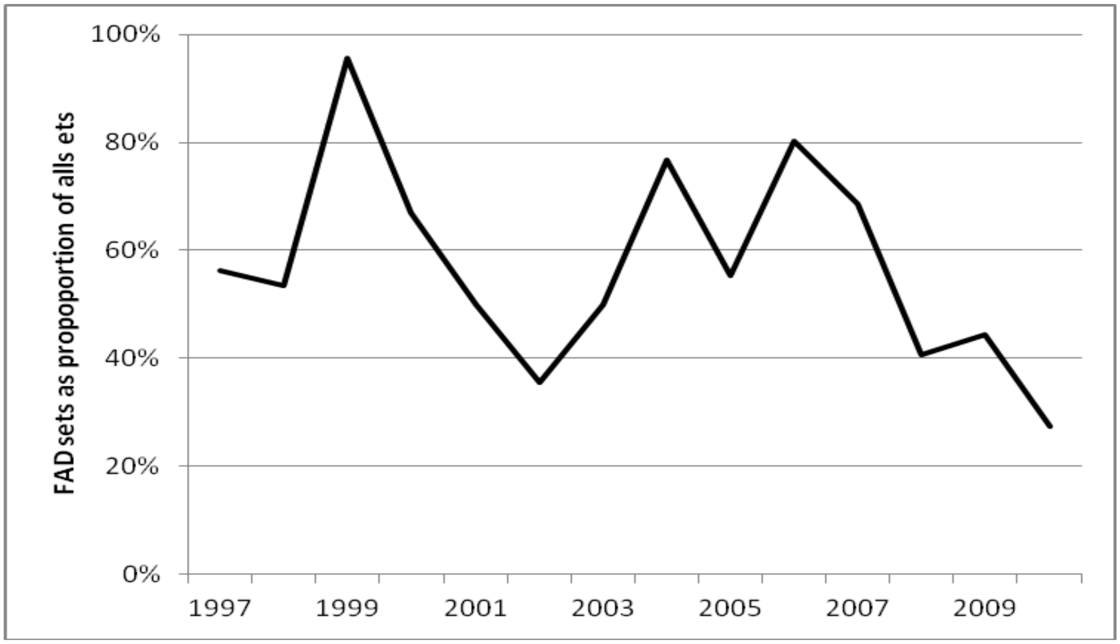
Table 3: Annual U.S. WCPO purse seine catch estimates in mt by set type (unassociated and FAD), 2006-2010 (data for 2010 are preliminary).

Year	Skipjack		Yellowfin		Bigeye		Totals
	Unass.	FAD	Unass.	FAD	Unass.	FAD	
2006	5,258	47,760	1,525	8,876	72	4,953	68,444
2007	13,041	58,829	3,733	8,540	98	4,495	88,736
2008	54,461	90,435	34,662	22,202	572	6,992	209,324
2009	87,820	137,455	17,585	27,798	1,351	9,579	281,588
2010	100,363	90,721	30,715	15,658	1,252	6,816	245,525
Total	260,943	425,200	88,220	83,074	3,345	32,835	893,617
5 year average	52,189	85,040	17,644	16,615	669	6,567	178,723

Source: SPC 2012a.

As indicated in Figure 8 below, from 1997 through 2010, FAD sets have at times accounted for more than 90 percent of all sets made by the fleet, and less than 30 percent of the sets in other years. There are likely many factors that cause this variability, all of which are not fully understood. However, some general determinates can be postulated: FADs provide a guaranteed location of fish (assuming they are marked with the appropriate electronic equipment) although the magnitude (mt) of the schools associated with FADs can vary considerably. Therefore in times of high relative fuel prices FADs provide a risk-adverse option for vessel operators. FAD sets that yield no tuna are limited while free unassociated sets have a much higher likelihood of sets with little or no catch. FADs provide a source of fish that may or may not be economic to operators – especially those that offload to canneries. Small skipjack along with juvenile yellowfin and bigeye tuna are very often associated with FADs or floating objects – however, not all fleets or operators can find markets for “small fish,” especially when ex-vessel price is low or fish demand is reduced. But in times of high fish demand when canneries are not rejecting fish based on size, FAD fishing presents an attractive scenario for many operators. On the other hand, although skipjack is the main target of the WCPO fishery, yellowfin tuna can provide an important component to vessel profitability given there is typically a premium paid for larger yellowfin, which are typically found in unassociated schools. Operators may be willing to search for these unassociated schools if fuel price is reasonable and fish can be found. However, if no school fish are available operators will fall back to the risk adverse or more assured FAD fishing. FADs provide some degree of certainty for an activity steeped in guesswork, risk, and probability.

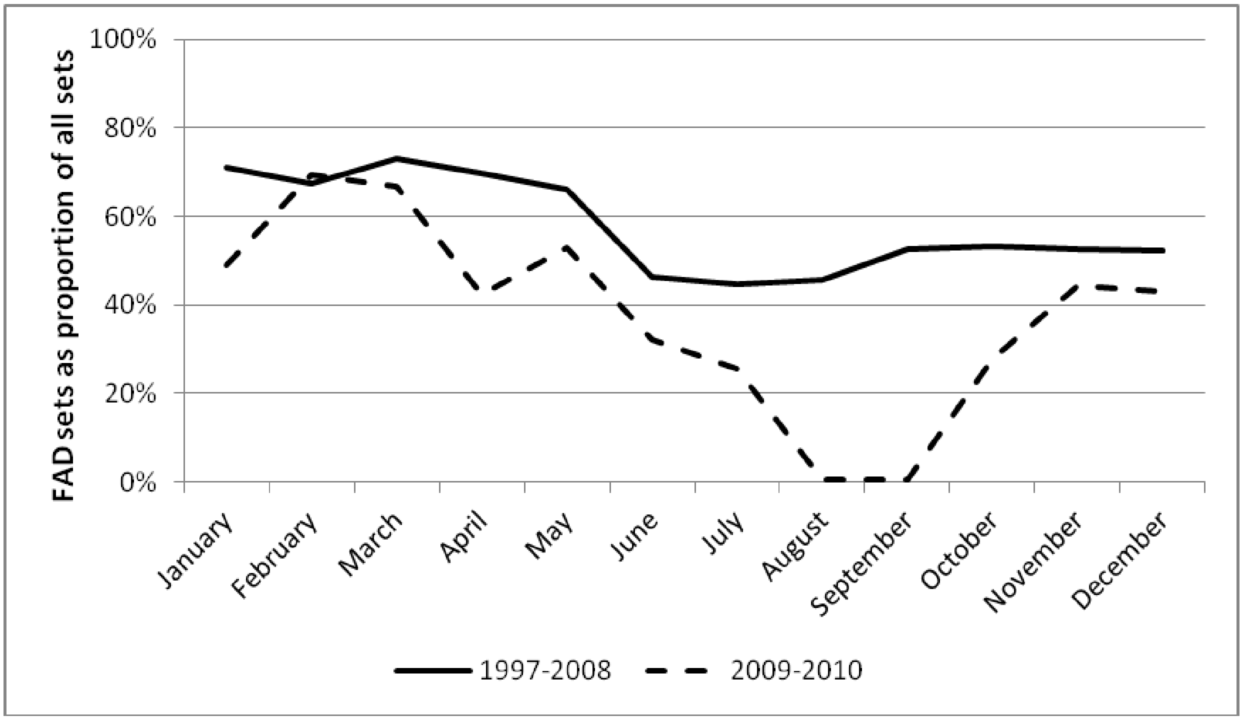
Figure 8: FAD sets as proportion of all sets by U.S. WCPO purse seine fleet, 1997-2010.



NMFS unpublished data.

Figure 9 below shows FAD sets as a proportion of all sets by the U.S. WCPO purse seine fleet, by month, for the periods 1997-2008 and 2009-2010 – the FAD restrictions pursuant to CMM 2008-01 were in effect in 2009 and 2010.

Figure 9: FAD sets as proportion of all sets by U.S. WCPO purse seine fleet, by month, 1997-2008 and 2009-2010 averages.



Source: NMFS unpublished data.

3.3 Bigeye Tuna, Skipjack Tuna, and Yellowfin Tuna

Table 4 summarizes the current status of bigeye tuna, yellowfin tuna, and skipjack tuna stocks in the Pacific Ocean, as determined by NMFS. The table expresses overfishing and overfished status in terms of the status determination criteria specified in the relevant Fisheries Management Plans (FMPs) or FEPs, as required by the MSA. Stock status with respect to these two criteria is presented as reported in the NMFS quarterly stock status updates.

Table 4: Stock status summary of select highly migratory fish stocks in the Pacific Ocean for 2008[19]

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 tropical Pacific	No	No

Source: http://www.nmfs.noaa.gov/sfa/statusoffisheries/SOSmain.htm.

As shown in Table 4 above, using the MSA stock status determination criteria, overfishing is occurring on Pacific bigeye tuna but the bigeye tuna stock is not overfished (for the purpose of these status determinations bigeye tuna is considered a single pan-Pacific stock; however, most of the assessments upon which the determinations are based consider bigeye tuna as two stocks, one to the west of 150° W. longitude and one to the east). Neither skipjack tuna nor yellowfin tuna in the WCPO or EPO are subject to overfishing or determined to be overfished.

3.3.1 Bigeye Tuna (*Thunnus obesus*)

Several studies on the taxonomy, biology, population dynamics, and exploitation of bigeye tuna have been carried out, including comprehensive reviews by Collette and Nauen (1983), and Whitelaw and Unithan (1997). Miyabe (1994) and Miyabe and Bayliff (1998) reviewed the biology and fisheries for bigeye tuna in the Pacific Ocean. Information from these studies are presented here – but may not be specifically referenced.

The species is a mixture between a tropical and temperate water tuna, characterized by equatorial spawning, high fecundity, and rapid growth during the juvenile stage with movements between temperate and tropical waters during its life cycle.

Bigeye tuna are trans-Pacific in distribution, occupying epipelagic and mesopelagic waters of the Indian, Pacific, and Atlantic Oceans. The distribution of the species within the Pacific stretches between northern Japan and the north island of New Zealand in the western Pacific and from 40° N to 30° S in the eastern Pacific (Calkins 1980). Molecular analyses (Grewe et al. 1998) and tagging projects executed by the SPC (Langley et al. 2008) indicate that a single stock exists for Pacific bigeye tuna. Large, mature-sized bigeye tuna are sought by sub-surface fisheries, primarily longline fleets. Smaller,

[19] As discussed in more detail below, the stock structure of bigeye tuna in the Pacific Ocean is not well known. The WCPFC has to date treated bigeye tuna in the WCPO as a single and entire stock, both in terms of stock assessments and management decisions. The WCPFC decisions manage bigeye tuna in the WCPO. The WCPFC decisions also manage yellowfin tuna and skipjack tuna in the WCPO and when the terms WCPO bigeye tuna, WCPO yellowfin tuna, or WCPO skipjack tuna are used in this document, they refer to the stocks of these species as defined and managed by the WCPFC.

juvenile fish are taken in many surface fisheries, either as a targeted catch or as a bycatch with other tuna species (Miyabe and Bayliff 1998). Large numbers are taken by purse seiners fishing on drifting objects in equatorial waters. Basic environmental conditions favorable for survival include clean, clear oceanic waters between 13° C and 29° C. Hanamoto (1987) estimated optimum bigeye habitat to exist in water temperatures between 10° to 15° C at salinities ranging between 34.5‰ to 35.5‰ where dissolved oxygen concentrations remain above 1 ml/l. He further suggested that bigeye range from the surface layers to depths of 600 meters. However, evidence from archival tagging studies indicates that greater depths and much lower ambient temperatures can be tolerated by the species. Juvenile bigeye occupy an ecological niche similar to juvenile yellowfin of a similar size.

There have been far fewer bigeye tuna tagged in the Pacific in comparison to skipjack and yellowfin tunas. Miyabe and Bayliff (1998) present summary information of some long distance movements of tagged bigeye tuna in the Pacific. Hampton et al. (1998) describe 8,000 bigeye tuna releases made in the western Pacific during 1990-1992. Most of the fish were recaptured close to the point of release; approximately 25 percent had moved more than 200 nautical miles, and more than 5 percent had moved more than 1,000 nautical miles. These migration patterns generally cause stock assessment in the WCPO and EPO to be conducted separately (Langley et al. 2008).

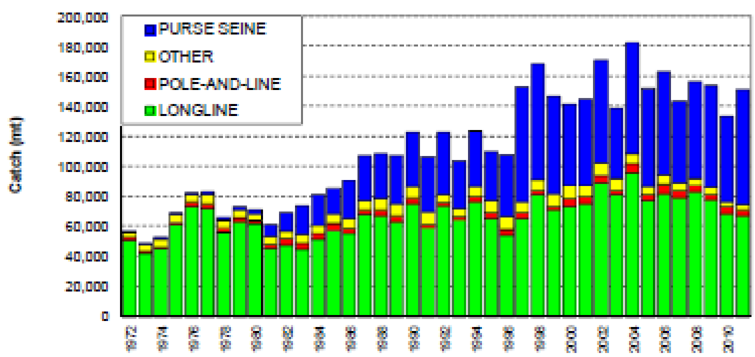
Feeding is opportunistic at all life stages, with prey items consisting primarily of crustaceans, cephalopods, and fish (Calkins 1980). There is significant evidence that bigeye feed at greater depths than yellowfin tuna, utilizing higher proportions of cephalopods and mesopelagic fishes in their diet thus reducing niche competition (Whitelaw and Unithan 1997). Spawning spans broad areas of the Pacific and occurs throughout the year in tropical waters and seasonally at higher latitudes at water temperatures above 23° or 24° C (Kume 1967). Bigeye are serial spawners, capable of repeated spawning at near daily intervals with batch fecundities of millions of ova per spawning event (Nikaido et al. 1991). Sex ratio is commonly accepted to be essentially 1:1 until a length greater than 150 centimeters after which the proportion of males increases. Alverson and Peterson (1963) state that juvenile bigeye less than 100 centimeters generally feed at the surface during daylight, usually near continental land masses, islands, seamounts, banks, or floating objects. Bigeye tuna are moderately fast growing, reaching maturity between the ages of two and a half and six years. A larger proportion of bigeye reach the age of eight, with some living as long as eighteen years (Langley et al.2008).

Bigeye tuna, especially during the juvenile stages, aggregate strongly to drifting or anchored objects, large marine animals, and regions of elevated productivity, such as near seamounts and areas of upwelling (Calkins 1980; Hampton and Bailey 1993; Holland et al. 1999). Major fisheries for bigeye tuna exploit aggregation effects either by targeting biologically productive areas (deep and shallow seamount and ridge features) or by utilizing artificial fish aggregation devices to aggregate commercial concentrations of bigeye tuna. Juvenile and pre-adult bigeye of 35 centimeters to approximately 99 centimeters are regularly taken as a bycatch in the eastern and western Pacific purse-seine fisheries, usually on sets made in association with floating objects (Hampton and Bailey 1993). Juvenile bigeye tuna form mono-specific schools at or near the surface with similar-sized fish or may be mixed with skipjack and/or juvenile yellowfin tuna (Calkins 1980; Holland et al. 1999). Juvenile and adult bigeye tuna are also known to aggregate near seamounts and submarine ridge features where they are exploited by pole-and-line, handline, and purse seine fisheries (Fonteneau 1991; Holland et al. 1999).

Small bigeye are caught near the surface by purse seines, while larger fish are caught deeper using longline gear (Gillett and Langley 2007). In the western Pacific, the purse seine fishery is diverse, occurring in the waters of a number of island nations as well as the high seas and carried out by both small domestic fleets and distant water fleets from developed nations.

In 2011, the estimated total bigeye catch in the WCPO was 159,479 mt, the highest catch since 2006 (WCPFC 2012). Figure 10 below shows the catch of bigeye tuna in the Convention Area from 1980-2011 by gear type.

Figure 10: Convention Area bigeye tuna catch (mt) by gear



Source: Williams and Terawasi 2012.

3.3.1.1 Skipjack Tuna (*Katsuwonus pelamis*)

Skipjack tuna are concentrated mostly in tropical waters; though they also seasonally expand into subtropical waters in both the north and south Pacific. The main characteristics of skipjack tuna are fast growth, early maturity (ten months to one year), high fecundity, year-round spawning (Hunter et al. 1986) over broad tropical regions, a relatively short life span compared to bigeye, albacore, and bluefin tunas, high and variable recruitment and few age classes on which the fishery depends. In describing the attributes of the species, Joseph (2002) states:

> These characteristics, together with their wide distribution, results in a huge biomass of fish, and very high levels of potential production. Ever since the beginning of heavy commercial exploitation in the early 1970s, the consensus among scientists had been that the populations of skipjack in all oceans of the world were lightly exploited and capable of sustaining much higher catches. This has been borne out by the fact that annual (global) catches increased from approximately 400,000 tons in 1970 to approximately 1.9 million tons in 1998. They remained near that level during 1999 and 2000.

In the western Pacific skipjack catches have continued to grow from that early 2002 quote.

CPUE trends for purse seiners dramatically rose between 2004 and 2007 before fluctuating until 2009. Post 2009 trends have been generally downward through 2011, but have not dipped much below 2005 levels (Harley et al. 2012).

In 2011, the estimated total skipjack catch in the WCPO exceeded 1.55 million mt, a slight decline from a record setting year in 2009 of 1.80 million mt, and a similarly high catch in 2010 of 1.68 million mt. The purse seine fishery was responsible for the bulk of this catch (WCPFC 2012).

Historically, bait boats (pole-and-line) were the main gear used in catching skipjack tuna but since the 1950s, purse seiners have come to dominate the fishery. Some skipjack tuna are also caught incidentally by longliners, particularly those using shallow gear (typically hooked when retrieving the gear). In the WCPO, fishing for skipjack tuna occurs in the waters of a number of island nations and is carried out by both small domestic fleets and distant water fleets from developed nations.

Genetic studies of the Pacific population of skipjack suggest that some mixing of fish occurs across the Pacific Ocean, but for management purposes, the stocks in the western Pacific have been considered by most scientists to be independent of those in the eastern Pacific. Tagging data showing limited movement of skipjack from the eastern Pacific to the western Pacific support the same conclusion (Joseph 2002). Recent research suggests that fast-growing, short-lived species like skipjack and yellowfin may have median lifetime displacements on the order of 644–805 kilometers, supporting the idea of “regional fidelity” (Sibert and Hampton 2003). Remote sensing has corroborated this data. Skipjack in the North Pacific only demonstrated north-south migrations, seeming to primarily follow sea surface temperature, with some influence from sea surface chlorophyll, and physical ocean features like currents, fronts and eddies (Mugo et al. 2010). The possibility of restricted movements of skipjack in the WCPO suggests the possibility for local depletion despite the large total biomass.

3.3.2 Yellowfin Tuna (*Thunnus albacares*)

Several studies on the taxonomy, biology, population dynamics, and exploitation of yellowfin tuna exist, including comprehensive reviews by Collette and Nauen (1983) and Suzuki (1994).

This is a tropical tuna characterized by a rapid growth rate and fast development to maturity. Estimates of length at maturity for central and western Pacific yellowfin tuna vary widely with some studies supporting an advanced maturity schedule for yellowfin tuna in coastal or archipelagic waters (Cole 1980). However, most estimates suggest that the majority of yellowfin tuna reach maturity between two and three years of age on the basis of length-age estimates for the species. Longevity for the species may not be explicitly defined, but a maximum age of six to seven years is commonly used in stock assessment. Itano (2000) notes from a large data set from the western tropical Pacific that 50% of yellowfin tuna sampled from purse seine and longline gear at 105 centimeters were histologically classified as mature and predicts a length at 50% maturity of 104.6 centimeters. Under appropriate conditions, yellowfin tuna exhibit high spawning frequency and fecundity (Cole 1980). Spawning occurs in broad areas of the Pacific. Spawning fish require surface salinity and temperature that remain above 24° C (Itano 2000). This means that spawning can occur throughout the year in tropical waters and seasonally at higher latitudes in areas such as Hawaii (Suzuki 1994).

Yellowfin tuna are trans-Pacific in distribution, occupying the surface waters of all warm oceans, and form the basis of large surface and sub-surface fisheries. The adult distribution in the Pacific lies roughly within latitudes 40° N to 40° S as indicated by catch records of the Japanese purse seine and longline fishery (Suzuki et al. 1978). Blackburn (1965) suggests the range of yellowfin tuna distribution is bounded by water temperatures between 18° C and 31° C with commercial concentrations occurring between 20° C and 30° C. Although the species preferentially occupies the surface mixed layer above the thermocline, archival tagging has revealed dives to depths in excess of 1,000 meters with water temperature of 5.8° C (Dagorn et al. 2006). Yellowfin are apex predators that rely on a wide diverse food base, but most heavily prey upon small teleost fish and crustaceans. As juveniles they prey mostly on zooplankton (Graham et al. 2007).

Although tag and recapture programs have documented that yellowfin tuna are clearly capable of large-scale movements, most recaptures occur within a short distance of release. Sibert and Hampton (2003) applied an advection-diffusion model to yellowfin tuna tagging data and determined a median lifetime displacement of 375 miles. Yellowfin tuna are known to aggregate around drifting flotsam, anchored buoys, and large marine animals (Hampton and Bailey 1993). Adult yellowfin tuna also aggregate in regions of elevated productivity, high zooplankton density (e.g., seamounts), and regions of upwelling and convergence. This association has presumably evolved to capitalize on the elevated forage available (Cole 1980; Suzuki 1994). Major fisheries for yellowfin tuna exploit aggregation effects either by utilizing artificial FADs or by targeting areas with vulnerable concentrations of tuna.

Some genetic analyses suggest that there may be several semi-independent yellowfin tuna stocks in the Pacific Ocean including possible eastern and western stocks, which may diverge around 150° W (Grewe and Hampton 1998; Itano 2000). Other analyses have failed to distinguish the presence of geographically distinct populations (Appleyard et al. 2001). Tagging studies have shown individual animals are capable of large east west movements that would suggest considerable pan-Pacific mixing of the stock.

Purse seining and longlining are the main gear employed in catching yellowfin tuna. Small yellowfin tuna may be caught on the surface by purse seine vessels, while larger fish are typically caught deeper using longline gear (Gillet et al. 2007). In the western Pacific, the fishery is diverse, occurring in the waters of a number of island nations and on the high seas and carried out by both small domestic fleets and distant water fleets from developed nations.

In 2011, the estimated total yellowfin catch in the WCPO was 479,403 mt, a decline of about 70,000 mt from the year before. The purse seine fishery was responsible for the bulk of this catch (WCPFC 2012).

3.4 Biological Environment

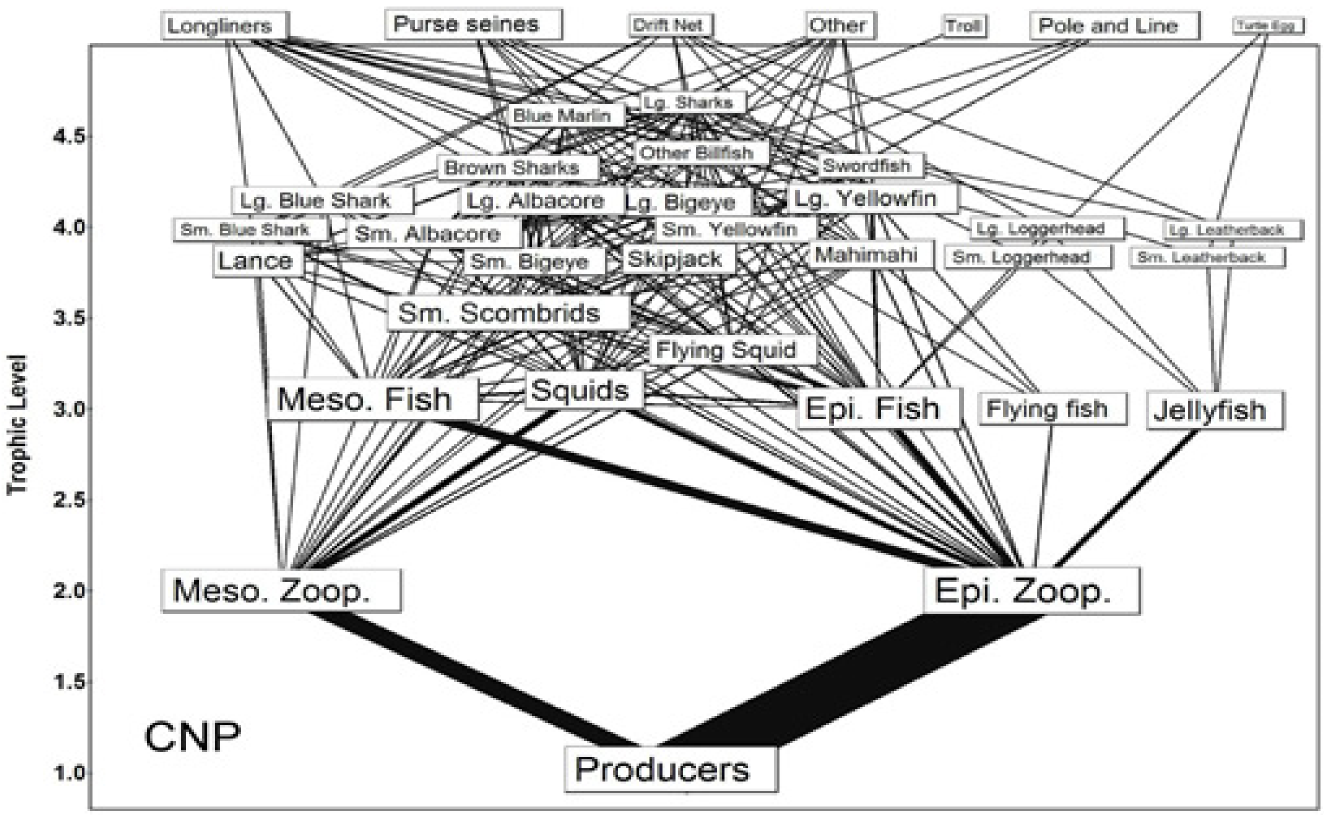
This section describes the other primary biological resources in the Convention Area as well as ecological interactions between the species.

3.4.1 Biodiversity and Ecosystem Function

The following description of a marine fisheries food web is taken from Begon et al. 2006, and Nybakken 1997. Primary producers such as diatoms, dinoflagellates, coccolithophores, and cyanobacteria, are organisms that utilize solar energy to convert carbon dioxide into oxygen. Primary producers are considered the first trophic (or eating) level. The next trophic level includes the zooplankton; animal planktonic forms such as copepods and larval stages of fish. These microorganisms drift through the water column grazing on phytoplankton (plant planktonic forms) and are referred to as “grazers”. Copepods are the most abundant zooplankton and make up most of the animal biomass in the ocean. The third trophic level is made up of the molluscan bivalves, amphipods, and larval forms of fish and crustaceans. Small bait fish make up the next trophic level. These include small fish such as sardines which in turn are eaten by big fish, the next trophic level. This level is made up of dominant predators, species that tend to migrate from coastal to deep ocean waters. They are also prey to the apex predators, species at the top trophic level. Species at this trophic level include tunas, billfish, and sharks. Dominant predators as well as apex predators feed opportunistically, eating anything they encounter. Digested or dead organic matter drifts towards the ocean bottom where both suspended decomposers and bottom feeders utilize the dead matter’s energy completing the food web cycle. Both biotic and abiotic factors interact with each other to create this cycle. Figure 11 depicts a food chain from the central North Pacific Ocean.

Organisms at the top of the food web tend to be larger and less abundant. This is mainly due to the amount of energy it takes to get to the top of a food web. Marine food webs are highly connected because of the openness of marine ecosystems, general lack of specialists, potential for long life-spans, and significant size changes across the life histories of many species (Link 2002). Few fully charted examples of open water marine food webs exist. Those that do demonstrate limitations such as low species diversity, high species aggregation, limited spatiotemporal studies, and low chances of detecting important factors such as species richness, interactions or links (Link 2002).

Figure 11: Trophic levels in the central North Pacific Ocean



Source: Hinke et al. 2004.

Understanding an ecosystem depends on the identification of its food web and the exchanges between the different trophic levels in the food chain. Food webs show the dynamics of biomass production, sinks, and partitioning. Even minor changes in abiotic factors can cause far reaching changes in the spatial distribution of primary and secondary pelagic production (Richardson et al. 2004). For example, increases in sea surface temperatures may lead to increases or decreases in phytoplankton abundance depending on the *in situ* water temperature (Richardson et al. 2004). Tuna removal by commercial fisheries or other changes in biotic balances could have lasting effects lower down the food chain. Models done by Hinke et al. (2004), and observations by Halpern et al. (2006) demonstrate that by removing top predators, mid and low trophic level species may expand due to the elimination of competition and predation, and that top down food web control may be more important to ecosystem balance than previously thought. As apex predators, bigeye, skipjack and yellowfin tuna are in the top trophic level with distinct energy pathways supporting each species (Hinke et al. 2004). They are opportunistic feeders, a quality that complicates trophic impact analysis (Cox et al. 2002).

When there is an overlap in the primary forage trophic level, as when multiple fisheries act on top predator tunas, there are indirect effects seen within their own forage groups. Hinke et al. (2004) concluded that the primary food webs for individual fisheries were relatively simple (Figure 10). Ecosystem analysis, however, is difficult because the interactions among a broad group of species are not always apparent or recognized. Each stock has a unique recruitment history so the variability in biomass over time and among stocks cannot all be attributed to fishing (Sibert et al. 2006). Cox et al. (2002) also found that declines in top predators could result in an increase in smaller tunas that serve as prey to larger tunas. Predation as a component of natural mortality is still unclear, as are the effects of fishing mortality on these predation rates and abundance (Cox et al. 2002).

Purse seining directly affects higher trophic levels but may also affect the lower trophic levels. Hinke et al., (2004) found that the aggregate effect of purse seine fishing in the central north Pacific Ocean showed a shift in the highest distributions of biomass from upper level predators to their prey. They also observed that similar changes in the overall structure of food webs can be seen in pelagic purse seine tuna fisheries in the EPO. Fishing a species at maximum sustainable yield may lead to the erosion of their trophic structure and have negative effects on recruitment (Sibert et al. 2006). Reducing population biomass too dramatically could lead to the outright collapse of the food chain (Sibert et al. 2006).

In 2010, SPC reported some of its findings on an ongoing study of the WCPO tuna ecosystem that attempts to model and understand species relationships, with an end goal of assessing future environmental and fishery impacts on tuna stock health. In the analysis of stomach contents, yellowfin, bigeye and skipjack tuna were split into three size categories (baby, small and large) to account for growth-related diet shifts as well as whether they filled a predominantly predator or prey role. All three were found to primarily eat smaller fish, followed by mollusks and crustaceans (Allain 2010).

3.4.2 Other Non-Target Fish Species[20]

As depicted in Table 5 below, the U.S. Purse Seine fleet operating in the WCPO catches a small amount of various non-target fish species, some of which is retained.

[20] This terminology is used throughout the EA to differentiate between bigeye tuna, a non-target species of the U.S. WCPO purse seine fleet, and other non-target fish species.

Table 5: Observed Estimates of Catch and Rate of Discards of "Other" Fish Species in 2010 by the U.S. WCPO Purse Seine Fleet.

	Catch (MT)	% Discarded
Black Marlin	52.51	44
Blue Marlin	89.12	58
Marlins - Sailfishes-Spearfishes (UnID)	<.005	100
Sailfish	4.15	25
Shortbilled Spearfish	0.25	72
Striped Marlin	18.12	67
Swordfish	0.49	10
Bigeye Thresher	<.005	100
Blacktip Shark	0.21	99
Blue Shark	0.3	100
Bull Shark	0.06	100
Giant Manta	4.73	99
Manta Rays (UnID)	11.43	100
Mobula (aka Devil Ray)	3.07	99
Oceanic Whitetip Shark	1.68	97
Pelagic Stingray	0.12	98
Rays, Skates and Mantas	0.02	100
Silky Shark	85.15	99
Thresher Sharks	<.005	100
Albacore	0.88	1
Bullet Tuna	0.59	74
Frigate and Bullet Tunas	2.5	58
Frigate Tuna	1.73	74
Kawakawa	1.29	93
Mackerel (UnID)	0.01	100
Wahoo	12.5	38
Amberjack (Longfin Yellowtail)	0.01	0
Amberjack/Giant Yellowtail	62.27	77
Amberjacks	2.72	100
Barracudas	1.07	55
Batfishes	0.3	24
Bigeye Scad	94.72	1
Bigeye Trevally	3.2	40
Black Triggerfish	1.55	96
Brilliant Pomfret	6.35	2
Crestfish/Unicornfish	<.005	100
Drift Fish	<.005	100
Drummer (Blue Chub)	9.5	68

Table 5 Continued	Catch (MT)	% Discarded
Filfish (Scribbled Leatherjacket)	<.005	100
Filefish (Unicorn Leatherjacket)	<.005	100
Filefishes	0.27	4
Golden Trevally	0.89	0
Great Barracuda	1.63	28
Greater Amberjack	10.6	100
Longfin Batfish	0.06	2
Mackerel Scad/Saba	146.01	97
Mahi Mahi/Dolphinfish/Dorado	44.66	73
Ocean Sunfish	0.98	17
Ocean Triggerfish (Spotted)	23.41	95
Oceanic Triggerfish (UnID)	106.37	95
Opah	0.02	100
Pelagic Puffer	<.005	100
Pilot Fish	<.005	100
Pomfrets and Ocean Breams	2.38	58
Rainbow Runner	510.71	94
Ray's Bream/Atlantic Pomfret	0.04	100
Sargent Major	<.005	100
Saury (Sanma)	0.01	20
Sickle Pomfret	0.01	0
Slender Sunfish	0.39	96
Snake Mackerel	0	100
Spanish Mackerel (Narrow-Barred)	0.04	80
Squids	0.02	75
Trevallies (Unidentified - Jacks)	1.74	58
Triple-Tail	0.25	5
Unspecified	19.21	85
Total	1342.3	

Source: SPC 2012b.

3.5 Protected Resources

This section provides information on protected resources in the WCPO.

3.5.1 Threatened and Endangered Species

Table 6 includes species listed under the U.S. Endangered Species Act (ESA; 16 USC 1531 *et seq*.) that could be affected by any changes to fishing patterns and practices in the Convention Area. NMFS has jurisdiction over all the species listed except for the dugong (*Dugong dugon)*, Short-tailed Albatross (*Phoebastria albatrus*), Newell's Shearwater (*Puffinus auricularis newelli*), Hawaiian Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*), Chatham Petrel (*Pterodroma axillaris*), Fiji Petrel (*Pseudobulweria macgillivrayi*), and Magenta Petrel (*Pterodroma magentae*). The U.S. Fish and Wildlife Service (USFWS) has jurisdiction over these seven species.

Table 6: Listing Status of Species in the WCPO Listed as Endangered or Threatened Under the ESA.

Scientific name	Common name	ESA Status
Balaenoptera musculus	Blue whale	Endangered
Balaena mysticetus	Bowhead whale	Endangered
Balaenoptera physalus	Fin whale	Endangered
Megaptera novaeangliae	Humpback whale	Endangered
Eubalaena japonica	North Pacific right whale	Endangered
Balaenoptera borealis	Sei whale	Endangered
Physeter macrocephalus	Sperm whale	Endangered
Eubalaena australis	Southern right whale	Endangered
Monachus schauinslandi	Hawaiian monk seal	Endangered
Eumetopias jubatus	Steller sea lion (western stock)	Endangered
Dugong dugon	Dugong	Endangered
Phoebastria albatrus	Short-tailed Albatross	Endangered
Pseudorca crassidens	Main Hawaiian Islands insular false killer whale[21]	Endangered
Puffinus auricularis newelli	Newell's Shearwater	Threatened
Pterodroma phaeopygia sandwichensis	Hawaiian Dark-rumped Petrel	Endangered
Pterodroma axillaris	Chatham Petrel	Endangered
Pseudobulweria macgillivrayi	Fiji Petrel	Endangered
Pterodroma magentae	Magenta Petrel	Endangered
Dermochelys coriacea	Leatherback turtle	Endangered
Caretta caretta	Loggerhead turtle North Pacific and South Pacific distinct population segments[22]	Endangered[1]
Chelonia mydas	Green turtle	Threatened
Lepidochelys olivacea	Olive Ridley turtle	Threatened
Eretmochelys imbricata	Hawksbill turtle	Endangered

Source: http://www.nmfs.noaa.gov/pr/; http://www.fws.gov/pacificislands/teslist.html.

The Final Biological Opinion and Incidental Take Statement for the U.S. purse seine fishery for effects to ESA-listed sea turtles and marine mammals was issued on November 1, 2006, concluding formal Section 7 ESA consultation for species under the

[21] NMFS issued a final determination to list the Main Hawaiian Islands insular false killer whale as distinct population segment as endangered (see 77 FR 70915; November 28, 2012).

[22] In September 2011, NMFS and USFWS listed nine distinct population segments of loggerhead turtles. Five of the distinct population segments were listed as endangered and four were listed as threatened. The two distinct population segments in the Pacific Ocean (North Pacific and South Pacific) are listed as endangered. See 76 FR 58868.

jurisdiction of NMFS. One species under the jurisdiction of NMFS (the main Hawaiian Islands insular false killer whale) has been ESA-listed since that time. However, the range of this species does not overlap with the area in which the U.S. WCPO purse seine fleet operates.[23]

By letter dated January 28, 2009, the USFWS concurred with NMFS' determination that a proposed regulation that would not alter U.S. purse fishing practices or fishing effort would not be likely to adversely affect ESA-listed species under the jurisdiction of USFWS, which at the time included the dugong, Newell's Shearwater, and Short-tailed Albatross. This determination was based on the fact that there was minimal spatial overlap between the U.S. purse seine fishery and the range of the dugong, no spatial overlap between the U.S. purse seine fishery and range of the Short-tailed albatross, and no recorded interactions between the U.S. purse seine fleet and seabirds or dugongs, based on observer data from August 1994 to January 2007. Four species under the jurisdiction of USFWS (the Hawaiian Dark-rumped Petrel, Chatham Petrel, Fiji Petrel, and Magenta Petrel) have been ESA-listed since that time. As stated in the 2009 EA, based on observer data available to NMFS, the U.S. WCPO purse seine fleet has not been reported to interact with seabirds.

[23] The range of the main Hawaiian Islands insular false killer whale includes the waters around the main Hawaiian islands from Ni'ihau to Hawai'i, and offshore as far as 140 kilometers. The U.S. WCPO purse seine fleet generally operates much further south, between 10° N and 10° S Latitude (see Section 3.2 of the EA).

3.5.2 Marine Mammals

All marine mammals receive protection under the Marine Mammal Protection Act (MMPA; 16 USC 1361, *et seq*.). The marine mammals found in the WCPO but not listed under the ESA as threatened or endangered (i.e., not included in Table 6 above) are listed in Table 7 below.

Table 7: Non-Listed Marine Mammals that Occur in the WCPO.

Species name	Common name
Balaenoptera acutorostrata	Minke whale
Balaenoptera bonaerensis	Antarctic minke whale
Balaenoptera edeni	Bryde's whale
Berardius arnuxii	Arnoux's beaked whale
Callorhinus ursinus	Northern Fur Seal
Caperea marginata	Pygme right whale
Delphinus delphis	Short-beaked common dolphin
Eschrichtius robustus	Gray whale
Feresa attenuata	Pygmy killer whale
Globicephala macrorhynchus	Short-finned pilot whale
Globicephala melas	Long-finned pilot whale
Grampus griseus	Risso's dolphin
Hyperoodon planifrons	Southern bottlenose whale
Indopacetus pacificus	Longman's beaked whale
Kogia breviceps	Pygme sperm whale
Kogia sima	Dwarf sperm whale
Lagenodelphis hosei	Fraser's dolphin
Lagenorhynchus cruciger	Hourglass dolphin
Lagenorhynchus obliquidens	Pacific white sided dolphin
Lagenorhynchus obscurus	Dusky dolphin
Lissodelphis peronii	Southern right whale dolphin
Mesoplodon bowdoini	Andrew's beaked whale
Mesoplodon densirostris	Blainville’s Beaked Whale
Mesoplodon ginkgodens	Ginkgo-toothed whale
Mesoplodon grayi	Gray's beaked whale
Mesoplodon hectori	Hector's beaked whale
Mesoplodon layardii	Strap-toothed whale
Mesoplodon stejnegeri	Stejneger's beaked whale
Mesoplodon traversii	Spade-toothed whale
Mirounga angustirostris	Northern Elephant Seal

Species name	Common name
Orcinus orca	Killer whale
Peponocephala electra	Melon headed whale
Phocoena dioptrica	Spectacled porpoise
Phocoena phocoena	Harbor porpoise
Phocoenoides dalli	Dall's porpoise
Pseudorca crassidens	False killer whale[24]
Stenella attenuata	Pantropical spotted dolphin
Stenella coeruleoalba	Striped dolphin
Stenella longirostris	Spinner dolphin
Steno bredanensis	Rough toothed dolphin
Tursiops truncatus	Bottlenose dolphin
Ziphius cavirostris	Cuvier's beaked whale

Source: http://www.wpcouncil.org/Protected/species_mammals.html; http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/; 2009 EA.

3.5.3 Essential Fish Habitat (EFH)

The EFH provisions (50 CFR Part 600 Subpart J) of the MSA are intended to maintain sustainable fisheries. NMFS and the Fishery Management Councils must identify and describe EFH and Habitat Areas of Particular Concern (HAPC) for each managed species using the best available scientific data and must ensure that fishing activities being conducted in such areas do not have adverse effects to the extent practicable. This process consists of identifying specific areas and the habitat features within them that provide essential functions to a particular species for each of its life stages. Both the EFH and the HAPC are documented in the FEPs established under the MSA.[25]

EFH and HAPC have been designated in the WCPO for pelagic, bottomfish and seamount groundfish, precious corals, crustaceans, and coral reef species. Table 8 lists the EFH and HAPC for species managed under the various western Pacific FEPs.

[24] As stated in Table 6 above, the Main Hawaiian Islands insular false killer whale distinct population segment has been listed as endangered.

[25] The FEPs being the FEP for the American Samoa Archipelago, the FEP for the Mariana Archipelago; the FEP for the Pacific Remote Island Areas; the FEP for the Hawaii Archipelago; and the FEP for Pacific Pelagic Fisheries of the Western Pacific Region.

Table 8: EFH and HAPC for Management Unit Species for the Western and Pacific Region.[1]

Species Group	**EFH (juveniles and adults)**	**EFH (eggs and larvae)**	**HAPC**
Pelagics	Water column down to 1,000 meters	Water column down to 200 meters	Water column down to 1,000 meters that lies above seamounts and banks
Bottomfish	Water column and bottom habitat down to 400 meters	Water column down to 400 meters	All escarpments and slopes between 40-280 meters, and three known areas of juvenile opakapaka habitat
Seamount Groundfish	(adults only): water column and bottom from 80 to 600 meters, bounded by 29°-35°N and 171°E-179°W	(including juveniles): epipelagic zone (0-200 meters) bounded by 29°-35°N and 171°E-179°W	Not identified
Precious Corals	Keahole, Makapuu, Kaena, Wespac, Brooks, and 180 Fathom gold/red coral beds, and Milolii, S. Kauai and Auau Channel black coral beds	Not applicable	Makapuu, Wespac, and Brooks Bank beds, and the Auau Channel
Crustaceans	Lobsters: Bottom habitat from shoreline to a depth of 100 meters Deepwater shrimp: The outer reef slopes at depths between 300-700 meters	Water column down to 150 meters Water column and associated outer reef slopes between 550 and 700 meters	All banks with summits less than 30 meters No HAPC designated for deepwater shrimp
Coral Reef Ecosystems	Water column and benthic substrate to a depth of 100 meters	Water column and benthic substrate to a depth of 100 meters	All Marine Protected Areas identified in FEP, all PRIAs,[2] many specific areas of coral reef habitat

Source: FEP for the American Samoa Archipelago, Table 20 (WPRFMC 2009).
[1] All areas bounded by the shoreline and the outward boundary of the U.S. EEZ, unless otherwise indicated.
[2] Pacific Remote Island Areas.

3.5.4 National Wildlife Refuges (NWRs) and Monuments

Pursuant to the National Wildlife System Administration Act of 1966 (16 USC 668dd, *et seq*.), USFWS carries out the mission of NWRs, which is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." National Monuments are designated by the President using the authority of the Antiquities Act of 1906 (16 U.S.C. 431). This act allows the President to protect areas of "historic or scientific significance.” There are 10 NWRs and four National Monuments in the Convention Area: Guam NWR; Baker Island NWR; Howland Island NWR; Jarvis Island NWR; Johnston Island NWR; Kingman Reef NWR; Palmyra Atoll NWR; Rose Atoll NWR; Hawaiian Islands NWR; Midway Atoll NWR; Papahanaumokuakea Marine National Monument; the Marianas Trench Marine National Monument; the Pacific Remote Islands Marine National Monument; and the Rose Atoll Marine National Monument.

NMFS has issued a notice of availability of proposed amendments by the Western Pacific Fishery Management Council (WPFMC) to the FEP of the Mariana Archipelago, the FEP for the Pacific Remote Island Areas, the FEP of American Samoa, and the Pelagics FEP to implement certain provisions for the Marianas Trench Marine National Monument, the Pacific Remote Islands Marine National Monument, and the Rose Atoll Marine National Monument (see 78 FR 7385). Comments are due on these proposed amendments by April 2, 2013. The provisions in the proposed amendment include the following: identify the boundaries of the Monuments and their various management units; prohibit commercial fishing in the Pacific Remote Islands and Rose Atoll Monuments, and in the Islands Units of the Marianas Trench Monument; establish management measures for non-commercial and recreational charter fishing in the Monuments; and prohibit the conduct of commercial fishing outside the Monuments and non-commercial fishing inside the Monuments during the same trip. The 2009 Presidential Proclamation establishing these three Monuments prohibits commercial fishing within the waters of the Monuments.

Chapter 4

Chapter 4 Environmental Consequences: Direct and Indirect Effects

This chapter provides an analysis of the direct and indirect environmental effects that could be caused by the implementation of the 2013 U.S. Purse Seine Rule under any of the action alternatives, as well as the No-Action Alternative and compares the alternatives; cumulative effects are addressed in Chapter 5.[26]

This chapter begins with a discussion of the potential impacts[27] from each of the alternatives to the U.S. WCPO purse seine fleet. Then, Sections 4.2 through 4.5 analyze the potential environmental impacts these changes to the fleet could cause to the resources in the affected environment.

4.1 The U.S. WCPO Purse Seine Fleet

The direct and indirect effects to the U.S. WCPO purse seine fleet would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The Regulatory Impact Review (RIR) for the 2013 U.S. Purse Seine Rule, prepared under Executive Order 12866, provides an in-depth analysis of the potential economic impacts of the rule to the fleet and to the nation and is incorporated here by reference, pursuant to 40 CFR §1502.23. The general information regarding economic impacts in the discussion below is provided to help compare the alternatives and to determine whether the economic impacts are interrelated with environmental impacts. Thus, the discussion in this section focuses on potential changes to the fishing patterns and practices of the fleet from each of the alternatives.

4.1.1 Alternative 1: No-Action Alternative

Under Alternative 1, the No-Action Alternative, the 2013 U.S. Purse Seine Rule under any of the action alternatives would not go into effect, and the fleet would continue to be managed under existing regulatory requirements, including SPTT-related requirements, and any changed or new requirements as the result of a renegotiated Treaty and its associated economic assistance agreement, as described in more detail in Section 3.2 of this document. Thus, under this alternative there would be no direct changes to the fishing patterns and practices of the fleet.

[26] According to the CEQ regulations implementing the Procedural Provisions of NEPA at 40 CFR §1508.7 and §1508.8, direct effects are caused by the action and occur at the same time and place; indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable; and cumulative effects are the impacts on the environment that result from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

[27] The terms effects and impacts are used interchangeably throughout this document. See 40 CFR 1508.8.

CMM 2012-01 includes specific objectives for the WCPO stocks of bigeye tuna, skipjack tuna, and yellowfin tuna: for each, the fishing mortality rate is to be reduced to or maintained at levels no greater than the fishing mortality rate associated with maximum sustainable yield. As stated in Section 3.3 of this EA, Pacific bigeye tuna in is currently subject to overfishing but not overfished, while the stocks of yellowfin tuna and skipjack tuna in the WCPO and EPO are neither experiencing overfishing nor overfished. As shown in Table 2 and Table 3 in Chapter 3 of this EA, skipjack tuna accounts for the majority of the fleet's catch, with the proportion of catch of each of the three tropical tuna species being approximately 77 percent skipjack tuna, 19 percent yellowfin tuna, and four percent bigeye tuna for the period 2006-2010. It is conceivable that the indirect effects (or long-term effects), of this alternative on the fleet would be negative, in that the No-Action Alternative would be less likely to achieve the objectives of CMM 2012-01, which in turn would be expected to adversely affect the catch rates of the U.S. WPCO purse seine fleet to maintain catch levels and the profitability of fishing businesses. However, as discussed in Section 3.3 of this EA, many factors other than purse seine fishing, especially the contribution of the U.S. fleet, affect the stock status of bigeye tuna, yellowfin tuna, and skipjack tuna in the WCPO, and, as described further below, implementation of the U.S. Purse Seine Rule under any of the action alternatives are not expected to substantially change the fishing practices and patterns of the fleet as a whole. The primary difference between the action alternatives are the fishing effort limits. As indicated in Table 1 and Sections 3.1and 3.2 of this EA, the spatial distribution of fishing effort by the fleet varies considerably from year to year, and is dependent mostly on oceanographic and market conditions affecting the location of the target tuna stocks and the marketability of the catch. Moreover, the majority of the fishing effort of the fleet takes place in the EEZs of Pacific Island Parties to the SPTT, and those EEZs would be unaffected by any of the action alternatives. Thus, the fishing patterns and practices of the fleet under the No-Action Alternative would be similar to the fishing patterns and practices of the fleet under any of the action alternatives analyzed in this EA. However, Alternative 4 (the least restrictive fishing effort limit alternative) would be more similar to the No-Action Alternative than Alternatives 3 or 2; Alternative 2 would be much less similar to the No-Action Alternative than either Alternatives 3 or 4, since it is much more likely that the effort limits would be reached under Alternative 2, triggering a closure of the fishery in the U.S. EEZ and/or on the high seas, as described below.

4.1.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Under Alternative 2, the U.S. purse seine fleet operating in the WCPO would be subject to the following management measures, as described in Chapter 2, all applicable to the Convention Area between 20° N. and 20° S. latitude and for the years 2013 and 2014: (1) annual limits on fishing effort, measured in terms of fishing days, on the high seas and in the U.S. EEZ; the limit for the U.S. EEZ would be 27 fishing days and the separate limit for the high seas would be 433 fishing days; (2) restrictions on FAD fishing from July 1 through October 31; and (3) a requirement to carry WCPFC observers on all fishing trips.

4.1.2.1 Fishing Effort Limit

As indicated in Table 1 in Chapter 3 of this EA, from the years 1997 through 2010, the fleet spent an average of approximately six percent of its total effort per year in the U.S. EEZ and 22 percent of its total effort per year on the high seas, and the remainder (or 73 percent)[28] in the EEZs of Pacific Island Parties to the SPTT. As stated above, NMFS used data from 2010 to derive the effort limits for Alternative 2. In 2010, the fleet spent approximately zero percent of its total effort in the U.S. EEZ (<0.5 percent as indicated in Table 1 of this EA) and six percent of its total effort on the high seas. Given that the proportion of days fished by the fleet in 2010 in the U.S. EEZ and on the high seas is substantially lower than the annual average of days fished by the fleet in its recent history, it is likely that the effort limits in both areas would be reached under this alternative, triggering a closure of the fishery in both the U.S. EEZ and on the high seas (likely at different times, starting when the respective limits are reached). The length of any such closures cannot be predicted with any degree of certainty, due to the large variation in the number of days fished in the U.S. EEZ and on the high seas from year to year, as shown in Table 1.

In an El Niño year, when the spatial distribution of effort is known to shift to the east, as discussed in Sections 3.1and 3.2 of this EA, the effort limits would likely be reached much sooner in the year, and perhaps even early in the year. In a La Niña year, the effort limits would likely be reached much later in the year. If the fishing patterns and practices of the fleet are similar to those of 2010, the effort limits may not be reached at all.

If the limits are reached in 2013 or 2014, vessels in the fleet could continue to fish in the EEZs of Pacific Island Parties to the SPTT, where the fleet expends the majority of its effort. Vessels in the fleet could also increase their effort in the EPO in the area managed by the Inter-American Tropical Tuna Commission (IATTC). Vessels licensed under the SPTT can each take one fishing trip per year in the area managed by the IATTC, for a period up to 90 days in duration, so long as the total number of trips by all vessels in the fleet does not exceed 32 per calendar year. In addition, although the IATTC has adopted capacity limits for purse seine vessels operating in the EPO, the United States has a little over 31,000 cubic meters remaining of its allocated capacity. So, this capacity is available for vessels in the U.S. WCPO purse seine fleet who wish to become active on the IATTC vessel register and fish in the EPO in the area of competence of the IATTC .

Given that the fleet expends most of its fishing effort in the EEZs of Pacific Island Parties to the SPTT, which would not be included in these effort limits, it is unlikely that this alternative would substantially affect the amount of fish captured by the fleet or the revenue earned by fishing businesses in the fleet. However, as stated above, since climate and ocean conditions, such as ENSO events, affect the location of optimal fishing grounds for the fleet, 2013 or 2014 could be years in which the U.S. EEZ or high seas

[28] Numbers do not sum to 100 percent due to rounding of the percentages for each area.

provides more optimal fishing grounds than usual, and in that case, the fleet could be substantially restricted by the effort limits.

In addition, the effort limits could change the temporal patterns of fishing effort. Since the limit would be a competitive allocation whereby fishing days would not be allocated among individual vessels and would be available to the entire fleet until the cap is reached, some vessel operators might have an incentive to fish harder in these two areas earlier in the calendar year than they otherwise would in an attempt to obtain as many fishing days as they can (i.e., “the race to fish”) before one or both limits are reached. To the extent such a shift does occur, it would affect the seasonal timing of deliveries to canneries. A race to fish could also bring costs if it causes vessel operators to forego vessel maintenance or to fish in weather or ocean conditions that it otherwise would not. This could bring costs in terms of human safety as well as the performance of the vessel and its fishing gear and crew. This race to fish effect could also be expected in the time period between when a closure of the fishery is announced and when the fishery is closed.

4.1.2.2 FAD Restrictions

Under Alternative 2, the FAD restrictions would be in place for the U.S. purse seine fleet from July 1 through October 31 in each of the calendar years 2013 and 2014. During these four months, no fishing on or near schools associated with FADs, and no deploying or servicing FADs, would be permitted in the Convention Area in the area between 20° N. and 20° S. latitude. The specific prohibitions, which include details for enforcement purposes, would be the following:

- No setting of a purse seine around a FAD or within one nautical mile of a FAD;
- No setting of a purse seine in a manner intended to capture fish that have aggregated in association with a FAD, such as by setting the purse seine in an area from which a FAD has been moved or removed within the previous eight hours, or setting the purse seine in an area in which a FAD has been inspected or handled within the previous eight hours, or setting the purse seine in an area into which fish were drawn by a vessel from the vicinity of a FAD;
- No deployment of a FAD into the water;
- No repairing, cleaning, maintaining, or otherwise servicing a FAD, including any electronic equipment used in association with a FAD, in the water or on a vessel while at sea, except that: a FAD may be inspected and handled as needed to identify the owner of the FAD, identify and release incidentally captured animals, un-foul fishing gear, or prevent damage to property or risk to human safety; and a FAD may be removed from the water and if removed may be cleaned, provided that it is not returned to the water.
- No submerging lights under water, suspending or hanging lights over the side of the purse seine vessel or any associated skiffs, other watercraft or equipment, or directing or using lights in a manner other than as needed to illuminate the deck of the purse seine vessel or associated skiffs, watercraft or equipment, except as

> needed to comply with navigational requirements, to ensure the health and safety of the crew, and in emergencies and as needed to prevent human injury or the loss of human life, the loss of the purse seine vessel, skiffs, watercraft or aircraft, or environmental damage.

As described in Chapter 3, Section 3.2, the U.S purse seine fleet operating in the WCPO has used FADs to varying degrees for its fishing operations. As indicated by Table 3 of this EA, FAD sets tend to yield more skipjack and small bigeye tuna than yellowfin tuna. Unassociated sets tend to yield more yellowfin tuna than skipjack tuna and very little bigeye tuna. Table 3 in Chapter 3, shows that between 2006 to 2010, approximately 61 percent of the catch of the U.S. WCPO purse seine fleet was made on FAD sets. During this same period, approximately 48 percent of the U.S. WCPO purse seine fleet's catch of yellowfin tuna was made on FAD sets, while approximately 62 percent of the catch of skipjack tuna and 91 percent of the catch of bigeye tuna was made on FAD sets. As discussed in Section 3.2.4 of this EA, FAD sets tend to yield smaller fish, including smaller adult skipjack tuna, and juvenile bigeye and yellowfin tuna, while unassociated sets tend to yield larger fish – primarily adult skipjack tuna and yellowfin tuna.

The overall composition of the catch made by the fleet would likely be affected by the FAD restrictions (as intended by CMM 2012-01). It is expected that there would be a transfer of effort to fishing on unassociated sets during the prohibition period (see Figure 9 in Chapter 3) – given that represents the only viable fishing option if vessels continue to operate – so the composition of the catch during those periods would likely consist of more larger yellowfin and skipjack tuna and less bigeye tuna. As shown in Table 3 in Chapter 3, bigeye tuna accounts for only a very small percentage of the catch of the U.S. purse seine fleet operating in the WCPO. FAD sets contribute a substantial percentage of skipjack catches (as indicated in Table 3 in Chapter 3, 62 percent of the total catch of skipjack tuna during the years 2006-2010 was from FAD sets). By putting restrictions on FAD fishing for one-third of the year in 2013 and 2014, skipjack tuna catches would expect to be impacted accordingly. Depending on the availability of operators to find unassociated schools of tuna, the expected shift in composition of the catch during the periods of restriction on FAD fishing would be expected to affect gross revenues generated by the fleet, but the magnitude of the impact would depend on market conditions (i.e., the price of bigeye tuna and skipjack tuna compared to the price of yellowfin tuna and the prices of small fish versus large fish – particularly, whether the canneries are even buying small fish).

The FAD restrictions could also affect operating costs (e.g., FAD fishing generally involves less searching time and thus lower fuel costs). In aggregate it is likely that the restrictions would have some negative effect on the ex-vessel revenue generated by the fleet in the short term.[29] Since other factors (e.g., shifts in ocean conditions, climatological changes, shifts in market conditions, fuel prices) also influence the catch

[29] See the Initial Regulatory Flexibility Analysis (IRFA) and RIR for the purse seine rule for more detailed discussion of the economic impacts of the rule on the U.S. WCPO purse seine fleet.

made by a fleet and/or the revenue generated by a fleet during a specific time period, quantification of the economic impact of the FAD restrictions to the U.S. purse seine fleet operating in the WCPO cannot be made with any degree of precision. It is possible that operators of some purse seine vessels would choose not to fish during the FAD restrictions because of reduced revenues profitability during that time. For example, vessel operators might choose to schedule their routine vessel maintenance during a portion of that time. The result of this could be somewhat less effort during that time than there otherwise would be. However, as shown in Figure 6 of this EA, during the FAD restrictions in the last four years (August 1 through September 30 in 2009, and July 1 through September 30 in 2010, 2011, and 2012), there was no substantial change in the proportion of the fleet that fished during those months in each of those years when compared to the proportion that fished during those months in 1997-2008.

As stated above, the FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during that time, and possibly reducing the amount of total fishing effort during that time relative to the No-Action Alternative.

4.1.2.3 Observer Requirements

U.S. purse seine vessels fishing in the WCPO are currently required to carry a WCPFC observer on all trips in the Convention Area, pursuant to the general WCPFC observer coverage requirements under 50 CFR 300.215. The observer coverage requirements under Alternative 2 would differ from the existing requirements by requiring a WCPFC observer to be carried only on trips that include the area between 20° N. and 20° S. latitude . Given that the fleet generally fishes only between 20° N. and 20° S. latitude and each vessel generally fishes in multiple EEZs on each trip (see Figure 3 in Chapter 3 of this EA), Alternative 2 would be almost identical to the existing observer requirements and thus, to the No-Action Alternative. Thus, these requirements would not be expected to affect the fishing patterns and practices of the fleet.

4.1.2.4 Summary of Impacts

The requirements of implementing the proposed rule under Alternative 2 have the potential to impact the gross revenue and profits earned by the U.S. WCPO purse seine fleet and cause impacts to its fishing patterns and practices. Overall, NMFS believes that it is unlikely that Alternative 2 would cause substantial financial burden to the fleet or substantially affect the fleet’s current fishing patterns and practices given the short duration of the rule (two years) and the other fishing opportunities available to the fleet. The primary direct effects of Alternative 2 on the fleet are the following: (1) the fishing effort limits on the high seas and in the U.S. EEZ could cause the fleet to fish more in the EEZs of Pacific Island Parties to the SPTT or in the EPO and could cause a reduction in the total fishing effort of the fleet; and (2) the FAD restrictions during July-October would likely transfer some fishing effort from FAD sets to unassociated sets, with consequent impacts in terms of species composition of the catch and possibly shift fishing effort from that time to other periods of the year.

4.1.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel

Under Alternative 3, the U.S. purse seine fleet operating in the WCPO would be subject to the following management measures, as described in Chapter 2, all applicable to the Convention Area between 20° N. and 20° S. latitude and for the years 2013 and 2014: (1) annual limits on fishing effort, measured in terms of fishing days, on the high seas and in the U.S. EEZ; the combined limit for the U.S. EEZ and high seas would be 2,588 fishing days; (2) FAD restrictions and restrictions for fishing on fish aggregating in association with vessels from July 1 through October 31 in each of the calendar years 2013 and 2014; and (3) a requirement to carry WCPFC observers on all fishing trips.

4.1.3.1 Fishing Effort Limit

This limit would be considerably higher than the limits under Alternative 2 and also would not include separate limits for the high seas and U.S. EEZ. Thus it is much less likely that the limit would be reached under this alternative than under Alternative 2. If the limit is reached, the fishery would be closed on the high seas and in the U.S. EEZ for the remainder of the calendar year. Although the length of any such closure cannot be predicted with any degree of certainty, due to the large variation in the number of days fished in the U.S. EEZ and on the high seas from year to year, as shown in Table 1, any closure period would likely be shorter than under Alternative 2, for the same reasons that the likelihood of reaching the limit is less than under Alternative 2, and would most likely take place toward the end of the year, if at all.

As discussed above for Alternative 2, if the limits are reached in 2013 or 2014, vessels in the fleet could continue to fish in the EEZs of Pacific Island Parties to the SPTT, where the fleet expends the majority of its effort. Vessels in the fleet could also increase their effort in the EPO in the area managed by the IATTC. Vessels licensed under the SPTT can each take one fishing trip per year in the area managed by the IATTC, for a period up to 90 days in duration, so long as the total number of trips by all vessels in the fleet does not exceed 32 per calendar year. In addition, although the IATTC has adopted capacity limits for purse seine vessels operating in the EPO, the United States has a little over 31,000 cubic meters remaining of its allocated capacity. So, this capacity is available for vessels in the U.S. WCPO purse seine fleet who wish to become active on the IATTC vessel register and fish in the EPO in the area of competence of the IATTC.

Given that the fleet expends most of its fishing effort in the EEZs of Pacific Island Parties to the SPTT, which would not be included in these effort limits, it is unlikely that this alternative would substantially affect the amount of fish captured by the fleet or the revenue earned by fishing businesses in the fleet. However, as discussed above for Alternative 2, climate and ocean conditions, such as ENSO events, affect the location of optimal fishing grounds for the fleet, and 2013 or 2014 could be years in which the U.S. EEZ or high seas provides more optimal fishing grounds than usual.

In addition, the effort limits could change the temporal patterns of fishing effort. Since the limit would be a competitive allocation whereby fishing days would not be allocated among individual vessels and would be available to the entire fleet until the cap is reached, vessel operators might have an incentive to fish harder in these two areas zone earlier in the calendar year than they otherwise would in an attempt to obtain as many fishing days as they can (i.e., “the race to fish”) before one or both limits are reached. To the extent such a shift does occur, it would affect the seasonal timing of deliveries to canneries, the implications of which are addressed in the RIR. A race to fish could also bring costs if it causes vessel operators to forego vessel maintenance or to fish in weather or ocean conditions that it otherwise would not. This could bring costs in terms of human safety as well as the performance of the vessel and its fishing gear and crew. This race to fish effect could also be expected in the time period between when a closure of the fishery is announced and when the fishery is closed.

4.1.3.2 FAD Restrictions

Under Alternative 3, FAD restrictions would be in effect from July 1 through October 31 in each of the calendar years 2013 and 2014 as well as restrictions on setting on fish that have aggregated in association with a vessel. During these months, no fishing on or near schools associated with FADs or vessels, and no deploying or servicing FADs, would be permitted in the Convention Area in the area between 20° N. and 20° S. latitude The specific prohibitions, which include details for enforcement purposes, would be the following:

- No setting of a purse seine around a FAD or within one nautical mile of a FAD;
- No setting of a purse seine in a manner intended to capture fish that have aggregated in association with a FAD or a vessel, such as by setting the purse seine in an area from which a FAD or a vessel has been moved or removed within the previous eight hours, or setting the purse seine in an area in which a FAD has been inspected or handled within the previous eight hours, or setting the purse seine in an area into which fish were drawn by a vessel from the vicinity of a FAD;
- No deployment of a FAD into the water;
- No repairing, cleaning, maintaining, or otherwise servicing a FAD, including any electronic equipment used in association with a FAD, in the water or on a vessel while at sea, except that: a FAD may be inspected and handled as needed to identify the owner of the FAD, identify and release incidentally captured animals, un-foul fishing gear, or prevent damage to property or risk to human safety; and a FAD may be removed from the water and if removed may be cleaned, provided that it is not returned to the water.

- No submerging lights under water, suspending or hanging lights over the side of the purse seine vessel or any associated skiffs, other watercraft or equipment, or directing or using lights in a manner other than as needed to illuminate the deck of the purse seine vessel or associated skiffs, watercraft or equipment, except as needed to comply with navigational requirements, to ensure the health and safety of the crew, and in emergencies and as needed to prevent human injury or the loss of human life, the loss of the purse seine vessel, skiffs, watercraft or aircraft, or environmental damage.

Alternative 3 would be the same as Alternative 2 except for the additional restrictions on setting on fish that have aggregated in association with a vessel.

As stated above, the FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the prohibition periods, and possibly reducing the amount of fishing effort during the prohibition periods relative to other periods of the year. In addition, under Alternative 3, there could be a transfer of fishing effort from setting on fish that have aggregated in association with a vessel to other unassociated set types. The number of these types of sets is small. According to logbooks maintained by vessel operators, sets on fish aggregating in association with vessels averaged about four per year for the entire fleet from 1997 through 2010 (examination by NMFS of observer data from selected years indicates a somewhat higher number than the number reported by vessel operators, so vessel logbook data might underestimate the actual number, but the number is still small in comparison to FAD sets). Thus, the effects to the fleet from the FAD restrictions under Alternative 3 would likely be almost identical to the effects caused by implementation of Alternative 2.

4.1.3.3 Observer Requirements

The observer coverage provisions under Alternative 3 would be the same as under Alternative 2. Thus, the effects to the fleet would be identical and the same as described above in Section 4.1.2.3.

4.1.3.4 Summary of Impacts

The requirements of implementing the proposed rule under Alternative 3 have the potential to impact the gross revenue and profits earned by the U.S. WCPO purse seine fleet and cause impacts to its fishing patterns and practices. Overall, it is unlikely that Alternative 3 would cause substantial financial burden to the fleet or substantially affect the fleet’s current fishing patterns and practices, given the short duration of the rule and the other fishing opportunities available to the fleet. The primary direct effects of Alternative 3 on the fleet are the following: (1) the fishing effort limit on the high seas and in the U.S. EEZ could cause the fleet to fish more in the EEZs of Pacific Island Parties to the SPTT or in the EPO and could cause a reduction in the total fishing effort of the fleet; and (2) the FAD restrictions during July-October would likely transfer some fishing effort from FAD sets to unassociated and from setting on fish that have aggregated in association with a vessel to other unassociated set types, with consequent impacts in terms of species composition of the catch, and possibly shift fishing effort from that time to other periods of the year. Given that the fishing day effort limit under this alternative would be substantially larger than the limits under Alternative 2, it is much less likely that the limit would be reached and a fishery closure triggered under Alternative 3 than Alternative 2. Thus, this alternative would likely cause fewer changes to the existing fishing patterns and practices of the fleet and would be more similar to Alternative 1, the No-Action Alternative.

4.1.4 Alternative 4: Least Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Under Alternative 4, the U.S. purse seine fleet operating in the WCPO would be subject to the following management measures, as described in Chapter 2, all applicable to the Convention Area between 20° N. and 20° S. latitude and for the years 2013 and 2014: (1) annual limits on fishing effort, measured in terms of fishing days on the high seas and in the U.S. EEZ; the combined limit for the U.S. EEZ and high seas would be 3,943 fishing days; (2) restrictions on FAD fishing from July 1 through October 31; and (3) a requirement to carry WCPFC observers on all fishing trips, unless NMFS determines that an observer is not available for a fishing trip and a written copy of the determination is carried on board the vessel.

4.1.4.1 Fishing Effort Limit

This limit would be considerably higher than the limits under Alternative 2 or the limit under Alternative 3, and represents the maximum fishing effort by the fleet in the U.S. EEZ and on the high seas in recent years. This alternative also would not include separate limits for the high seas and U.S. EEZ as does Alternative 2. Thus it is highly unlikely that the limit would be reached under this alternative. If the limit is reached, the fishery would be closed on the high seas and in the U.S. EEZ for the remainder of the calendar year. While the length of any such closure cannot be predicted with any degree of certainty, due to the large variation in the number of days fished in the U.S. EEZ and on the high seas from year to year, as shown in Table 1, any closure period would be shorter than under Alternative 2 or Alternative 3, and would likely take place toward the end of the year, if at all.

However, as discussed above for Alternative 2 and Alternative 3, if the limits are reached in 2013 or 2014, vessels in the fleet could continue to fish in the EEZs of Pacific Island Parties to the SPTT, where the fleet expends the majority of its effort. Vessels in the fleet could also increase their effort in the EPO in the area managed by the IATTC. Vessels licensed under the SPTT can each take one fishing trip per year in the area managed by the IATTC, for a period up to 90 days in duration, so long as the total number of trips by all vessels in the fleet does not exceed 32 per calendar year. In addition, although the

IATTC has adopted capacity limits for purse seine vessels operating in the EPO, the United States has a little over 31,000 cubic meters remaining of its allocated capacity. So, this capacity is available for vessels in the U.S. WCPO purse seine fleet who wish to become active on the IATTC vessel register and fish in the EPO in the area of competence of the IATTC .

Given that the fleet expends most of its fishing effort in the EEZs of Pacific Island Parties to the SPTT, which would not be included in these effort limits, it is unlikely that this alternative would substantially affect the amount of fish captured by the fleet or the revenue earned by fishing businesses in the fleet. However, as stated above for Alternatives 2 and 3, climate and ocean conditions, such as ENSO events, affect the location of optimal fishing grounds for the fleet, and 2013 or 2014 could be years in which the U.S. EEZ or high seas provides more optimal fishing grounds than usual.

In addition, the effort limits could change the temporal patterns of fishing effort. Since the limit would be a competitive allocation whereby fishing days would not be allocated among individual vessels and would be available to the entire fleet until the cap is reached, vessel operators might have an incentive to fish harder in these two areas zone earlier in the calendar year than they otherwise would in an attempt to obtain as many fishing days as they can (i.e., “the race to fish”) before one or both limits are reached. To the extent such a shift does occur, it would affect the seasonal timing of deliveries to canneries, the implications of which are addressed in the RIR. A race to fish could also bring costs if it causes vessel operators to forego vessel maintenance or to fish in weather or ocean conditions that it otherwise would not. This could bring costs in terms of human safety as well as the performance of the vessel and its fishing gear and crew. This race to fish effect could also be expected in the time period between when a closure of the fishery is announced and when the fishery is closed. Given that the limits under this alternative reflect the maximum fishing effort by the fleet in recent years, it is unlikely that any race to fish effect would be pronounced under this alternative, since it is unlikely that the limits would be reached or that vessel owners and operators would need to compete for available fishing days under the limit.

4.1.4.2 Restrictions on FAD Fishing

Under Alternative 4, the FAD restrictions would be in effect from July 1 through October 31 in each of the years 2013 and 2014. During these months, no fishing on or near schools associated with FADs or vessels, and no deploying or servicing FADs, would be permitted in the Convention Area in the area between 20° N. and 20° S. latitude. The specific prohibitions, which include details for enforcement purposes, would be identical to those described above in Section 4.1.2.2 for Alternative 2. Thus, the effects to the fleet from the restrictions on FAD fishing under Alternative 4 would be the same as those under Alternative 2.

As stated above, the periods restricting fishing on FADs are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the prohibition periods, and possibly reducing the amount of fishing effort during the prohibition periods relative to other periods of the year.

4.1.4.3 Observer Requirements

The observer coverage provisions under Alternative 4 would be the same as under Alternative 2 and Alternative 3. Thus, the effects to the fleet would be identical and the same as described above in Section 4.1.2.3.

4.1.4.4 Summary of Impacts

The requirements of implementing the proposed rule under Alternative 4 have the potential to impact the gross revenue and profits earned by the U.S. purse seine fleet operating in the WCPO and cause impacts to its fishing patterns and practices. Overall, it is unlikely that Alternative 4 would cause substantial financial burden to the fleet or substantially affect the fleet's current fishing patterns and practices, given the short duration of the rule and the other available fishing opportunities. The primary direct effects of Alternative 4 on the fleet are the following: (1) the fishing effort limit on the high seas and in the U.S. EEZ could cause the fleet to fish more in the EEZs of Pacific Island Parties to the SPTT or in the EPO and could cause a reduction in the total fishing effort of the fleet; and (2) the FAD restrictions during July-October would likely transfer some fishing effort from FAD sets to unassociated sets, with consequent impacts in terms of species composition of the catch, and possibly shift fishing effort from that time to other periods of the year. Given that the fishing day effort limit under this alternative would be substantially larger than the limits under Alternative 2 or the limits under Alternative 3 and represents the highest effort exerted by the fleet in recent years, it is very unlikely that the limit would be reached to trigger a closure of the fishery in the U.S. EEZ or on the high seas. Thus, Alternative 4 would likely cause fewer changes to the existing fishing patterns and practices of the fleet and would be the most similar of all the action alternatives to Alternative 1, the No-Action Alternative.

4.2 Physical Environment and Climate Change

None of the alternatives (No-Action Alternative or any of the action alternatives) would be expected to cause direct or indirect effects to the physical environment of the WCPO. In addition, none of the alternatives would be expected to contribute to climate change. Under the action alternatives, the FAD restrictions could increase search time and thus, fuel use, if vessels in the fleet shift to fishing on FAD sets during that time, and the fishing day effort limits could also increase fuel use, if vessels in the fleet steam to locations farther than they otherwise would due to any closure of the U.S. EEZ or high seas to fishing. However, the fishing effort limits could also cause an overall decrease in fuel use if there is an overall decrease in fishing effort. Moreover, given that the catch and effort of the fleet varies substantially from year to year, as shown in Table 1 in Chapter 3 of this EA, as does the use of FADs, as shown in Figure 8 in Chapter 3 of this EA, the overall fuel use of the fleet would be expected to depend more on other factors (market conditions, oceanographic changes affecting the location of the target tunas, etc.), and the action alternatives would not be expected to lead to increased emissions of greenhouse gases affecting climate change.

4.3 Bigeye Tuna, Skipjack Tuna, and Yellowfin Tuna

This section presents the analysis of the potential impacts that could be caused by the No-Action Alternative and each of the action alternatives for the 2013 U.S. Purse Seine Rule to bigeye tuna, skipjack tuna, and yellowfin tuna in the WCPO – the three stocks on which CMM 2012-01 focuses.

4.3.1 Alternative 1: No-Action Alternative

Under Alternative 1, the U.S. purse seine fleet would continue to be managed through existing requirements, and the elements of the 2013 U.S. Purse Seine Rule would not be implemented. Thus, there would be no direct changes to the fishing patterns or practices of the fleet and thus, no resulting direct effects to bigeye tuna, yellowfin tuna, or skipjack tuna.

As shown in Table 4 of this EA, the stock of Pacific bigeye tuna in the Pacific is currently experiencing overfishing, but the stocks of skipjack tuna and yellowfin tuna in the WCPO and EPO are neither experiencing overfishing nor are they overfished. CMM 2012-01 includes specific objectives for the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna: for each, the fishing mortality rate is to be reduced to or maintained at levels no greater than the fishing mortality rate associated with maximum sustainable yield. Because Alternative 1 would not implement the provisions of CMM 2012-01 for the U.S. purse seine fleet, the objectives of the CMM would be less likely to be met under this alternative than under any of the action alternatives. It is conceivable that the indirect effects (or long-term effects), of this alternative on bigeye tuna, yellowfin tuna, and skipjack tuna would be increased fishing pressure on stocks, leading to a decline to sizes smaller than that which is capable of producing maximum sustainable yield.

On the other hand, as stated above, many other factors affect the status of these stocks, and implementation of 2013 U.S. Purse Seine Rule under any of the action alternatives would not substantially change the fishing practices and patterns of the fleet. Thus, the status of the stocks under the No-Action Alternative would not differ substantially from any of the action alternatives. Under this alternative, however, any minor beneficial effects that the stocks could experience from implementation of the 2013 U.S. Purse Seine Rule under any of the action alternatives would not occur. Thus, there could be some increased potential for long-term negative effects to the stocks over the action alternatives, although such effects cannot be predicted with certainty.

4.3.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Overall, Alternative 2 would likely lead to some direct beneficial impact on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna by reducing the fishing mortality on predominantly juvenile tunas and adult skipjack tuna during the FAD restrictions and by a potential overall reduction in fishing effort from the implementation of the fishing effort limits. The FAD restrictions could also have some potentially adverse effects on the WCPO stock of yellowfin tuna by an increase in the overall fishing mortality on the stock as a result of the fleet targeting large unassociated tunas during the FAD restrictions. Any adverse effects would be ameliorated by reduced catches of juvenile yellowfin tuna during the FAD restrictions, which may have a chance to move or recruit to a deeper, non-predominantly FAD associated life cycle that would provide benefits in terms of additional adult yellowfin tuna available to unassociated fishing.

The indirect effects of Alternative 2 on bigeye, skipjack, and yellowfin tuna stocks would likely be beneficial, since this alternative would be expected to result in some decreased fishing mortality on the stocks, which could lead to long-term positive effects on the stocks. However, these beneficial effects would be relatively small, because: (1) the FAD restrictions and fishing effort limits would only be in effect for two years – 2013 and 2014; and (2) this alternative would result in only a small reduction in the overall fishing mortality on these stocks.

As discussed in Chapter 3, Section 3.3, adult bigeye tuna, skipjack tuna, and yellowfin tuna are considered among the top predators of the tropical or warm pool marine ecosystem. Changes to the stocks of these species could lead to trophic interactive effects, including increased competition for prey species with other top predators. Larval and juvenile tunas are also sources of food for other marine species, such as fish, seabirds, porpoises, marine mammals, and sharks. Thus, increases in larval and juvenile tuna could increase the food available for these other species. It is unlikely that the effects of Alternative 2 to the stocks of bigeye, skipjack and yellowfin tuna, which would be short-lived, would be large enough to impact the marine ecosystem. Overall, Alternative 2 would not cause substantial effects on biodiversity and ecosystem function.

4.3.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel

Under Alternative 3, the impacts to the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna would be similar to the impacts under Alternative 2. However, the fishing effort limits are more restrictive under Alternative 2 than under Alternative 3. Thus, it is much more likely that the fishing effort limits under Alternative 2 would be reached in a given year, necessitating a closure of the U.S. purse seine fishery in the U.S. EEZ and on the high seas. In addition, any similar fishery closure under Alternative 3 would be shorter than under Alternative 2, since the limit under Alternative 3 would be reached later in the year. Thus, any effects on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna would be less than under Alternative 2.

Alternative 3 would also include the additional prohibition during the FAD restrictions, which would prohibit U.S. purse seine vessels from fishing on fish that have aggregated in association with a vessel. It is unlikely that this additional prohibition would affect the stocks of bigeye tuna, skipjack tuna, or yellowfin tuna. The number of these types of sets is small. According to logbooks maintained by vessel operators, sets on fish aggregating in association with vessels averaged about four per year for the entire fleet from 1997 through 2010 (examination by NMFS of observer data from selected years indicates a somewhat higher number than the number reported by vessel operators, so vessel logbook data might underestimate the actual number, but the number is still small in comparison to FAD sets).

4.3.4 Alternative 4: Least Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Under Alternative 4, the impacts to the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna would be similar to the impacts under Alternative 2 and Alternative 3. However, the fishing effort limits are more restrictive under Alternative 2 and Alternative 3 than under Alternative 4. Thus, it is much more likely that the fishing effort limits under Alternative 2 or Alternative 3 would be reached in a given year, necessitating a closure of the U.S. purse seine fishery in the U.S. EEZ and on the high seas. In addition, any similar fishery closure under Alternative 4 would be shorter than under Alternative 2 or under Alternative 3, since the limit under Alternative 4 would be reached later in the year. Thus, any effects on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna would be less than under Alternative 2 or Alternative 3, and Alternative 4 would be more similar to the No-Action Alternative.

4.4 Other Non-target Fish Species[30]

This section discusses the potential impacts from the No-Action Alternative or from implementation of any of the action alternatives for the 2013 U.S. Purse Seine Rule on non-target fish species caught by the U.S.WCPO purse seine fleet.

4.4.1 Alternative 1: No-Action Alternative

Under Alternative 1, the No-Action Alternative, there would be no direct changes to the existing fishing patterns of the U.S. WCPO purse seine fleet, and thus, no direct effects to non-target fish species. As discussed above in Section 4.3.1 of this EA, it is conceivable that the indirect, or long-term, effects of the No-Action Alternative on bigeye tuna, skipjack tuna, and yellowfin tuna would be negative, should this alternative lead to increased fishing pressure on the stocks. Any such increased fishing pressure could also lead to long-term negative effects on other non-target fish species that are caught by the U.S. WCPO purse seine fleet. However, as shown in Table 5 in Chapter 3 of this EA, the U.S. WCPO purse seine fleet does not generally catch a substantial amount of other fish species. Also, given that many other factors influence the status of non-target fish species (e.g., fisheries that target those species, oceanic conditions), it is unlikely that there would be any indirect effects to non-target species under the No-Action Alternative, stemming from lack of implementation of the 2013 U.S. Purse Seine Rule. In addition, none of the action alternatives would substantially change the fishing patterns and practices of the

[30] This terminology is used throughout the EA to differentiate between bigeye tuna, a non-target species of the U.S. WCPO purse seine fleet, and other non-target fish species.

fleet as a whole. The primary difference between the action alternatives are the fishing effort limits. As indicated in Table 1 and Sections 3.1 and 3.2 of this EA, the spatial distribution of fishing effort by the fleet varies considerably from year to year, and is dependent mostly on oceanographic and market conditions affecting the location of the target tuna stocks and the marketability of the catch. Moreover, the majority of the fishing effort of the fleet takes place in the EEZs of Pacific Island Parties to the SPTT, and those EEZs would be unaffected by any of the action alternatives. Thus, the fishing patterns and practices of the fleet under the No-Action Alternative would be similar to the fishing patterns and practices of the fleet under any of the action alternatives analyzed in this EA. However, Alternative 4 (the least restrictive fishing effort limit alternative) would be more similar to the No-Action Alternative than Alternatives 3 or 2; Alternative 2 would be much less similar to the No-Action Alternative than either Alternatives 3 or 4, since it is much more likely that the effort limits would be reached under Alternative 2, triggering a closure of the fishery in the U.S. EEZ and/or on the high seas, as described above. So the effects to non-target species from the No-Action Alternative would not be substantially different from the effects to non-target species under any of the action alternatives.

4.4.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Under Alternative 2, there could be some change in the amount and type of non-target fish species caught by the U.S. WCPO purse seine fleet. As discussed above, during the FAD restrictions, the fleet may fish in different areas than fished historically (i.e., make unassociated rather than FAD sets), which would affect the composition of the catch, including both target stocks and non-target species, and the fishing day effort limits could cause some shift in effort to the EEZs of Pacific Island Parties to the SPTT or to the EPO. Direct impacts to non-target fish species would include a potential increase in the catch of some species and a decrease in the catch of other species, due to the changes in fishing patterns and practices of the fleet and the potential for an overall decrease in fishing effort due to implementation of the fishing effort limits and any associated fishery closure. Indirect or long-term effects would include the greater potential for adverse effects to the stocks of non-target fish species that experience increased fishing mortality and reduced potential for adverse effects to the stocks of non-target fish species that experience decreased fishing mortality. Because the U.S. WCPO purse seine fleet fishing does not generally catch large amounts of other non-target fish species (see Table 5 in Chapter 3 of this EA), the overall direct and indirect effect on non-target fish species would be negligible.

4.4.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel

Under Alternative 3, similar to Alternative 2 there could be some change in the amount and type of non-target fish species caught by the U.S. WCPO purse seine fleet. The nature of the potential direct and indirect impacts to other non-target fish species would be identical to those identified under Alternative 2, although the extent of effects would be less, since it is much less likely that the fishing limit would be reached under this alternative to trigger a fishery closure leading to an overall reduction in fishing effort. However, the overall effects to other non-target fish species would be negligible for the reasons discussed above for Alternative 2.

4.4.4 Alternative 4: Least Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Under Alternative 4, similar to Alternative 2 and Alternative 3, there could be some change in the amount and type of non-target fish species caught by the U.S. WCPO purse seine fleet. The nature of the potential direct and indirect impacts to other non-target fish species would be identical to those identified under Alternative 2 and Alternative 3, although the extent of effects would be less, since it is highly unlikely that the fishing limit would be reached under this alternative to trigger a fishery closure leading to an overall reduction in fishing effort. Alternative 4 would be the most similar to the No-Action Alternative out of all the action alternatives. However, the overall effects to other non-target fish species and overall the effects would be negligible for the reasons discussed for Alternative 2.

4.5 Protected Resources

This section discusses the potential impacts from each of the alternatives to protected resources in the affected environment.

4.5.1 Alternative 1: No-Action Alternative

Under Alternative 1, the No-Action Alternative to the purse seine rule, there would be no direct changes to the existing fishing patterns of the U.S. WCPO purse seine fleet, and thus, no direct effects to protected resources. As discussed above in Section 4.3.1 of this EA, it is conceivable that the indirect, or long-term, effects of the No-Action Alternative on bigeye tuna, skipjack tuna, and yellowfin tuna would be negative, should this alternative lead to increased fishing pressure on the stocks. Any such increased fishing pressure could also lead to long-term negative effects on protected resources with which the U.S. WCPO purse seine fleet interacts. However, given that many other factors influence the status of those species (e.g., other fisheries, oceanic conditions), it is unlikely that there would be any substantive indirect effects to protected resources stemming from lack of implementation of the 2013 U.S. Purse Seine Rule under the No-Action Alternative.

4.5.2 Alternative 2: Most Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

Data indicates that the U.S. purse seine fleet has had some interaction with marine mammals and sea turtles in the WCPO, and the U.S. WCPO purse seine fleet has not been known to interact with seabirds. The direct and indirect effects to marine mammals and sea turtles from the Alternative 2 would likely be negligible. To the extent that there could be a reduction in fishing effort, any effect to ESA-listed species or critical habitat of these species would be beneficial, since there would be a reduced risk of interaction with the protected resource. To the extent that there is a shift in fishing patterns and practices, any effects in terms of interactions with protected resources would be negligible compared to typical year-to-year variations in interactions with species driven by changing oceanic and economic conditions. As indicated in Table 1 of the EA, the distribution of effort of the fleet varies considerably from year to year, and as indicated in Figure 8 of the EA, the proportion of FAD versus unassociated sets also varies from year to year, so the overall shifts in fishing patterns and practices of the fleet in a given year depend mostly on oceanographic and economic factors, which would not be affected by this alternatives. Moreover, the FAD restrictions and fishing effort limits would only be in effect for two years – 2013 and 2014. Thus, for these reasons, it is likely that there would be no net change in interactions stemming from implementation of the proposed. Alternative 2 would not cause any effects to ESA-listed species that have not been addressed in prior consultations and would not cause additional impacts to marine mammals protected under the MMPA.

The changes in fishing patterns and practices of the fleet would not affect the following areas designated as EFH or HAPC: ocean or coastal habitats; historic properties listed in or eligible for listing in the National Register of Historic Places; or NWRs or National Monuments. Such resources would not be affected because the potential changes in fishing patterns and practices of the fleet would take place in areas of the ocean far from shorelines and would not affect the seafloor or benthic habitats since purse seine fishing does not involve contact with the seafloor (see Section 3.2 of this EA for a description of purse seine fishing). Also, because any effects to fish stocks would be minor or negligible, as discussed above, any pelagic fish habitat designated as EFH, including the water column, or HAPC, would not be expected to experience any substantial effects – either beneficial or adverse – from implementation of this alternative. In addition, as discussed in Section 3.5 of this EA, commercial fishing is already prohibited in the Monuments, pursuant to the 2009 Presidential Proclamation.

4.5.3 Alternative 3 (Preferred): Past Regulatory Precedent Fishing Limit Alternative; FAD Prohibition Period Including Prohibition on Fishing on FADs and Prohibition on Setting on Fish that Have Aggregated in Association with a Vessel

The effects to protected resources under Alternative 3 would be essentially the same as under Alternative 2. However, as discussed above, under Alternative 3 it would be much less likely that there would be closure of the fishery in the U.S. EEZ or on the high seas as a result of the fishing effort limit being reached, so it is much less likely that there would be an overall decrease in fishing effort. Thus, the potential for any beneficial impacts to protected resources from a reduction in fishing effort leading to a potential for reduced risk of interactions with the protected resource would be much less under Alternative 3 than under Alternative 2.

4.5.4 Alternative 4: Least Restrictive Fishing Effort Limit Alternative; FAD Prohibition Period Limited to Prohibition on Fishing on FADs

The effects to protected resources under Alternative 4 would be essentially the same as under Alternative 2 and Alternative 3. However, as discussed above, under Alternative 4 it would be much less likely that there would be closure of the fishery in the U.S. EEZ or on the high seas as a result of the fishing effort limit being reached than under Alternative 2 or even under Alternative 3, given that the effort limit represents the maximum effort exerted by the fleet in recent years, so it is much less likely that there would be an overall decrease in fishing effort. Thus, the potential for any beneficial impacts to protected resources from a reduction in fishing effort leading to a potential for reduced risk of interactions with the protected resource would be much less under Alternative 4 than under Alternatives 2 or 3, and Alternative 4 would be more similar to the No-Action Alternative.

4.6 Environmental Justice

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” states that “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” As discussed above, the overall environmental effects from under any of the alternatives would be minor and generally would be distributed evenly among the affected vessels in the fleet. Thus, none of the alternatives considered would result in significant and adverse effects on minority or low-income populations.

Chapter 5

Chapter 5 Cumulative Impacts

This chapter presents the cumulative impacts analysis for the 2013 U.S. Purse Seine Rule.

A cumulative impact is defined by the CEQ's regulations at 40 CFR § 1508.7 as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." And further: "cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." The cumulative impacts analysis examines whether the direct and indirect effects of the proposed action and alternatives on a given resource interact with the direct and indirect effects of other actions on that same resource to determine the overall, or cumulative effects, on that resource. As discussed in Chapter 4, the analysis of the direct and indirect effects of the No-Action Alternative and the three action alternatives indicates that each of the alternatives may have some minor effects on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna in the WCPO. The direct and indirect effects on other resources in the affected environment would be none or negligible. Thus, this chapter focuses on the potential cumulative effects to bigeye, skipjack, and yellowfin tuna in the WCPO.

Before beginning a cumulative impacts analysis, the geographic area of the analysis and the time frame for the analysis must be identified to determine the appropriate scope for the analysis (CEQ 1997). The geographic area of the analysis here is the Pacific Ocean area as described in Chapter 3 and in Section 5.1.1. The time frame for this analysis is from 2009 – when the United States first implemented a WCPFC decision for the management of tropical tunas through rulemakings with effects on the environment similar to the effects that would be caused by implementation of the 2013 U.S. Purse Seine Rule – to 2017, the reasonably foreseeable end date of the new multi-year CMM for tropical tunas that the WCPFC may adopt at the end of this year. Although it is likely that the WCPFC would adopt additional management measures for tropical tunas after 2017, any specific actions beyond 2017 that would affect tropical tunas in the WCPO are not definitive enough to be reasonably foreseeable at this time.

Section 5.1 provides some additional information on the affected environment, Section 5.2 describes the identified past, present, and reasonably foreseeable future actions during the 2009-2017 time period, and Section 5.3 presents the cumulative effects analysis.

5.1 Affected Environment

Chapter 3 describes the affected environment that could be affected by the proposed action under any of the alternatives studied in depth. Chapter 3 sets forth the baseline for assessing the direct and indirect impacts of the proposed action, as presented in Chapter 4. This section supplements the information in Chapter 3 in order to establish the baseline for studying the other actions that are part of the cumulative impacts analysis. The section provides information on the fisheries that are active in the area of application of the Convention.

5.1.1 Convention Area HMS Fisheries

The dominant HMS fisheries in the Convention Area are tuna fisheries that target skipjack tuna, yellowfin tuna, bigeye tuna, and albacore tuna. Many distant-water fishing nations and coastal states participate and operations vary from small-scale, subsistence, and artisanal operations in the coastal waters of Pacific Island States, to industrial scale operations both in the EEZs of Pacific Island States and on the high seas.

HMS fisheries in the Convention Area are individually managed under a number of international agreements and associated domestic authorities. Catch and effort information is compiled by the Oceanic Fisheries Programme at the Secretariat of the Pacific Community as the scientific and data support provider to the WCPFC for most fisheries. The WCPFC Tuna Yearbook, produced by the OFP at SPC, summarizes this information and is available to the public.[31] Table 9 through Table 12 below summarize relevant data, such as, total catch by species, catch by gear, catch by nation, and number of active vessels.

Williams and Terawasi (2012) summarized the Convention Area HMS fishery in the following terms: Annual total catches of the four main tuna species (skipjack, yellowfin, bigeye and albacore) in the [Convention Area] increased steadily during the 1980s as the purse seine fleet expanded and remained relatively stable during most of the 1990s until the sharp increase in catch during 1998. From 2004 until 2009, there had been a clear increasing trend in total tuna catch, primarily due to increases in purse-seine fishery catches. . . . The provisional total [Convention Area] tuna catch for 2011 was estimated . . . the lowest since 2005 and [about] 300,000 mt lower than the record in 2009.

[31] See http://www.wcpfc.int/statistical-bulletins. The Tuna Fishery Yearbook 2011 is referenced in this document and cited as WCPFC 2012.

Table 9: Tuna catches in WCPFC Statistical Area[32] by species (in mt)

Year	Albacore		Bigeye		Skipjack		Yellowfin		Total
	MT	%	MT	%	MT	%	MT	%	MT
1997	112,900	7	153,184	9	909,607	56	460,638	28	1,636,329
1998	112,465	6	173,674	9	1,189,457	59	557,066	27	2,032,662
1999	131,066	7	151,726	8	1,100,482	59	477,400	26	1,860,674
2000	101,171	5	142,029	7	1,145,613	60	524,341	27	1,913,154
2001	121,561	7	145,295	8	1,041,466	57	513,336	28	1,821,658
2002	147,793	7	171,691	9	1,222,323	61	476,380	24	2,018,187
2003	122,949	6	140,411	7	1,223,454	61	516,280	26	2,003,094
2004	122,343	6	184,919	9	1,308,800	62	506,057	24	2,122,119
2005	105,135	5	152,959	7	1,378,374	63	565,635	26	2,202,103
2006	104,986	5	164,296	7	1,484,948	66	491,216	22	2,245,446
2007	126,701	5	146,665	6	1,650,123	68	511,550	21	2,435,039
2008	104,966	4	156,467	6	1,647,371	66	574,825	23	2,483,629
2009	135,476	5	157,679	6	1,799,991	69	510,200	20	2,603,346
2010	126,393	5	137,302	5	1,688,473	68	546,084	22	2,498,252
2011	126,577	5	159,479	7	1,557,588	67	479,403	21	2,323,047
Current 5 year average	124,023	5	151,518	6	1,668,709	68	524,412	21	2,468,663

Source: WCPFC 2012, Table 78.

[32] The Convention Area is essentially encompassed by the WCPFC Statistical Area, but the WCPFC Statistical Area is defined on the west side, unlike the Convention Area..

Table 10: Tuna catches in WCPFC Statistical Area by gear (albacore, bigeye, skipjack, and yellowfin tuna, in mt).

	Longline		Pole and Line		Purse Seine		Troll		Other		Total
	MT	**%**	**MT**	**%**	**MT**		**MT**	**%**	**MT**	**%**	**MT**
1997	213,450	13	273,844	17	981,357	60	18,732	1	148,946	9	1,636,329
1998	233,645	11	313,968	15	1,295,422	64	19,099	1	170,528	8	2,032,662
1999	202,973	11	338,832	18	1,128,758	61	13,476	1	176,635	9	1,860,674
2000	226,730	12	299,976	16	1,168,429	61	25,845	1	192,174	10	1,913,154
2001	246,221	14	243,337	13	1,144,443	63	17,329	1	170,328	9	1,821,658
2002	266,963	13	254,785	13	1,297,472	64	16,129	1	182,838	9	2,018,187
2003	250,160	12	260,875	13	1,292,289	65	19,875	1	179,895	9	2,003,094
2004	266,581	13	253,330	12	1,393,992	66	23,445	1	184,771	9	2,122,119
2005	250,167	11	266,663	12	1,479,329	67	13,293	1	192,651	9	2,202,103
2006	255,328	11	257,485	11	1,512,944	67	10,098	0	209,591	9	2,245,446
2007	245,129	10	284,564	12	1,656,445	68	9,249	0	239,652	10	2,435,039
2008	245,509	10	269,304	11	1,709,352	69	11,740	0	247,724	10	2,483,629
2009	279,012	11	264,246	10	1,785,627	69	9,894	0	264,567	10	2,603,346
2010	269,578	11	270,004	11	1,697,608	68	11,320	0	249,742	10	2,498,252
2011	264,772	11	274,105	12	1,543,140	66	12,404	1	228,626	10	2,323,047
2007-2011 average	260,800	11	272,445	11	1,678,434	68	10,921	0	246,062	10	2,468,663

Source: WCPFC 2012, Table 84.

Table 11: 2007 Tuna catches in WCPFC Statistical Area by nation/territory/fishing entitiy (albacore, bigeye, skipjack, and yellowfin tuna, in mt).

Australia	2,924	Indonesia	390,279	Samoa	1,932
Belize	220	Japan	363,257	Solomon Islands	40,374
Canada	1	Kiribati	60,003	Spain	39,468
China	105,275	Korea	231,558	Tokelau	4
Chinese Taipei	226,901	Marshall Islands	90,544	Tonga	224
Cook Islands	3,636	Nauru	4	Tuvalu	7,283
Ecuador	18,045	New Caledonia	2,362	United States of America	214,645
El Salvador	12,226	New Zealand	23,792	Vanuatu	34,519
Fiji	11,286	Papua New Guinea	164,556	Vietnam	49,584
French Polynesia	6,028	Philippines	192,956	Wallis and Futuna	13
FSM	28,432	Portugal	7		

Source: WCPFC 2012, Table 83.

Table 12: Number of vessels active[33] in WCPFC Statistical Area

Year	Purse seine	Pole & Line	Longline
1997	608	1,553	5,135
1998	343	1,483	5,008
1999	417	1,518	4,912
2000	413	1,436	4,917
2001	1,389	619	5,900
2002	1,585	549	5,837
2003	1,494	589	4,687
2004	1,512	573	4,288
2005	1,494	586	4,282
2006	1,436	538	4,011
2007	1,464	515	3,569
2008	1,399	497	3,443
2009	1,467	496	3,411
2010	1,480	492	4,561
2011	1,488	490	3,667

Source: WCPFC 2012, Table 71.

The changes in purse seine and pole and line between years 2000-2001 are due to increasingly improved data coming from Indonesia. In recent years Indonesia has reported around 1,000 domestic purse seine vessels – most of which are small (under 400 gross tons), many of which had been previously counted as pole and line vessels; the larger vessels still contribute to the majority of the total catch.

5.2 Past, Present, and Reasonably Foreseeable Future Actions

This section describes the other actions in the period 2009-2017 that have the potential to affect bigeye tuna, skipjack tuna, and yellowfin tuna in the WCPO. The analysis of cumulative impacts is presented in the following section.

5.2.1 Past Actions

Past actions include:

- U.S. implementation of the purse seine provisions of CMM 2008-01 and CMM 2011 through the 2009 rule and the 2011 rule, as discussed in Chapter 1 of this EA;
- U.S. implementation of the longline provisions of CMM 2008-01 and CMM 2011-01, which was essentially implementation of a 3,763 mt catch limit for bigeye tuna for the U.S. longline fleets operating in the Convention Area for the

[33] An active vessel is any vessel that has actively fished at some point during the course of the year.

years 2009-2012 (see final rule published December 7, 2009 at 74 FR 63999; and final rule published August 27, 2012 at 77 FR 51709);

- U.S. implementation of the IATTC decisions for tropical tunas in the EPO in 2009 and 2011, which include bigeye tuna catch limits for longline fisheries and closed areas and periods for purse seine fishing for the years 2009 through 2013 (see final rule published November 23, 2009 at 74 FR 61046; and final rule published November 4, 2011 at 76 FR 68332); and
- actions by other nations to implement the WCPFC and IATTC decisions for tropical tunas, details of which are unknown.

5.2.2 Other Present Actions

Present actions include:

- U.S. implementation of the longline provisions of CMM 2012-01 through a separate rulemaking later this year, as discussed in Chapter 1 of this EA, which would put into place a catch limit for bigeye tuna;
- Amendments to the relevant FEPs to implement certain provisions for the Marine National Monuments, as described in Section 3.5 of this EA; and
- actions by other nations to implement CMM 2012-01, details of which are unknown.

5.2.3 Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions include:

- Implementation of the WPFMC recommendations for an amendment to the Pelagics FEP that would set up a system for the assignment of WCPFC-imposed HMS catch limits among the United States and American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands;
- actions by the United States and other nations to implement a new multi-year WCPFC CMM for tropical tunas for 2014-2017, details of which are unknown;
- actions by the United States and other nations to implement a new multi-year IATTC management measure for tropical tunas for 2014 and beyond, details of which are unknown; and
- actions by the United States to implement a renegotiated SPTT, the specific details of which are unknown at this time.

5.3 Discussion of Cumulative Impacts to Bigeye, Skipjack, and Yellowfin Tuna in the WCPO

As discussed in Chapter 4, the direct and indirect effects from any of the action alternatives to bigeye, skipjack, and yellowfin tuna stocks in the WCPO would likely be minor and beneficial. Alternative 2 would have more potential for beneficial effects on the stocks, given that the length of any closure caused by the fishing effort limits would be longer; Alternative 3 would have less potential for beneficial effects on the stocks than Alternative 2, since the fishing effort limit would be reached later in the year, if at all, but less than Alternative 4; Alternative 4 would have the least potential for beneficial effects on the stocks, since the fishing effort limit would be reached even later in the year than under Alternative 3, if at all. As for the No-Action Alternative, there would be no direct effects to bigeye, skipjack, and yellowfin tuna stocks, and the potential indirect effects would be minor and perhaps negative.

The status of the stocks of bigeye, skipjack, and yellowfin tuna has not changed since 2009, thus, it is evident that the past management actions identified above, which were intended to help to conserve the stocks, have also had, at the most, minor biological effects. The other identified present actions would also be expected to have minor effects on these stocks. Some of the other present actions would implement interim measures under CMM 2012-01, and in CMM 2012-01, the WCPFC contemplates that additional management measures for 2014-2017 will be needed to achieve its stated objectives. The proposed amendments to the relevant FEPs to implement certain provisions for the Marine National Monuments are not expected to substantially affect fish stocks (see WPFMC 2013).CMM 2012-01 includes specific objectives for each of the three stocks: for each, the fishing mortality rate is to be reduced to or maintained at levels no greater than the fishing mortality rate associated with maximum sustainable yield.

The details of the reasonably foreseeable future actions are unknown, and thus, specific assessment of each of their potential contributions to cumulative impacts on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna is not possible at this time. However, given the WCPFC’s articulated objectives in CMM 2012-01 and the current status of the stocks, it is likely that the reasonably foreseeable future actions will be consistent with the objectives of CMM 2012-01 and would likely include some provisions that are similar to the provisions in CMM 2012-01.

Thus, the cumulative impacts from the identified past, present, and reasonably foreseeable future actions on the stocks of bigeye tuna, yellowfin tuna, and skipjack tuna in the WCPO would likely be beneficial. However, it is unlikely that the current status of the stocks will change as a collective result of all of these actions – though this is difficult to predict without knowing the details of the reasonably foreseeable future actions. Therefore, the cumulative impacts from implementation of the 2013 U.S. purse seine rule under any of the action alternatives or lack of implementation under the No-Action Alternative would not be expected to lead to substantial cumulative impacts on the status of the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna in the WCPO.

Consultation

Consultation

NAO 216-6 requires a listing of the agencies and persons who were consulted while preparing this EA. Table 13 lists the agencies, NOAA units, and entities that were contacted for information.

Table 13: List of agencies and offices contacted

NMFS – Headquarters – Office of International Affairs
NMFS – Pacific Islands Regional Office – Observer Program
NMFS – Pacific Islands Regional Office – Sustainable Fisheries Division
NMFS – Pacific Islands Fisheries Science Center
NMFS – Southwest Regional Office – Sustainable Fisheries Division
NMFS – Southwest Science Center
NMFS – Alaska Regional Office – Sustainable Fisheries Division
NOAA Office of Law Enforcement
North Pacific Fishery Management Council
Pacific Fishery Management Council
Department of State – Office of Marine Conservation
U.S. Coast Guard – 14th Coast Guard District
Western Pacific Fishery Management Council

List of Preparers

Name	**Organization**
Rini Ghosh	NMFS – Pacific Islands Regional Office – International
Valerie Chan	NMFS – Pacific Islands Regional Office – International
Zora McGinnis	NMFS – Pacific Islands Regional Office – International
Emily Crigler	NMFS – Pacific Islands Regional Office – International

Literature Cited

Ainsworth, C. H., J.F. Samhouri, D.S. Busch, W.W.L. Cheung, J. Dunne, J. and T.A. Okey. 2011. Potential impacts of climate change on Northeast Pacific marine foodwebs and fisheries. *Ices Journal of Marine Science* 68(6): 1217-1229.

Allain, V. 2010. Trophic structure of the pelagic ecosystems of the western and central Pacific Ocean. WCPFC Report SC6-2010/EB- IP10. Nukualofa, Tonga, Western and Central Pacific Fisheries Commission.

Alverson, F.G. and C.L. Peterson. 1963. Synopsis of the biological data on bigeye tuna *Parathunnus sibi* (Temminck and Schlegel) 1844. FAO Fisheries Report 6(2):482-514. Rome, Food and Agriculture Organization for the United Nations.

Appleyard, S., P. Grewe, B. Innes, and R. Ward. 2001. Population structure of yellowfin tuna (*Thunnus albacares*) in the western Pacific Ocean, inferred from microsatellite loci. *Marine Biology* 139(2):383-393.

Baker, J.D., C.L. Littnan, 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* 2: 21-30.

Bala, G., K. Caldeira, R. Nemani. 2010. Fast versus slow response in climate change: implications for the global hydrological cycle. *Climate Dynamics* 35: 423–434.

Begon, M., C.A. Townsend, and J.L. Harper. 2006. *Ecology: From Individuals to Ecosystems*. Hoboken, New Jersey: Wiley-Blackwell.

Blackburn, M. 1965. Oceanography and ecology of tunas. *Oceanography and Marine Bioloby: An Annual Review* 3:299-322.

Calkins, T.P. 1980. Synopsis of biological data on the bigeye tuna, *Thunnus obesus* (Lowe, 1839), in the Pacific Ocean. *In* Bayliff, W.H. (ed.) Synopses of Biological Data on Eight Species of Scombrids. IATTC Special Report 2. La Jolla, California, Inter-American Tropical Tuna Commission.

Carpenter, K.E., M. Abrar, G. Aeby, R. B. Aronson, S. Banks, A. Bruckner, A. Chiriboga, J. Cortés, J.C. Delbeek, L. DeVantier, et al. 2008. One-Third of Reef-Building Corals Face Elevated Extinction Risk from Climate Change and Local Impacts. *Science* 321: 560-563.

Chavez, F.P., J. Ryan, S.E. Lluch-Cota, and C.M. Niquen. 2003. From anchovies to sardines and back: Multidecadal change in the Pacific Ocean. *Science* 299(5604):217-221.

Coan Jr., A.L, G.T. Sakagawa and G. Yamasaki. 2002. The 2001 U.S. purse seine fishery for tropical tunas in the central-western Pacific. Fifteenth Meeting of the Standing Committee on Tuna and Billfish, 22-27 July 2002. Working Paper FTWG-1. Honolulu, Hawaii. Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Cole, J.S. 1980. Synopsis of biological data on the yellowfin tuna *(Thunnus albacares)* (Bonnaterre 1788) in the Pacific Ocean. IATTC Special Report 2:75-150. La Jolla, California, Inter-American Tropical Tuna Commission.

Collette, B.B. and C.E. Nauen. 1983. *Scombrids of the world: An annotated and illustrated catalogue of tunas, mackerels, bonitos, and related species known to date*. Rome: Food and Agriculture Organization for the United Nations.

Council on Environmental Quality. 1997 Considering cumulative effects under the National Environmental Policy Act. Washington, D.C., Executive Office of the President of the United States.

Cox, S.P., T.E. Essington, J.F. Kitchell, S.J.D. Martell, C.J. Walters, C. Boggs, and I. Kaplan. 2002. Reconstructing ecosystem dynamics in the central Pacific Ocean, 1952-1998. II. A preliminary assessment of the trophic impacts of fishing and effects on tuna dynamics. *Canadian Journal of Fisheries and Aquatic Sciences* 59:1736-1747.

Dagorn, L., K.N. Holland, J.P. Hallier, M. Taquet, G. Moreno, G. Sancho, D.G. Itano et al. 2006. Deep diving behavior observed in yellowfin tuna (*Thunnus albacares*). *Aquatic Living Resources* 19:85-88.

Dagorn, L., K.N. Holland, V. Restrepo, and G. Moreno. 2012. Is it good or bad to fish with FADs? What are the real impacts of the use of drifting FADs on pelagic marine ecosystems? *Fish and Fisheries*.

Dambacher, J.M., J.W. Young, R.J. Olson, V. Allain, F. Galván-Magaña, M. J. Lansdell, N. Bocanegra-Castillo, V. Alatorre-Ramírez, S. P. Cooper, L.M. Duffy. 2010. Analyzing pelagic food webs leading to top predators in the Pacific Ocean: A graph-theoretic approach. *Progress in Oceanography* 86(1-2):152-165.

Edwards, M., M. Heath, and A. McQuatters-Gollop. 2010. Plankton *in* MCCIP Annual Report Card 2010-11, MCCIP Science Review:10.

Fonteneau, A. 1991. Seamounts and tuna in the tropical eastern Atlantic. *Aquatic Living Resources* 4(1):13-25.

Galbraith, H., R. Jones, R. Park, J. Clough, S. Herrod-Julius, B. Harrington and G.Page. 2002. Global Climate Change and Sea Level Rise: Potential Losses of Intertidal Habitat for Shorebirds. *The International Journal of Waterbird Biology* 25(2):173-183.

Gillett, R.D., M. McCoy, and D.G. Itano. 2002. Status of the United States western Pacific tuna purse seine fleet and factors affecting its future. SOEST/JIMAR Report SOEST contribution 00-02 and JIMAR contribution 00-01. Honolulu, Joint Institute for Marine and Atmospheric Research and School of Ocean and Earth Science and Technology, University of Hawaii.

Gillet, R. and A. Langley. 2007. Tuna for tomorrow? Some of the science behind an important fishery in the Pacific Islands. Noumea, New Caledonia, Asian Development Bank and Secretariat of the Pacific Community.

Graham, B.S., D. Grubbs, K. Holland, and B. N. Popp. 2007. A rapid ontogenetic shift in the diet of juvenile yellowfin tuna from Hawaii. *Marine Biology*, 150(4): 647-658.

Grewe, P.M. and J. Hampton. 1998. An assessment of bigeye (*Thunnus obesus*) population structure in the Pacific Ocean based on mitochondrial DNA and DNA microsatellite analysis. Hobart, Australia, Australian Commonwealth Scientific and Research Organization.

Halpern, B.S., K. Cottenie, and B.R. Broitman. 2006. Strong top-down control in southern California kelp forest ecosystems. *Science* 312:1230-1232.

Hampton, J. and K. Bailey. 1993. Fishing for tunas associated with floating objects: A review of the western Pacific fishery. SPC Report 31. Noumea, New Caledonia, South Pacific Commission, Tuna and Billfish Assessment Programme, South Pacific Commission.

Hampton, J., K. Bigelow, and M. Labelle. 1998. A summary of current information on the biology, fisheries, and stock assessment of bigeye tuna (*Thunnus obesus*) in the Pacific Ocean, with recommendations for data requirements and future research. SPC Report 36. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Hanamoto, E. 1987. Effect of oceanographic environment on bigeye tuna distribution. *Bulletin of the Japanese Society of Fisheries Oceanography* 51:203-216.

Harley, S., P. Williams, and J. Hampton. 2012. A compendium of fisheries indicators for bigeye, skipjack, yellowfin, and south Pacific albacore tunas and south Pacific swordfish. WCPFC Report SC8-2012/SA-WP-02. Busan, Republic of Korea, Western and Central Pacific Fisheries Commission.

Hays, G.C., A.J. Richardson, and C. Robinson. 2005. Climate change and marine plankton. *Trends in Ecology and Evolution* 20(6):337-344.

Hinke, J.T., I.C. Kaplan, K. Aydin, G.M. Watters, R.J. Olson, and J.F. Kitchell. 2004. Visualizing the food-web effects of fishing for tunas in the Pacific Ocean. *Ecology and Society* 9(1) Article 10.

Hoegh-Guldberg, O., and J. Bruno. 2010. The Impact of Climate Change on the World's Marine Ecosystems. *Science* 328: 1523-1528.

Holland, K., P. Kleiber, and S. Kajiura. 1999. Different residence times of bigeye and yellowfin tuna occurring in mixed aggregations over a seamount. *Fisheries Bulletin* 97:392-395.

Hunter, J.S., B. J. Macewicz, And J.R. Sibert. 1986. The Spawning Frequency of Skipjack Tuna, *Katsuwonus Pelamis*, from the South Pacific. *Fishery Bulletin*, 84(4): 895-903.

Intergovernmental Panel on Climate Change. 2007. Climate change 2007: Synthesis report. An assessment of the Intergovernmental Panel on Climate Change, IPCC Plenary Session XXVII, Valencia, Spain.

Itano, D.G. 2000. The reproductive biology of yellowfin tuna (*Thunnus Albacares*) in Hawaiian waters and the western tropical Pacific Ocean: Project summary. SOEST/Jimar Report SOEST contribution 00-01 JIMAR Contribution 00-328. Honolulu, Joint Institute for Marine and Atmospheric Research and the School for Ocean and Earth Science and Technology, University of Hawaii.

Joseph, J. 2002. Managing fishing capacity of the world tuna fleet. FAO Fisheries Circular Number 982. Rome, Food and Agriculture Organization of the United Nations.

Kaeriyama, M., H. Seo, H. Kudo, M. Nagata. 2012. Perspectives on wild and hatchery salmon interactions at sea, potential climate effects on Japanese chum salmon, and the need for sustainable salmon fishery management reform in Japan. *Environmental Biology of Fishes* 94(1, SI): 165-177.

Kume, S. 1967. Distribution and migration of bigeye tuna in the Pacific Ocean. *Report of the Nankai Regional Fisheries Research Laboratory* 25:75-80.

Langley, A., P. Williams, P. Lehodey, and J. Hampton. 2004. The western and central Pacific tuna fishery 2003: Overview and status of tuna stocks. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Langley, A., J. Hampton, P. Kleiber, and S. Hoyle. 2008. Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean, Including an Analysis of Management Options. WCPFC-SC4-2008/SA-WP-1 Rev.1. Port Moresby, Papua New Guinea, Western and Central Pacific Fisheries Commission.

Lehodey, P., M. Bertignac, J. Hampton, A. Lewis, and J. Picaut. 1997. El Niño Southern Oscillation and tuna in the western Pacific. *Nature* 389(6652):715-718.

Lehodey P., JM. Andre, M. Bertignac, J. Hampton, A. Stoens, C. Menkes, L. Memery, and N. Grima. 1998. Predicting skipjack tuna forage distributions in the equatorial Pacific using a coupled dynamical bio-geochemical model. *Fisheries Oceanography* (special issue of GLOBEC Open Science Meeting) 7(3 and 4):317–32.

Link, J. 2002. Does food web theory work for marine ecosystems? *Marine Ecology Progress Series* 230:1-9.

Loukos, H., P. Monfray, L. Bopp, and P. Lehodey. 2003. Potential changes in skipjack tuna (Katsuwonus pelamis) habitat from a global warming scenario: modelling approach and preliminary results. *Fisheries Oceanography* 12(4-5):474-482.

Mayfield A.B., Chan P., H.M. Putnam, C. Chen, T. Yung Fan. 2012. The effects of a variable temperature regime on the physiology of 10 the reef-building coral *Seriatopora hystrix*: results from a laboratory-based reciprocal transplant. *The Journal of experimental Biology* 215(23): 4183-95.

Miyabe, N. 1994. A review of the biology and fisheries for bigeye tuna, *Thunnus obesus*, in the Pacific Ocean. FAO Fisheries Report T336 Volume 2. Rome, Food and Agriculture Organization for the United Nations.

Miyabe, N. and W.H. Bayliff. 1998. A review of information on the biology, fisheries, and stock assessment of bigeye tuna, *Thunnus obesus*, in the Pacific Ocean. *In* Deriso, R.B., W.H. Bayliff, and N.J. Webb (eds.) Proceedings of the First World Meeting on Bigeye Tuna, 129-170. La Jolla, California: Inter-American Tropical Tuna Commission.

Mugo, R., S. Saitoh, A. Nihira, and T. Kuroyama. 2010. Habitat characteristics of skipjack tuna (Katsuwonus pelamis) in the western North Pacific: a remote sensing perspective. *Fisheries Oceanography* 19(5): 382–396.

Munday, P.L., M. I. McCormick, and G.E. Nilsson. 2012. Impact of global warming and rising CO2 levels on coral reef fishes: what hope for the future? *Journal Of Experimental Biology* 215(22): 3865-3873.

National Marine Fisheries Service. 2004. Environmental assessment for the third extension of the South Pacific Tuna Treaty. Honolulu, United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Regional Office.

Nikaido, H., N. Miyabe, and S. Ueyanagi. 1991. Spawning time frequency of bigeye tuna, *Thunnus obesus*. *Bulletin of Natural Resources: Institute of the Far Seas Fisheries* 28:47-73.

Nybakken, J.W. 1997. *Marine biology: An ecological approach*. New York: Addison-Wesley.

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.

Polovina, J.J., E. Howell, D.R. Kobayashi, and M.P. Seki. 2001. The transition zone chlorophyll front, a dynamic global feature defining migration and forage habitat for marine resources. Beyond El Niño conference: Climate variability and marine ecosystem impacts from the tropics to the Arctic, 49(1-4):469-483. La Jolla, California, United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Rahmstorf, S. 2007. A Semi-Empirical Approach to Projecting Future Sea-Level Rise. *Science* 315:368-370.

Richardson, T.L., G.A. Jackson, H.W. Ducklow, and M.R. Roman. 2004. Planktonic food webs 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.

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.

Secretariat of the Pacific Community. 2012a. Status of the Purse Seine Fishery for 2011. A paper prepared for the Internal Meeting of the Pacific Island Parties for the U.S. Treaty Consultation 24th Annual Meeting February 25-27, 2012 Honolulu, Hawaii. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Secretariat of the Pacific Community. 2012b. Observer Scientific Data for 23rd LP (2010/2011). A paper prepared for the Internal Meeting of Pacific Island Parties for the U.S. Treaty Consultation 24th Annual Meeting March 25-27, 2012 Honolulu, Hawaii. Noumea, New Caledonia, Oceanic Fisheries Programme, Secretariat of the Pacific Community.

Seki, M.P., R. Lumpkin, and P. Flament. 2002. Hawaii cyclonic eddies and blue marlin catches: The case study of the 1995 Hawaiian International Billfish Tournament. *Journal of Oceanography* 58(5):739-745.

Sibert, J. and J. Hampton. 2003. Mobility of tropical tunas and the implications for fisheries management. *Marine Policy* 27(1):87-95.

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):1773-1776.

Solomon, S., D. Quin, M. Manning, Z. Chen, M. Marquis, K.B. Avryt, M. Tignor et al. 2007. Summary for policy makers. *In* Climate Change 2007: The Physical Science Basis. WGI-IPCC Report 4. Cambridge and New York, Cambridge University Press.

Stewart. R.H. 2005. *Introduction to physical oceanography*. September 2005 Edition. Galveston, Texas: Department of Oceanography, Texas A&M University.

Sturman, A.P. and H.A. McGowan. 1999. Mesoscale and local climates in New Zealand. *Progress Physical Geography* 23(4):611-635.

Suzuki, Z., P.K. Tomlinson, and M. Honma. 1978. Population structure of Pacific yellowfin tuna. *Inter-American Tropical Tuna Commission Bulletin* 17(5):227-446.

Suzuki, Z. 1994. A review of the biology and fisheries for yellowfin tuna (*Thunnus albacares*) in the western and central Pacific Ocean. *In* Shomura, R. S., J. Majkowski, and S. Langi (eds.) Interactions of Pacific Tuna Fisheries. Volume 2: Papers on biology and fisheries, 108-137. Rome, Food and Agriculture Organization for the United Nations.

The World Bank. 2000. *Cities, seas, and storms: managing change in Pacific Islands economies.* Volume IV: Adapting to climate change. Washington D.C.: The World Bank.

United States Coast Guard and National Marine Fisheries Service. 2012. Distant water tuna fleet (aka U.S. purse seine fleet). Annual report to Congress. United States Coast Guard, Homeland Security and United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Regional Office.

United States Coast Guard and National Marine Fisheries Service. 2013. *In press*. Distant water tuna fleet (aka U.S. purse seine fleet). Annual report to Congress. United States Coast Guard, Homeland Security and United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Pacific Islands Regional Office.

Western and Central Pacific Fisheries Commission. 2012. Tuna Fishery Yearbook 2011. Secretariat of the Pacific Community, Noumea, New Caledonia, 151 pp.

Western Pacific Regional Fishery Management Council. 2009. Fishery Ecosystem Plan for the American Samoa Archipelago. Honolulu, Western Pacific Fishery Management Council.

Western Pacific Fishery Management Council. 2013. Fishery Management in the Marianas Trench, Pacific Remote Islands, and Rose Atoll Marine National Monuments, including an Environmental Assessment and Regulatory Impact Review: Amendment 3 to the Fishery Ecoystem Plan for the Mariana Archipelago; Amendment 2 to the Fishery

Ecosystem Plan for the Pacific Remote Island Areas; Amendment 3 to the Fishery Ecosystem Plan for American Samoa; Amendment 6 to the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific. January 25, 2013 draft document.

Whitelaw, A.W. and V.K. Unithan. 1997. Synopsis on the distribution, biology, and fisheries of the bigeye tuna (*Thunnus obesus*) with a bibliography. Hobart, Australia, Australian Commonwealth Scientific and Research Organization.

Williams, P. 2003. Overview of the western and central Pacific Ocean tuna fisheries – 2002. Sixteenth Meeting of the Standing Committee on Tuna and Billfish 9–16 July. Working Paper GEN-1. Mooloolaba, Australia.

Williams, P. and P. Terawasi. 2012. Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions -2011. WCPFC Report SC8-2012/GN WP-1. Busan, Scientific Committee, Western and Central Pacific Fisheries Commission.

Woesik, R., P. Houk, A.L. Isechal, J.W. Idechong, S. Victor, and Y. Golbuu. 2012. Climate-change refugia in the sheltered bays of Palau: analogs of future reefs. *Ecology and Evolution* 2(10): 2474–2484.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1845 Wasp Blvd., Bldg 176
Honolulu, Hawaii 96818
(808) 725-5000 • Fax: (808) 725-5215

Finding of No Significant Impact

Restrictions on the Use of Fish Aggregating Devices in Purse Seine Fisheries for 2015; RIN 0648-BE36

This Finding of No Significant Impact (FONSI) was prepared according to the guidelines established in National Marine Fisheries Service (NMFS) Instruction 30-124-1 and the requirements set forth in the National Oceanic and Atmospheric Administration's (NOAA) Administrative Order (NAO 216-6, May 20, 1999). The FONSI is based on the 2014 Supplemental Environmental Assessment (SEA) prepared pursuant to the requirements of the National Environmental Policy Act (NEPA; 42 U.S.C. § 4321 et seq.) to analyze the potential impacts on the human environment from promulgation of the rule (RIN 0648-BE36), "Restrictions on the Use of Fish Aggregating Devices in Purse Seine Fisheries for 2015."

Background

At its Tenth Regular Session, in December 2013, the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Commission or WCPFC) adopted Conservation and Management Measure (CMM) 2013-01, "Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean." CMM 2013-01 went into effect February 4, 2014, and is generally applicable for the 2014-2017 period. The CMM includes provisions for purse seine vessels, longline vessels, and other types of vessels that fish for highly migratory species. The CMM's provisions for purse seine vessels include limits on fishing capacity, limits on the allowable level of fishing effort, restrictions on the use of fish aggregating devices (FADs), a requirement to retain all bigeye tuna, yellowfin tuna, and skipjack tuna except in specific circumstances, and a requirement to carry observers. The SEA analyzed a proposed rule to implement the FAD restrictions for 2015. The CMM's FAD restrictions for subsequent years, as well as other provisions of the CMM, would be implemented through separate rules. The National Marine Fisheries Service (NMFS) is implementing CMM 2013-01 through multiple rules primarily for timing reasons – different provisions of the CMM need to go into effect at different times.

Earlier WCPFC CMMs for tropical tuna management, which contained provisions for FAD restrictions in purse seine fisheries and which NMFS implemented via rulemaking, include CMM 2008-01, "Conservation and Management Measure for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean," CMM 2011-01, "Conservation and Management Measure for temporary extension of CMM 2008-01," and CMM 2012-01, "Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean." CMM 2008-01 set forth specific provisions for purse seine fisheries for the years 2009, 2010, and 2011, which NMFS implemented in

2009 (see final rule published August 4, 2009, in 74 *Federal Register* (FR) 38544; hereafter 2009 rule). Due to a change in meeting schedule, in December 2011, the WCPFC adopted an intersessional decision to extend the provisions of CMM 2008-01 until the WCPFC met in March 2012. NMFS implemented that intersessional decision for the U.S. purse seine fleet operating in the WCPO through an interim rule in 2011 (see interim rule published December 30, 2011 in 76 FR 82180; hereafter 2011 rule). Adopted in March 2012, CMM 2011-01 extended the majority of the provisions of CMM 2008-01 through the end of 2012. Given that the 2011 rule extended the applicable provisions of CMM 2011-01 for the U.S. purse seine fleet through 2012, there was no need for NMFS to take additional regulatory action to put into place the measures of CMM 2011-01 for purse seine fisheries. NMFS implemented the purse seine provisions of CMM 2012-01 for 2013 and 2014 in 2013 (see final rule published May 23, 2013 in 78 FR 30773; hereafter 2013 rule). CMM 2013-01 has provisions for FAD restrictions that are similar to the previous CMMs.

NMFS prepared an Environmental Assessment (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 Restriction 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" (hereafter 2009 EA), which analyzed the impacts of the 2009 rule on the human environment.[1]

In the 2009 EA, NMFS analyzed four action alternatives for the 2009 rule, as well as the No-Action Alternative. NMFS concluded that all of the alternatives would have similar effects. NMFS determined that all of the action alternatives analyzed in the 2009 EA would have minor beneficial effects or no effects on resources in the affected environment.

NMFS prepared an EA, "Environmental Assessment for a Rule to Implement Decisions of the Western and Central Pacific Fisheries Commission for: Fishing Restrictions and Observer Requirements in Purse Seine Fisheries for 2013 and 2014" (hereafter 2013 EA), which analyzed the impacts of the 2013 rule on the human environment and incorporated the 2009 EA by reference.[2] The 2013 EA included detailed analysis of three action alternatives, as well as the No-Action Alternative. Similar to the 2009 EA, NMFS concluded that all of the alternatives would have similar effects. NMFS determined that all of the action alternatives analyzed in the 2013 EA would have minor beneficial effects or no effects on resources in the affected environment.

The final 2014 SEA supplements the 2013 EA to account for changes to the FAD restrictions as part of the implementation of WCPFC decisions on tropical tunas.

The SEA analyzes two action alternatives for implementing the FAD restrictions for 2015, as well as the No-Action Alternative. One action alternative (Alternative 2) would prohibit setting on FADs and on fish that have aggregated in association with a fishing vessel, in the WCPFC's area of competence (Convention Area) between the latitudes of 20° North and 20° South, from July 1 through September 30, 2015. There would also be a specified 2,202 limit on the number of FAD sets that could be made in 2015. The other action alternative (Alternative 3, which is NMFS' preferred alternative) would prohibit setting on FADs and on fish that have aggregated in association with a fishing vessel, in the Convention Area between the latitudes of 20° North and 20° South, during the months of January, February, July, August

[1] The 2009 EA (combined with the Finding of No Significant Impact) is available at *http://www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2009-0108.*
[2] The 2013 EA (combined with the Finding of No Significant Impact) is available at *http://www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2013-0043.*

and September in 2015. There would also be a specified 3,061 limit on the number of FAD sets that could be made in 2015. The SEA concluded that all of the alternatives would have similar effects to resources in the human environment. However, the extent of the effects could vary somewhat depending on the period of time that the FAD restrictions would be in effect under the different action alternatives. For the purposes of this document, the term "proposed action" refers to Alternative 3, which is the alternative NMFS set forth in the proposed rule.

The September 2014 version of the draft SEA was made available to the public in conjunction with the publication of the proposed rule. Based on further internal review, several minor editorial changes have been made to the SEA, which is attached to this FONSI.

Significance Analysis

NAO 216-6 contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality regulations for implementing NEPA at 40 C.F.R. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant to making this FONSI and has been considered individually, as well as in combination with the others.

The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1) Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?

Response: No. The target species of the U.S. WCPO purse seine fishery are skipjack tuna and yellowfin tuna, with bigeye tuna being an incidentally caught species. As stated in Section 4.3 of the SEA, the proposed action would likely decrease the impacts from fishing on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna by reducing the fishing mortality on predominantly juvenile tunas and adult skipjack tuna. The FAD restrictions could also have some potentially adverse effects on the WCPO stock of yellowfin tuna by an increase in the overall fishing mortality on the stock as a result of the fleet targeting large unassociated tunas during the period of the FAD restrictions. However, any adverse effects would be ameliorated by reduced catches of juvenile yellowfin tuna during the period of the FAD restrictions, which may have a chance to move or recruit to a deeper, non-predominantly FAD associated life cycle that would provide benefits in terms of additional adult yellowfin tuna available to unassociated fishing.

The indirect effects of the proposed action on bigeye, skipjack, and yellowfin tuna stocks in the WCPO would be similar to the direct effects described above, since the proposed action would be expected to result in decreased fishing mortality on the stocks, particularly decreased fishing mortality on juvenile tunas, which could lead to long-term positive effects on the stocks. However, these effects would be relatively small, because numerous other factors contribute to the status of the stocks.

2) Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?

Response: No. Section 4.4 of the SEA discusses the potential impacts to non-target fish species (other than bigeye tuna) from the proposed action. The proposed action could cause some change in the amounts and types of non-target fish species caught by the U.S. WCPO purse seine fleet. During the periods when the FAD prohibitions would be in effect, the fleet might make unassociated rather than FAD sets, which would affect the composition of the catch, including both target stocks and non-target species. Direct impacts to these non-target fish species would include a potential increase in the catch of some species and a decrease in the catch of other species, due to the changes in fishing patterns and practices of the fleet from shifting to unassociated sets during the periods when the restrictions would be in effect. Indirect or long-term effects would include the greater potential for adverse effects to the stocks of these non-target fish species that experience increased fishing mortality from increased fishing on unassociated sets during the periods when the restrictions would be in effect and reduced potential for adverse effects to the stocks of non-target fish species that experience decreased fishing mortality from decreased fishing on associated sets. However, these effects would be relatively small, because numerous other factors contribute to the status of the stocks.

3) Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat (EFH) as defined under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and identified in FMPs?

Response: No. As stated in Chapter 4, Section 4.5 of the SEA, the proposed action would not cause any adverse impacts to areas designated as EFH or Habitat Areas of Potential Concern under MSA provisions, or to ocean and coastal habitats. Such resources would not be affected because the potential changes in fishing patterns and practices of the fleet would take place in areas of the ocean far from shorelines and would not affect the seafloor or benthic habitats since purse seine fishing does not involve contact with the seafloor (see Section 3.2 of the SEA for a description of purse seine fishing). Also, because any effects to fish stocks would be relatively small, as discussed above, any pelagic fish habitat designated as EFH, including the water column, or HAPC, would not be expected to experience any effects – either beneficial or adverse – from implementation of the proposed action.

4) Can the proposed action reasonably be expected to have a substantial adverse impact on public health or safety?

Response: No. As indicated in Section 4.1 of the SEA, under the proposed action, the FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the five months the restrictions would be in effect and after the 3,061 FAD set limit is reached (if it is reached), and possibly reducing the amount of fishing effort during the prohibition periods relative to other periods of the year. As stated in the Regulatory Impact Review (RIR) for the proposed rule, it is possible that vessel operators may schedule routine maintenance activities during the FAD prohibition periods or after the FAD set limit is reached. On the other hand, the FAD set limit, which would be a competitive limit (not allocated among vessels) could motivate vessels to fish harder earlier in the year than they otherwise would. Such a "race-to-fish" effect could cause vessel operators to forego maintenance in favor of fishing or to fish in weather or ocean conditions that they otherwise would not. This could affect the health and safety of the crew, but given that the fleet generally fishes throughout the year, even when FAD restrictions are in effect (see Figure 4 of the SEA), these effects are not expected to be substantial.

5) Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?

Response: No. Based on incomplete and unverified observer data from the Pacific Islands Forum Fisheries Agency, the U.S. purse seine fishery may have had limited interactions with marine mammals in recent years. The number of these interactions and whether the marine mammals were ESA-listed species is unknown at this time. Data also indicate that the U.S. purse seine fleet has had some interaction with sea turtles in the WCPO, but the U.S. WCPO purse seine fleet has not been known to interact with seabirds. As stated in Section 4.5 of the SEA, direct and indirect effects to marine mammals and sea turtles listed as endangered or threatened under the Endangered Species Act (ESA) from the implementation of the proposed action would likely be negligible, although it is possible there would be a slight reduction in interactions with protected species. To the extent that there is a shift in fishing patterns and practices, any effects in terms of interactions with protected resources would be little compared to typical year-to-year variations in interactions with species driven by changing oceanic and economic conditions. As indicated in Figure 7 of the SEA, the proportion of FAD versus unassociated sets varies substantially from year to year, so the overall shifts in fishing patterns and practices of the fleet in a given year depend mostly on oceanographic and economic factors, which would not be affected by the proposed action. The Indo-West Pacific distinct population segment (DPS) of the scalloped hammerhead shark has been recently listed as threatened under the ESA. NMFS has reinitiated ESA consultation on the effects of the U.S. WCPO purse seine fishery on this species and has determined that the continued operation of the fishery during the consultation period is not likely to jeopardize the continued existence of the Indo-West Pacific DPS of the scalloped hammerhead shark.

6) Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

Response: No. The purpose of the proposed action is to implement the FAD restriction provisions of CMM 2013-01 for the U.S. WCPO purse seine fleet, in order to contribute to the underlying objectives of CMM 2013-01 regarding WCPO bigeye tuna, yellowfin tuna and skipjack tuna, which are to reduce or maintain their respective fishing mortality rates at levels no greater than the fishing mortality rates associated with maximum sustainable yield. As discussed in Section 3.5 and Section 4.3 of the SEA, adult bigeye tuna, skipjack tuna, and adult yellowfin tuna are considered among the top predators of the tropical or warm pool marine ecosystem. Changes to WCPO stocks of these species could lead to trophic interactive effects, including increased competition for prey species with other top predators. Larval and juvenile tunas are also sources of food for other marine species, such as fish, seabirds, porpoises, marine mammals, and sharks. Thus, increases in larval and juvenile tuna could increase the food available for these other species. However, it is unlikely that the effects of the proposed action to the WCPO stocks of bigeye, skipjack, and yellowfin tuna, which would be short-lived, would be large enough to impact the marine ecosystem. Overall, the proposed action would not cause substantial effects on biodiversity and ecosystem function.

7) Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: No. As stated in the Regulatory Impact Review, some of the provisions of the rule could lead to some adverse economic impacts to fishing operations. Vessels in the U.S. WCPO purse seine fleet make both unassociated sets and FAD sets when not constrained by regulation. So constraints on either type of set are expected to bring adverse economic effects to fishing operations. Because the factors affecting the relative value of FAD sets and unassociated sets are many, and the relationships among them are not well known, it is not possible to quantify the expected economic impacts of the proposed action. As stated in Section 4.1 of the SEA, the FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the five months that FAD sets would be prohibited and after the 3,061 FAD set limit is reached (if it is reached), as compared to the No-Action Alternative. As discussed throughout the SEA, these direct effects on the fishery would not lead to substantial effects on the human environment – at the most, there could be some decreased fishing pressure on the WCPO stocks of bigeye tuna, skipjack tuna, and yellowfin tuna, with the effects on other resources in the affected environment being none, negligible, or minor.

8) Are the effects on the quality of the human environment likely to be highly controversial?

Response: No. As stated in the SEA, the FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the five months that FAD sets would be prohibited and after the 3,061 FAD set limit is reached (if it is reached), as compared to the No-Action Alternative. Overall, these effects could lead to some decreased fishing pressure on the WCPO stocks of bigeye tuna, skipjack tuna, and yellowfin tuna, and it is unlikely that there would be any controversy regarding the size, nature, or effects of the action (i.e., the effects of the action on the quality of the human environment). Moreover, the SEA was made available during the public comment period for the proposed rule and the two comment letters submitted on the proposed rule did not raise any issues regarding the information in the SEA.

9) Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?

Response: No. As described in Section 3.6.4 of the SEA, there are several National Wildlife Refuges and National Monuments in the affected environment. However, these resources would not be affected because the potential changes in fishing patterns and practices of the fleet would take place in areas of the ocean far from shorelines and would not affect the seafloor or benthic habitats since purse seine fishing does not involve contact with the seafloor. In addition, as discussed in Section 3.6 of the SEA, commercial fishing is already prohibited in the National Monuments, pursuant to the 2009 Presidential Proclamation.

10) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: No. As described throughout the SEA, although the magnitude of the effects on the human environment cannot be quantified with certainty, the types of effects and the direction of those effects can be predicted. The purpose of the proposed action is to implement the provisions of CMM 2013-01 for the U.S. WCPO purse seine fleet that are necessary prior to January 1, 2015, in order to contribute to the underlying objectives of CMM 2013-01 regarding WCPO bigeye tuna, yellowfin tuna and skipjack tuna, which are to reduce or maintain their respective fishing mortality rates at levels no greater than the fishing mortality rates associated with maximum sustainable yield. Under the proposed action, the FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the five months that FAD sets would be prohibited and after the 3,061 FAD set limit is reached (if it is reached), as compared to the No-Action Alternative. Overall, these effects could lead to some decreased fishing pressure on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna. Thus, the effects on the human environment from the proposed action would not be highly uncertain or involve unique or unknown risks.

11) Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

Response: No. As discussed in Chapter 5 of the EA, the cumulative impacts on the resources in the affected environment that could be impacted by the proposed action are not expected to be substantial. The primary direct effects of the proposed action would be to decrease fishing pressure on the stocks of bigeye, skipjack, and yellowfin tuna in the WCPO. As stated in the 2013 EA, the status of the stocks of bigeye, skipjack, and yellowfin tuna with respect to MSA status determination criteria (i.e., with respect to whether a stock is overfished or subject to overfishing) has not changed since 2009, and a status change due to this action is not anticipated. The other present and reasonably foreseeable future actions identified in Sections 5.2.2 and 5.2.3 of the SEA would also be expected to have minor effects on these stocks, though this is difficult to predict with certainty. With respect to non-target fish stocks and protected resources, the cumulative effects would also not be expected to be substantial. The other actions include other NMFS rulemakings to implement provisions of CMM 2013-01, including a rulemaking to implement purse seine fishing effort limits, which is not expected to have substantial effect on the human environment. Overall, the cumulative impacts from implementation of the proposed action would not be expected to lead to substantial cumulative impacts on resources in the affected environment, and no significant cumulative impacts on the human environment are anticipated from implementation of the proposed action.

12) Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

Response: No. As stated in Section 4.5 of the SEA, such resources would not be affected because the potential changes in fishing patterns and practices of the fleet would take place in areas of the ocean far from shorelines and would not affect the seafloor or benthic habitats since purse seine fishing does not involve contact with the seafloor. Thus, there would be no effects to districts, sites, highways, structures or objects listed in or eligible for listing in the National Register of Historic Places or potential loss or destruction of significant scientific, cultural, or historical resources.

13) Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

Response: No. As stated above, under the proposed action, the FAD restrictions are expected to affect the fishing patterns and practices of the fleet by transferring fishing effort from FAD sets to unassociated sets during the five months that FAD sets would be prohibited and after the 3,061 FAD set limit is reached (if it is reached), as compared to the No-Action Alternative. Overall, these effects could lead to some decreased fishing pressure on the stocks of bigeye tuna, skipjack tuna, and yellowfin tuna. Although some transfer of effort is anticipated, none of these effects would be expected to result in the introduction or spread of a nonindigenous species since the vessels in the fleet are not expected to enter any new geographic areas of operation.

14) Is the proposed action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?

Response: No. The purpose of the proposed action is to implement the provisions of CMM 2013-01 for the U.S. WCPO purse seine fleet that are necessary prior to January 1, 2015, in order to contribute to the underlying objectives of CMM 2013-01 regarding WCPO bigeye tuna, yellowfin tuna and skipjack tuna, which are to reduce or maintain their respective fishing mortality rates at levels no greater than the fishing mortality rates associated with maximum sustainable yield. The need for the rule is to satisfy the obligations of the United States as a Contracting Party to the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, pursuant to the authority of the Western and Central Pacific Fisheries Commission Implementation Act. Thus, the rule is limited to an immediate and focused objective and it does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration.

15) Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

Response: No. As stated in the response to #14, the purpose of the rule is to implement specific conservation and management measures and the need for the rule is to satisfy the international obligations of the United States as a member of the WCPFC. As such, the rule would not be expected to violate any laws or requirements imposed for the protection of the environment.

16) Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

Response: No. See the response to #11 above for a discussion of cumulative effects. The overall cumulative impacts to the WCPO stocks of bigeye tuna, skipjack tuna, and yellowfin tuna are not expected to be substantial.

DETERMINATION
In view of the information presented in this document and the analysis contained in the supporting SEA and RIR prepared for the rule "Restrictions on the Use of Fish Aggregating Devices in Purse Seine Fisheries for 2015," it is hereby determined that the proposed action will not significantly impact the quality of the human environment as described above and in the supporting SEA. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an Environmental Impact Statement for this action is not necessary.

NOV 1 2 2014

Regional Administrator
Pacific Islands Regional Office

Date