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

Fishing Restrictions regarding the Oceanic Whitetip Shark, the Whale Shark, and the Silky Shark

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List of Abbreviations and Acronyms

CCM	Commission Members, Cooperating Non-Members, and Participating Territories
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species
CMM	Conservation and Management Measure
CNMI	Commonwealth of the Northern Mariana Islands
CNPO	Central North Pacific Ocean
CPUE	Catch per Unit of Effort
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
DNA	Deoxyribonucleic Acid
DPS	Distinct Population Segment
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
FAO	Food and Agriculture Organization of the United Nations
FEP	Fishery Ecosystem Plan
FFA	Forum Fisheries Agency
FMP	Fishery Management Plan
GFCM	General Fisheries Commission for the Mediterranean
HAPC	Habitat Areas of Particular Concern
HMS	Highly Migratory Species
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IOPA Sharks	International Plan of Action for the Conservation and Management of Sharks

IOTC	Indian Ocean Tuna Commission
IUCN	International Union for Conservation of Nature
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	North East Atlantic Fisheries Commission
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWR	National Wildlife Refuge
NWSAA	National Wildlife System Administration Act of 1966
Pelagics FEP	Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region
PNA	Parties to the Nauru Agreement
RFMO	Regional Fishery Management Organization
ROP	Regional Observer Programme
RPL	Regional Purse Seine Logsheet
SCA	Shark Conservation Act of 2010
SEAFO	South East Atlantic Fisheries Organization
SFPA	Shark Finning Prohibition Act of 2000
SPC	Secretariat of the Pacific Community
SPTA	South Pacific Tuna Act of 1988
SPTT or Treaty	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)
SST	Sea Surface Temperature
USFWS	United States Fish and Wildlife Service
UV	Ultraviolet Radiation
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

List of Figures

List of Tables

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 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).

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 for Oceanic Whitetip Shark" (CMM 2011-04) to address recent declines in catch rates and size of oceanic whitetip sharks (*Carcharhinus longimanus*) in the longline and purse seine fisheries. The WCPFC also adopted "Conservation and Management Measure for Protection of Whale Sharks from Purse Seine Fishing Operations" (CMM 2012-04) in response to concerns about the potential impacts of purse seine fishing operations on the sustainability of the whale shark (*Rhincodon typus*) and "Conservation and Management Measure for Silky Sharks" (CMM 2013-08) to address fisheries impacts to silky sharks (*Carcharhinus falciformis*) in the western and central Pacific Ocean (WCPO). The National Marine Fisheries Service (NMFS) is promulgating a rule to implement the applicable provisions of CMM 2011-04, CMM 2012-04, and CMM 2013-08 for U.S. fishing vessels used for commercial fishing for highly migratory species (HMS) in the area of application of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Convention). The regulations for oceanic whitetip sharks and silky sharks would prohibit the retention, transshipment, storage, or landing of either of the two species and would require the release of any oceanic whitetip shark or silky shark as soon as possible after it is caught with as little harm to the shark as possible. The regulations for whale sharks would prohibit setting a purse seine on a whale shark and would specify certain measures to be taken and reporting requirements in the event a whale shark is encircled in a purse seine net.

1.1 Background

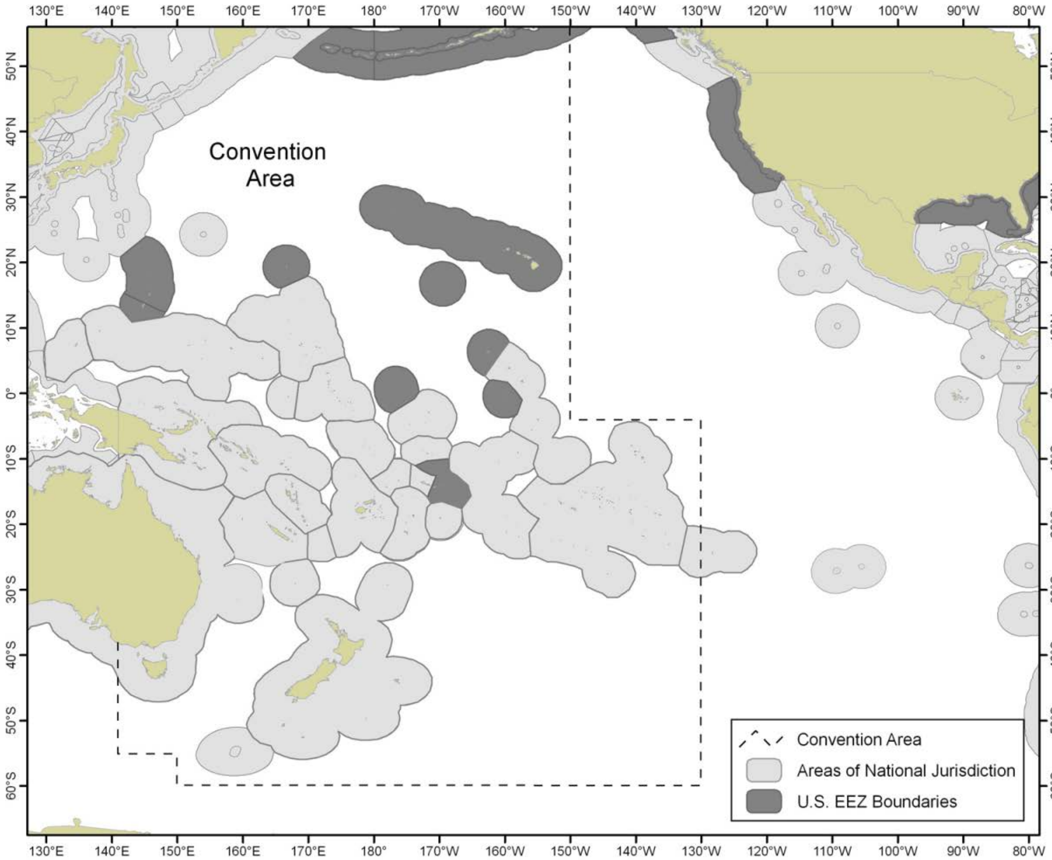
The United States ratified the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Convention) in 2007.[1] The area of application of the Convention (Convention Area) is shown in Figure 1.

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

[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*.

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.

Figure 1: The Convention Area - high seas (in white); U.S. Exclusive Economic Zone (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.

[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.

CMM 2011-04 includes two provisions for CCMs to apply to their vessels. The first provision requires CCMs to prohibit their vessels from retaining on board, transshipping, storing on board, or landing any oceanic whitetip shark, in whole or in part, in the fisheries covered by the Convention. The second provision requires CCMs to require their vessels to release any oceanic whitetip shark that is caught as soon as possible after the shark is brought alongside the vessel, and to do so in a manner that results in as little harm to the shark as possible. CMM 2011-04 also includes a provision allowing observers to collect samples from oceanic whitetip sharks that are dead on haulback, provided that the collection is part of a research project approved by the WCPFC Scientific Committee. The proposed rule would implement all of these provisions for U.S. fishing vessels, as detailed in Chapter 2.

CMM 2012-04 includes four provisions for CCMs to implement for their vessels, which apply only to the high seas and exclusive economic zones (EEZs) in the Convention Area (i.e., not to territorial or archipelagic waters). The first provision requires CCMs to prohibit their flagged vessels from setting a purse seine on a school of tuna associated with a whale shark if the animal is sighted prior to the commencement of the set. The measure specifies in the EEZs of Parties to the Nauru Agreement (PNA),[3] the prohibition shall be implemented in accordance with the "Third Arrangement Implementing the Nauru Agreement Setting Forth Additional Terms and Conditions of Access to the Fisheries Zones of the Parties," as amended on September 11, 2010 (Third Arrangement). Thus, because the responsibility for implementation of this provision in the EEZs of the PNA lies with the PNA, the proposed rule would not implement the prohibition in the EEZs of the PNA, but would implement the prohibition in all other EEZs and on the high seas in the Convention Area, as detailed in Chapter 2.

The second and third provisions of CMM 2012-04 require CCMs to require that operators of their vessels take certain measures in the event that a whale shark is encircled in a purse seine net: the operator shall ensure that reasonable steps are taken to ensure the safe release of the shark; and report the incident to the relevant authority of the flag State, including the number of individuals, details of how and why the encirclement happened, where it occurred, steps taken to ensure safe release, and an assessment of the life status of the whale shark on release (including whether the animal was released alive, but subsequently died). These two provisions are applicable to the high seas and all EEZs in the Convention Area, including the EEZs of the PNA. The proposed rule would implement these two provisions, as detailed in Chapter 2.

The final provision of CMM 2012-04 for CCMs to apply to their vessels is for CCMs to require their vessels to follow any guidelines adopted by the WCPFC for the safe release of whale sharks. The proposed rule would not implement this provision because the WCPFC has not yet adopted guidelines for the safe release of whale sharks.

[3] The PNA currently includes the following countries: Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands, and Tuvalu.

CMM 2012-04 also specifies the importance of maintaining the safety of the crew during the implementation of the provisions in the CMM, and this concept would be included in the proposed rule.

As stated above, the provisions of CMM 2012-04 apply to the high seas and all of the EEZs in the Convention Area, except for the first provision, which does not apply to the EEZs of the PNA. In addition, CMM 2012-04 states that for fishing activities in the EEZs of CCMs north of 30° N. latitude, CCMs shall implement the provisions of CMM 2012-04 or compatible measures consistent with the obligations under CMM 2012-04, so the same provisions need not be implemented in the EEZs of CCMs north of 30° N. latitude.

CMM 2013-08 includes two provisions for CCMs to apply to their vessels that are similar to the provisions of CMM 2011-04. The first provision requires CCMs to prohibit their vessels from retaining on board, transshipping, storing on board, or landing any silky shark caught in the Convention Area, in whole or in part, in the fisheries covered by the Convention. The second provision requires CCMs to require their vessels to release any silky shark that is caught as soon as possible after the shark is brought alongside the vessel, and to do so in a manner that results in as little harm to the shark as possible. CMM 2013-08 also includes a provision allowing observers to collect samples from silky sharks that are dead on haulback, provided that the collection is part of a research project approved by the WCPFC Scientific Committee. The proposed rule would implement all of these provisions for U.S. fishing vessels, as detailed in Chapter 2.

1.2 Purpose and Need

The purpose of the proposed rule is to implement the provisions of CMM 2011-04 and CMM 2013-08 for U.S. fishing vessels fishing for HMS in the Convention Area and the provisions of CMM 2012-04 for U.S. purse seine fishing vessels fishing in the Convention Area. The need for the proposed rule is to satisfy the obligations of the United States as a Contracting Party to the Convention, pursuant to the authority of the WCPFCIA.

1.3 Organization of This Document

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

Chapter 2 provides a 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 HMS fisheries 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, providing detailed information on the oceanic whitetip shark, the whale shark, and the silky shark.

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 rule, which will be subject to a public review and comment period. Although comments are not being solicited on the EA, any comments on the rule that require a revision of the analysis or presentation will be considered and incorporated in the EA, as appropriate.

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 decision maker and the public with a clear basis for choosing among the alternatives.[4]

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 a rule to implement the provisions of CMM 2011-04 and CMM 2013-08 for U.S. fishing vessels fishing for HMS in the Convention Area and the provisions of CMM 2012-04 for U.S. purse seine vessels fishing in the Convention Area. The proposed action would include six elements – three elements regarding the oceanic whitetip shark and the silky shark and three elements regarding the whale shark.

For the oceanic whitetip shark and the silky shark, the three elements are as follows:

1. Prohibit the crew, operator, and owner of the fishing vessel from retaining on board, transshipping, storing, or landing any part or whole carcass of an oceanic whitetip shark or silky shark that is caught in the Convention Area.
2. Require the crew, operator, and owner of the fishing vessel to release any oceanic whitetip shark or silky shark caught in the Convention Area as soon as possible after the shark is caught and brought alongside the vessel, and in a manner that results in as little harm as possible, without compromising the safety of any persons.
3. Allow observers to collect samples of oceanic whitetip sharks or silky sharks that are dead when brought alongside the fishing vessel in the Convention Area by requiring the crew, operator, and owner of the vessel to allow and assist a NMFS observer or WCPFC observer to collect samples from dead oceanic whitetip sharks or silky sharks, if requested to do so by the observer, notwithstanding the two elements described above. The samples must be part of research project approved by the WCPFC Scientific Committee.

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

For the whale shark, the three elements are as follows:

1. Prohibit the crew, operator, and owner of the fishing vessel from setting or attempting to set a purse seine on or around a whale shark if the animal is sighted prior to the commencement of the set or the attempted set. This element would apply on the high seas and in the EEZs in the Convention Area, except for the EEZs of the PNA.
2. Require the crew, operator, and owner of the fishing vessel to release any whale shark that is encircled in a purse seine net in the Convention Area, and, use reasonable steps to ensure its safe release, without compromising the safety of any persons. This element would apply on the high seas and in the EEZs in the Convention Area, including the EEZs of the PNA.
3. Require the owner and operator of the fishing vessel that encircles a whale shark with a purse seine in the Convention Area to ensure that the incident is recorded by the end of the day on the catch report form (i.e., the Regional Purse Seine Logsheet (RPL) maintained pursuant to 50 CFR § 300.34(c) (1)) in the format specified by the NMFS Pacific Islands Regional Administrator. This element would apply on the high seas and in the EEZs in the Convention Area, including the EEZs of the PNA.

Each of these elements of the proposed action has been included in the action alternative, Alternative B, analyzed in depth in this EA. Section 2.2 describes the two alternatives analyzed in this EA: Alternative A, the No-Action Alternative; and Alternative B, the action alternative. Alternatives initially considered but excluded from detailed analysis are described in Section 2.3 below.

2.2 Alternatives Considered in Detail

Alternative A: The No-Action Alternative

Alternative A, 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 action alternative. 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 A, the U.S. fleets fishing for HMS in the WCPO would continue to be managed under existing laws and regulations, which are described in Chapter 3 of this document, but none of the elements of the proposed action, described above in Section 2.1, would be implemented.

Alternative B: The Action Alternative

Alternative B, the action alternative, would implement the six elements of the proposed action, as described above in Section 2.1.

2.3 Alternatives Excluded from Detailed Analysis

NMFS did not identify any other alternative means for implementing the elements of CMM 2011-04 on the oceanic whitetip shark or CMM 2013-08 on the silky shark. However, NMFS identified potential alternative means for implementing the elements of CMM 2012-04 on the whale shark.

As stated above, the first element of the proposed action for the whale shark would prohibit owners, operators, and crew of fishing vessels from setting or attempting to set a purse seine in the Convention Area on or around a whale shark if the animal is sighted prior to the commencement of the set or the attempted set. This element would apply on the high seas and in the EEZs of the Convention Area, except for the EEZs of the PNA. CMM 2012-04 states that "CCMs shall prohibit their flagged vessels from setting a purse seine on a *school of tuna associated with a whale shark* if the animal is sighted prior to the commencement of the set" (emphasis added). NMFS considered developing alternative means of implementing the prohibition on setting on a school of tuna, such as specifying a minimum distance for the prohibition (e.g., no setting within half a mile of a whale shark sighting) or a minimum time period for the prohibition (e.g., no setting within 10 minutes of sighting a whale shark). However, NMFS did not identify any such alternative for this element that would be reasonable and feasible. As described in more detail in Chapter 3, Section 3.3.2.2.1 of this EA, after a whale shark is sighted, it is unclear where and when it will next be sighted, since sharks do not have to return to the surface regularly to breathe. Therefore, NMFS determined that there is only one reasonable and feasible manner of implementing this element of the proposed action, which is described in Section 2.1, above.

As stated in Chapter 1 of this EA, CMM 2012-04 states that for fishing activities in the EEZs of CCMs north of 30° N. latitude, CCMs shall implement either the provisions of CMM 2012-04 or compatible measures consistent with the obligations under CMM 2012-04. As described in more detail in Chapter 3, Section 3.2.1 of this EA, the U.S. purse seine fleet does not fish north of 30° N. latitude in the WCPO. Thus, rather than attempting to develop a separate set of "compatible measures" for EEZs of CCMs north of 30 °N. latitude that may or may not be triggered by any actual U.S. purse seine operations, NMFS decided to implement the provisions of CMM 2012-04 for all EEZs in the Convention Area (with the exception of the first element not being applicable to the EEZs of the PNA, as described above). No additional alternatives were developed for detailed consideration in this EA.

Chapter 3 Affected Environment

This chapter describes the physical and biological environment in which the U.S. fishing vessels used for commercial fishing for HMS in the Convention Area operate. This chapter is organized as follows: (1) overview of sharks and international fisheries; (2) description of the U.S. HMS fisheries in the WCPO, including information on catch of and interactions with oceanic whitetip sharks, whale sharks, and silky sharks; (3) information on sharks in the WCPO, focusing on oceanic whitetip sharks, whale sharks, and silky sharks; (4) description of the physical environment; (5) description of the biological environment; and (6) description of protected resources.

3.1 Overview of Sharks and International Fisheries

Global demand for shark products has risen in modern times mostly due to an increase in disposable income in China, where the largest shark product market is located. This increase in demand has led to an increase in the market price of sharks (Pratt et al. 1990).

Besides being the main component of shark fin soup and other shark meat based dishes, shark products can be utilized in many different industries. Shark products are used by the health industry in anti-cancer treatment research, as artificial skin, and in anti-coagulation medication (Seki et al. 1998). They are also used in folk medicine, leather products, and oils (Camhi 2008, Bonfil et al. 2008). Published estimates indicate that in the early 2000s tuna fleets finned the majority of the sharks they caught. Notable countries active in finning included China with the highest percentage at 96.8%, followed by Fiji with an estimated 84% finned, and New Zealand with 83.8% finned (Worm et al. 2013). For the fin trade alone, it has been estimated that between 26 and 73 million sharks are caught every year (Clarke et al. 2006b).

For other industries, such as the tuna fleets that target other fish species, catching sharks can cause problems. Target species can be lost through gear damage, catch damage, or complete catch loss. Many sharks are also discarded by fishermen who do not have the hold space, ability or desire to sell them. The number of sharks caught as bycatch in fisheries is difficult to estimate as many shark catches go unreported. However, the bycatch numbers that are reported are high and represent only a certain portion of catches, so the total number of sharks caught is likely even higher. Total recorded shark catches rose at the rate of 261,000 mt per ocean basin per year (about 2% of the global total annually) between 1988 and 2002, though more recent trends imply stability if not regional decreases (Camhi et al. 2008b). Being caught does not always imply mortality as properly released sharks can rebound from being taken in fishing gear. In Worm et al.'s study (2013), an estimated 85% of sharks globally survived after being released alive in the year 2000.

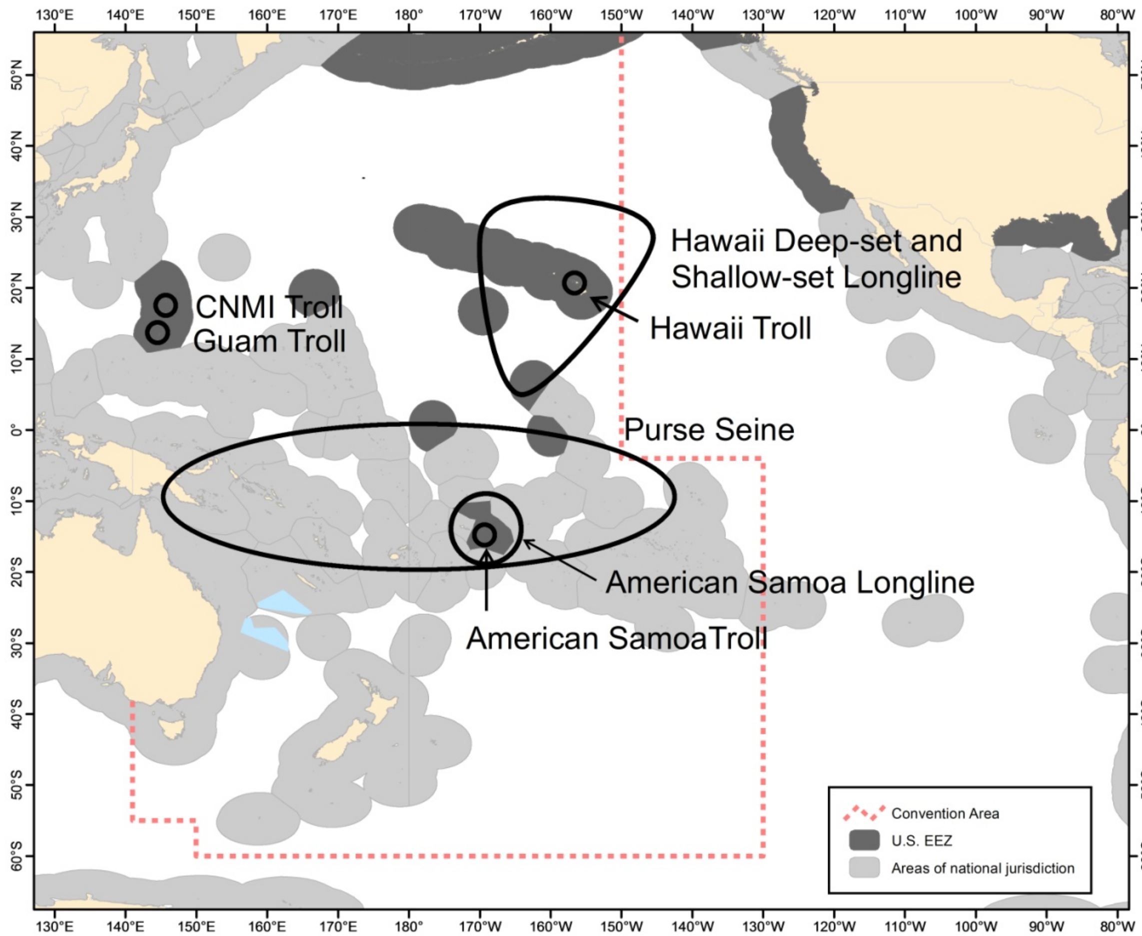
The Worm et al. (2013) study estimated global shark catch for all fishing gear types was 1,638,000 metric tons (mt) in the year 2000 alone. This study estimates that 70% of all sharks caught were discarded (1,135,000 mt), and that 80% of those discards were finned before being dumped (908,000 mt). When added to those landed whole for commercial use and those that did not survive the catch and release process, the global estimated mortality equaled 1,445,000 mt for the year 2000. Though species average weights and compositions vary, and there are many caveats to this data (such as inaccurate/absent reporting of species, illegal and unreported and unregulated fishing practices, and a lack of data from artisanal and recreational takes), Worm et al. (2013) estimated that this amount equates to a global mortality rate of between 69 to 273 million individual sharks depending on the parameters used (a conservative estimate for the year 2000 being 100 million). For 2010, the estimate of total shark mortality is around 97 million.

In the WCPO, longline fisheries catch the most sharks. Observer data from the longline fisheries across the WCPO held by the Secretariat of the Pacific Community (SPC) includes records of 290,000 sharks of more than 40 species reported from more than 21,000 sets. Most sharks in this data set were identified to species. The dominant shark species in this dataset include blue sharks (*Prionace glauca*) and silky sharks. Molony's (2005) longline fisheries analysis across the WCPO region produced an annual estimated catch of 696,401±907,848 sharks per year. The high number of shark species, relatively high abundance of sharks, the existence of dedicated shark longline fisheries, and the fact that sharks and shark products (e.g., fins) are part of the commercial catch of many fleets, all contribute to the level of catch and to the estimation that mortality rates are similar to catch rates. The average catch per unit of effort (CPUE) per 1000 hooks for the pelagic longline fisheries in the Pacific Ocean as a whole (1990-2009) was 16.5 (Worm et al. 2013).

3.2 U.S. Fisheries in the WCPO and Sharks

Vessels of the United States in the following HMS fisheries in the Convention Area could be affected by the requirements of the proposed rule: purse seine fishery, Hawaii-based deep-set and shallow-set longline fisheries, American Samoa longline fishery, the Mariana Islands longline fishery (includes vessels operating out of the Commonwealth of the Northern Mariana Islands (CNMI) and Guam) and the tropical troll fisheries (Hawaii, Guam, American Samoa, and the CNMI). Detailed descriptions of each of these fisheries are provided in Sections 3.2.1 to 3.2.6 below. Figure 2 below shows the main fishing grounds of the fisheries. Additional HMS fisheries in which the proposed requirements for the oceanic whitetip shark and the silky shark would apply include the commercial Hawaii handline fisheries, the Hawaii pole and line fishery, and the U.S. West Coast-based albacore troll fishery. As indicated in Section 3.2.7, based on data from 2005 through the present, it appears that no oceanic whitetip sharks or silky sharks have been caught in these fisheries.

Figure 2: The main fishing grounds of the fisheries that could be affected by the proposed rule.



Note: The demarcations of fishing grounds are intended to only roughly depict each fishery's main fishing grounds, such as with respect to the U.S. EEZ, areas under the national jurisdiction of other nations, and the high seas. The demarcations do not show the full extent of fishing grounds and do not reflect specific areas in which fishing is not authorized.

3.2.1 U.S. WCPO Purse Seine Fishery

Vessels of the U.S. purse seine fishery engage in targeting skipjack (*Katsuwonus pelamis*) and to a lesser extent yellowfin tuna (*Thunnus albacores*) 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 10° N and 10° S within the Convention Area. 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 fish aggregating devices (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 1,500 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" known as brails holding several metric tons (mt), and then is placed in brine tanks for freezing and later storage. Joseph (2003) and NMFS (2004) provide a detailed description of tuna purse seining and the fleets involved in the Pacific Ocean fisheries. Although these studies are ten or more years old, basic vessel design is approximately the same while gear has significantly improved.

The fishing activities of U.S. WCPO purse seine vessels are governed in large part by the Treaty on Fisheries between the Governments of certain Pacific Islands States and the Government of the United States of America (SPTT or Treaty). 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, the SPTT is being renegotiated, which may result in changes to the current management regime. The High Seas Fishing Compliance Act and implementing regulations (50 CFR 300 Subpart B), the WCPFCIA and implementing regulations (50 CFR 300 Subpart O), and regulations implementing the Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region (Pelagics FEP) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (50 CFR Part 665) also regulate this fishery. Under the existing management regimes, vessels in the U.S. WCPO purse seine fleet must carry an observer on all trips in the Convention Area, unless the trip takes place entirely in areas under the jurisdiction of a single nation other than the United States or entirely outside of the Convention Area between 20° N. latitude and 20° S. latitude (50 CFR 300.223(e)). This essentially 100% observer requirement has been in effect since January 1, 2010. Previously (from 1988-2009), observer coverage was at 20% for the fleet under SPTT requirements. Observers for the fleet are deployed by the Pacific Islands Forum Fisheries Agency (FFA).

Participation in the U.S. WCPO purse seine fishery increased from the late 1980s to the mid-1990s, peaking at approximately 50 vessels, 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 March 2014 there were 40 vessels in the fleet. Table 1 shows the performance of the U.S. purse seine fishery in the Convention Area in 2010 and 2011 – the most recent years for which data are available and during which the 100% observer coverage provisions were in effect.

Table 1: Performance of the U.S. purse seine fishery in the Convention Area, 2010-2011.

Year	Active vessels	Sets	Fishing days	Skipjack tuna retained catches (mt)	Yellow-fin tuna retained catches (mt)	Bigeye tuna retained catches (mt)
2010	38	8,640	8,111	207,074	32,494	4,878
2011	37	6,260	7,871	171,242	24,008	7,763

Source: [U.S. Annual Report Part 1 report to WCPFC for catches; NMFS unpublished information for sets; and RPL data].

Table 2 and Table 3 below show the rates of whale shark catches and their fate, as recorded by FFA deployed vessel observers, in the U.S. WCPO purse seine fishery in 2010 and 2011. The first of the two tables (Table 2) includes the entire Convention Area. The second (Table 3) shows the same information but excludes activity in the waters under the national jurisdiction of the PNA within the Convention Area (where most of the fishing effort occurred).

Table 4 shows the rates of oceanic whitetip shark and silky shark catches and their fate, as recorded by FFA-deployed vessel observers, in the U.S. purse seine fishery in the entire Convention Area.

For the purse seine fishery, the data presented and analyzed in this EA are mostly limited to 2010 and 2011 because observer coverage increased from approximately 20 percent of all trips prior to 2010 to 100 percent in 2010, and 2011 is the last year for which observer data are available (although observer coverage was 100% in 2010 and 2011, not all the data have been processed, so the observer data presented here do not represent all fishing activity).

The unit of fishing effort used for the whale shark information is days fished[5] while that for the oceanic whitetip shark and the silky shark is sets.[6]

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[5] Fishing day means 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 clearing the gear and resulting in no catch (see 50 CFR 300.211).

[6] The latter is slightly preferable because future expected fishing effort can be better predicted in terms of sets (as done in Section 4.1.2), but set-by-set information broken down for PNA waters versus other waters – as needed for the whale shark analysis – is not available, so fishing day is used for whale sharks.

Table 2: U.S. purse seine fishery – catch rates[7] and fate of whale sharks in the Convention Area, 2010-2011, based on vessel observer data.

	Number of observed days fished	Number caught per observed day fished	Number kept per observed day fished	Number discarded per observed day fished		
				Alive	Dead	Unknown
2010	8,023	0.0086	0.0000	0.0057	0.0001	0.0027
2011	7,732	0.0021	0.0000	0.0016	0.0001	0.0004

Source: [Observer data provided by FFA].

Table 3: U.S. purse seine fishery –catch rates and fate of whale sharks in the Convention Area, excluding waters under the national jurisdiction of the PNA, 2010-2011, based on vessel observer data.

	Number of observed days fished	Number caught per observed day fished	Number kept per observed day fished	Number discarded per observed day fished		
				Alive	Dead	Unknown
2010	533	0.0000	0.0000	0.0000	0.0000	0.0000
2011	883	0.0034	0.0000	0.0023	0.0000	0.0011

Source: [Observer data provided by FFA].

[7] This chapter presents information on shark catch rates in the various fisheries per a particular unit of fishing effort (days fished, sets, etc.). Chapter 4 of this EA uses these catch rates to approximate the total number of shark interactions in the respective fisheries for analytical purposes.

Table 4: U.S. WCPO purse seine fishery –catch rates and fate of oceanic whitetip sharks and silky sharks in the Convention Area, 2010-2011, based on vessel observer data.

	Number of observed sets	Number caught per observed set		Number kept per observed set		Number discarded per observed set	
		Oceanic Whitetip	Silky	Oceanic Whitetip	Silky	Oceanic Whitetip	Silky
2010	7,773	0.0105	0.8091	0.0002	0.0159	0.0105	0.7949
2011	5,792	0.0150	0.7046	0.0006	0.0148	0.0143	0.6978

Source: [Observer data provided by FFA].
Notes: There are some discrepancies in the observer data; therefore, these numbers should be considered to be only roughly indicative of the actual rates. The catch rate for a given year was calculated as the product of the proportion of all observed sets in which at least one individual of the species was caught and the average number of individuals caught per such set (which was recorded for only some such sets). The sum of kept rates and discarded rates do not sum to the catch rate because as described above they are based on the numbers of sets in which catches of the species occurred; in those cases where some of the catch from a given set was kept and the remainder was discarded, the entire set's catch was counted here as both kept and discarded (so both the kept rates and discard rates may be over-estimated).

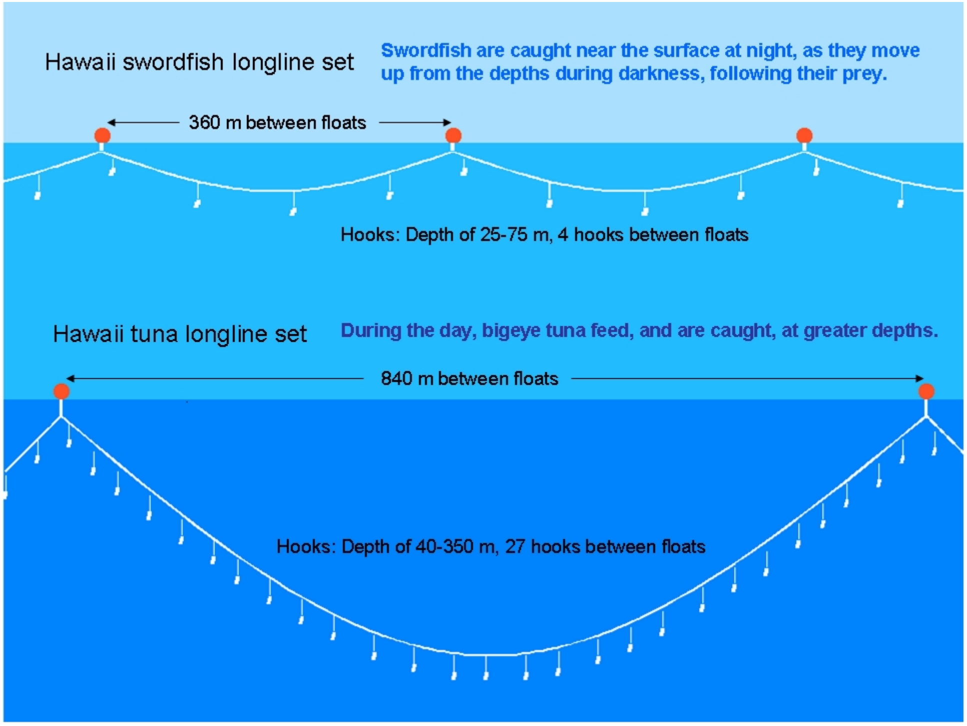
3.2.2 U.S. WCPO Longline Fisheries

The U.S. longline fisheries operating in the Convention Area include the Hawaii-based fisheries, which include a tuna-targeting deep-set fishery and swordfish-targeting shallow-set fishery, and the American Samoa-based fishery. There has also been limited longlining activity based in Guam and the CNMI (hereafter, the Mariana Islands longline fishery), but due to the small number of vessels in this fishery, data from this fishery is confidential and not described further in this chapter (see 50 CFR 600.425). These longline fisheries are managed under the Pelagics FEP, implemented by regulation at 50 CFR Part 665, as well as by regulations implemented under the WCPFCIA at 50 CFR Part 300 Subpart O. Summaries of management measures for the respective longline fisheries are available on the NMFS Pacific Islands Regional Office Web site.

There is also a small longline fleet based on the U.S. West Coast, managed under the Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species (West Coast HMS FMP), implemented by regulations at 50 CFR Part 660. This fleet has not fished in the Convention Area in recent years and is not expected to do so in the foreseeable future, so it is not considered further in this EA.

Longline fishing gear consists of a main line strung horizontally, supported at regular intervals by vertical float lines connected to surface floats. Descending from the main line are branch lines, each ending in a single, baited hook. The main line droops in a curve from one float to the next and bears some number (2-25) of branch lines between floats. Fishing depth is determined by the length of float lines and branch lines, and the amount of sag in the main line between floats. Figure 3 illustrates typical gear configurations in the shallow-set and deep-set Hawaii-longline fisheries. WPRFMC 2013 and WPRFMC 2009a provide more detailed descriptions of longline fishing in the WCPO.

Figure 3: Schematic Diagram of Longline Fishing in Hawaii.



Source: [NMFS Pacific Islands Fisheries Science Center]

3.2.2.1 Hawaii-Based Deep-Set and Shallow-Set Longline Fisheries

The Hawaii-based longline fisheries are managed under the Pelagics Fishery Ecosystem Plan (FEP). Regulations for the management of these fisheries are set forth at 50 CFR Part 665. A summary of management measures is provided in the Hawaii longline regulations summary, which is available on the NMFS Pacific Islands Regional Office website.[8]

The Hawaii-based longline fleet is the largest U.S. longline fleet operating in the Convention Area. The fleet has historically operated, and continues to operate, in two distinct fisheries based on gear deployment: deep-set longline by vessels that target primarily bigeye tuna (*Thunnus obesus*) and shallow-set longline by those that target swordfish (*Xiphias gladius)*. Fishing effort is mainly exercised to the north and south of the Hawaiian Islands between the Equator and 40° N and longitudes 140° W and 180° W. However, the majority of deep-set fishing occurs south of 25° N or 30° N. Most fishing occurs in the U.S. EEZ around Hawaii and in adjacent high seas waters. An additional small amount of fishing takes place around Palmyra Atoll, Kingman Reef, and Johnston and Jarvis Islands. Table 5 and Table 6 show the performance of the Hawaii-based deep-set longline fishery and Hawaii-based shallow-set longline fishery using the five most recent years for which complete data are available. Table 7 and Table 8 show the estimated catch

[8] http://www.fpir.noaa.gov/

and fate of oceanic whitetip sharks and silky sharks in the observed sets in the Convention Area in 2008-2012 in each of the two longline fisheries.

Table 5: Hawaii-based deep set longline fleet performance factors in the WCPFC area, 2008-2012

Year	Active Vessels	Number of Sets	Total Hooks Set	Total Retained Catch (mt)	Bigeye tuna retained catch (mt)	Swordfish retained catch (mt)	Yellowfin tuna retained catch (mt)
2008	127	15,307	34,100,313	8,398	4,591	239	816
2009	127	14,577	32,682,233	6,832	3,865	181	432
2010	120	12,316	28,452,663	6,885	4,042	167	504
2011	127	14,274	33,671,822	8,607	4,617	158	865
2012	127	15,866	38,349,900	9,001	4,969	208	835

Source: [U.S. data submitted to the WCPFC]

Table 6: Hawaii-based shallow set longline fleet performance factors in the WCPFC area, 2008-2012

Year	Active Vessels	Number of Sets	Total Hooks Set	Total Retained Catch (mt)	Bigeye tuna retained catch (mt)	Swordfish retained catch (mt)	Yellowfin tuna retained catch (mt)
2008	26	1010	959,489	1,253	58	1,043	25
2009	28	1346	1,325,226	1,213	32	1,067	11
2010	27	1252	1,240,276	986	42	866	10
2011	20	829	867,812	836	34	701	17
2012	17	823	901,335	786	24	688	12

Source: [U.S. data submitted to the WCPFC]

Table 7: Hawaii deep-set longline fishery – catch rates and fate of oceanic whitetip sharks and silky sharks in sets in Convention Area, 2008-2012, based on vessel observer data.

	Number of observed sets	Number caught per set		Number kept per set		Number discarded alive per set		Number discarded dead per set	
		Oceanic Whitetip	Silky	Oceanic Whitetip	Silky	Oceanic Whitetip	Silky	Oceanic Whitetip	Silky
2008	3,213	0.045	0.050	0.002	0.003	0.033	0.034	0.009	0.013
2009	3,052	0.080	0.105	0.002	0.001	0.064	0.080	0.014	0.025
2010	2,641	0.090	0.063	0.000	0.000	0.074	0.044	0.016	0.019
2011	2,887	0.078	0.067	0.001	0.000	0.063	0.055	0.014	0.011
2012	3,138	0.056	0.079	0.000	0.000	0.044	0.061	0.012	0.018

Source: [NMFS observer program]

Table 8: Hawaii shallow-set longline fishery – catch rates and fate of oceanic whitetip sharks and silky sharks sets in Convention Area, 2008-2012, based on vessel observer data

	Number of observed sets	Number caught per set		Number kept per set		Number discarded alive per set		Number discarded dead per set	
		Oceanic Whitetip	Silky	Oceanic Whitetip	Silky	Oceanic Whitetip	Silky	Oceanic Whitetip	Silky
2008	1,011	0.045	0.007	0.006	0.000	0.038	0.007	0.002	0.000
2009	1,346	0.039	0.006	0.008	0.000	0.028	0.004	0.001	0.001
2010	1,251	0.070	0.008	0.011	0.002	0.058	0.006	0.002	0.001
2011	828	0.094	0.006	0.002	0.000	0.083	0.005	0.008	0.001
2012	822	0.029	0.001	0.001	0.000	0.027	0.001	0.001	0.000

Source: [NMFS observer program]

3.2.2.2 American Samoa Longline Fishery

The American Samoa Longline Limited Entry Program is managed under the Pelagics FEP. The regulations implementing the program are codified at 50 CFR 665.816. The American Samoa Longline Limited Entry Program allows for as many as 60 vessels. Permits are issued by vessel size class and permit holders are restricted to using vessels within their size class or smaller. The class sizes are as follows: Class A vessels are 40 feet long or smaller; Class B (and B-1) vessels are longer than 40 feet, but no longer than 50 feet; Class C (and C-1) vessels are longer than 50 feet, but no longer than 70 feet; and Class D (and D-1) vessels are longer than 70 feet.[9]

Albacore continued to dominate the catch of pelagic species in 2011. The catch composition for 2011 included primarily tuna species (about 94%): 75.5% of the tuna landings were albacore (*Thunnus alalunga*); 15.5% of the tuna landings were yellowfin tuna; 5% of the tuna landing were bigeye tuna; and 4% of the tuna landings were skipjack tuna (WPRFMC 2013). The majority of the non-tuna landings (59%) were of wahoo (*Acanthocybium solandri*).

This fishery has two discrete components based on vessel size and fishing technology: small-scale vessels, 40 feet (12.2 meters) or less in length, generally fishing within 25 nautical miles from shore (i.e., the "*alia* fleet"); and larger monohull vessels, mostly over 50 feet (15.2 meters) in length, fishing throughout and beyond the U.S. EEZ. The entry of numerous large (>15 meters) longline vessels in the early 2000s resulted in a dramatic increase in longline fishing effort as well as a shift of fishing effort in waters between 50 and 200 nautical miles from shore. On average, the smaller vessel *alia* fleet has three person crews, while the large vessel fleet generally has six person crews. Currently, the American Samoa longline fleet can be characterized as primarily a large vessel fleet. In order to reduce the potential for gear conflicts and catch competition, there are area closures for large vessels.

Total revenue for the longline fleet in 2011 was approximately $7.24 million, dominated by albacore ($5.1 million) (WPRFMC 2013). Table 9 below shows catch and effort information for the fishery using the five most recent years for which complete data are available. Table 10 shows the estimated catch and fate of oceanic whitetip sharks and silky sharks in observed sets in the Convention Area from 2008-2012 in the fishery.

Table 9: American Samoa-based longline fishery performance factors in the Convention Area, 2008-2012

Year	Active Vessels	Number of Sets	Hooks Set	Retained Catch (mt)	Bigeye tuna retained catch (mt)	Swordfish retained catch (mt)	Yellowfin tuna retained catch (mt)
2008	29	4,754	14,444,331	4,388	132	7	336
2009	26	4,907	15,067,775	4,829	161	13	386
2010	26	4,534	13,174,655	4,888	178	11	445
2011	24	3,776	10,767,655	3,341	178	12	555
2012	25	4,099	11,800,893	4,074	167	14	337

Source: [U.S. data submitted to the WCPFC]

[9] Class A vessels are 12.2 meters or less; Class B (and B-1) vessels are longer than 12.2 meters, but no longer than 15.2 meters; Class C (and C-1) vessels are longer than 15.2 meters, but no longer than 21.3 meters; and Class D (and D-1) vessels are longer than 21.3 meters.

Table 10: American Samoa longline fishery –catch rates and fate of oceanic whitetip sharks and silky sharks in observed sets in Convention Area, 2008-2012, based on vessel observer data

	Number of observed sets	Number caught per set		Number kept per set		Number discarded alive per set		Number discarded dead per set	
		Oceanic Whitetip	Silky	Oceanic Whitetip	Silky	Oceanic Whitetip	Silky	Oceanic Whitetip	Silky
2008	334	0.138	0.263	0.000	0.003	0.090	0.186	0.048	0.075
2009	306	0.147	0.235	0.000	0.000	0.105	0.092	0.042	0.144
2010	989	0.148	0.407	0.000	0.000	0.105	0.260	0.042	0.148
2011	1,103	0.092	0.556	0.001	0.000	0.055	0.329	0.035	0.227
2012	640	0.092	0.325	0.000	0.000	0.055	0.163	0.038	0.163

Source: [NMFS observer program]

3.2.3 Hawaii Troll Fishery

The Hawaii troll fishery lands primarily yellowfin tuna, skipjack tuna, blue marlin (*Makaira mazara*), mahimahi (*Coryphaena hippurus*), and ono or wahoo (WPRFMC 2013). Table 11 below shows fishing effort and retained catches of these species from 2008-2012, the five most recent years for which complete data are available.

Table 11: Performance of the Hawaii Commercial Troll Fishery, 2008-2012

Year	Fishing effort (days fished	Skipjack tuna retained catches (mt)	Yellowfin tuna retained catches (mt)	Mahimahi retained catches (mt)	Wahoo retained catches (mt)	Blue marlin retained catches (mt)
2008	29,937	157	427	252	227	175
2009	29,553	139	436	316	199	164
2010	29,328	96	401	305	209	134
2011	28,935	126	440	298	140	188
2012	30,072	120	651	493	212	142

Source: [WPRFMC 2013 and Hawaii Division of Aquatic Resources unpublished data, based on mandatory reporting by holders of Hawaii Commercial Marine Licenses. Catch data from U.S. Annual Report Part 1 to WCPFC 2013]

In the Hawaii troll fishery, the logbooks maintained by commercial fishermen and collected and processed by the Hawaii Department of Aquatic Resources are the best source of data for retained catches of the oceanic whitetip shark and the silky shark. Fishermen record both retained and discarded catches. The logbooks include a specific code for oceanic whitetip sharks but not for silky sharks, so catches of the latter species would be recorded as an "unidentified shark". It is also possible that some oceanic whitetip shark catches are recorded as "unidentified sharks". Therefore, the recorded retained catches of oceanic whitetip shark are believed to represent a lower-bound estimate for that species, and the recorded combined retained catches of oceanic whitetip sharks and "unidentified" sharks (which could include any number of species) represent an upper-bound estimate for both species combined.

As reflected in Table 11, the average annual fishing effort in the Hawaii troll fishery in 2008-2012 is estimated to be 29,565 days fished. Logbook data for the same five-year period indicate the retained catch rates (in terms of numbers of fish) of oceanic whitetip sharks and unidentified sharks to be 0.03 per 1,000 days fished and 0.28 per 1,000 days fished, respectively.

3.2.4 Guam Troll Fishery

The main species of fish caught by the Guam troll fishery are mahimahi, wahoo, skipjack tuna, yellowfin tuna, and blue marlin (WPRFMC 2013). Vessels are generally small in size (less than 10 meters) and fish in the internal waters, territorial seas, and U.S. EEZ around Guam and the Commonwealth of the Northern Mariana Islands (WPRFMC 2013). The main source of data for the Guam troll fishery is a creel survey conducted by the Guam Division of Aquatic and Wildlife Resources. Table 12 below shows the estimated total retained catches, based on the creel survey data from 2008-2012, of most marketable species by trolling vessels.

Table 12: Guam Troll Fishery Performance Factors 2008-2012 (estimated retained catch from creel surveys)

Year	Number of Fishing Vessels	Fishing effort (Trips)	Skipjack tuna retained catches (mt)	Yellowfin Tuna retained catches (mt)	Mahimahi retained catches (mt)	Wahoo retained catches (mt)	Blue marlin retained catches (mt)
2008	385	6947	134	9	51	45	4
2009	368	10014	150	23	67	59	15
2010	432	10935	154	11	128	21	14
2011	454	8336	159	37	41	17	9
2012	351	6337	142	13	38	20	6

Source: [WPRFMC 2013, PIFSC unpublished data for 2012, U.S. Annual Report Part 1 to WCPFC 2013]

In the troll fisheries of American Samoa, CNMI, and Guam, creel surveys conducted by the territories' respective fisheries agencies are the best source of data for retained catches of the oceanic whitetip shark and the silky shark. The creel surveys record a subsample of all fishing effort, and these data can be used to generate estimates of total fishing effort and total catches in the fishery, along with catch per unit of fishing effort. The creel surveys cover both commercial and non-commercial activities, and the two cannot be readily distinguished from each other. Troll trips are sometimes mixed with bottomfishing trips, in which case the catches associated with the two methods cannot be distinguished. Because the creel surveys record only a sample of all troll fishing effort, and because the two species are retained only infrequently, it is difficult to generate estimates of total catches. Furthermore, the catches of some retained sharks are not identified to species by surveyors, in which case they are recorded as "unidentified" sharks. For these reasons, the creel survey data have limitations with respect to estimating total retained catches in the fisheries.

As reflected in Table 12, the average annual fishing effort in the Guam troll fishery in 2008-2012 was about 8,514 trips. During the same five-year period, the creel census data collectors documented zero retained oceanic whitetip sharks, one retained silky shark, and no retained unidentified sharks. Again, although this is the best available data, using these sample data to generate estimates of total catches and catch rates in the fishery is problematic because of the infrequency of the events. The following estimates should therefore be considered only roughly indicative of actual retained catches in the fishery: The estimated retained catch rates (in terms of numbers of fish) per unit of fishing effort in 2008-2012 for oceanic whitetip sharks, silky sharks, and unidentified sharks were about 0 per 1,000 trips, 0.2 per 1,000 trips, and 0 per 1,000 trips, respectively.

3.2.5 American Samoa Troll Fishery

The American Samoa-based troll fleet catches primarily skipjack tuna and yellowfin tuna, as well as small amounts of mahimahi, wahoo, blue marlin, and sailfish (*Istiophorus platypterus*) (WPRFMC 2013). Table 13 below provides the totals in metric tons of skipjack tuna and yellowfin tuna caught by this fleet from 2008 to 2012.

Table 13: Performance of the American Samoa Troll Fishery, 2008-2012

Year	Fishing effort (Trips)	Skipjack tuna retained catches (mt)	Yellowfin tuna retained catches (mt)
2008	143	7	9
2009	81	1	1
2010	53	1	1
2011	147	10	6
2012	76	9	4

Source: [WPRFMC 2013, PIFSC unpublished data for 2012, U.S. Annual Report Part 1 to the WCPFC 2013]

As reflected in Table 13, the average annual fishing effort in the American Samoa troll fishery in 2008-2012 was about 100 trips. During the same five-year period, the creel census data collectors documented one retained oceanic whitetip shark, zero retained silky sharks, and one retained unidentified shark. Again, although this is the best available data, using these sample data to generate estimates of total catches and catch rates in the fishery is problematic because of the infrequency of the events. The following estimates should therefore be considered only roughly indicative of actual retained catches in the fishery: The estimated retained catch rates (in terms of numbers of fish) per unit of fishing effort in 2008-2012 for oceanic whitetip sharks, silky sharks, and unidentified sharks were about 2 per 1,000 trips, 0 per 1,000 trips, and 2 per 1,000 trips, respectively.

3.2.6 Commonwealth of the Northern Mariana Islands Troll Fishery

The troll fleet based in the Commonwealth of the Northern Mariana Islands primarily targets skipjack tuna, with seasonal landings of yellowfin tuna and mahimahi, and small catches of other species. Vessels are generally less than 24 feet in length and catch fish within a 20-mile[10] radius from Saipan (WPRFMC 2013). Table 14 below shows the total commercial landings of skipjack tuna, yellowfin tuna, mahimahi, and wahoo from 2008-2012.

[10] Units of measurement throughout this document are based upon the sources of information used and thus, both non-metric and metric units are used.

Table 14: Performance of the CNMI Troll Fishery, 2008-2012

Year	Fishing effort (Trips)	Skipjack tuna retained catches (mt)	Yellowfin tuna retained catches (mt)	Mahimahi retained catches (mt)	Wahoo retained catches (mt)
2008	4,921	190	15	37	3
2009	4,141	123	12	29	6
2010	4,312	166	14	34	6
2011	3,662	101	19	25	5
2012	3,423	130	33	18	8

Source: [WPRFMC 2013, PIFSC unpublished data for 2012, U.S. Annual Report Part 1 to WCPFC 2013]

As reflected in Table 14, the average annual fishing effort in the CNMI troll fishery in 2008-2012 was about 4,092 trips. During the same five-year period, the creel census data collectors documented no oceanic whitetip sharks, no retained silky sharks, and no retained unidentified sharks. Thus, the best estimates of the two species' retained catch rates per unit of fishing effort are zero. Again, although this is the best available data, using the creel survey's sample data to generate estimates of total catches and catch rates in the fishery is problematic because of the infrequency of the events, and the estimates should be considered only roughly indicative of actual retained catch rates in the fishery.

3.2.7 Other WCPO HMS fisheries

Other HMS fisheries in which the proposed requirements for the oceanic whitetip shark and the silky shark would apply include the commercial Hawaii handline fisheries, the Hawaii pole and line fishery, and the U.S. West Coast-based albacore troll fishery.

The performance characteristics of the Hawaii fisheries can be found in the Pelagics FEP annual reports (e.g., WPRFMC 2013). Based on mandatory reporting to the Hawaii Division of Aquatic Resources by commercial fishermen in these fisheries, there are no records of any oceanic whitetip shark or silky shark captured in the handline or pole-and-line fisheries at least as far back as 2005 (NMFS 2013, 2012, 2011, 2010). The reporting forms include a specific reporting code for oceanic whitetip shark, but not for silky shark; silky shark would be recorded with all other unidentified sharks as "miscellaneous sharks," none of which have been recorded from 2005 through 2012).

The albacore troll fishery, which includes distinct North Pacific and South Pacific components, is based on the U.S. West Coast and only a small portion of the fishery takes place in the Convention Area. The performance characteristics of the fishery can be found in the annual fishery reports (Childers and Pease 2012). Logbook data provided to NMFS under mandatory reporting requirements that have been in place since 2005 indicate no catches of oceanic whitetip shark or silky shark in the fishery. This fishery has not been subject to a regular observer program, but a limited pilot observer program that was conducted by NMFS on a voluntary basis in the North Pacific Ocean in 1990-1997 and 2000 revealed no records of any oceanic whitetip shark or silky shark captured in this fishery.

3.3 Sharks in the WCPO

3.3.1 Overview

There are more than fifty known species of sharks in the WCPO (Table 17) occupying all portions of the water column, from benthic to epipelagic waters, coastal shallows to the deepest open ocean areas. This diverse group of animals also occupies most available feeding niches with species acting as filter feeders, keystone predators, active hunters, and scavengers. Sharks hold important roles in the ocean ecosystem, particularly in the food chain, acting as population controllers, 'garbage disposals,' and facilitators of energy exchange in the upper trophic levels (Wetherbee et al. 1990). In many Pacific nations, sharks are an important source of protein in limited diets or a way of earning income through international trade or in local markets. Various shark parts are also used for developing pharmaceuticals, clothing, cosmetics, cultural items, and art (Pratt et al. 1990). Sharks also represent an important cultural resource in many Pacific Island societies.

Sharks are notable in that they produce relatively small numbers of young. Sharks are either oviparous (egg laying) or viviparous (producing living young instead of eggs from within the body). Viviparity typically reduces the susceptibility of young to predation, but the production of comparatively few, well-developed offspring makes sharks particularly vulnerable to overfishing. Pratt et al. (1990) state that, unlike teleost fish, sharks can generally be characterized as having a direct relationship between stock and recruitment; slow growth, late sexual maturity, and a reproductive strategy of low fecundity combined with a low number of well-formed offspring imply that the number of offspring produced closely correlates with number of parents available to breed. This reproductive strategy makes sharks as a family very vulnerable to the pressures of fishing, either through targeted fisheries or as bycatch (Pratt et al. 1990).

As of July 2014, the most recent version of the NOAA Fisheries stock status and the Fish Stock Sustainability Index report listed thirty-five fish species that are overfished, including five shark species: the blacknose shark (*Carcharhinus acronotus)*, the dusky shark (*Carcharhinus obscurus*), the porbeagle shark (*Lamna nasus*), the sandbar shark (*Carcharhinus plumbeus*), and the scalloped hammerhead shark (*Sphyrna lewini*), all of which are HMS (see Annex I of the United Nations Convention on the Law of the Sea). Of those five, the blacknose sharks, dusky sharks, and scalloped hammerhead sharks are listed as being subject to overfishing (NOAA 2013). Sharks, fished for their meat and fins, are not only vulnerable to overfishing themselves, but the prey they rely on can be as well. Many commercially valuable HMS and other fish stocks are part of global shark diets.

As stated above, given sharks basic biology they are especially vulnerable to over exploitation; on average they are slow to reproduce so stocks can be depleted quickly if too many mature specimens are removed. Many sharks, especially those primarily found in the open ocean, are not well studied. Population numbers are uncertain, making maximum sustainable yield difficult to determine. Dulvy et al. (2003) asserts that since most sharks have large body sizes, they are more likely to be pursued by humans and that every shark species that has gone extinct on local or regional scales in the last 300 years has done so because of exploitation by humans.

3.3.2 Focus Species

3.3.2.1 Oceanic Whitetip Shark (Carcharhinus longimanus)

Little is known about the oceanic whitetip shark as it typically inhabits remote waters and mostly avoids land masses. The oceanic whitetip shark is characterized as an especially aggressive shark, making *in situ* studies risky and infrequent (Compagno 1984b). Phylogenetically, the oceanic whitetip shark is a part of the Carcharhinidae family, known as requiem sharks which are typified by precaudal pits, bladelike teeth, a smaller second dorsal fin, a fifth gill slit and a well developed nictitating membrane under a very round eye socket (Grace 2001). The oceanic whitetip shark is a stocky shark with grey/yellow-bronze skin with a white belly and has mottled white markings on their long paddle-like pectoral fins (sometimes with black spots) and a white tip on their tall rounded first dorsal fin, giving them their name (Compagno 1984b). The oceanic whitetip shark has a short blunt snout with triangular strongly serrated upper teeth and relatively narrow, finely serrated lower teeth (Grace 2001).

Once one of the most commonly encountered top tropical pelagic predators along with silky and blue sharks (Compagno 1984b, Seki et al. 1998), the oceanic whitetip shark's spawning biomass, total biomass, and recruitment levels appear to have all dropped in the past fifteen years (Rice and Harley 2012b). The oceanic whitetip shark is still one of the most common oceanic sharks despite this apparent population decline (Bonfil et al. 2008).

3.3.2.1.1 Distribution and Movements

The oceanic whitetip shark is an epipelagic circumtropical species. It is the only truly oceanic shark in its genus, preferring open waters of a depth of 184 meters (m) and greater, declining in numbers as one nears a major landmass. The oceanic whitetip shark is most commonly found at depths around 80 m in the water column, but can survive anywhere between the surface and 152 m+ down (Compagno 1984b). It usually ranges in the high seas between 10° N and 10° S latitude but can be found in lower abundances extending as far north and south as 30° N and 30°S latitude depending on water temperature (Bonfil et al. 2008). This species seems to prefer waters that have a much narrower range of 21° C to 25° C of a 34-35.5 parts per thousand salinity, especially if there is a 17° C or cooler upwelling current as this often causes aggregations of their favorite foods (Colman 1997).

The oceanic whitetip shark is generally slow moving but can rapidly dart and rush after prey or away from danger (Compagno 1984b). They seem equally active during the day and night (Bonfil et al. 2008). Little is known about their migration patterns in the Pacific (Rice and Harley 2012b), though some trends appear to delineate breeding grounds. Some *in situ* research has been done through the tagging of oceanic whitetip sharks in the Atlantic; one study indicates they can travel large distances during the year at a top speed of 32 kilometers (km) per day (Kohler et al. 1998). As oceanic whitetip sharks are a highly migratory and generally understudied species, no specific regional stock has been identified to date; however, the WCPFC has recently completed a stock assessment of the oceanic whitetip shark in the WCPO, as described in more detail below in Section 3.3.2.1.6.

3.3.2.1.2 Reproduction and Life History

The few studies conducted on the oceanic whitetip shark all have identified them to be a slow breeding species. In ecological terms, the oceanic whitetip shark is a K-selected species, like most elasmobranchs, meaning if left undisturbed their population numbers would fluctuate around the "carrying capacity" of their environment. Species such as these are known for their long gestation periods, low number of large young per birth, followed by slow maturation (Lessa et al. 1999).

Seki et al. (1998) conducted the largest study of the oceanic whitetip shark's reproduction and growth to date, examining 225 sharks caught over a 28 year period in the central Pacific by longline fleets targeting tuna. They were able to successfully age sharks by counting vertebral growth rings. This process was repeated by Lessa et al. (1999) with 110 oceanic whitetip sharks with similar success rates. Each ring represents a year of growth and has proven to be more accurate than just measuring body length (Seki et al. 1998, Lessa et al. 1999). Both studies showed the oceanic whitetip shark to be slow growing with no differential growth rates by sex. The oceanic whitetip shark can grow up to four meters, but the most common body size for the species is less than three meters (Compagno 1984b).

Current data suggests that the maximum age is 11 years in the Pacific and 13 in the Atlantic (Bonfil et al. 2008), although there has been one documented shark aged at 17 years (Lessa et al. 1999). The oceanic whitetip shark is viviparous with embryos developing in a yolk sack placenta (Seki et al. 1998). Lessa et al. (1999) and Seki et al. (1998) arrived at different conclusions at the age which oceanic whitetip sharks become sexually mature, with Seki estimating four to five years and Lessa estimating six to seven years; however both studies agree that males and females fall within the same range. In the North Pacific the oceanic whitetip shark mates between June and July (Seki et al. 1998). Females probably only mate once every two years as females have a nine to twelve month gestation period and have not been observed to mate again while pregnant (Bonfil et al. 2008).

Pregnant sharks have been documented to stay between 140° W and 140° E longitude and 10° N-10° S. Pups are found up to 20° N, but occur in the highest concentrations around 10° N, suggesting that these areas may serve as a pupping ground for the oceanic whitetip shark in the

Pacific (Bonfil et al. 2008). A corresponding area in the western Atlantic may lie off of equatorial Brazil (Bonfil et al. 2008). Females average six live born pups per litter (though larger females can birth up to fifteen) (Seki et al. 1998). Newborn sharks measure between 55 and 75 cm at birth and add a maximum of 30 percent of their birth length in their first year of growth (Bonfil et al. 2008). This species has a low fecundity so is vulnerable to any pressures put on its population (Bonfil et al. 2008). Overall, literature suggests that the species has been poorly studied and that additional research is needed to develop a more comprehensive understanding of the oceanic whitetip shark's life cycle.

3.3.2.1.3 Ecosystem Importance

The oceanic whitetip shark mainly serves in an apex predator role in the open oceans (Bonfil et al. 2008) but also serves in the role of scavenger (Compagno 1984b). The oceanic whitetip shark has a very strong jaw with large pointy and serrated teeth that are optimal for biting and sawing through large chunks of meat. Its diet is wide raging and opportunistic. The oceanic whitetip shark relies mostly on bony fish such as tuna, lancetfish, oarfish, jacks, marlin and barracuda, and cephalopods, but have also have been known to eat stingrays, birds, turtles, gastropods, crustaceans, marine mammal carrion (and rarely live cetaceans, Heithaus 2001) and the occasional piece of garbage (Compagno 1984b).

The oceanic whitetip shark has developed feeding styles as diverse as its diet. When investigating large prey they bump their noses against it with increasing persistence until the first experimental bite. To catch smaller schooling fish, the oceanic whitetip shark will take small bites out of the school, much like one would an apple. For larger fish like tuna, they have been observed to swim erratically at the surface of a school waiting to bite until something lands in their mouth. The oceanic whitetip shark has also been observed to follow fishing boats, which can lead to damaged, half eaten fish on the hook (Compagno 1984b). They also have been seen to follow live whales. In Hawaii oceanic whitetip sharks were photographed following pilot whales that are known to find and eat squid (Stafford 1988).

Oceanic whitetip sharks are characterized as mostly solitary creatures, but are regularly observed to swarm en masse when a plentiful food source is available. Seemingly tolerant of each other, oceanic whitetip sharks will aggressively guard their food from other sharks (especially silky sharks that are often found in association with oceanic whitetip sharks) (Compagno 1984b). It is hypothesized that part of the reason that adult oceanic whitetip sharks avoid shallow water habitats is to avoid food competition with their cousins the blue shark that tend to hunt on the continental shelf or near coastlines (Bonfil et al. 2008). Adults have no natural predators, but juveniles often stick quite close to reefs and ledges found along continental shelves to avoid being eaten by other sharks, including their own kind (Bonfil et al. 2008).

Like most sharks, the oceanic whitetip shark serves several important ecosystem roles. A loss of a top predator like the oceanic whitetip shark could result in a drastic shift in prey species diversity as one prey species may be able to outcompete other prey species without predation pressure (Sergio et al. 2006). Predation also limits the expansion of prey territory, prey size distributions, prey behaviors, and overgrazing, which help to maintain specific niches (Frid et al.

2008). Shark loss could cascade all the way to the bottom layers of the food web; they are believed to be integral to keeping many systems balanced (Griffin et al. 2008). Predation on the sick or weakest and oldest individuals in prey groups helps maintain healthy breeding populations and limit the spread of disease (Temple 1987). As sharks eat, they leave small pieces of detritus that sinks and provides nutrients for lower trophic level detritivores and by serving as scavengers themselves, limit detritus build up in the oceans (Griffin et al. 2008).

3.3.2.1.4 Human Interactions

The oceanic whitetip shark is a notoriously aggressive and stubborn shark that has been associated with some verified attacks on humans (Compagno 1984b). Many attacks are not well documented so it is hard to know how many of the shark attacks by species in the generally classified requiem family can be attributed to this species. Divers have classified them as not easy to frighten and very persistent in their investigation of potential food sources. They often have to be physically dissuaded through force to prevent them from becoming too curious (Compagno 1984b). They are anecdotally associated with attacks on at-sea ship wrecks and plane crashes, and have been blamed for higher rates of human mortality in these accidents (Compagno 1984b).

3.3.2.1.5 The Oceanic Whitetip Shark in WCPO Fisheries

There are very few documented fisheries that target this shark specifically but oceanic whitetip sharks are one of the most incidentally caught species in WCPO tuna longline fleets, often taken as juveniles. They are often viewed by vessels worldwide as pests that destroy or tangle gear, damage catch or as dangerous to the crew because of their large size and aggressive nature. Until the 1990s they were mostly treated as unwanted bycatch, occasionally being finned before the rest of the carcass was tossed overboard (Bonfil et al. 2008).

There are a few small scale multi-shark fisheries that do target oceanic whitetip sharks where they are mostly sought for their fins (Clarke et al. 2006a, Bonfil et al. 2008). They have become a major component of the shark fin trade as they are so frequently caught in other fishing operation, such as longline fisheries (Bonfil et al. 2008). The demand and value of the fins have increased in the world market to where the fins are of considerable value. This is causing incidentally caught sharks to be retained at a higher rate and may be putting the oceanic whitetip shark at risk, especially as this type of catch often goes unreported. Oceanic whitetip shark fins are often not labeled at markets, but have a particularly distinctive shape making them easy to identify. The Food and Agriculture Organization of the United Nations (FAO) (2013) estimated that 1.8% of all fins sold in the main Hong Kong fin market were from oceanic whitetip sharks between November 2002 and February 2004. Market reports however are not entirely reliable data sources as there are no unique customs codes for shark products in international trade (FAO 2013). Clarke et al. (2006b) estimated that anywhere from 300,000 to 1,400,000 (10,000 to 53,000 mt) oceanic whitetip sharks are caught for sale every year. Prices ranged from $45 to $85 in the Hong Kong markets in the late 90s and early 2000s. Other products derived from oceanic whitetip sharks include meat and skin (consumed in Europe, North America, and Asia), hides used for leather (primarily in the United States and Mexico), and liver oil used to produce vitamin A (Bonfil et al. 2008, FAO 2013).

Data on the reported catch of the oceanic whitetip shark is extremely patchy. The WCPFC's CMM 2010-07 includes provisions for CCMs to submit information on key shark species, one of which is the oceanic whitetip shark, but catch reports of shark catches are often lumped into one indistinct group (Clarke et al. 2012).

During the period from 2000 to 2010, the average oceanic whitetip catch reported to the FAO was 335 mt a year but these reports only came from three countries: Brazil, China, and Portugal (FAO 2013). Observer data from the WCPFC Regional Observer Programme (ROP) were also used to estimate the WCPO oceanic whitetip catch, but the WCPFC only requires 100% observer coverage for purse seine fleets. Underreporting or the total lack of reporting of shark catch is frequent. A recent WCPFC report estimated the average number of all oceanic whitetip sharks caught by longliners between 1992 and 2009 to be 127,000, representing 6.34% of the total estimated shark catch of the main five sharks species caught by this fishery. For the years 1995 to 2010 in the purse seine industry the average catch of oceanic whitetip sharks was 2,267 sharks, 4.21% of the total average reported shark catch of the two main species caught (Lawson 2011). As described in the report of the recent stock assessment for the oceanic whitetip shark in the WCPO (Rice and Harley 2012b), estimation of shark catches in fisheries where sharks are mostly taken incidentally is difficult, and the estimates are consequently very approximate. Lawson (2011) estimated the recent history of catches of the oceanic whitetip shark in the longline and purse seine fisheries in the WCPO (specifically, in the WCPFC Statistical Area[11] east of 130° W longitude, and excluding the fisheries of the Philippines and Indonesia). The estimated average annual catch, in numbers for 2005-2009 were about 57,000 oceanic whitetip sharks. For the purpose of the stock assessment, and using a variation of the catch estimation method used by Lawson (2011), Rice and Harley (2012b) estimated alternative catch histories for the stock. The estimated average annual catch in numbers, for 2005-2009 were about 100,000 oceanic whitetip sharks.

3.3.2.1.6 Stock Status

For the United States, the oceanic whitetip shark in the WCPO is managed under the Pelagics FEP. Using the Magnuson-Stevens Fishery Conservation and Management Act (MSA) stock status determination criteria established in the FEP, NMFS has not yet determined that the stock is overfished or subject to overfishing.[12]

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[11] 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.

[12] See NOAA Fisheries, Office of Sustainable Fisheries webpage at http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/.

Although NMFS has not made affirmative status determinations under the MSA, a stock assessment for the oceanic whitetip shark in the WCPO was prepared for the WCPFC in 2012. Rice and Harley (2012b) concluded that the estimated fishing mortality rate had increased to levels far in excess of F_{MSY} ($F_{CURRENT}/F_{MSY} = 6.5$) and that estimated spawning biomass had declined to a level far below SB_{MSY} ($SB_{CURRENT}/SB_{MSY} = 0.153$). Although the assessment report acknowledged uncertainties inherent in the contributing data, the catch, CPUE, and size composition data all show consistent declines over the period of the model (1995-2009).

No stock assessment of the oceanic whitetip shark has been done in the Eastern Pacific Ocean (EPO) (IATTC 2013). However, based on information from the Inter-American Tropical Tuna Commission (IATTC), the historical extent of decline in catches of the oceanic whitetip shark in the EPO is 95% (FAO 2013), and appear in some ways to mimic the trend in the WCPO.

3.3.2.2 Whale Shark (Rhincodon typus)

The whale shark is the largest fish currently living (Colman 1997). It is so unique that it is the only species in its genus. Whale sharks can grow up to twenty meters long, but average sizes range between four and twelve meters (Stevens 2007). They are one of three known filter feeding sharks. They have broad, flat heads with an extremely large terminal mouth with numerous minute teeth, positioned in front of their eyes. They have a special filter screen on their gill slits to aid in prey capture and small barbels to aid in prey sensing. The whale shark also has unique skin markings – white polka dots encased in cross-hatching on a dark background (Compagno 1984a). These patterns may be used for social reasons such as mating displays or individual recognition, or as a shield against ultraviolet (UV) radiation (Colman 1997).

Despite their large size and charismatic nature and the efforts of a few exceptionally dedicated researchers, relatively little is known about this species (Stevens 2007). Most of the current information on these sharks is based on anecdotal records, incidental catches, strandings (Colman 1997, Eckert & Stewart 2001, Nelson & Eckert 2007) or scientific studies on a very limited number of individuals (Heyman et al. 2001, Eckert & Stewart 2001, Nelson & Eckert 2007, Thums et al. 2013).

3.3.2.2.1 Distribution and Movements

The whale shark is epipelagic and has a widespread distribution in both oceanic and coastal environments (Stevens 2007). It is circumglobal in tropical and warm seas and is usually found at or near the surface (Compagno 1984a). Whale sharks are a highly migratory species, and there is little genetic differentiation between geographic populations. There is a high degree of genetic flow between the Indian Ocean and Pacific Ocean whale sharks, with a lesser, but still significant amount of gene flow between these basins and the Atlantic (Castro et al. 2007, Schmidt et al. 2009). They are also known to move among these basins often enough to connect them on a generational time-scale (meaning gene flow from other basins can be seen from one generation to the next) (Sequeria et al. 2013). As such, it is not known whether there are distinct subpopulations from the information currently available.

Encounters with whale sharks, outside of a very few well known grazing spots (Nelson & Eckert 2007) are sporadic and unpredictable (Colman 1997). It is accepted that they are highly migratory, but it is not known if the migration is seasonal (Heyman et al. 2001). Tagging studies have shown that they can travel considerable distance over long periods of time, but it not known if they are nomadic or if their movements fit into very large, unrecognized multiyear patterns (Eckert & Stewart 2001).

Eckert and Stewart (2001) conducted a study of the movement of whale sharks from the Sea of Cortez to other parts of the North Pacific Ocean. Seventeen whale sharks were satellite tagged and successfully traced from twelve days to 37 months. Unlike tagged marine mammals or turtles, sharks do not have to regularly return to the surface to breathe; therefore readings from traveling sharks can be infrequent and may include less than precise movement tracks. Eckert and Stewart (2001) were however able to determine that whale sharks can move up to 96 km per day but most average 23.9 km per day, with distance traveled correlating to size. The whale sharks they monitored spent 80% of their time at depths of 10 m or less, most likely feeding. They dove up to 240 m+, but did not show any particular pattern. Their dives did not show the swim at depth during the day/on the surface at night pattern that would classify them as diel migrants (Eckert and Stewart 2001). Though poorly understood, migration is obviously important to whale sharks, otherwise it is doubtful they would conduct such long energy demanding trips. This puts whale sharks at considerable risk of ship strikes, given their presence in global shipping lanes and along coasts (Stevens 2007).

Other studies have tracked whale sharks that regularly dove to 90 m but could go as deep as 980 m (Stevens 2007). Sea surface temperature is the best predictor of whale shark distribution, with most occurring between 26.5° and 30° C (Sequeira et al. 2013). However, Colman (1997) states that whale sharks can tolerate a temperature range of 4.2° C to 28.4° C, and Eckert and Stewart (2001)showed them to endure waters as warm as 32° C ; the highest temperatures were encountered during midday feedings, and the lowest in deep dives.

3.3.2.2.2 Reproduction and Life History

The whale shark is an obligate lecithotrophic livebearer, meaning that embryos grow in a yolk sack filled egg case inside a female’s uterus. This fact was only solidly confirmed in 1995 when a pregnant female was harpooned off of Taiwan (Joung et al. 1996). Most of what is known about the reproductive cycles of these sharks comes from the post mortem study of pregnant females and young pups (Stevens 2007). One particular shark was carrying 300 embryos in its uterus along with empty egg cases and a few fully grown viable pups (some of which were removed alive, two of which survived to time of publication of the study describing them in aquariums). This specimen was not an exceptionally large female and Joung et al. (1996) speculate that larger females would be able to carry even larger litters. The various stages of development found in this female support the idea of an extended period of parturition. These size classes helped to determine that a full term whale shark pup ranges from 58 to 64 centimeters (cm) total length (Stevens 2007).

Very little else is known about the whale shark including mating habits or even growth curves. It is estimated that male whale sharks reach maturity between 7 and 9 m and female whale sharks reach maturity around 9 m (Rowat and Brooks 2013). Varying growth rates have been observed in a few captive whale sharks (Stevens 2007). Studies of vertebral growth rings and aquarium resident whale sharks have offered differing estimates of age at maturity, the best estimate being between 8.9 and 21.4 years (Rowat and Brooks 2013). A study did conclude that it was possible for whale sharks to live as long as 60-100 years (Stevens 2007). Encounters with juveniles have been rare, and studies of adolescents (thought to be under three meters) have been practically non-existent (Colman 1997).

3.3.2.2.3 Ecosystem Importance

The whale shark has one of the most unique feeding systems of any shark. Whale sharks are ram filter feeders. Ram filter feeding consists of swimming actively forward with the mouth open letting food particles flood into the mouth and water to filter out over special filters covering the internal gills (Nelson and Eckert 2007). Whale sharks can do this both at the surface of the water and at depth (Heyman et al. 2001). Even more uniquely whale sharks also have the ability to suction feed. They can hang either horizontally or vertically in the water and actively draw water into their mouths (Compagno 1984a). This gives them the ability to ingest small particles like krill, tiny crustaceans, larvae (Compagno 1984a), copepods (Clark & Nelson 1997), and fish spawn. They can also ingest much larger nektonic prey such as jellyfish (Heyman et al. 2001), small schooling fish, squids, and even young tuna (Compagno 1984a). Phytoplankton and macroalgae in varying quantities have also been observed amongst the stomach contents of captured whale sharks but it remains unclear if this is a sign of an omnivorous lifestyle or just accidental ingestion as a consequence of their foraging behaviors or capture (Colman 1997).

Though the whale shark’s feeding system is less efficient and requires denser food patches than other filter feeding sharks (Heyman et al. 2001, Colman 1997), being able to use multiple foraging techniques (Nelson & Eckert 2007) gives whale sharks a competitive advantage over other filter feeding sharks by widening their range of prey (Compagno 1984a). This also makes them opportunists, feeding heavily when food sources are available and traveling extensively to find the next dense patch of mobile prey. The need for high volume food sources, as well as their association with tuna and forage fishes has made some scientists to consider whale sharks as an indicator species, suggesting that their presence signifies good ecosystem health (Stevens 2007).

According to Heyman et al. (2001) whale sharks use visual, audible and olfactory cues to find prey and sense seasonal signals. They have been observed to aggregate seasonally or temporally in areas coinciding with reef-fish spawning events. These aggregations can number into the hundreds (Heyman et al. 2001). These aggregations also follow tides (Colman 1997), and can move diurnally, feeding on reefs at night and offshore during the day (Heyman et al. 2001).

Whale sharks are often associated with schools of fish like tuna that can feed on the same prey species (Heyman et al. 2001), which may provide some foraging advantage (Colman 1997).

Whale sharks have also been observed to actively swim with other groups of macrofauna including hammerhead sharks, tiger sharks (*Galeocerdo cuvier)*, and manta rays. Remora and pilot fish often accompany whale sharks, as do juvenile golden trevallies (*Gnathanodon speciosus*). It is believed that this association provides these smaller species with protection (Colman 1997).

Although whale sharks have few natural predators, their size, slow speed and lack of defense mechanisms do make them vulnerable to the occasional attack. Juveniles have been discovered in the stomachs of blue sharks and marlins. One adult was recorded as being attacked and eaten by two killer whales (*Orcinus orca*), and another was observed with the bite marks from a large shark, speculated to be a great white shark (*Carcharodon carcharias*) (Stevens 2007).

3.3.2.2.4 Human Interactions

As whale sharks are generally considered to be harmless they have become a popular ecotourism attraction, especially in areas where food sources make them common guests. As ecotourism becomes a more important part of regional economies, the demand for live healthy whale sharks is rising. Though adult whale sharks are generally aloof and are known to dive to avoid attention, young whale sharks are curious and will often approach divers and swimmers, perhaps attracted to the bubbles created by fins. Locations that regularly draw both whale sharks and tourists are not always well monitored, and of course not all people in close encounters follow the guidelines in place to respect the sharks. It is not known how this increasing attention and human interaction is affecting the sharks, but it could be adding to stress or altering natural behaviors and movements (Colman 1997). These interactions are limited to the small portion of whale sharks that frequent these sites, so it is unlikely the species as a whole is being adversely affected by ecotourism (Rezzola and Storai 2010). There have been no observed drops in abundance at these sites (Holmberg et al. 2009).

Because of their enormous size, slow movements, and tendency to occupy surface waters, whale sharks are especially vulnerable to ship strikes. Large ships often do not report or even notice the striking of megafauna so the number of whale sharks killed per year in this manner is unknown. Whale sharks in coastal areas do display scars and fin damage, likely from collisions with smaller craft (Stevens 2007). Another danger faced by whale sharks, like most marine species, is that of oil spills. For example, the Deepwater Horizon incident occurred within whale shark habitat and may have affected individuals and their prey, but it is doubtful that there were negative impacts on the species as a whole (78 FR 50032).

3.3.2.2.5 The Whale Shark in WCPO Fisheries

In the 1980s and 1990s whale sharks were primarily caught for their liver oil which was painted on wooden boats as waterproofing with the bulk of the meat being thrown overboard. Occasionally the oil was taken for the manufacturing of shoe polish or as a treatment for certain skin conditions (Colman 1997). Whale sharks were actively fished by harpoon and net in certain Asian countries, where 30-100 sharks could be taken in a season in the 70s and early 80s but where more recently, fewer than ten were caught (Joung et al. 1996). These countries have since closed these fisheries and whale shark fishing is now prohibited (Rowat and Brooks 2012). There is also a limited consumption of whale shark meat in Pakistan, Malaysia, China, and Senegal where it is either eaten fresh or dried and salted (Stevens 2007). Whale sharks are legally protected in Australia, Belize, Honduras, Mexico, the Maldives, Malaysia, Thailand, and the United States (Norman 2005). As a commercial species, whale sharks draw one of the highest prices for meat of all sharks, being valued for its tofu-like texture and unique flavor (Joung et al. 1996).

Whale sharks may act as natural FADs, as they often either associate with commercially valuable species or at least indicate high bait fish levels that will in turn attract schools of commercial species. This has led to the practice of some fishermen deliberately encircling them in purse seine nets to harvest the economically valuable catch. This was a problem as trapped whale sharks could damage gear (an occurrence that caused others to actively avoid them), and the sharks also often suffered injury as a result (Coleman 1997, Norman 2005).

Whale sharks are incidentally caught in the Pacific, with the highest mortality rates believed to be occurring in the gillnet and purse seine fisheries (Stevens 2007). Whale sharks are so large that any accidental encounters with fishing gear can be disastrous to both the fisherman and shark. Whale sharks surrounded or entangled in nets can thrash and become more trapped. Whale sharks often weigh more than net winch capacity. They must be carefully rolled out of the net, or in the case of entanglement, physically cut out of the offending strands. Both of these processes may result in the loss of some or all of the targeted catch, loss of fishing time, and potential threats to the crew. Although not aggressive in themselves, a blow from the tail of a panicked, thrashing shark can be dangerous (Poisson et al. 2012).

No estimates of total fishing mortality of the whale shark in the WCPO are available. Rowat and Brooks (2012) describe both whale shark-directed fisheries and incidental catches in tuna fisheries as known sources of fishing mortality. The authors describe the rapid development of whale shark-directed fisheries in the Philippines and Taiwan in the 1990s, with combined recorded annual catches reaching on the order of 1,000 animals per year. Catches in those two directed fisheries have since declined substantially, and both countries have established bans on fishing for whale shark (Rowat and Brooks 2012). The main source of mortality in the WCPO HMS fisheries is believed to be the tropical purse seine fishery. Provisional mortality estimates in that fishery are available in SPC-OFP (2012) and Rice and Harley (2012a). Using vessel observer data, OFP (2012) estimated the numbers of whale shark mortalities in the WCPO tropical purse seine fishery in 2009 and 2010 was reported to be 56 and 19, respectively. Rice and Harley (2012a) used the same information to estimate that there were 75 mortalities in the fishery in 2007-2010, or about 19 per year, on average (omitting the fisheries in the EEZs of the Philippines and Indonesia, for which no estimates are available). The authors noted that this estimate does not include mortalities that might have occurred after a whale shark was released alive.

3.3.2.2.6 Stock Status

No stock assessment of the whale shark in the WCPO, or any ocean basin has yet been conducted and thus, the stock status is unknown. Given that whale sharks are one of the longest lived and latest to mature species in the WCPO, they are likely to have a small rate of population growth. This could make whale sharks vulnerable to fishery induced mortality. Any major decline natural or otherwise may take decades to recover from (Rice and Harley 2012a).

Deoxyribonucleic acid (DNA) studies may supply the best estimate of number of whale sharks. These studies estimated the effective population size, which is the number of breeding individuals (able to produce offspring in the next generation) that would be necessary to prevent inbreeding and maintain an ideal amount of genetic diversity. Effective population size is often smaller than the actual number of individuals in a population. By examining mitochondrial DNA, Castro et al. (2007) estimated that there are 238,000 to 467,000 adult whale sharks in the world. A study by Schmidt et al. (2009) examining microsatellite DNA estimated an effective population of 103,572 with a standard error range of 27,401 to 179,794 animals. Since these numbers are likely smaller than the actual total number of whale sharks, the population may be larger than previously assumed, but much more research is needed to validate these estimates.

3.3.2.3 Silky shark (Carcharhinus falciformis)

Despite being one of the most commonly encountered species in the world oceans, little is known about the biology or behaviors of the silky shark. The silky shark is a part of the Carcharhinidae family, and is one of the larger species in the family. The silky shark can grow up to 3.3 m in total length. The silky shark gets its name from its uniquely smooth skin made up of small, fine denticles, which are not found on many other sharks (Bonfil 2008). Skin color ranges from dark grey to grey brown, with white undersides. The tips of silky shark fins are often pigmented (Compagno 1984b). Silky sharks are characterized by their sickle shaped first dorsal and pectoral fins and uniquely shaped upper teeth (Bonfil 2008).

3.3.2.3.1 Distribution and Movements

The silky shark is found in both coastal and oceanic waters. Its range is mostly restricted to circumglobal tropical waters of 23° C or more. Silky sharks inhabit continental slopes and shelves and are found both in the open ocean and on deepwater reefs. The silky shark can be found ranging from the surface to a depth 500 m or more. It is one of the most abundant and cosmopolitan species in the Pacific Ocean (Bonfil 2008). Size segregation is common with younger silky sharks sticking closer to coastlines and island nursing grounds with adults ranging through the open ocean (Compagno 1984b). This separation makes adult populations isolated from younger generations (Oshitani et al. 2003). Evidence of sexual segregation has only been found in the Pacific Ocean population (Bonfil 2008).

Little definitive information is known about any migration patterns, but tracking studies have revealed they do have the ability to cover long distances quickly, possibly up to 60 km per day.

In the Pacific, silky sharks have been observed to move from the equator to higher latitudes in the summer. The reason for this movement and if it occurs in other oceans is yet unknown (Bonfil 2008). Juvenile silky sharks display some vertical diel migrations, diving to depths of up to 100 m at night (Hutchinson et al. 2013).

Very few stock assessments of silky sharks have been completed, but from the examination of available studies on life history of silky sharks around the world, Bonfil (2008) believes that there are distinct populations. These populations are found in the Northwest Atlantic, the Western-central Pacific, the Eastern Pacific, and the Indian Ocean. It is possible that other distinct populations have yet to be discovered (Bonfil 2008). Section 3.3.2.3.6 below provides a description of the recent WCPFC stock assessment of the silky shark in the WCPO.

3.3.2.3.2 Reproduction and Life History

The reproduction of silky sharks is probably the best studied aspect of their ecology (Bonfil 2008). Silky sharks are viviparous with a yolk sack placenta (Compagno 1984b). Silky sharks can have litters ranging from one to sixteen pups, with an average litter size of six to twelve (Oshitani et al. 2003, Bonfil 2008). Gestation lasts between nine and twelve months. Silky sharks may take a year off between pregnancies. Some populations display evidence of breeding seasons. Central Pacific silky sharks mate and give birth between February and August, but other populations seem to reproduce in other months, or do not display seasonality at all. Some female silky sharks have been found carrying embryos at different stages of development suggesting that mating and pregnancy can be a prolonged cycle (Bonfil 2008).

Size at birth is generally correlated with the size of the mother but varies widely regionally (Bonfil 2008, Oshitani et al. 2003). Body weight increases exponentially with size and there are no significant differences between sexes (Oshitani et al. 2003). Birth size in the Pacific Ocean ranges between 48 and 81 cm (Oshitani et al. 2003, Bonfil 2008). The oldest documented silky shark was 22 years old (Bonfil 2008). There are a wide range of estimates for age of maturity, but in the Pacific the ages are between six and seven years for females and four or more years old for males (Oshitani et al. 2003). Size at maturity has a range even within ocean basins; several reproductive studies done in the Pacific Ocean are summarized in Table 15: Silky Shark Length at Maturity in the Pacific Ocean.

Table 15: Silky Shark Length at Maturity in the Pacific Ocean

Region	Sex	Total Length (TL) at Maturity	Source
Central Pacific	Female	213-218cm	Strasburg 1958
Western Pacific	Female	202-208 cm	Stevens 1984
	Male	214 cm	Stevens 1984
Pacific Ocean	Female	193-200 cm	Oshitani et al. 2003
	Male	>186 cm (but down to 126 cm)	Oshitani et al. 2003

These life characteristics have caused researchers to assess them as moderately able to rebound from overexploitation, but further research, especially into distinct populations segments is needed to establish their actual population fluctuations (Bonfil 2008).

3.3.2.3.3 Ecosystem Importance

The silky shark is an apex predator that feeds both near the bottom and in the water column. It is an opportunistic feeder that eats mostly bony fish such as tuna, snappers, and mackerel, but also will eat eels, squid, octopus, and crabs if they are available. They are quick and agile and highly active (Bonfil 2008, Compagno 1984b). Adults will aggregate when food is plentiful and hunt cooperatively. They are often found in association with schools of tuna. Silky sharks can be aggressive, but will almost always defer to oceanic whitetip sharks when competing for the same prey (Bonfil 2008).

3.3.2.3.4 Human Interactions

Though the silky shark has a reputation of being potentially dangerous very few if any verified attacks on humans have been recorded. Divers have reported that silky sharks will assume a “hunch” position, arching their backs and lowering their tail as a defensive threat display (Compagno 1984b).

Silky sharks have been shown to be attracted to low frequency sound pulses (especially in the range of 10-20 hertz). These sounds mimic those generated by feeding dolphins and seabirds indicating a food source, but may have human interaction implications. Many rescue helicopters transmit sounds in a similar range, and therefore may attract silky sharks to the sites of emergencies (Myrberg et al. 1972).

3.3.2.3.5 The Silky Shark in WCPO Fisheries

Silky sharks are a targeted catch in many Pacific countries, but the majority of those taken are probably incidentally caught in the tropical tuna longline and purse seine fisheries. It is one of the most frequently caught sharks and is commercially important to the fin trade (being the second most common fin seen globally). Their meat is also eaten fresh or dried, their skin used for leather, and their liver used for oil that is high in vitamin A (Compagno 1984b). Numbers and catches of silky sharks caught have not been historically well kept. Data are often unreliable because they do not reflect the actual number of those killed or released alive. Also, silky sharks can be easily mixed up with other Carcharhinidae, especially blacktip sharks (*Carcharhinus limbatus).*

Silky sharks are probably caught more frequently in purse seine and in longline sets near continental or insular shelves. They are also associated with tuna schools and FADs, so are often incidentally caught when FADs are used (Filmalter et al. 2012). Juveniles, which are especially FAD oriented, usually stay within 100 m of the surface at all times, making them constantly vulnerable to purse seine gear. Juveniles make up the largest component of silky shark catch for the WCPO purse seiners (Hutchinson et al. 2013). They are especially problematic to fisherman as they commonly steal tuna catch and also damage gear. In some areas this damage is so prevalent they are known as the “net eater shark” (Compagno 1984b).

Lawson (2011) estimated the recent history of catch of the silky shark in the longline and purse seine fisheries in the WCPO (specifically, in the WCPFC Statistical Area east of 130° W longitude, and excluding the fisheries of the Philippines and Indonesia). The estimated average annual catch of silky sharks by longliners between 1992 and 2009 was 124,000 representing 6.18% of the total estimated shark catch of the main five sharks species caught by this fishery . For the years 1995 to 2010 in the purse seine industry the average catch of silky sharks was 51,608 sharks, 95.79% of the total average reported shark catch of the two main species caught (Lawson 2011). The estimated average annual catch for longliners and purse seiners combined was 235,000 for 2005-2009.

As described in the reports of the recent stock assessment for the silky shark in the WCPO (Rice and Harley 2012c), estimation of shark catches in fisheries where sharks are mostly taken incidentally is difficult, and population estimates are consequently provisional or indicative. For the purpose of the stock assessment, and using a variation of the catch estimation method introduced by Lawson (2011), Rice and Harley (2012c) estimated alternative catch histories for the stock. The estimated average annual catch, in numbers, for 2005-2009 were about 371,340 silky sharks in the WCPO.

3.3.2.3.6 Stock Status

For the United States, the silky shark is managed under the Pelagics FEP in the WCPO. Using the MSA stock status determination criteria established in the FEP, NMFS has determined that the stock status is unknown (i.e., with respect to whether it is overfished or subject to overfishing).[13]

Although NMFS has not made affirmative status determinations under the MSA, a stock assessment for the silky shark in the WCPO was prepared for the WCPFC in 2012. Rice and Harley (2012c) concluded that the estimated fishing mortality rate had increased to levels far in excess of F_{MSY} ($F_{CURRENT}/F_{MSY}$ = 6.4) and that estimated spawning biomass had declined to a level far below SB_{MSY} ($SB_{CURRENT}/SB_{MSY}$ = 0.66). The assessment report states that although there are difficulties with the data, size composition information show consistent declines over the 1995-2009 period of the model, as well as increasing fishing mortality and a recently declining CPUE trend.

[13] See NOAA Fisheries, Office of Sustainable Fisheries webpage at http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/.

3.3.3 Current Conservation Concerns and Measures

3.3.3.1 Global Status of Sharks

Data gaps on shark species contribute to difficulties in making accurate stock assessments. Underreporting of shark catch is common and in many fisheries, shark catch reports are not required, or are prone to errors. This makes it nearly impossible to accurately gauge the population levels from standard CPUE estimates, and also eliminates reliable data to base catch limits upon (Camhi et al. 2008a). Total shark biomass worldwide is estimated to be declining 6.4% to 7.9% per year as exploitation rates are much higher than the rebound rates. It is expected that shark numbers will continue to decline if fishing pressure remains at current levels (Worm et al. 2013). Worm et al. (2013) determined that 48% of shark species globally are fished well above rebound rates and that 68% of these exploited sharks have rebound rates that are smaller than their median global exploitation rate. Worm et al. 2013 defines a species rebound potential as the maximum rate of species increase given its life history and thus its ability to withstand fishing pressures or recover from overfishing when experiencing ideal environmental conditions.

The main threats to shark populations include various fishing activities, habitat loss and degradation, pollution, prey loss, and human recreational activities (Dulvy et al. 2003, Stevens et al. 2005, Clarke et al. 2006a). There is also the threat of rapid climate change. Water temperature changes may increase or shrink certain sharks' geographic ranges, while simultaneously changing the food chain. For example a coral bleaching event will cause disruption at the lowest level of the food chain that can cascade up to the sharks (while in some cases degrading their habitat). The ecological specialism and small geographic ranges seen in some species of sharks may make put them especially at risk (Dulvy et al. 2003).

3.3.3.2 International Conservation Measures

The International Union for Conservation of Nature's (IUCN) group of shark analysts considers 28% of all sharks listed (and considered data sufficient) on its database at risk of extinction. Though further stock assessments and data collection could reveal a much more dire outlook. Sharks have historically been neglected by fishery managers, demonstrated in part by the fact that pelagic shark fisheries are less regulated than coastal ones (Camhi et al. 2008a, b).

These issues have not gone completely unrecognized. In 1999 the International Plan of Action for the Conservation and Management of Sharks (IOPA-Sharks) recognized the need for responsible management and suggested voluntary guidelines. However, implementation on national levels has been slow or ignored. Thirteen nations have adopted a National Plan of Action, but many others have drafted them without reaching approval (FAO 2014, Camhi et al. 2008c).

A few nations (notably the United States and Japan) now require logbook reporting to enhance better understanding of catch numbers and population dynamics of shark species. Many countries are passing finning regulations (many adhere to the fins attached, and the no more than 5% of body weight rule) and some have banned shark fishing in their EEZs outright (Table 16). Others have extended protection to certain species like whale sharks, great whites, or basking sharks (Camhi et al. 2008a).

There is no international or regional body that specifically governs the management of sharks (Camhi et al. 2008a); however there are many organizations that do try to establish their own international and regional rules. Shark data are now collected by most regional fisheries management organizations (RFMOs).

The Convention on International Trade in Endangered Species (CITES) met most recently in early 2013 for the Sixteenth Meeting of the Conference of the Parties. In an unprecedented move for shark conservation, CITES decided to add five shark and ray species to Appendix II[14]. Oceanic whitetip sharks, scalloped hammerhead sharks, smooth hammerhead sharks (*Sphyrna zygaena*), great hammerhead sharks (*Sphyrna mokarran*), and porbeagle sharks were all included on Appendix II. Appendix II requires certifications that any exports of oceanic whitetip shark products were legally obtained and that the fishing methods used are sustainable to help ensure the future of the species. These regulations could help lower mortality and increase monitoring, but compliance could be variable.

Table 16 below provides countries and organizations with shark conservation measures, while Table 17 below provides the Endangered Species Act (ESA), World Conservation Union, and CITES status of WCPO shark species.

[14] Under CITES, species are listed in one of three appendices. Species listed in Appendix I are species considered to be threatened with extinction and trade of these species is limited to exceptional circumstances – to situations where the specimen of the species is not to be used for primarily commercial purposes and the import will not be detrimental to the survival of the species. Species listed in Appendix II are those that are not necessarily threatened with extinction, but for which trade restrictions are necessary for the survival of the species. Species listed in Appendix III are those that are considered protected species in at least one CITES country and that country has asked CITES for assistance in managing the trade of the species (“How Cites works” page of CITES website site at http://www.cites.org/eng/disc/how.php).

Table 16: Countries and Organizations with Shark Conservation Measures

Countries with Active Finning Regulations	Countries with Shark Take Bans in Their EEZ or Defined Exclusion Zones	Regional Fisheries Management Organizations (RFMO) with Shark Protection Measures
Argentina	American Samoa	CCAMLR
Australia	Bahamas	GFCM
Brazil	Brunei	IATTC
Canada	Congo-Brazzaville	ICCAT
Cape Verde	Cook Islands	IOTC
Chile	Ecuador (directed shark fishing prohibited, incidental catch must be fully utilized, fins landed must be naturally attached)	NAFO
Colombia	Egypt	NEAFC
Costa Rica	Fiji (Pending)	SEAFO
Gambia	French Polynesia	WCPFC
Guinea	Guinea-Bissau	
El Salvador	Honduras	
Japan	Israel	
India	Maldives	
Members of the EU	Marshall Islands	
Mexico	Mauritania	
Namibia	Palau	
New Zealand	Raja Ampat Islands, Indonesia	
Nicaragua	Saudi Arabia	
Nigeria	Tokelau	
Pakistan		
Oman		
Panama		
Seychelles		
Sierra Leone		
South Africa		
Spain		
Sri Lanka		
Taiwan		
United Arab Emirates		
United Kingdom		
United States		
Venezuela		

Source: [Camhi et al. 2008a, HSI 2014]

Table 17: WCPO Shark Species: Internationally Designated Conservation Status

Species	ESA Status[15]	The World Conservation Union[16]	CITES[17]
Basking shark (*Cetorhinus maximus*)	Negative 90-Day ESA finding 2013, North Pacific and Northeast Atlantic	Endangered in North Pacific	Appendix II, entire range
Baxter's lantern dogfish *(Etmopterus baxteri)*	Not listed	Least Concern	Not listed
Bigeye sand tiger shark (*Odontaspis noronhai*)	Not listed	Data Deficient	Not listed
Bigeye thresher shark (*Alopias superciliosus)*	Not listed	Vulnerable	Not listed
Bignose shark (*Carcharhinus altimus*)	Not listed	Data Deficient	Not listed
Blacktip reef shark (*Carcharhinus melanopterus*)	Not listed	Near Threatened	Not listed
Blacktip shark (*Carcharhinus limbatus*)	Not listed	Near Threatened	Not listed
Blue shark (*Prionace glauca*)	Not listed	Near Threatened	Not listed
Broadsnouted sevengill shark (*Notorynchus cepedianus*)	Not listed	Near Threatened East Pacific, Data Deficient elsewhere	Not listed
Bronze whaler shark (*Carcharhinus brachyurus*)	Not listed	Vulnerable East Asia, Near Threatened elsewhere	Not listed
Bull shark (*Carcharhinus leucas*)	Not listed	Near Threatened	Not listed
Bullhead sharks (Heterodontiformes spp.)	Not listed	Data Deficient/Least Concern	Not listed
Carpet shark (*Cephaloscyllium isabellum*)	Not listed	Least Concern	Not listed
Common thresher shark (*Alopias vulpinus*)	Not listed	Vulnerable	Not listed
Cookie-cutter shark *(Isistius brasiliensis)*	Not listed	Least Concern	Not listed
Crocodile shark (*Pseudocarcharius kamoharia*)	Not listed	Near Threatened	Not listed

[15] U.S. Endangered Species Act - http://www.nmfs.noaa.gov/pr/species/esa.htm, 2014.
[16] IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. www.iucnredlist.org. Shark group has not updated since 2006.
[17] CITES, http://www.cites.org/eng/app/appendices.php, 2014.

Deepwater spiny dogfish *(Centrophorus squamosus)*	Not listed	Vulnerable	Not listed
Dusky shark (*Carcharhinus obscurus*)	Candidate for ESA listing 2013	Vulnerable	Rejected proposal, Appendix II, 2010
Dumb gulper shark (Harrison's dogfish) (*Centrophorus harrissoni)*	Candidate for ESA listing 2013	Endangered	Not listed
Galapagos shark (*Carcharhinus galapagensis*)	Not listed	Near Threatened	Not listed
Gray reef shark (*Carcharhinus amblyrhynchos*)	Not listed	Near Threatened	Not listed
Great hammerhead shark (*Sphyrna mokarran*)	Candidate for ESA listing 2013	Endangered	Appendix II, 2013
Great white shark (*Carcharodon carcharias*)	ESA listing not warranted, 2013	Vulnerable	Appendix II, entire range
Largespine velvet dogfish *(Proscymnodon macracanthus)*	Not listed	Data Deficient	Not listed
Longfin mako shark (*Isurus paucus*)	Not listed	Vulnerable	Not listed
Longnose velvet dogfish (*Centroselachus crepidater*)	Not listed	Least Concern	Not listed
Megamouth shark (*Megachasma pelagios*)*	Not listed	Data Deficient	Not listed
Oceanic whitetip shark *(Carcharhinus longimanus)*	Not listed	Vulnerable	Appendix II, entire range, 2013
Pelagic thresher shark (*Alopias pelagicas*)	Not listed	Vulnerable	Not listed
Plunket's shark (dogfish) *(Proscymnodon plunketi*)	Not listed	Near Threatened	Not listed
Porbeagle shark (*Lamna nasus*)	Entire range –Negative 90-Day ESA finding 2010	Vulnerable	Appendix II
Portuguese dogfish (*Centroscymnus coelolepis*)	Not listed	Near Threatened	Not listed
Roughskin dogfish (*Centroscymnus owstoni*)	Not listed	Least Concern	Not listed
Salmon shark (*Lamna ditropis*)	Not listed	Least Concern	Not listed
Sandbar shark (*Carcharhinus plumbeus*)	Not listed	Vulnerable	Rejected proposal, Appendix II, 2010

Scalloped hammerhead shark (*Sphyrna lewini*)	Listed[18]	Endangered	Appendix II, 2013, Appendix III for Costa Rica
School shark (*Galeorhinus galeus*)	Not listed	Vulnerable	Not listed
Seal shark (aka black, kitefin) (*Dalatias licha*)	Not listed	Near Threatened	Not listed
Sharpsnouted sevengill shark (*Heptranchias perlo*)	Not listed	Near Threatened	Not listed
Shortfin mako shark *(Isurus oxyrinchus)*	Not listed	Vulnerable	Not listed
Shovelnose spiny dogfish (*Deania calcea*)	Not listed	Least Concern	Not listed
Silky shark (*Carcharhinus falciformis*)	Not listed	Near Threatened	Not listed
Silvertip shark (*C. albimarginatus*)	Not listed	Near Threatened	Not listed
Slender hammerhead shark (*Eusphyra blochii*)*	Not listed	Near Threatened	Not listed
Smooth hammerhead shark *(Sphyrna zygaena)*	Not listed	Vulnerable	Appendix II, 2013
Tiger shark (*Galeocerdo cuvier*)	Not listed	Near Threatened	Not listed
Velvet dogfish (*Zameus squamulosus*)	Not listed	Data Deficient	Not listed
Whale shark (*Rhincodon typus*)	Negative 90-Day ESA finding 2013	Vulnerable	Appendix II, entire range
Whitenose shark (*Nasolamia velox*)	Not listed	Data Deficient	Not listed
Whitetail dogfish (*Scymnodalatias albicauda*)	Not listed	Data Deficient	Not listed
Whitetip reef shark (*Triaenodon obesus*)	Not listed	Near Threatened	Not listed

*Denotes species that have not been recorded to interact with WCPO fisheries, species interaction determined from Kirby (2006).

3.3.4 Recent U.S. Shark Management Measures

The Shark Finning Prohibition Act of 2000 (SFPA; Pub. L. 106-557) made it illegal to remove any of the fins of a shark (including the tail) and discard the carcass of the shark at sea, to have custody, control, or possession of any such fin aboard a fishing vessel without the corresponding carcass, or to land any such fins without the corresponding carcass. The Shark Conservation Act of 2010 (Pub. L 111-348) amended the language of the SFPA to prohibit finning practices that had continued on some vessels.

[18] 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.

As of this writing, there are several shark species being evaluated for listing under the ESA.[19]

There are eleven shark species currently being considered as ESA candidate species (78 FR 69376, 78 FR 29100, 78 FR 24701). Candidate species are any species that are undergoing a status review by NOAA. These species may have been the subject of a petition requesting that they be listed under the ESA, or have been proposed for listing by the agency itself. These species will undergo a 90 day evaluation period to determine if they warrant being listed as threatened or endangered under the ESA. Two species currently being considered are found in the WCPO: the great hammerhead shark (*Sphyrna mokarran*) and the dumb gulper shark (*Centrophorus harrissoni*). All the others are Atlantic species or only being evaluated in their Atlantic distinct population segment (DPS).

As stated above, four DPSs of the scalloped hammerhead shark (*Sphyrna lewini*), have been listed under the ESA, effective September 2, 2014. The history and current status of the sharks in the WCPO in regards to the ESA can be seen above in Table 17.

3.3.5 Post Release Survival Rates

Sharks that are caught on or entangled in fishing gear are subject to several potential stresses and injuries, depending on gear type and the handling they receive (Skomal 2007). Many of these injuries are not fatal in themselves, but when combined with other factors such as increased stress, the experience can prove deadly to the shark, even when released “alive” initially (Skomal 2007). Trauma can occur externally, such as cuts and scrapes from rough handling or interaction with fishing gear, or can be internal such as organ damage caused by contusions or tissue damage caused by swallowed hooks or changes to osmoregulation and blood chemistry. Hook type and hooking site also influences survival rates (Campana et al. 2009). For example, jaw hookings are more survivable than stomach hookings, especially when a hook is retained internally (Skomal 2007, Campana et al. 2009).

Internal physiological stress also determines the survivability of a capture event. Time out of water or entanglement that decreases mobility and restricts water flow over the gills causes critical oxygen levels to be depleted and carbon dioxide to build up in the blood (Skomal and Chase 2002, Frick et al. 2010). Muscular fatigue is also a factor as many sharks struggle violently when captured. Changes in biochemistry are seen also in the blood (Skomal 2007). Stress hormones, pH, lactate, electrolyte, metabolite, and proteins all change dramatically during and after a capture event (Skomal 2007, Skomal and Chase 2002, Frick et al. 2010).

Sharks may also be subject to predation while trapped on or in gear, or during the post release recovery period (Skomal and Chase 2002, Filmalter et al. 2012). Almost all sharks demonstrated the need for a recovery period, ranging from less than two hours (Skomal and Chase 2002) to 27 days (Campana et al. 2009).

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[19] http://www.nmfs.noaa.gov/pr/species/esa/candidate.htm#proposed

Survival rates also appear to be highly dependent on the species. Using a satellite tags, blood chemistry and a model to predict survivorship, Moyes et al. (2006) found that blue sharks were particularly resilient estimating that 90% of the 174 they caught on longline gear survived after being released. A similar study using longline gear (Campana et al. 2009) saw 35% mortality. In contrast, silky sharks, one of the main incidentally caught species in the Indian Ocean, were studied for their resilience to capture during routine purse seine fishing (Filmalter et al. 2012). Out of the 86 sharks caught during a 39 day cruise, 74% were deemed mortalities as soon as they came on deck. An additional 8% to 17% (7 sharks remained unaccounted for) were judged to have died post release by way of dart and satellite tags. The total estimated mortality for the study was between 82% and 91%.

Post release survival studies specifically examining oceanic whitetip sharks or whale sharks have not been done at this time. Silky sharks, however, were examined in both the previously mentioned study and Hutchinson et al.'s (2013) study of purse seine fishing in the WCPO. They found that post release mortality rates of silky sharks topped 84%. The best chance at survival for silky sharks is to be released after being encircled and before being entangled in the net (100%). Entangled sharks that were released shortly into the hauling process had a survival rate of 68.7%. As soon as the sharks are lifted in a brail their survival rate drops to 16.7% (for the first) and down to just 6.67% in subsequent brails. Minimizing handling and time out of the water seems to be key for the post-capture survival of silky sharks.

3.4 Physical Setting

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.

3.4.1 Oceanography

The WCPO contains several major currents and one major gyre that control most of the mixing patterns and nutrient flow of the system. Currents and mixing patterns are influenced by large-scale oceanographic events, such as El Niño Southern Oscillation (ENSO), or La Niña, which change the characteristics of water temperature and productivity. ENSO events cause 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 slows, leaving warm, nutrient poor surface water pooled in the EPO (Kamikuri et al. 2009).

El Niño affects the ecosystem dynamics in the equatorial and subtropical Pacific by significantly warming the upper ocean layer, raising the thermocline in the western Pacific and lowering it 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). A La Niña event exhibits the opposite conditions: cooler than normal sea-surface temperatures in the central and eastern tropical Pacific Ocean that can impact global weather patterns.

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 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.

3.4.2 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, pH, 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, and 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, van 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 ecosystems and commercial fisheries. Climate change may impact commercial fisheries by: (1) increasing in ocean stratification leading to less primary production, which in turn leads to less overall energy for fish production; (2) decreasing spawning habitat leading to decreased stock sizes; and (3) changes in currents that may lead to changes in larval dispersal and retention, which could also lead to decreases in stock sizes (Roessig et al. 2004).

Ainsworth et al. (2011) also investigated 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).

3.4.3 Habitat Change

Ocean habitat can be affected by changes in pH, nutrient influxes, pollution, and construction activities. 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.

Areas near coastlines are especially sensitive to nutrient influxes. Rivers discharge elements like phosphorous and nitrogen from both natural sources like green waste or from human activity such as fertilizer runoff, sewage discharge, urban storm water, and deposition of atmospheric particles from fossil fuel combustion (Paerl 1997, Slomp and Cappellen 2004). Iron, another limiting nutrient, is blown into the ocean through dust clouds. An overdose from any of these sources can cause eutrophication of coastal waters, including blooms of algae that can produce a toxin that can be consumed by shellfish and transmitted to their consumers, including humans (Paerl 1997). Eutrophication can also block sunlight and starve photosynthetic benthic life. Nutrients are also often transported in particulate form which can accumulate and smother benthic communities.

Other impacts to ocean habitat come from pollution, and construction. The following are examples of pollution: $CO_{2,}$ nitrogen and phosphorus, radioactive waste, plastic and other trash, chemicals and pharmaceuticals, oil spills, and even noise and heat. The construction of shoreline or at sea structures can also impact habitat by altering substrate, removing areas from biological use, creating noise and vibration pollution, as well as disturbing/disrupting sediment dynamics. Animals can be blocked from traditional habitat or breeding grounds, scared away, disoriented or poisoned.

Over exploitation of any species can disrupt ecosystem balance. Over exploitation can come from fishing pressure or natural pressures from higher trophic levels. A reduction in a prey species can cause higher trophic levels to collapse; conversely, by removing top predators, mid and low trophic level species may expand due to the elimination of competition and predation, which may in turn cause overgrazing on the lowest trophic levels (Hinke et al. 2004, Halpern et al. 2006).

3.5 Biological Environment

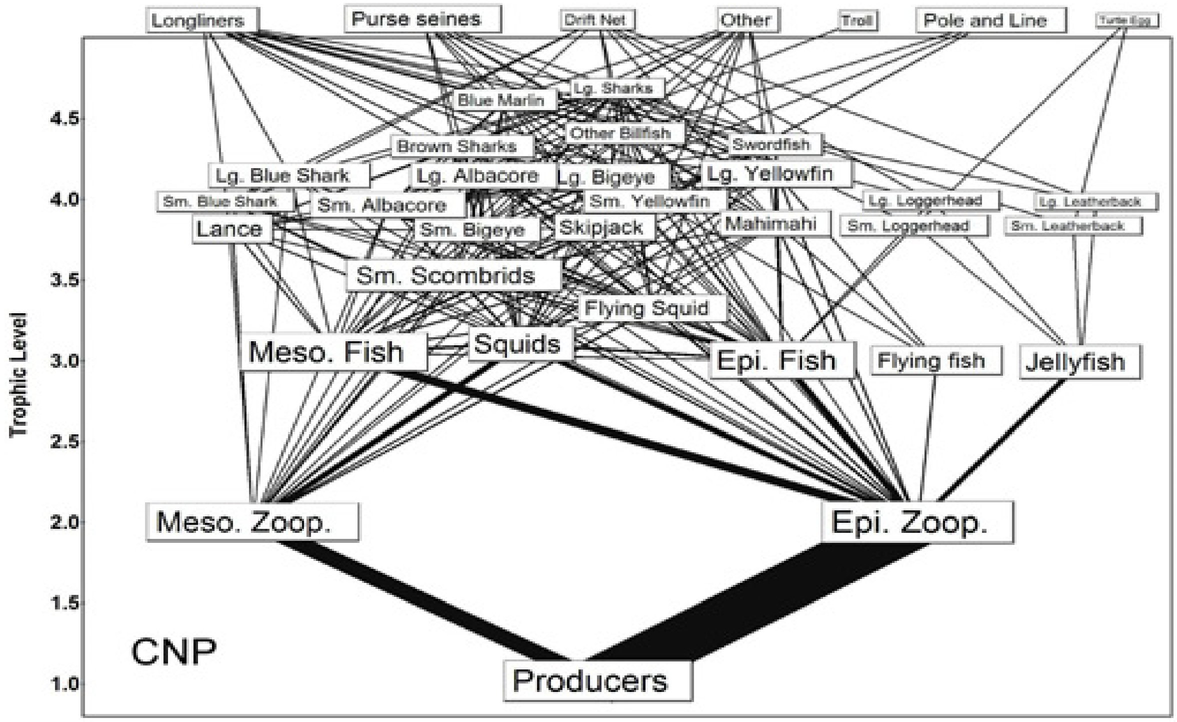
This section describes the other primary biological resources in the Convention Area as well as ecological interactions between the species.

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, 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; planktonic animals such as copepods and larval stages of fish. These microorganisms drift through the water column grazing on phytoplankton (plant-like plankton) 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 predators, species that tend to migrate from coastal to deep ocean waters. They are also prey to the apex predators, species at the top-most trophic levels. Species at this trophic level include tunas, billfish, and sharks. Dominant predators as well as apex predators often 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 4 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 survive at 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 4: 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 4). Precise 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 can not necessarily 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).

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 has been postulated as possible leading to the outright collapse of the food chain (Sibert et al. 2006).

In 2010, SPC, OFP 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 tunas were found to primarily eat smaller fish, followed by mollusks and crustaceans (Allain 2010).

3.5.2 Target Stocks

Table 18 shows the U.S. official designation of the current status of the main target stocks in the fisheries that would be affected by the proposed rule.

Table 18: Stock status summary of main target HMS for U.S. longline fleets in the Pacific Ocean

Species	Stock	Overfishing?	Overfished?
Albacore (*Thunnus alalunga)*	North Pacific	No	No
	South Pacific	No	No
Bigeye tuna (*Thunnus obesus)*	Pacific	**Yes**	No
Blue marlin (*Makaira nigricans)*	Pacific	No	No
Mahimahi (dolphinfish, *Coryphaena hippurus*)	Pacific	Unknown	Unknown
Skipjack tuna *(Katsuwonus pelamis)*	Central western Pacific	No	No
Swordfish *(Xiphias gladius)*	North Pacific	No	No
Yellowfin tuna (*Thunnus albacares)*	Central western Pacific	No	No
	Eastern tropical Pacific	No	No
Wahoo (*Acanthocybium solandri)*	Pacific	Unknown	Unknown

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

3.6 Protected Resources

This section provides information on protected resources in the WCPO.

3.6.1 Threatened and Endangered Species

Table 19 includes species listed under the U.S. Endangered Species Act 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 United States Fish and Wildlife Service (USFWS) has jurisdiction over these seven species.

Table 19: Listing Status of Species in the WCPO Listed as Endangered or Threatened Under the U.S. Endangered Species Act

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[20]	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[21]	Endangered
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]

[20] 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).

[21] 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.

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 19) are listed in Table 20 below.

Table 20: Non- Listed Marine Species 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	Pygmy 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	Pygmy 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
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[22]
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; NOAA, http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans, 2014.]

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.[23]

EFH and HAPC have been designated in the WCPO for pelagic, bottomfish and seamount groundfish, precious corals, crustaceans, and coral reef species. Table 21 lists the EFH and HAPC for species managed under the various western Pacific FEPs.

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[22] As stated in Table 19 above, the Main Hawaiian Islands insular false killer whale distinct population segment has been listed as endangered.

[23] 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 21: EFH and HAPC for Management Unit Species for the Western Pacific Region[24]

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 Pacific Remote Island Areas, many specific areas of coral reef habitat

Source: [FEP for the American Samoa Archipelago, Table 20 (WPRFMC 2009b)]

[24] All areas bounded by the shoreline and the outward boundary of the U.S. EEZ, unless otherwise indicated.

3.6.4 National Wildlife Refuges and Monuments

Pursuant to the National Wildlife System Administration Act of 1966 (NWSAA; 16 USC 668dd, *et seq*.), USFWS carries out the mission of National Wildlife Refuges (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 Environmental Consequences

This chapter provides an analysis of the direct and indirect environmental effects that could be caused by the implementation of the oceanic whitetip shark, the silky shark, and the whale shark elements of the proposed rule under Alternative B, as well as Alternative A, the No-Action Alternative, and compares the alternatives; cumulative effects are addressed in Chapter 5.[25]

This chapter begins with a discussion of the potential impacts[26] from each of the alternatives to the HMS fisheries in the Convention Area that could be affected by the proposed rule. Then, Sections 4.11 through 4.18 analyze the potential environmental impacts these changes to the fisheries could cause to the resources in the affected environment.

4.1 The U.S. WCPO Purse Seine Fishery

The direct and indirect effects to the U.S. WCPO purse seine fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The Regulatory Impact Review (RIR) for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

4.1.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark, the silky shark, and the whale shark would not go into effect, and the U.S. WCPO purse seine fishery would continue to be managed under existing regulatory requirements, including SPTT-related requirements, and any changes or new requirements as the result of a renegotiated SPTT and its associated economic assistance agreement, as described in more detail in Section 3.2.1 of this EA. Under this alternative there would be no direct or indirect changes to the fishing patterns or practices of the fishery.

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[25] 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.

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

4.1.2 Alternative B: The Action Alternative

Under Alternative B, all six elements of the proposed rule, as described in Chapter 2 of this EA, would be implemented.

The three oceanic whitetip shark and silky shark elements would: (1) prohibit the crew, operator, and owner of the vessel from retaining on board, transshipping, storing, or landing any part or whole carcass of an oceanic whitetip shark or silky shark that is caught in the Convention Area; (2) would require the crew, operator, and owner to release any oceanic whitetip shark or silky shark caught in the Convention Area as soon as possible after the shark is caught and brought alongside the vessel, and ensure that reasonable steps are taken to ensure its safe release, without compromising the safety of any persons, and (3) notwithstanding the first two elements, would allow NMFS or WCPFC observers to collect samples of oceanic whitetip sharks and silky sharks that are dead when brought alongside the vessel, with the assistance of the crew, operator or owner of the vessel.

As indicated in Section 3.2.1 of this EA, U.S. purse seine vessels operating in the WCPO do not catch or retain many oceanic whitetip sharks or silky sharks, though the number of silky sharks caught is much greater than the number of oceanic whitetip sharks that are caught. Based on the 2010-2011 data, as shown in Table 1of this EA, the annual U.S. purse seine fishing effort in the Convention Area is 7,450 sets per year. Using the interaction rates in Table 4 of this EA, Table 22 below shows the annual number of oceanic whitetip sharks and silky sharks that are expected to be caught, kept and discarded by U.S. purse seine vessels operating in the Convention Area if the proposed rule were not implemented (i.e., under the No-Action Alternative).

Table 22: Expected approximate fishing effort, catches, and fate of oceanic whitetip sharks and silky sharks in the Convention Area under the No-Action Alternative.

Fishery	Annual fishing effort		Annual number caught		Annual number kept		Annual number discarded	
			OWT	Silky	OWT	Silky	OWT	Silky
Purse seine	7,450	sets	95	5,638	3	114	92	5,560
Hawaii LL deep	14,468	sets	1,008	1,055	18	13	990	1,042
Hawaii LL shallow	1,052	sets	58	6	6	0	52	6
Am. Samoa LL	4,414	sets	544	1,578	1	3	543	1,575
Hawaii troll	29,565	days fished	90		9		81	
Am Samoa troll	100	trips			0.3			
CNMI troll	4,092	trips			0			
Guam troll	8,514	trips			2			

Expected levels of fishing effort and of retained and discarded catches are based on the 2008-2012 average annual level of fishing effort and the 2008-2012 average annual retention and discard rates (per unit of fishing effort) in each fishery, except the purse seine fishery, for which the 2010-2011 average annual levels are used (see chapter 3 of this EA for those histories and data sources).

Some of the numbers might not sum because of rounding. For purse seine the catch rate for a given year was calculated as the product of the proportion of all observed sets in which at least one individual of the species was caught and the average number of individuals caught per such set (which was recorded for only some such sets). The sum of kept rates and discarded rates do not sum to the catch rate because as described above they are based on the numbers of sets in which catches of the species occurred; in those cases where some of the catch from a given set was kept and the remainder was discarded, the entire set's catch was counted here as both kept and discarded (so both the kept rates and discard rates could be slightly over-estimated).

See Chapter 3 of this EA for limitations in the reliability of the catch data for the purse seine and troll fisheries; given these limitations, these projections should be considered to be only roughly indicative of expected future catches and retained catches in those fisheries.

For the troll fisheries, the numbers given are upper-bound estimates in that they assume that all unidentified sharks in the historical data were oceanic whitetip shark or silky shark.

Table 22 shows that the majority of oceanic whitetip sharks and silky sharks caught by U.S. purse seine vessels in the Convention Area are discarded, so the first element of the proposed rule would cause only minor effects on the operations of the U.S. purse seine fishery in the Convention Area. As indicated in Table 22, only 2 percent of silky sharks that are caught are retained and only 3 percent of oceanic whitetip sharks that are caught are retained. Thus, the first element of the proposed rule would be expected to lead to only minor changes in the species composition of the fish retained by U.S. purse seine vessels fishing in the Convention Area.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of U.S. purse seine vessels to release oceanic whitetip sharks and silky sharks are unknown, but are believed to occur on the deck of the vessel upon brailing, so implementation of the requirements to release the sharks as soon as possible and to take steps to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes; the crew, operators, and owners could have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the purse seine fishery.

The three whale shark elements of the proposed rule would (1) prohibit the crew, operator, and owner of the vessel from setting or attempting to set a purse seine in the Convention Area on or around a whale shark if the animal is sighted prior to the commencement of the set or the attempted set; (2) require the crew, operator, and owner of the fishing vessel to release any whale shark that is encircled in a purse seine net in the Convention Area, and ensure that reasonable steps are taken to ensure its safe release, without compromising the safety of any persons, and (3) require the owner and operator of a fishing vessel that encircles a whale shark with a purse seine in the Convention Area to ensure that the incident is recorded by the end of the day on the catch report form, or RPL maintained pursuant to 50 CFR § 300.34(c)(1), in the format specified by the Pacific Islands Regional Administrator. All of the elements would apply on the high seas and in the EEZs of the Convention Area; the first element would not apply in the EEZs of the PNA.

As indicated in Table 2 of this EA, U.S. purse seine vessels operating in the WCPO do not interact frequently with whale sharks. Based on the 2010-2011 data, as shown in Table 1 of this EA, the annual U.S. purse seine fishing effort in the Convention Area is 7,991 fishing days per year, 7,339 days in PNA EEZs and 652 days on the high seas and in the U.S. EEZ. Using the catch rates in Table 2 and Table 3 of this EA, five whale sharks would be caught per 1,000 fishing days in the Convention Area and two whale sharks are caught per 1,000 fishing days in the Convention Area, excluding the PNA EEZs. However, catch rates are not equivalent to instances of whale sharks being sighted in the vicinity of a desired set. On the one hand, presumably not all whale sharks within “sightable” distance of a set are actually caught in the gear. On the other hand, according to anecdotal information from purse seine vessel operators, not all captured whale sharks are seen before the set commences (thus the 2010-2011 catch data include events that would not be subject to the prohibition). Thus, it is not possible to project the rate of pre-set whale shark-sighting events with any certainty. Nonetheless, the observed catch rates of 2-5 whale sharks per thousand fishing days give a rough indication of the likely frequency of such events. Using 652 fishing days per year on the high seas and in the U.S. EEZ, this would equate to about 1-3 sharks caught per year on the high seas and in the U.S. EEZ. Using 7,339 fishing days per year in PNA EEZs; this would equate to about 15-37 sharks caught per year in PNA EEZs.

Based on the data and a fairly limited projected frequency of whale shark interactions with U.S. purse seine vessels, the three whale shark elements of the proposed rule would only have minor effects on the operations of the fishery. In those instances that a whale shark is sighted prior to a set, the vessel operator would have to wait and/or move the vessel to find the next opportunity to make a set. This could lead to some loss in fishing time and an increase in distance traveled by vessels. The requirement to release any encircled whale sharks would not be expected to cause effects on fishing operations because based on the historical vessel observer data, all captured whale sharks would be expected to be released even without this requirement. However, the specific methods currently used by the crew, operators, and owners of U.S. purse seine vessels to release whale sharks are not definitively known, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes; the crew, operators, and owners could have less time for other tasks, such as fishing or searching for fish. The requirement to report all whale shark encirclements in the Convention Area in the vessel logbook would also lead to some minor effects on the operations of the fishery, as labor and time would be required to record the information. Catch and effort logbooks are already required to be maintained and submitted to NMFS, so the time would be required only for recording the additional information in the already-required logbook. The required information for each fish would include a description of the steps taken to minimize harm and an assessment of its condition upon its release. NMFS estimates that it would take about 10 minutes to record this information for each whale shark encirclement. Given the projected low frequency of whale shark interactions with U.S. purse seine vessels operating in the Convention Area – 2 to 5 interactions per 1,000 fishing days – it is unlikely that any of the whale shark elements of the proposed rule would substantially affect the fishing patterns or practices of the fleet or cause substantial operational changes to the fishery.

In summary, the six elements of the proposed rule could cause some minor effects on the operations of the U.S. purse seine fishery in the WCPO, but would not be expected to lead to substantial changes in the fishing patterns and practices of the fleet. The oceanic whitetip shark and silky shark elements of the proposed rule could cause some minor changes in the species composition of retained catch as well as some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught. The whale shark elements of the proposed rule could also cause some minor changes in terms of time spent on fishing or other activities, since vessel owners/operators/crew may need to wait or change locations to make sets, increase handling time to release sharks that are caught, and spend time reporting on whale shark encirclements.

4.2 The Hawaii-based Deep-set Longline Fishery

The direct and indirect effects to the Hawaii-based deep-set longline fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The RIR for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

Only the three oceanic whitetip shark and silky shark elements of the proposed rule would be applicable to this fishery.

4.2.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark and the silky shark would not go into effect and the fishery would continue to be managed under existing requirements, as described in Chapter 3 of this EA. Under this alternative, there would be no direct or indirect effects to the fishing patterns or practices of the fishery.

4.2.2 Alternative B: The Action Alternative

Under Alternative B, the three oceanic whitetip shark and silky shark elements of the proposed rule would be implemented. As indicated in Table 7 of this EA, vessels in the Hawaii-based deep-set longline fishery do not catch or retain many oceanic whitetip sharks or silky sharks. Based on the data in Table 5 of this EA for the years 2008-2012, the average annual effort in the Hawaii-based deep-set longline fishery is 14,468 sets (or 33,451,386 hooks) per year. Thus, using the interaction data in Table 7 of this EA, Table 22 above shows the projected annual number of oceanic and silky sharks caught, retained and discarded by vessels in the Hawaii-based deep-set longline fishery under the No-Action Alternative.

Table 22 shows that the number of oceanic whitetip sharks and silky sharks retained by Hawaii-based deep-set longline vessels in the Convention Area is small, so the first element of the proposed rule would cause only minor effects on the operations of the Hawaii-based deep-set fishery. The first element of the proposed rule would be expected to lead to only minor changes in the species composition of the fish retained by the Hawaii-based deep-set longline vessels fishing in the Convention Area; the increase in discards of oceanic whitetip sharks and silky sharks could increase the hold space available for other fish, such as the target tuna species caught by these vessels.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes, as the crew, operators, and owners would then have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the Hawaii-based deep-set longline fishery.

4.3 The Hawaii-based Shallow-set Longline Fishery

The direct and indirect effects to the Hawaii-based shallow-set longline fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The RIR for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

Only the three oceanic whitetip shark and silky shark elements of the proposed rule would be applicable to this fishery.

4.3.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark and the silky shark would not go into effect and the fishery would continue to be managed under existing requirements, as described in Chapter 3 of this EA. Under this alternative, there would be no direct or indirect effects to the fishing patterns or practices of the fishery.

4.3.2 Alternative B: The Action Alternative

Under Alternative B, the three oceanic whitetip shark and silky shark elements of the proposed rule would be implemented. As indicated in Table 8 of this EA, vessels in the Hawaii-based shallow-set longline fishery do not catch or retain many oceanic whitetip sharks or silky sharks. Based on the data in Table 6 of this EA for the years 2008-2012, the average annual effort in the Hawaii-based shallow-set longline fishery is 1,052 sets (or 1,058,828 hooks) per year. Thus, using the interaction data in Table 8 of this EA, Table 22 above shows the projected annual number of oceanic and silky sharks caught, retained and discarded by vessels in the Hawaii-based shallow-set longline fishery under the No-Action Alternative.

Table 22 shows that the number of oceanic whitetip sharks and silky sharks retained by Hawaii-based shallow-set longline vessels in the Convention Area is small, so the first element of the proposed rule would cause only minor effects on the operations of the Hawaii-based shallow-set fishery. As indicated in Table 22, only a small amount of the oceanic whitetip sharks that are caught per year is retained and virtually no silky sharks are retained. Thus, the first element of the proposed rule would be expected to lead to only minor changes in the species composition of the fish retained by the Hawaii-based shallow-set longline vessels fishing in the Convention Area; the increase in discards of oceanic whitetip sharks and silky sharks could increase the hold space available for other fish, such as the target tuna species caught by these vessels.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes; the crew, operators, and owners could have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the Hawaii-based shallow-set longline fishery.

4.4 American Samoa Longline Fishery

The direct and indirect effects to the American Samoa longline fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The RIR for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

Only the three oceanic whitetip shark and silky shark elements of the proposed rule would be applicable to this fishery.

4.4.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark and the silky shark would not go into effect and the fishery would continue to be managed under existing requirements, as described in Chapter 3 of this EA. Under this alternative, there would be no direct or indirect effects to the fishing patterns or practices of the fishery.

4.4.2 Alternative B: The Action Alternative

Under Alternative B, the three oceanic whitetip shark and silky shark elements of the proposed rule would be implemented. As indicated in Table 10 of this EA, vessels in the American Samoa longline fishery do not catch or retain many oceanic whitetip sharks or silky sharks. Based on the data in Table 9 of this EA for the years 2008-2012, the average annual effort in the American Samoa longline fishery is 4,414 sets (or 13,051,062 hooks) per year. Thus, using the interaction data in Table 10 of this EA, Table 22 above shows the projected annual number of oceanic and silky sharks caught, retained and discarded by vessels in the American Samoa longline fishery under the No-Action Alternative.

Table 22 shows that the number of oceanic whitetip sharks and silky sharks retained by American Samoa longline vessels in the Convention Area is small, so the first element of the proposed rule would cause only minor effects on the operations of the American Samoa longline fishery. As indicated in Table 22, only a small amount of silky sharks and oceanic whitetip sharks that are caught per year are retained. Thus, the first element of the proposed rule would be expected to lead to only minor changes in the species composition of the fish retained by the American Samoa longline vessels fishing in the Convention Area; the increase in discards of oceanic whitetip sharks and silky sharks could increase the hold space available for other fish, such as the target tuna species caught by these vessels.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes; the crew, operators, and owners could have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the American Samoa longline fishery.

4.5 Mariana Islands Longline Fishery

The direct and indirect effects to the Mariana Islands longline fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The RIR for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

Only the three oceanic whitetip shark and silky shark elements of the proposed rule would be applicable to this fishery.

4.5.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark and the silky shark would not go into effect and the fishery would continue to be managed under existing requirements, as described in Chapter 3 of this EA. Under this alternative, there would be no direct or indirect effects to the fishing patterns or practices of the fishery.

4.5.2 Alternative B: The Action Alternative

As stated in Section 3.2.2 of this EA, due to the small number of vessels participating in this fishery, the data are confidential and a quantitative basis cannot be provided for anticipated interaction rates with oceanic whitetip sharks and silky sharks in this fishery. However, given the geographic location of the fishery and types of species targeted, the Hawaii based deep-set longline fishery is probably similar to this fishery. Using the interaction rates for the Hawaii deep-set longline fishery provided in Table 22 above, and given the small number of vessels in the Mariana Islands longline fishery, it is unlikely that many oceanic whitetip sharks or silky sharks are caught in this fishery. Thus, the first element of the proposed rule would be expected to lead to only minor changes in the species composition of the fish retained by the Mariana Islands longline vessels fishing in the Convention Area; the increase in discards of any oceanic whitetip sharks and silky sharks that are caught could increase the hold space available for other fish, such as the target species caught by these vessels.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of vessels to release any oceanic whitetip sharks and silky sharks that are caught are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes, as the crew, operators, and owners would then have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the Mariana Islands longline fishery.

4.6 Hawaii Troll Fishery

The direct and indirect effects to the Hawaii troll fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The RIR for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

Only the three oceanic whitetip shark and silky shark elements of the proposed rule would be applicable to this fishery.

4.6.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark and the silky shark would not go into effect and the fishery would continue to be managed under existing requirements, as described in Chapter 3 of this EA. Under this alternative, there would be no direct or indirect effects to the fishing patterns or practices of the fishery.

4.6.2 Alternative B: The Action Alternative

Under Alternative B, the three oceanic whitetip shark and silky shark elements of the proposed rule would be implemented. As indicated in Section 3.2.3 of this EA, vessels in the Hawaii troll fishery do not catch or retain many oceanic whitetip sharks or silky sharks. Based on the data in Table 11 of this EA for the years 2008-2012, the average annual effort in the Hawaii troll fishery is 29,565 days fished per year. Logbook data for the same five-year period indicate the retained catch rates (in terms of numbers of fish) of oceanic whitetip sharks and unidentified sharks (silky shark catches, if any, are not recorded by species) to be 0.03 per 1,000 days fished and 0.28 per 1,000 days fished, respectively.

Thus, even under the generous assumption that all unidentified sharks are oceanic whitetip shark or silky shark, the first element of the proposed rule would be expected to lead to only minor changes in the species composition of the fish retained by the Hawaii troll vessels fishing in the Convention Area; the increase in discards of oceanic whitetip sharks and silky sharks could increase the hold space available for other fish, such as the target tuna species caught by these vessels.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes; the crew, operators, and owners could have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the Hawaii troll fishery.

4.7 Guam Troll Fishery

The direct and indirect effects to the Guam troll fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The RIR for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

Only the three oceanic whitetip shark and silky shark elements of the proposed rule would be applicable to this fishery.

4.7.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark and the silky shark would not go into effect and the fishery would continue to be managed under existing requirements, as described in Chapter 3 of this EA. Under this alternative, there would be no direct or indirect effects to the fishing patterns or practices of the fishery.

4.7.2 Alternative B: The Action Alternative

Under Alternative B, the three oceanic whitetip shark and silky shark elements of the proposed rule would be implemented. As indicated in Section 3.2.4 of this EA, vessels in the Guam troll fishery do not catch or retain many oceanic whitetip sharks or silky sharks. The estimated retained catch rates (in terms of numbers of fish) per unit of fishing effort in 2008-2012 for oceanic whitetip sharks, silky sharks, and unidentified sharks were about 0 per 1,000 trips, 0.2 per 1,000 trips, and 0 per 1,000 trips, respectively.

Thus, the first element of the proposed rule would be expected to lead to only minor changes in the species composition of the fish retained by the Guam troll vessels fishing in the Convention Area; the increase in discards of oceanic whitetip sharks and silky sharks could increase the hold space available for other fish, such as the target tuna species caught by these vessels.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes; the crew, operators, and owners could have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the Guam troll fishery.

4.8 American Samoa Troll Fishery

The direct and indirect effects to the American Samoa troll fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The RIR for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

Only the three oceanic whitetip shark and silky shark elements of the proposed rule would be applicable to this fishery.

4.8.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark and the silky shark would not go into effect and the fishery would continue to be managed under existing requirements, as described in Chapter 3 of this EA. Under this alternative, there would be no direct or indirect effects to the fishing patterns or practices of the fishery.

4.8.2 Alternative B: The Action Alternative

Under Alternative B, the three oceanic whitetip shark and silky shark elements of the proposed rule would be implemented. As indicated in Section 3.2.5 of this EA, vessels in the American

Samoa troll fishery do not catch or retain many oceanic whitetip sharks or silky sharks. The estimated retained catch rates (in terms of numbers of fish) per unit of fishing effort in 2008-2012 for oceanic whitetip shark, silky shark, and unidentified sharks were about 2 per 1,000 trips, 0 per 1,000 trips, and 2 per 1,000 trips, respectively.

Thus, even under the generous assumption that all unidentified sharks are oceanic whitetip shark or silky shark, the first element of the proposed rule would be expected to lead to only minor changes in the species composition of the fish retained by the American Samoa troll vessels fishing in the Convention Area; the increase in discards of oceanic whitetip sharks and silky sharks could increase the hold space available for other fish, such as the target tuna species caught by these vessels.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks. This increased time used for releasing the sharks could cause operational changes; the crew, operators, and owners could have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the American Samoa troll fishery.

4.9 CNMI Troll Fishery

The direct and indirect effects to the CNMI troll fishery would fall into two categories: (1) economic; and (2) changes to fishing patterns and practices. The RIR for the proposed rule, 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. Economic effects are not detailed in this document, but rather the discussion in this section focuses on potential changes to the fishing patterns and practices of the fishery from each of the alternatives.

Only the three oceanic whitetip shark and silky shark elements of the proposed rule would be applicable to this fishery.

4.9.1 Alternative A: No-Action Alternative

Under Alternative A, the No-Action Alternative, the proposed rule to implement the provisions for the oceanic whitetip shark and the silky shark would not go into effect and the fishery would continue to be managed under existing requirements, as described in Chapter 3 of this EA. Under this alternative, there would be no direct or indirect effects to the fishing patterns or practices of the fishery.

4.9.2 Alternative B: The Action Alternative

Under Alternative B, the three oceanic whitetip shark and silky shark elements of the proposed rule would be implemented. As indicated in Section 3.2.6 of this EA, vessels in the CNMI troll fishery do not catch or retain many oceanic whitetip sharks or silky sharks. The best estimates of the two species' retained catch rates per unit of fishing effort are zero for the last five years for which data are available.

Thus, the first element of the proposed rule would be expected to lead to only minor changes – if any changes – in the species composition of the fish retained by the CNMI troll vessels fishing in the Convention Area; the increase in discards – if any – of oceanic whitetip sharks and silky sharks could increase the hold space available for other fish, such as the target tuna species caught by these vessels.

The second element of the proposed rule could also have some minor effects on the fishery. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks – if they are caught at all – are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more time to release the sharks, if they are caught. This increased time used for releasing the sharks could cause operational changes; as the crew, operators, and owners could have less time for other tasks, such as fishing. The third element of the proposed rule is a limited exemption from the first two elements in that vessel crew, operators, and owners would be relieved of the no-retention and release requirements in those cases where the vessel observer collects a sample of an oceanic whitetip shark or silky shark. Observers would be under instructions to collect samples only if they do so as part of a program that has been specifically authorized by the WCPFC Scientific Committee, and only from sharks that are dead when brought alongside the vessel. It is not possible to project how often observers would request assistance in collecting samples. When it does occur, it is not expected that sample collection would be so disruptive as to substantially delay or otherwise impact fishing operations and thus would not be expected to lead to any direct or indirect effects on the CNMI troll fishery.

4.10 Other Fisheries

Other HMS fisheries in which the proposed requirements for the oceanic whitetip shark and the silky shark would apply include the commercial Hawaii handline fisheries, the Hawaii pole and line fishery, and the U.S. West Coast-based albacore troll fishery, but as stated in Section 3.2.7 of this EA, there have been no recorded interactions with oceanic whitetip sharks or silky sharks in these fisheries in recent years. Thus, there would unlikely be any effects on these fisheries. To the extent that either of the two shark species are caught in the fisheries, the effects would be expected to be of the same type, as described for the other fisheries, above.

4.11 Effects on the Oceanic Whitetip Shark and Silky Shark

The three oceanic whitetip shark and silky shark elements of the proposed rule would apply to all of the fisheries described in Sections 4.1 to 4.10 above.

As stated in Section 3.3.2.1.5 of this EA, the estimated average annual catch of the oceanic whitetip shark in all nations' longline and purse seine fisheries in the WCPO (except for the Philippines and Indonesia) – which are believed to constitute the majority of fishing mortality on the stocks – from 2005-2009 was about 57,000 oceanic whitetip sharks per year or about 100,000 oceanic whitetip sharks per year, using alternative catch histories. Based on this information, 57,000 to 100,000 oceanic whitetip sharks per year can be used as an approximate range of the number of oceanic whitetip sharks that are currently caught per year in all WCPO fisheries. For the silky shark, Section 3.3.2.3.5 of the EA indicates that the average annual catches, in all nations' longline and purse seine fisheries in the WCPO (except for the Philippines and Indonesia) – which are believed to constitute the majority of fishing mortality on the stocks – in numbers, for 2005-2009 were about 235,000 silky sharks per year or about 371,340 silky sharks per year, using alternative catch histories. Based on this information, 235,000 to 371,000 silky sharks per year can be used as an approximate range of the number or silky sharks that are currently caught per year in all WCPO fisheries.

As discussed in Sections 4.1 to 4.10 of this EA, in each of the fisheries that could be affected by the proposed rule, the majority of oceanic whitetip sharks and silky sharks that are caught are discarded, and the number that is retained per unit of time is almost negligible. Thus, the first element of the proposed rule would be expected to cause only minor effects on the abundance of oceanic whitetip shark and the silky shark in the WCPO. The small number of these sharks that are currently retained in the fisheries would be expected to be discarded under the first element of the proposed rule. Section 3.3.5 of the EA presents information on the post release survival rates of sharks. A recent study of post release survival rates of the silky shark in WCPO purse seine fisheries demonstrated that at least some silky sharks survive post release. No specific studies were identified on the post release survival rates of the oceanic whitetip shark. However, based on the information available on post release survival of sharks in general and the study for post release survival rates of silky sharks, it can be expected that at least some oceanic whitetip sharks and silky sharks that are released to comply with the first element of the proposed rule would survive, with the rates of survival for silky sharks likely dependent on when the shark is released. Comparing the small number of these types of sharks currently caught and retained in the U.S. fisheries in the WCPO compared to the number of these types of sharks caught overall in WCPO fisheries– only very minor direct effects on the size of the populations of the oceanic whitetip shark or the silky shark as a result of the first element of the proposed rule would be expected. Over time, the number of sharks that could survive in response to the first element of the proposed rule could have some minor beneficial contribution to the overall status of the stocks (i.e., a minor increase in the size of the stock), so there could be some minor beneficial indirect effects to the stocks as a result of the proposed rule.

The second element of the proposed rule could also have some minor beneficial direct and indirect effects on abundance and the overall status of the stocks (i.e., a minor increase in the size of the stock) of the oceanic whitetip shark and the silky shark. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more precautions when releasing the sharks. This increase in precaution could in turn increase the post release survival of the sharks. Comparing the small number of these types of sharks currently caught and retained in the U.S. fisheries in the WCPO compared to the number of these types of sharks caught overall in WCPO fisheries, only minor direct effects on the size of the populations of the oceanic whitetip shark or the silky shark as a result of the second element of the proposed rule would be expected. Over time, the number of sharks that could survive in response to the second element of the proposed rule could have some minor beneficial contribution to the overall status of the stocks (i.e., a minor increase in the size of the stock), so there could be some minor beneficial indirect effects to the stocks as a result of the proposed rule.

As stated above, the third element of the proposed rule would not be expected to lead to any direct or indirect effects on the fisheries that would be affected by the proposed rule. Moreover, samples would only allowed to be collected from sharks that are already dead on haulback, so this element of the rule would not affect fishing mortality on sharks. Thus, no direct or indirect effects to the oceanic whitetip shark or the silky shark would be anticipated from this element of the rule.

4.12 Effects on the Whale Shark

The three whale shark elements of the proposed rule would only apply to the U.S. WCPO purse seine fishery. As stated in Section 4.1.2 above, a rough estimate of the rate of interactions with whale sharks in the U.S. WCPO purse seine fishery is 2-5 whale sharks per 1,000 fishing days, or 1-3 sharks per year on the high seas and in the U.S. EEZ and 15-37 sharks per year in PNA EEZs. Based on the information in Table 2 in Chapter 3 of this EA, about 2 whale sharks caught in the U.S. WCPO purse seine fishery per year are dead upon release, and the condition of about

25 whale sharks per year is unknown upon release. Using the information in Section 3.3.2.2.5 of this EA, about 19 whale shark mortalities per year, on average, are estimated to occur in all nations' WCPO tropical purse seine fisheries, omitting the fisheries in the EEZs of the Philippines and Indonesia for which no estimates are available; this number does not include mortalities that might occur after the whale shark is released alive.

The first whale shark element of the proposed rule would only apply on the high seas and in the U.S. EEZ. Thus, given the limited number of estimated annual whale shark interactions by the U.S. WCPO purse seine fishery in these areas, this element of the proposed rule would be expected to only have limited direct effects on the abundance of the whale shark. Should the first element of the proposed rule lead to any reduction in interactions with whale sharks in the fishery (it is unclear how many interactions currently take place after the whale shark is sighted prior to the commencement of the set), there is a small potential for minor beneficial direct and indirect effect on the whale shark. If some of the interactions that currently result in mortalities are avoided as a result of the proposed rule, then there could be minor direct effects on the whale shark. Over time, this reduction in mortalities could have some minor beneficial indirect effects on the overall status of the stock (i.e., a minor increase in the size of the stock).

The second whale shark element of the proposed rule would apply on the high seas and in all EEZs in the Convention Area, including PNA EEZs. Based on the data summarized above, it appears that the estimated number of annual whale shark mortalities in the U.S. WCPO purse seine fishery in these areas may contribute approximately ten percent of the estimated number of annual whale shark mortalities per year in all WCPO tropical purse seine fisheries. Thus, similar to the first element, the second whale shark element of the proposed rule could have some direct and indirect, beneficial effects on the whale shark. The specific methods currently used by the crew, operators, and owners of U.S. purse seine vessels to release whale sharks are not definitively known, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more precautions when releasing the sharks, thus increasing the number of whale sharks that are alive upon release. As stated in Chapter 3 of this EA, no specific studies were identified on the post release survival rates of the whale shark, however, this increase in precaution could also lead to an increase in the post release survival of the sharks.

The third whale shark element of the proposed rule – reporting of whale shark encirclements – would not be expected to lead to any direct or indirect effects on the whale shark. The only anticipated effects from this element of the rule are the approximately 10 minutes of labor and time needed by the crew, owners, and operators for reporting each encirclement. However, the increased data collection could provide information for the development of future management efforts for the conservation of the whale shark.

As indicated in Chapter 3 of this EA, fisheries interactions are just one of many threats to the whale shark. In addition, no estimates of total fishing mortality of the whale shark in the WCPO are available.

4.13 Effects on the Physical Environment and Climate Change

There would be no effects to the physical environment or contributions to climate change under Alternative A.

The proposed rule under Alternative B would not be expected to lead to any direct or indirect effects on the physical environment or to contribute to climate change. The changes in fishing operations that could result from the proposed rule, include some decrease in time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught, or if vessel owners/operators/crew need to wait or change locations to make sets and spend time reporting on whale shark encirclements. However, these effects are anticipated to be minor, as described in Sections 4.1 to 4.10 above, and are not expected to substantially affect fishing patterns or practices and thus, there would be no anticipated effects on the physical environment or anticipated contributions to climate change. If owners/operators/crew change locations to make sets, to comply with the first whale shark element of the proposed rule, there could be some increase in greenhouse gas emissions from the extra time needed to steam from one location to another. However, given the estimated interaction rate of 1-3 sharks per year on the high seas and in the U.S. EEZ where this element of the rule would apply, any increase in greenhouse gas emissions would be minor and not expected to contribute to climate change.

4.14 Effects to Target Stocks

There would be no effects on target stocks under Alternative A.

The oceanic whitetip shark and silky shark elements of the proposed rule under Alternative B could cause some minor changes in the species composition of retained catch due to the increase in discards leading to an increase in hold space available for other species, at least in the longline and troll fisheries. Thus, it is possible that there could be some increase in effort for fishing for the target stocks and an increase in the amount of target stocks caught and retained. However, given that only a small number of oceanic whitetip sharks and silky sharks are currently retained, it is unlikely that any increase in hold space as a result of the proposed rule would be large enough to substantially affect the fishing practices of the affected fleets. Thus, though there is some small potential for increased fishing effort on target stocks, it is more likely that the rule would not lead to an increase in fishing effort and would result in no direct or indirect effects to target stocks. Moreover, the proposed rule could lead to some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught, or if vessel owners/operators/crew need to wait or change locations to make sets and spend time reporting on whale shark encirclements. This decrease in fishing time would counteract the possible increase in fishing effort.

4.15 Effects to Non-target Stocks

There would no effects on non-target stocks under Alternative A (other than the effects to the oceanic whitetip shark, the silky shark, and the whale shark, which are discussed in Sections 4.11 to 4.12 above).

As discussed in Section 4.14 above, it is possible that, under Alternative B, there could be minor increases in effort for fishing for the target stocks and an increase in the amount of target stocks caught and retained.

Any such increase in effort for target species could lead to additional catch of non-target stocks. However, given that it is more likely that there would be no direct or indirect effects to target stocks as a result of the proposed rule, it is also likely that there would no direct or indirect effect to non-target stocks as a result of the proposed rule.

4.16 Effects to Protected Resources

There would be no effects on protected resources under Alternative A.

As discussed throughout this chapter, the six elements of the proposed rule under Alternative B could cause some minor effects on the operations of the affected fisheries, but would not be expected to lead to substantial changes in fishing patterns and practices. The oceanic whitetip shark and silky shark elements of the proposed rule could cause some minor changes in the species composition of retained catch as well as some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught. The whale shark elements of the proposed rule could also cause some minor changes in terms of time spent on fishing or other activities, since vessel owners/operators/crew may need to wait or change locations to make sets, increase handling times to release sharks that are caught, and spend time reporting on whale shark encirclements.

To the extent that there is an increase in fishing effort, there would be some small potential for increased interactions with protected species. However, given that only a small number of oceanic whitetip sharks and silky sharks are currently retained, it is unlikely that the increase in hold space as a result of the proposed rule would be large enough to substantially affect the fishing practices of the affected fleets. Thus, though there is some small potential for increased fishing effort on target stocks, it is more likely that the rule would not lead to an increase in fishing effort and would result in no direct or indirect effects to target stocks, and consequently no direct or indirect effects to protected species. Moreover, the proposed rule could lead to some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught, or if vessel owners/operators/crew need to wait or change locations to make sets and spend time reporting on whale shark encirclements. This decrease in fishing time would counteract the possible increase in fishing effort. Thus, Alternative B 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.

Similarly, any potential operational changes in the fisheries would not be expected to 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. Any potential minor increase in fishing effort would be counteracted by a potential minor decrease in fishing effort and would not be expected to cause impacts to EFH or HAPC, ocean or coastal habitats, historic properties, NWRs or National Monuments.

4.17 Effects to Biodiversity and Ecosystem Function

There would be no effects on biodiversity and ecosystem function under Alternative A.

The proposed rule under Alternative B would not be expected to lead to any direct effects on biodiversity and ecosystem function. As discussed in Sections 4.11 to 4.12 above, the proposed rule could lead to some minor beneficial direct and indirect effects on the oceanic whitetip shark and the silky shark in the WCPO, as well as a potential reduction in whale shark mortalities caused by purse seine fishing operations in the WCPO, which could in turn lead to some minor beneficial direct and indirect effects to the whale shark in the WCPO. As discussed in Chapter 3 of this EA, the oceanic whitetip shark, the silky shark, and the whale shark are all apex predator species, so indirect effects on these species could in turn lead to indirect trophic interactive effects that could affect the ecosystem over time. Given the anticipated minor effects of this proposed rule on the three sharks, any effects on the ecosystem also would be expected to be minor. The types of effects to the ecosystem (e.g., increases or decreases to prey or other species) cannot be predicted at this time as there are too many unknowns and variables that would need to be taken into consideration – for example, the diet of the three shark species could change over time in response to as yet unknown circumstances.

4.18 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 of the proposed rule under Alternative B would be minor and generally would be distributed evenly among the affected vessels in each of the fisheries. Thus, the proposed rule would not result in significant and adverse effects on minority or low-income populations.

Chapter 5 Cumulative Impacts

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 Alternative B indicates that Alternative B may have some minor beneficial direct and indirect effects on the oceanic whitetip shark, the silky shark, and the whale shark in the WCPO. The direct and indirect effects on other resources in the affected environment would likely be none or negligible. Thus, this chapter focuses on the potential cumulative effects to the oceanic whitetip shark, the silky shark, and the whale shark 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. The time frame for this analysis is from 2011 – when the United States implemented a decision made by the Inter-American Tropical Tuna Commission (IATTC) for the oceanic whitetip shark – to five years into the future. The implementation of the IATTC decision was the first fisheries management action in the Pacific that focused on one of the three shark species that are the subject of the proposed rule, so it provides a reasonable starting point for the cumulative impacts analysis. Although it may be possible to identify actions that could take place later on in time, looking five years ahead provides a reasonable framework for analysis of fisheries management actions in the WCPO, given that management actions currently planned to take place later in time would likely be modified in response to changed circumstances.

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 2011-2019 time period, and Section 5.3 presents the cumulative effects analysis.

5.1 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 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.[27] Table 23 through Table 25 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 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.

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

Table 23: Tuna catches in WCPFC Statistical Area[28] by species (in mt)

Year	Albacore		Bigeye		Skipjack		Yellowfin		Total
	MT	%	MT	%	MT	%	MT	%	MT
1997	112,900	7	153,993	9	910,613	56	460,824	28	1,636,330
1998	112,465	6	170,815	8	1,195,621	59	556,066	27	2,034,967
1999	131,066	7	150,460	8	1,099,932	59	481,597	26	1,863,055
2000	101,171	5	139,961	7	1,142,491	60	529,631	28	1,913,154
2001	121,561	7	143,171	8	1,058,209	58	498,716	27	1,821,657
2002	147,793	7	168,869	8	1,232,665	61	468,861	23	2,018,188
2003	122,949	6	139,243	7	1,219,482	61	521,420	26	2,003,094
2004	122,343	6	183,355	9	1,300,944	61	515,489	24	2,122,131
2005	105,135	5	152,301	7	1,395,238	63	549,501	25	2,202,175
2006	104,986	5	161,980	7	1,480,137	66	498,452	22	2,245,555
2007	126,701	5	145,458	6	1,658,141	68	503,892	21	2,434,192
2008	104,966	4	156,016	6	1,640,945	66	581,948	23	2,483,875
2009	135,476	5	159,473	6	1,775,790	68	532,907	20	2,603,646
2010	126,701	5	141,052	6	1,689,772	67	547,277	22	2,504,547
2011	125,903	5	159,597	7	1,521,035	65	521,665	22	2,328,200
2012	132,349	5	161,561	6	1,647,936	64	646,165	25	2,588,011
2008-2012 average	125,079	5	155,540	6	1,655,096	66	565,992	22	2,501,656

Source: [WCPFC 2013, Table 78]

[28] 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 24: 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	981,358	60	18,732	1	148,946	9	1,636,330
1998	233,645	11	313,968	15	1,297,727	64	19,099	1	170,528	8	2,034,967
1999	202,973	11	338,832	18	1,131,139	61	13,476	1	176,635	9	1,863,055
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	1,144,442	63	17,329	1	170,328	9	1,821,657
2002	266,963	13	254,785	13	1,297,473	64	16,129	1	182,838	9	2,018,188
2003	250,160	12	260,875	13	1,292,289	65	19,875	1	179,895	9	2,003,094
2004	266,581	13	253,342	12	1,393,992	66	23,445	1	184,771	9	2,122,131
2005	250,167	11	266,753	12	1,479,329	67	13,293	1	192,651	9	2,202,175
2006	255,328	11	257,594	11	1,512,944	67	10,098	0	209,591	9	2,245,555
2007	245,129	10	284,661	12	1,655,501	68	9,249	0	239,652	10	2,434,192
2008	245,509	10	269,551	11	1,709,351	69	11,740	0	247,724	10	2,483,875
2009	279,012	11	264,350	10	1,785,823	69	9,894	0	264,567	10	2,603,646
2010	269,885	11	270,123	11	1,703,138	68	11,320	0	250,081	10	2,504,547
2011	266,913	11	276,765	12	1,543,651	66	11,966	1	228,905	10	2,328,200
2012	263,194	10	214,981	8	1,799,097	70	12,421	0	298,318	12	2,588,011
2008-2012 average	264,903	11	259,154	10	1,708,212	68	11,468	0	257,919	10	2,501,656

Source: [WCPFC 2013, Table 84]

Table 25: Number of vessels active[29] by gear type 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	3,358
2010	1,480	493	4,557
2011	1,486	490	3,769
2012	1,493	491	3,000

Source: [WCPFC 2013, Table 71]

The changes in purse seine and pole and line vessel numbers between years 2000-2001 are a reporting artifact due to 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 2011-2019 that have the potential to affect the oceanic whitetip shark, the silky shark, and the whale shark in the WCPO. The analysis of cumulative impacts is presented in the following section.

Relevant other past and present (recently completed and in-progress) actions include specific actions being taken to manage U.S. HMS fisheries in the Convention Area. They include:

- 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). The elements of the rule are similar to those in this proposed rule – oceanic whitetip shark may not be retained by U.S. HMS fishing vessels in the EPO.

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

- NMFS issued a final rule to implement the provisions of IATTC Resolution C-11-01, on tropical tunas for 2012 and 2013, for U.S. purse seine vessels and longline vessels (76 FR 68332; November 4, 2011). The longline element is a bigeye tuna catch limit of 500 mt for each of 2012 and 2013, applicable to U.S. longline vessels more than 24 m in length. The purse seine elements include the following: a period of time when all purse seine fishing is prohibited – vessel owners can choose between two closure periods; an area of the high seas that is closed to fishing during certain times of the year; and catch retention requirements.

- 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).

- 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.

- Based on a WPFMC recommendation, NMFS issued a final rule on July 26, 2012 (77 FR 43721), to revise the number of swordfish that may be retained or landed during a Hawaii-based deep-set longline trip north of the Equator, effective August 27, 2012.

- NMFS issued a final rule to revise the annual number of incidental interactions that are allowed between the Hawaii-based shallow-set pelagic longline fishery and leatherback and loggerhead sea turtles (see 77 FR 60637; October 4, 2012), effective November 5, 2012.

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

- 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.

- NMFS issued a final rule to implement a False Killer Whale Take Reduction Plan (TRP) (77 FR 71259; November 29, 2012), effective February 27, 2013, which includes gear requirements for the Hawaii deep-set longline fishery, longline prohibited areas, training and certification in marine mammal handling and release, captains' supervision of marine mammal handling and release, and posting of NMFS-approved placards on longline vessels. The gear requirements for the Hawaii deep-set longline fishery are that weak (small diameter) circle hooks have to be used.

- NMFS issued a final rule to implement the longline-related provisions of WCPFC CMM 2012-01, for tropical tunas (78 FR 58240; September 23, 2013). This action establishes a bigeye tuna catch limit of 3,763 mt in the Convention Area for the U.S. longline fishery for each of 2013 and 2014.

- NMFS issued a final rule to implement the purse seine-related provisions of WCPFC CMM 2012-01, for tropical tunas (78 FR 30773; May 23, 2013). This action establishes purse seine fishing effort limits on the high seas and in the U.S. EEZ for 2013-2014, a four-month FAD prohibition period in each of 2013 and 2014, and observer coverage requirements.

- NMFS issued a proposed rule to implement the Shark Conservation Act of 2010 (78 FR 25685; May 2, 2013). To implement the Shark Finning Prohibition Act, enacted in 2000, there are already prohibitions on possessing, transshipping, or landing shark fins without their corresponding carcasses. This rule would require that the fins remain naturally attached to the carcass up to the point of landing.

- NMFS issued a final rule to implement the provisions of IATTC Resolution C-13-01, on tropical tunas, for U.S. purse seine vessels and longline vessels (79 FR 19487; April 9, 2014). The rule extends through 2016 the regulations issued to implement Resolution C-11-01 (see above). The longline element is a bigeye tuna annual catch limit of 500 mt, applicable to U.S. longline vessels more than 24 m in length. The purse seine elements include the following: a seasonal period when all purse seine fishing is prohibited – vessel owners can choose between two closure periods; and an area of the high seas that is closed to fishing during certain times of the year.

- NMFS issued a proposed rule to implement the whale shark provisions of IATTC Resolution C-13-04 (79 FR 32903; June 9, 2014). The elements in the rule are similar to those in the proposed rule – prohibit setting a purse seine net on a whale shark and certain measures to protect whale sharks in the event that a whale shark is encircled in a purse seine net.

Reasonably foreseeable future actions include future fishery management actions by the United States and other nations:

- It is reasonably foreseeable that other WCPFC members will implement the shark CMMs 2011-04, 2012-04, and 2013-08 by establishing requirements in their fisheries that are similar to those in this proposed rule for U.S. fisheries.

- It is reasonably foreseeable that other IATTC members will (or have already) implemented the oceanic whitetip shark measures in Resolution C-11-10.

- It is reasonably foreseeable that CITES member nations will institute procedures to implement the recent CITES Appendix II listing of the oceanic whitetip shark.

- 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.

- The WCPFC adopted a new CMM for tropical tunas, CMM 2013-01, in December 2013. The measure generally applies from 2014 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 longline fishing effort and slightly less purse seine fishing effort, including less fishing effort on FADs (i.e., "associated" fishing effort) in 2014-2017 than in the last few years.

- Provisions of the South Pacific Tuna Treaty, 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 an interim arrangement that was agreed for 2014, the overall fishing patterns and practices of the U.S. fleet under the renegotiated Treaty 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 Endangered Species Act with respect to threatened and endangered marine species, the South Pacific Tuna Act to implement the South Pacific Tuna Treaty, the WCPFC Implementation Act 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 Discussion of Cumulative Impacts to the Oceanic Whitetip Shark, the Silky Shark, and the Whale Shark

As discussed in Chapter 4, the direct and indirect effects from implementation of the proposed rule under Alternative B would include the potential for minor beneficial direct and indirect effects on the oceanic whitetip shark, the silky shark, and the whale shark in the WCPO. There would be no direct or indirect effects to the oceanic whitetip shark, the silky shark, or the whale shark under Alternative A, the No-Action Alternative.

Of the identified other past and present actions, the issuance of the final NMFS rule to implement the IATTC resolution on oceanic whitetip sharks would be expected to have some beneficial effects on the stock of the oceanic whitetip shark in the EPO. As the oceanic whitetip shark is a highly migratory species and no specific regional stock has been identified to date, such effects in the EPO could affect oceanic whitetip sharks in the WCPO and vice versa. Similarly, the NMFS rulemaking to implement the IATTC resolution on the whale shark would be expected to have some beneficial effects on the stock of the whale shark in the EPO, which could affect whale sharks in the WCPO and vice versa.

Of the other identified future actions, the actions by other WCPFC members to implement the shark CMMs 2011-04, 2012-04, and 2013-08 by establishing requirements in their fisheries that are similar to those in this proposed rule for U.S. fisheries would also be expected to have some beneficial effects on the oceanic whitetip shark, the silky shark, and the whale shark in the WCPO.

The other identified past, present, and reasonably foreseeable future actions could have some effects on the fishing patterns and practices of the affected fisheries, and to the extent that fishing effort is increased, there could be an increased risk of interaction with the oceanic whitetip shark, the silky shark, and the whale shark. To the extent fishing effort is decreased, there could be a decreased risk of interaction with the oceanic whitetip shark, the silky shark, and the whale shark.

Given that the objective of the other actions is sustainable management of fisheries and that the majority of the other actions would constrain fishing effort to some degree, it is expected that the overall cumulative impacts from the identified past, present, and reasonably foreseeable future actions to the oceanic whitetip shark, the silky shark, and the whale shark in the WCPO would be beneficial. The degree of beneficial impacts would be dependent on the effectiveness of the management measures, and as such, cannot be predicted at this time. However, as the majority of the other actions are not specifically focused on the conservation and management of the oceanic whitetip shark, the silky shark, and the whale shark, it is expected that the cumulative impacts to these sharks in the WCPO from the proposed action and the other identified past, present, and reasonably foreseeable actions would not be significant. Indeed, as discussed in Chapter 4, the likely effects on these sharks from the proposed action under Alternative B would be minor and beneficial direct and indirect effects, and it is likely that any effects from the other identified actions would be similar. As described in Chapter 3, fishing activities are just one of many threats to shark populations worldwide.

Consultation

NAO 216-6 requires a listing of the agencies and persons who were consulted while preparing this EA.
Table 26 lists the agencies, NOAA units, and entities that were contacted for information.

Table 26: 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 – 14^{th} Coast Guard District
Western Pacific Fishery Management Council

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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.

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

Bonfil, R., S. 2008. The Biology and Ecology of the Silky Shark, *Carcharhinus falciformis.* In E.K. Pikitch, M.D. Camhi, and E.A. Babcock (Eds.), *Sharks of the Open Ocean: Biology, Fisheries & Conservation.* (pp. 114-127). Blackwell Publishing Ltd., Oxford.

Bonfil, R., S. Clarke, and H. Nakano. 2008. The Biology and Ecology of the Oceanic Whitetip Shark, *Carcharhinus longimanus.* In E.K. Pikitch, M.D. Camhi, and E.A. Babcock (Eds.), *Sharks of the Open Ocean: Biology, Fisheries & Conservation.* (pp. 128-139). Blackwell Publishing Ltd., Oxford.

Camhi, M.D. 2008. Conservation Status of Pelagic Elasmobranchs. In M.D. Camhi, E.K. Pikitch, and E.A. Babcock (Eds.), *Sharks of the Open Ocean: Biology, Fisheries & Conservation.* (pp. 397-417). Blackwell Publishing Ltd., Oxford.

Camhi, M.D., S.V. Fordham, and S.L. Fowler. 2008a. Domestic and International Management for Pelagic Sharks. In M.D. Camhi, E.K. Pikitch, and E.A. Babcock (Eds.), *Sharks of the Open Ocean: Biology, Fisheries & Conservation.* (pp. 418-444). Blackwell Publishing Ltd., Oxford.

Camhi, M.D., E.L. Lauck, E.K. Pikitch, and E.A. Babcock. 2008b. A Global Overview of Commercial Fisheries for Open Ocean Sharks. In M.D. Camhi, E.K. Pikitch, and E.A. Babcock (Eds.), *Sharks of the Open Ocean: Biology, Fisheries & Conservation.* (pp. 166-192). Blackwell Publishing Ltd., Oxford.

Camhi, M.D., E.K. Pikitch, and E.A. Babcock. 2008c. Part V: Conservation and Management Outlook for Pelagic Sharks. In M.D. Camhi, E.K. Pikitch, and E.A. Babcock (Eds.), *Sharks of the Open Ocean: Biology, Fisheries & Conservation.* (pp. 395-396). Blackwell Publishing Ltd., Oxford.

Campana, S.E., W. Joyce, and M.J. Manning. 2009. Bycatch and discard mortality in commercially caught blue sharks *Prionace glauca* assessed using archival satellite pop-up tags. *Marine Ecology Progress Series* 387: 241-253.

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.

Castro, A. L. F., B. S. Stewart, S.G. Wilson, R.E. Hueter, M. G. Meekan, P. J. Motta, B.W. Bowen, and S.A. Karl. 2007. Population genetic structure of Earth's largest fish, the whale shark (Rhincodon typus). *Molecular Ecology* 16(24): 5183-5192.

Childers, J. and A. Pease. 2012. Summary of the 2009 and 2010 U.S.A North and South Pacific Albacore Troll and Pole-and-Line Fisheries. NOAA-NMFS Administrative Report LJ 10-02. La Jolla, California, United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Clarke, S.C., S.J. Harley, S. D. Hoyle, and J.S. Rice. 2012. Population trends in Pacific oceanic sharks and the utility of regulations on shark finning. *Conservation Biology*, 27(1): 197-209.

Clarke, S.C., J.E. Magnussen, D.L. Abercrombie, M.K. McAllister, and M.S. Shivji. 2006a. Identification of shark species composition and proportion in the Hong Kong shark fin market based on molecular genetics and trade records. *Conservation Biology*, 20(1): 201-211.

Clarke, S.C., M.K. McAllister, E.J. Milner-Gulland, G.P. Kirkwood, C.G.J. Michielsens, D.J. Agnew, E.K. Pikitch, H. Nakano, and M.S. Shivji. 2006b. Global estimates of shark catches using trade records from commercial markets. *Ecology Letters* 9: 1115-1126.

Clark, E. and D.R Nelson. 1997. Young whale sharks, *Rhincodon typus*, feeding on a copepod bloom near La Paz, Mexico. *Environmental Biology of Fishes* 50: 63–73.

Colman, J.G. 1997. A review of the biology and ecology of the whale shark. *Journal of Fish Biology* 51: 1219-1234.

Compagno, L.J.V. 1984a. FAO species catalogue. Vol. 4. Sharks of the World. An annotated and illustrated catalogue of shark species known to date. Part 1**.** *Hexanchiformes to Lamniformes FAO Fisheries Synopsis*, 125(4). FAO, Rome, Italy. pp. 209-211.

Compagno, L.J.V. 1984b. FAO species catalogue. Vol. 4. Sharks of the World. An annotated and illustrated catalogue of shark species known to date. Part 2. *Carcharhiniformes. FAO Fisheries Synopsis*, 125(4). FAO, Rome, Italy. pp. 470-486.

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.

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, and 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.

Dulvy, N.K., Y. Sadovy, and J.D. Reynolds. 2003. Extinction vulnerability in marine populations. *Fish and Fisheries* 4(1): 25-64.

Eckert, S.A., and B.S. Stewart. 2001. Telemetry and satellite tracking of whale sharks, *Rhincodon typus*, in the Sea of Cortez, Mexico, and the North Pacific Ocean. *Environmental Biology of Fishes* 60: 299–308.

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

“Endangered and Threatened Wildlife; 90-Day Finding on a Petition To List the Whale Shark as Threatened or Endangered Under the Endangered Species Act,” 78 Federal Register 159 (16 August 2013) pp. 50032-50037.

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.

FAO. 2013. *Report of the fourth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species, Rome, 3–8 December 2012.* FAO Fisheries and Aquaculture Report No. R1032. Rome, FAO. 161 pp.

FAO. 2014. International Plan of Action for the Conservation and Management of Sharks. http://www.fao.org/fishery/ipoa-sharks/npoa/en. Accessed 5/5/14.

Filmalter, J., F. Forget, F. Poisson, A-L. Vernet, and L. Dagorn. 2012. An update on the post-release survival of silky sharks incidentally captured by tuna purse seine vessels in the Indian Ocean. In *8th Session of the IOTC Working Party on Ecosystems and Bycatch, September 17-19 2012, Cape Town, South Africa*. IOTC-2012-WPEB08-20.

Frick, L.H., R.D. Reina, and T.I. Walker. 2010. Stress related physiological changes and post-release survival of Port Jackson sharks (*Heterodontus portusjacksoni*) and gummy sharks (*Mustelus antarcicus*) following gill-net and longline capture in captivity. *Journal of Experimental Marine Biology and Ecology* 385: 29-37.

Frid, A., G.G. Baker, and L.M. Dill. 2008. Do shark declines create fear-released systems? *Oikos* 117: 191-201.

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.A. McCoy, and D.G. Itano. 2002. *Status of the United States Western Pacific tuna purse seine fleet and factors affecting its future*. University of Hawaii-NOAA, Joint Institute for Marine and Atmospheric Research.

Grace, M.A. 2001. Field guide to requiem sharks (*Elasmobranchiomorphi: Carcharhinidae*) of the Western North Atlantic. U.S. Dep. Commerce, NOAA Tech. Rep. NMFS 153, 32 p.

Griffin, E., K.L. Miller, B. Freitas, and M. Hirshfield. 2008. Predators as Prey: Why Healthy Oceans Need Sharks. Oceana. Washington DC.

Halpern, B.S., K. Cottenie, and B.R. Broitman. 2006. Strong Top-Down Control in Southern California Kelp Forest Ecosystems. *Science* 312(5777): 1230-1232.

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

Heithaus, M.R. 2001. Predator-prey and competitive interactions between sharks (order Selachii) and dolphins (suborder Odontoceti): a review. *Journal of Zoology, London* 253: 53-68.

Heyman, W.D., R.T. Graham, B. Kjerfve, and R.E. Johannes. 2001. Whale sharks *Rhincodon typus* aggregate to feed on fish spawn in Belize. *Marine Ecology Progress Series* 215: 275–282.

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): 10.

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

Holmberg, J., B. Norman, and Z. Arzoumanian. 2009. Estimating population size, structure, and residency time for whale sharks Rhincodon typus through collaborative photo-identification. Endangered Species Research, 7: 39-53.

Humane Society International. 2014. "National laws, multi-lateral agreements, regional and global regulations on shark protection and shark finning as of March, 2014." http://www.hsi.org/assets/pdfs/shark_finning_regs_2014.pdf. Accessed: 4/7/14.

Hutchinson, M., D. Itano, J. Muir, B. Leroy, and K. Holland. 2013. Fishery interactions and post-release survival rates of silky sharks caught in purse seine fishing gear. WCPFC-SC9-2013/ EB-WP-12. Pohnpei, Federated States of Micronesia.

Inter-American Tropical Tuna Commission. 2013. Tunas and Billfishes in the Eastern Pacific Ocean in 2012. Fishery Status Report No. 11. La Jolla, California.

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.

Joseph, J. 2003. Managing fishing capacity of the world tuna fleet. FAO Fisheries Circular Number 982. Rome, Food and Agriculture Organization of the United Nations.

Joung, S-J, C-T Chen, E. Clark, S. Uchida, and W.Y.P. Huang. 1996. The whale shark, *Rhincodon typus*, is a livebearer: 300 embryos found in one 'megamamma' supreme. *Environmental Biology of Fishes* 46: 219-223.

Kaeriyama, M., H. Seo, H. Kudo, and 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): 165-177.

Kamikuri, S., I. Motoyama, H. Nishi, and M. Iwai. 2009. Evolution of Eastern Pacific Warm Pool and upwelling processes since the middle Miocene based on analysis of radiolarian assemblages: Response to Indonesian and Central American Seaways. *Palaeogeography, Palaeoclimatology, Palaeoecology* 280: 469-479.

Kirby, D.S. 2006. Ecological risk assessment for species caught in WCPO tuna fisheries: inherent risk as determined by productivity-susceptibility analysis [EB WP-1]. Kolonia, Pohnpei State, Federated States of Micronesia: Western and Central Pacific Fisheries Commission. Scientific Committee Second Regular Session, Manila, Philippines.

Kohler, N.E., J.G. Casey, and P.A. Turner. 1998. NMFS Cooperative Shark Tagging Program, 1962-93: An Atlas of Shark Tag and Recapture Data. *Marine Fisheries Review* 60(2): 1-87.

Lawson, T. 2011. Estimation of Catch Rates and Catches of Key Shark Species in Tuna Fisheries of the Western and Central Pacific Ocean Using Observer Data. WCPFC–SC7–2011 /EB–IP–02. Pohnpei, Federated States of Micronesia. Western and Central Pacific Fisheries Commission.

Lessa, R., F.M. Santana, and R. Paglerani. 1999. Age, growth and stock structure of the oceanic whitetip shark, *Carcharhinus longimanus*, from the southwestern equatorial Atlantic. *Fisheries Research* 42: 21-30.

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: modeling approach and preliminary results. *Fisheries Oceanography* 12(4-5):474-482.

Mayfield A.B., Chan P., H.M. Putnam, C. Chen, and 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): 4183-4195.

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

Moyes, C.D., N. Fragoso, M.K. Musyl, and R.W. Brill. 2006. Predicting Postrelease Survival in Large Pelagic Fish. *Transactions of the American Fisheries Society* 135: 1389-1397.

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.

NMFS. 2010. 2010 Annual Report to the Western and Central Pacific Fisheries Commission; United States of America; Part I. Information on Fisheries, Research, and Statistics (for 2009). National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Available at: http://www.fpir.noaa.gov/Library/IFD/Annual%20Report%20Part%20I%202010.pdf

NMFS. 2011. 2011 Annual Report to the Western and Central Pacific Fisheries Commission; United States of America; Part I. Information on Fisheries, Research, and Statistics (for 2010). National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Available at: http://www.fpir.noaa.gov/Library/IFD/Annual%20Report%20part%20I%202011.pdf

NMFS. 2012. 2012 Annual Report to the Western and Central Pacific Fisheries Commission; United States of America; Part I. Information on Fisheries, Research, and Statistics (for 2011). National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Available at: http://www.fpir.noaa.gov/Library/IFD/Annual_Report_PartI_for2012.pdf

NMFS. 2013. 2013 Annual Report to the Western and Central Pacific Fisheries Commission; United States of America; Part I. Information on Fisheries, Research, and Statistics (for 2012). National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Available at: http://www.fpir.noaa.gov/Library/IFD/Annual%20_Report_Part_1_2013.pdf

Myrberg Jr., A.A., S.J. Ha, S. Walewsi, and J.C. Banbury. 1972. Effectiveness of Acoustic Signals in Attracting Epipelagic Sharks to an Underwater Sound Source. Bulletin of Marine Science 22(4): 929-949.

Nelson, J.D., and S.A. Eckert. 2007. Foraging ecology of whale sharks (*Rhincodon typus*) within Bahia de Los Angeles, Baja California Norte, Mexico. *Fisheries Research* 84: 47–64.

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.

NOAA, NMFS, Office of Sustainable Fisheries. 2013. Status of U.S. Fisheries. http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html. Accessed 4/28/14.

Norman, B.M., 2005. Whale shark. In: Fowler, S.L., Cavanagh, R.D., Camhi, M., Burgess, G.H., Cailliet, G.M., Fordham, S.V., Simpfendorfer, C.A., Musick, J.A. (Eds.), Sharks, Rays and Chimaeras: The Status of the Chondrichthyans Fishes. IUCN, Gland, Switzerland, pp. 242–245.

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.

Oshitani, S., H. Nakano, and S. Tanaka. 2003. Age and growth of the silky shark *Carcharhinus falciformis* from the Pacific Ocean. *Fisheries Science,* 69: 456-464.

Paerl, H.W. 1997. Coastal Eutrophication and Harmful Algal Blooms: Importance of Atmospheric Deposition and Groundwater as "New" Nitrogen and Other Nutrient Sources. *Limnology and Oceanography,* 42(5, pt. 2): 1154-1165.

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.

Pikitch, E.K., M.D. Camhi, and E.A. Babcock. 2008. Introduction to Sharks of the Open Ocean. In E.K. Pikitch, M.D. Camhi, and E.A. Babcock (Eds.), *Sharks of the Open Ocean: Biology, Fisheries & Conservation.* (pp. 1-13). Oxford: Blackwell Publishing Ltd.

Poisson F., A.L. Vernet, B. Seret, and L. Dagorn. 2012. Good Practices to Reduce the Mortality of Sharks and Rays Caught Incidentally by the Tropical Tuna Purse Seiners. WCPFC-SC8-2012/ EB-IP-12. Busan, Republic of Korea. Western and Central Pacific Fisheries Commission.

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.

Pratt, H.L., S.H. Gruber, and T. Taniuchi (eds.). 1990. Elasmobranchs as Living Resources: Advances in the Biology, Ecology, Systematics, and the Status of the Fisheries: Proceedings of the Second United States-Japan Workshop, East-West Center, Honolulu, Hawaii, 9-14 December 1987. NOAA Technical Report NMFS, 90.

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

Rezzolla, D., and T. Storai. 2010. "Whale Shark Expedition": Observations on *Rhincodon typus* from Arta Bay, Gulf of Tadjoura, Djibouti Republic, Southern Red Sea. Cybium, 34(2): 195-206.

Rice, J. and S. Harley. 2012a. Assessment of the whale shark as a key shark species. WCPFC-SC8-2012/EB-WP-04. Busan, Republic of Korea. Western and Central Pacific Fisheries Commission.

Rice, J. and S. Harley. 2012b. Stock assessment of oceanic whitetip sharks in the western and central Pacific Ocean. WCPFC-SC8-2012/ SA-WP-06 Rev. 1. Busan, Republic of Korea. Western and Central Pacific Fisheries Commission.

Rice, J. and S. Harley. 2012c. Stock assessment of silky sharks in the western and central Pacific Ocean. WCPFC-SC8-2012/ SA-WP-07 Rev. 1. Busan, Republic of Korea. Western and Central Pacific Fisheries Commission.

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.

Rowat, D. and K.S. Brooks. 2012. A review of the biology, fisheries and conservation of the whale shark *Rhincodon typus*. Journal of Fish Biology 80: 1019-1056.

Schmidt, J.V., C.L. Schmidt, F. Ozer, R.E. Ernst, K.A. Feldheim, M.V. Ashley, and M. Levine. 2009. Low genetic differentiation across three major ocean populations of the whale shark, *Rhincodon typus*. *PLoS One* 4(4): 4988.

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.

Seki, T., T. Taniuchi, H. Nakano, and M. Shimizu. 1998. Age, Growth and Reproduction of the Oceanic Whitetip Shark from the Pacific Ocean. *Fisheries Science* 61(1): 14-20.

Sergio, F., I. Newton, L. Marchesi, and P. Pedrini. 2006. Ecologically justified charisma: preservation of top predators delivers biodiversity conservation. *Journal of Applied Ecology* 43: 1049–1055.

Sequeira, A.M.M., C. Mellin, M.G. Meekan, D.W. Sims, and C.J.A. Bradshaw. 2013. Inferred global connectivity of whale shark *Rhincodon typus* populations. *Journal of Fish Biology* 82(2): 367-389.

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.

Skomal, G.B. 2007. Evaluating the physiological and physical consequences of capture on post-release survivorship in large pelagic fishes. *Fisheries Management and Ecology* 14: 81-89.

Skomal, G.B., and B.C. Chase. 2002. The Physiological Effects of Angling on Post-Release Survivorship in Tunas, Sharks, and Marlin. *American Fisheries Society Symposium* 20: 135-138.

Slomp, C.P. and P.V. Cappellen. 2004. Nutrient inputs to the coastal ocean through submarine groundwater discharge: controls and potential impact. *Journal of Hydrology* 295: 64–86.

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.

Secretariat of the Pacific Community Oceanic Fisheries Programme (SPC-OFP). 2012. Summary information on whale shark and cetacean interactions in the tropical WCPFC purse seine fishery. WCPFC8-2011-IP-01 (rev. 1). Western and Central Pacific Fisheries Commission: Eighth Regular Session, Tumon, Guam, USA, 26-30 March 2012.

SPC-OFP. 2013. Western and Central Pacific Fisheries Commission Tuna Fishery Yearbook 2012. Western and Central Pacific Fisheries Commission

Stafford-Deitsch, J. 1988. *Shark: A Photographer's Story.* Sierra Club Books, California, 200p.

Stevens, J.D. 1984. Biological observations on sharks caught by sport fisherman of New South Wales. *Marine and Freshwater Research* 35(5): 573-590.
Stevens, J.D. 2007. Whale shark (*Rhincodon typus)* biology and ecology: A review of the primary literature. *Fisheries Research* 84(1): 4-9.

Stevens J.D., T. Walker, S. Cook, and S. Fordham. 2005. Threats faced by chondrichthyan fish. In: Fowler S, Cavanagh R, Camhi M, Burgess G, Cailliet G, Fordham S, Simpfendorfer C, Musick J, editors. Sharks, rays and chimaeras: the status of the chondrichthyan fishes. Gland, Switzerland: The World Conservation Union (IUCN): 48–57.

Strasburg, D.W. 1958. Distribution, abundance, and habits of pelagic sharks in the central Pacific Ocean. *Fisheries* 1: 2S.

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

Temple, S.A. 1987. Do Predators Always Capture Substandard Individuals Disproportionately From Prey Populations? *Ecology* 68(3): 669-674.

Thums, M., M. Meekan, J. Stevens, S. Wilson, and J. Polovina. 2012. Evidence for behavioural thermoregulation by the world's largest fish. *Journal of the Royal Society Interface* 10: 20120477.

Western and Central Pacific Fisheries Commission. 2012. Conservation and Management Measure for Protection of Whale Sharks from Purse Seine Fishing Operations. Conservation and Management Measure 2012-04. Manila, Philippines.

Western Pacific Regional Fishery Management Council. 2009a. Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region. Honolulu, Western Pacific Fishery Management Council.

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

Western Pacific Regional Fishery Management Council. 2013. Pelagic Fisheries of the Western Pacific Region: 2011 Annual Report. Honolulu, HI, WPFMC Report NA77FC0008. Honolulu, Western Pacific Fishery Management Council.

Wetherbee, B.M., S.H. Gruber, and E. Cortes. 1990. Diet, feeding habits, digestion, and consumption in sharks, with special reference to the lemon shark, *Negaprion brevirostris*. In H.L. Pratt, Jr., S.H. Gruber and T. Taniuchi (eds.) Elasmobranchs as living resources: advances in the biology, ecology, systematics, and the status of the fisheries. NOAA Tech. Rep. NMFS 90: pp. 28-47.

Williams, P., Terawasi, P. 2013. Overview of tuna fisheries in the Western and Central Pacific Ocean, including economic conditions – 2012. WCPFC-SC9-2013/GN WP-1. Pohnpei, Federated States of Micronesia. Western and Central Pacific Fisheries Commission

Worm, B., B. Davis, L. Kettemer, C.A. Ward-Paige, D. Chapman, M.R. Heithaus, S.T. Kessel, and S.H. Gruber. 2013. Global catches, exploitation rates, and rebuilding options for sharks. *Marine Policy* 40: 194-204.

van 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.

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Finding of No Significant Impact

Fishing Restrictions regarding the Oceanic Whitetip Shark, the Whale Shark, and the Silky Shark; RIN 0648-BD44

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 Environmental Assessment (EA) 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-BD), "Fishing Restrictions regarding the Oceanic Whitetip Shark, the Whale Shark, and the Silky Shark."

Background

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 for Oceanic Whitetip Shark" (CMM 2011-04) to address recent declines in catch rates and size of oceanic whitetip sharks (*Carcharhinus longimanus*) in the longline and purse seine fisheries. The WCPFC also adopted "Conservation and Management Measure for Protection of Whale Sharks from Purse Seine Fishing Operations" (CMM 2012-04) in response to concerns about the potential impacts of purse seine fishing operations on the sustainability of the whale shark (*Rhincodon typus*) and "Conservation and Management Measure for Silky Sharks" (CMM 2013-08) to address fisheries impacts to silky sharks (*Carcharhinus falciformis*) in the western and central Pacific Ocean (WCPO). The National Marine Fisheries Service (NMFS) is promulgating a rule to implement the applicable provisions of CMM 2011-04, CMM 2012-04, and CMM 2013-08 for U.S. fishing vessels used for commercial fishing for highly migratory species (HMS) in the area of application of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Convention). The regulations for oceanic whitetip sharks and silky sharks would prohibit the retention, transshipment, storage, or landing of either of the two species and would require the release of any oceanic whitetip shark or silky shark as soon as possible after it is caught with as little harm to the shark as possible. The regulations for whale sharks would prohibit setting a purse seine on a whale shark and would specify certain measures to be taken and reporting requirements in the event a whale shark is encircled in a purse seine net.

NMFS prepared an EA to analyze the impacts of the proposed rule on the human environment. The EA analyzed the proposed action (Alternative B), as well as the No-Action Alternative (Alternative A) and concluded that the proposed action would not have substantial effects on resources in the human environment.

The six elements of the proposed action are as follows:

1. Prohibit the crew, operator, and owner of the fishing vessel from retaining on board, transshipping, storing, or landing any part or whole carcass of an oceanic whitetip shark or silky shark that is caught in the Convention Area.
2. Require the crew, operator, and owner of the fishing vessel to release any oceanic whitetip shark or silky shark caught in the Convention Area as soon as possible after the shark is caught and brought alongside the vessel, and to use reasonable steps for its safety, without compromising the safety of any persons.
3. Allow observers to collect samples of oceanic whitetip sharks and silky sharks that are dead when brought alongside the fishing vessel in the Convention Area by requiring the crew, operator, and owner of the vessel to allow and assist a NMFS observer or WCPFC observer to collect samples from dead oceanic whitetip sharks or silky sharks, if requested to do so by the observer, notwithstanding the two elements described above.
4. Prohibit the crew, operator, and owner of the fishing vessel from setting or attempting to set a purse seine on or around a whale shark if the animal is sighted prior to the commencement of the set or the attempted set. This element would apply on the high seas and in exclusive economic zones (EEZs) in the Convention Area, except for the EEZs of the Parties to the Nauru Agreement (PNA)[1].
5. Require the crew, operator, and owner of the fishing vessel to release any whale shark that is encircled in a purse seine net in the Convention Area, and to take reasonable steps for its safe release, without compromising the safety of any persons. This element would apply on the high seas and in EEZs in the Convention Area, including the EEZs of the PNA.
6. Require the owner and operator of the fishing vessel that encircles a whale shark with a purse seine in the Convention Area to ensure that the incident is recorded by the end of the day on the catch report form (i.e., the Regional Purse Seine Logsheet maintained pursuant to 50 CFR § 300.34(c)(1)) in the format specified by the NMFS Pacific Islands Regional Administrator. This element would apply on the high seas and in EEZs in the Convention Area, including the EEZs of the PNA.

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 fisheries that would be affected by the proposed action include albacore, bigeye tuna, blue marlin, mahimahi, skipjack tuna, swordfish, yellowfin tuna, and wahoo. As stated in Section 4.14 of the EA, the oceanic whitetip shark and silky shark elements of the proposed rule under the proposed action could cause some minor changes in the species composition of retained catch due to the increase in discards leading to an increase in hold space available for other species, at least in

[1] The PNA currently includes the following countries: Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands, and Tuvalu.

the longline and troll fisheries. Thus, it is possible that there could be some increase in effort for fishing for the target stocks and an increase in the amount of target stocks caught and retained. However, given that only a small number of oceanic whitetip sharks and silky sharks are currently retained, it is unlikely that any increase in hold space as a result of the proposed rule would be large enough to substantially affect the fishing practices of the affected fleets. Thus, though there is some small potential for increased fishing effort on target stocks, it is more likely that the rule would not lead to an increase in fishing effort and would result in no direct or indirect effects to target stocks. Moreover, the proposed rule could lead to some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught, or if vessel owners/operators/crew need to wait or change locations to make sets and spend time reporting on whale shark encirclements. This decrease in fishing time would counteract the possible increase in fishing effort.

2) Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?

Response: No. Section 4.11 of the EA describes the effects of the proposed action on the oceanic whitetip shark and the silky shark. The oceanic whitetip shark and silky shark elements of the proposed rule would be expected to cause only minor effects on the abundance of oceanic whitetip shark and the silky shark in the WCPO. The small number of these sharks that are currently retained in the fisheries would be expected to be discarded under the first element of the proposed rule. A recent study of post release survival rates of the silky shark in WCPO purse seine fisheries demonstrated that at least some silky sharks survive post release. No specific studies were identified on the post release survival rates of the oceanic whitetip shark. However, based on the information available on post release survival of sharks in general and the study for post release survival rates of silky sharks, it can be expected that at least some oceanic whitetip sharks and silky sharks that are released to comply with the first element of the proposed rule would survive, with the rates of survival for silky sharks likely dependent on when the shark is released. Comparing the small number of these types of sharks currently caught and retained in the U.S. fisheries in the WCPO compared to the number of these types of sharks caught overall in WCPO fisheries– only very minor direct effects on the size of the populations of the oceanic whitetip shark or the silky shark as a result of the first element of the proposed rule would be expected. Over time, the number of sharks that could survive in response to the first element of the proposed rule could have some minor beneficial contribution to the overall status of the stocks (i.e., a minor increase in the size of the stock), so there could be some minor beneficial indirect effects to the stocks as a result of the proposed rule.

The second element of the proposed rule could also have some minor beneficial direct and indirect effects on abundance and the overall status of the stocks (i.e., a minor increase in the size of the stock) of the oceanic whitetip shark and the silky shark. The specific methods currently used by the crew, operators, and owners of vessels to release oceanic whitetip sharks and silky sharks are unknown, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more precautions when releasing the sharks. This increase in precaution could in turn increase the post release survival of the sharks. Comparing the small number of these types of sharks currently caught and retained in the U.S. fisheries in the WCPO compared to the number of these types of sharks caught overall in WCPO fisheries, only minor direct effects on the size of the populations of the oceanic whitetip shark or the silky shark as a result of the second element of the proposed rule would be expected. Over time, the number of sharks that could survive in response to the second element of the proposed rule could have some minor beneficial contribution to the overall status of the stocks (i.e., a minor increase in the size of the stock), so there could be some minor beneficial indirect effects to the stocks as a result of the proposed rule.

As stated in Section 4.12 of the EA, should the first whale shark element of the proposed rule lead to any reduction in interactions with whale sharks in the fishery (it is unclear how many interactions currently take place after the whale shark is sighted prior to the commencement of the set), there is a small potential for minor beneficial direct and indirect effect on the whale shark. If some of the interactions that currently result in mortalities are avoided as a result of the proposed rule, then there could be minor direct effects on the whale shark. Over time, this reduction in mortalities could have some minor beneficial indirect effects on the overall status of the stock (i.e., a minor increase in the size of the stock).

The second whale shark element of the proposed rule could have some direct and indirect, beneficial effects on the whale shark. The specific methods currently used by the crew, operators, and owners of U.S. purse seine vessels to release whale sharks are not definitively known, so implementation of the requirements to release the sharks as soon as possible and to ensure that reasonable steps are taken to ensure the safe release of the sharks may lead to the crew, operators, and owners to take more precautions when releasing the sharks, thus increasing the number of whale sharks that are alive upon release. As stated in Chapter 3 of the EA, no specific studies were identified on the post release survival rates of the whale shark, however, this increase in precaution could also lead to an increase in the post release survival of the sharks.

As for other non-target stocks, Section 4.15 of the EA indicates that any effects on such stocks would be minor or negligible. Any increase in effort for target species could lead to additional catch of non-target stocks, but as stated in the response to question 1, above, it is more likely that the rule would not lead to an increase in fishing effort and would result in no direct or indirect effects to target 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 Section 4.16 of the EA, 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. Any potential minor increase in fishing effort would be counteracted by a potential minor decrease in fishing effort and would not be expected to cause impacts to EFH or HAPC or ocean or coastal habitats.

4) Can the proposed action reasonably be expected to have a substantial adverse impact on public health or safety?

Response: No. As stated above in the description of the elements of the proposed rule, the regulations include explicit language taking into consideration the safety of all persons when releasing oceanic whitetip sharks, silky sharks, and whale sharks. The other elements of the proposed rule would not be expected to lead to safety concerns.

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. As stated in Section 4.16 of the EA, the six elements of the proposed rule under the proposed action could cause some minor effects on the operations of the affected fisheries, but would not be expected to lead to substantial changes in fishing patterns and practices. The oceanic whitetip shark and silky shark elements of the proposed rule could cause some minor changes in the species composition of retained catch as well as some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught. The whale shark elements of the proposed rule could also cause some minor changes in terms of time spent on fishing or other activities, since vessel owners/operators/crew may need to wait or change locations to make sets, increase handling times to release sharks that are caught, and spend time reporting on whale shark encirclements.

To the extent that there is an increase in fishing effort, there would be some small potential for increased interactions with protected species. However, given that only a small number of oceanic whitetip sharks and silky sharks are currently retained, it is unlikely that the increase in hold space as a result of the proposed rule would be large enough to substantially affect the fishing practices of the affected fleets. Thus, though there is some small potential for increased fishing effort on target stocks, it is more likely that the rule would not lead to an increase in fishing effort and would result in no direct or indirect effects to target stocks, and consequently no direct or indirect effects to protected species. Moreover, the proposed rule could lead to some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught, or if vessel owners/operators/crew need to wait or change locations to make sets and spend time reporting on whale shark encirclements. This decrease in fishing time would counteract the possible increase in fishing effort.

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. As stated in Section 4.17 of the EA, the proposed rule could lead to some minor beneficial direct and indirect effects on the oceanic whitetip shark and the silky shark in the WCPO, as well as a potential reduction in whale shark mortalities caused by purse seine fishing operations in the WCPO, which could in turn lead to some minor beneficial direct and indirect effects to the whale shark in the WCPO. As discussed in Chapter 3 of this EA, the oceanic whitetip shark, the silky shark, and the whale shark are all apex predator species, so indirect effects on these species could in turn lead to indirect trophic interactive effects that could affect the ecosystem over time. Given the anticipated minor effects of the proposed rule on the three sharks, any effects on the ecosystem also would be expected to be minor. The types of effects to the ecosystem (e.g., increases or decreases to prey or other species) cannot be predicted at this time as there are too many unknowns and variables that would need to be taken into consideration – for example, the diet of the three shark species could change over time in response to as yet unknown circumstances.

7) Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: No. As described above, the six elements of the proposed rule under the proposed action could cause some minor effects on the operations of the affected fisheries, but would not be expected to lead to substantial changes in fishing patterns and practices. The oceanic whitetip shark and silky shark elements of the proposed rule could cause some minor changes in the species composition of retained catch as well as some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught. The whale shark elements of the proposed rule could also cause some minor changes in terms of time spent on fishing or other activities, since vessel owners/operators/crew may need to wait or change locations to make sets, increase handling times to release sharks that are caught, and spend time reporting on whale shark encirclements. As stated in the Regulatory Impact Review for the proposed rule, these effects could lead to neutral or very small positive benefits that the United Staets can potentially enjoy through the maintenance of populations of these sharks, though these benefits would be partially offset by losses to consumers and producers and public sector expenditures. Overall, these costs would be expected to be small.

8) Are the effects on the quality of the human environment likely to be highly controversial?

Response: No. As described above, the six elements of the proposed rule under the proposed action could cause some minor effects on the operations of the affected fisheries, but would not be expected to lead to substantial changes in fishing patterns and practices. The oceanic whitetip shark and silky shark elements of the proposed rule could cause some minor changes in the species composition of retained catch as well as some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught. The whale shark elements of the proposed rule could also cause some minor changes in terms of time spent on fishing or other activities, since vessel owners/operators/crew may need to wait or change locations to make sets, increase handling times to release sharks that are caught, and spend time reporting on whale shark encirclements. Moreover, the EA was made available during the public comment period for the proposed rule and the 41 comments submitted on the proposed rule did not raise any issues regarding the information in the EA.

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 EA, there are several National Wildlife Refuges and National Monuments in the affected environment. However, these resources would not be affected because any potential minor increase in fishing effort would be counteracted by a potential minor decrease in fishing effort.

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 EA, 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 rule is to implement the provisions of CMM 2011-04 and CMM 2013-08 for U.S. fishing vessels fishing for HMS in the Convention Area and the provisions of CMM 2012-04 for U.S. purse seine fishing vessels fishing in the Convention Area. The need for the proposed rule is to satisfy the obligations of the United States as member of the WCPFC. As described above, the six elements of the proposed rule under the proposed action could cause some minor effects on the operations of the affected fisheries, but would not be expected to lead to substantial changes in fishing patterns and practices. The oceanic whitetip shark and silky shark elements of the proposed rule could cause some minor changes in the species composition of retained catch as well as some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught. The whale shark elements of the proposed rule could also cause some minor changes in terms of time spent on fishing or other activities, since vessel owners/operators/crew may need to wait or change locations to make sets, increase handling times to release sharks that are caught, and spend time reporting on whale shark encirclements. 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 some minor beneficial direct and indirect effects on the oceanic whitetip shark, the silky shark, and the whale shark in the WCPO. The other identified past, present, and reasonably foreseeable future actions could have some effects on the fishing patterns and practices of the affected fisheries, and to the extent that fishing effort is increased, there could be an increased risk of interaction with the oceanic whitetip shark, the silky shark, and the whale shark. To the extent fishing effort is decreased, there could be a decreased risk of interaction with the oceanic whitetip shark, the silky shark, and the whale shark.

Given that the objective of the other actions is sustainable management of fisheries and that the majority of the other actions would constrain fishing effort to some degree, it is expected that the overall cumulative impacts from the identified past, present, and reasonably foreseeable future actions to the oceanic whitetip shark, the silky shark, and the whale shark in the WCPO would be beneficial. The degree of beneficial impacts would be dependent on the effectiveness of the management measures, and as such, cannot be predicted at this time. However, as the majority of the other actions are not specifically focused on the conservation and management of the oceanic whitetip shark, the silky shark, and the whale shark, it is expected that the cumulative impacts to these sharks in the WCPO from the proposed action and the other identified past, present, and reasonably foreseeable actions would not be significant. As discussed in Chapter 4 of the EA, the likely effects on these sharks from the proposed action would be minor and beneficial direct and indirect effects, and it is likely that any effects from the other identified actions would be similar. As described in Chapter 3 of the EA, fishing activities are just one of many threats to shark populations worldwide.

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 4.16 of the EA, such resources would not be affected because any effects would not be expected in areas where these resources occur. The six elements of the proposed rule under the proposed action could cause some minor effects on the operations of the affected fisheries, but would not be expected to lead to substantial changes in fishing patterns and practices. The oceanic whitetip shark and silky shark elements of the proposed rule could cause some minor changes in the species composition of retained catch as well as some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught. The whale shark elements of the proposed rule could also cause some minor changes in terms of time spent on fishing or other activities, since vessel owners/operators/crew may need to wait or change locations to make sets, increase handling times to release sharks that are caught, and spend time reporting on whale shark encirclements. However, any potential minor increase in fishing effort would be counteracted by a potential minor decrease in fishing effort.

13) Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

Response: No. The six elements of the proposed rule under the proposed action could cause some minor effects on the operations of the affected fisheries, but would not be expected to lead to substantial changes in fishing patterns and practices. The oceanic whitetip shark and silky shark elements of the proposed rule could cause some minor changes in the species composition of retained catch as well as some minor changes in terms of time spent on fishing or other activities, if increased handling time is needed to release sharks that are caught. The whale shark elements of the proposed rule could also cause some minor changes in terms of time spent on fishing or other activities, since vessel owners/operators/crew may need to wait or change locations to make sets, increase handling times to release sharks that are caught, and spend time reporting on whale shark encirclements. However, any potential minor increase in fishing effort would be counteracted by a potential minor decrease in fishing effort. None of these effects would be expected to result in the introduction or spread of a nonindigenous species since the vessels in the fleets 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 rule is to implement the provisions of CMM 2011-04 and CMM 2013-08 for U.S. fishing vessels fishing for HMS in the Convention Area and the provisions of CMM 2012-04 for U.S. purse seine fishing vessels fishing in the Convention Area. 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 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 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 oceanic whitetip shark, the silky shark, and the whale shark are not expected to be substantial.

DETERMINATION
In view of the information presented in this document and the analysis contained in the supporting EA and Regulatory Impact Review prepared for the rule "Fishing Restrictions regarding the Oceanic Whitetip Shark, the Whale Shark, and the Silky Shark," 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 EA. 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.

JAN 1 4 2015

Regional Administrator
Pacific Islands Regional Office

Date