Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion

Action Agency: National Marine Fisheries Service, Pacific Islands Region, Sustainable Fisheries Division

Federal Action: Reinitiation of Endangered Species Act Section 7 consultation on the bottomfish fisheries of American Samoa, Guam, the Northern Mariana Islands, and the Main Hawaiian Islands as managed under the American Samoa, Mariana Archipelago, and Hawaii Archipelago Fishery Ecosystem Plans

Consultation Conducted by: National Marine Fisheries Service, Pacific Islands Region, Protected Resources Division

NMFS File No. (ECO): PIRO-2019-01148

PIRO Reference No.: I-PI-18-1752-AG

Approved By: ______________________________
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Date Issued: ______________________________

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1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1536(A)(2)) requires each federal agency to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a federal agency's action "may affect" an ESA-listed species, that agency is required to consult formally with the National Marine Fisheries Service (NMFS; for marine species or their designated critical habitat) or the U.S. Fish and Wildlife Service (FWS; for terrestrial and freshwater species or their designated critical habitat). Federal agencies are exempt from this formal consultation requirement if they have concluded that an action "may affect, but is not likely to adversely affect" ESA-listed species or their designated critical habitat, and NMFS or the FWS concur with that conclusion (50 CFR 402.14 (b)).

If an action is likely to adversely affect a listed species, the appropriate agency (either NMFS or FWS) must provide a biological opinion (opinion) to determine if the proposed action is likely to jeopardize the continued existence of listed species (50 CFR 402.14(e)). "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." (50 CFR 402.02)

This document represents NMFS' batched biological opinion of the effects that may result from the operation of the bottomfish fishery in American Samoa, Guam, the Commonwealth of the Northern Mariana Islands (CNMI) and the Main Hawaiian Islands (MHI) on the following ESA-listed marine species: oceanic whitetip shark, giant manta ray, and chambered nautilus, and designated critical habitat for MHI insular false killer whales (IFKW). Other threatened and endangered species under NMFS' jurisdiction that occur within the Action Area and may be affected by the authorization of these bottomfish fisheries were addressed previously in other consutlation documents. A summary of these consultations and species is provided in Appendix A of this biological opinion.

This biological opinion is based on the review of the February 2, 2019 (NMFS 2019a), and June 5, 2019, biological evaluations (2019b) provided for these fisheries, published and unpublished scientific information on the biology and ecology of threatened and endangered marine species of concern in the *Action Area*, monitoring reports and research in the region, and relevant scientific and gray literature (see *Literature Cited*).

This response to your request was prepared by NMFS pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 *et seq*.), and updated regulations at 50 CFR 402 (84 FR 44976; 10/28/2019).

1.1 Consultation History

On March 3, 2002, NMFS issued a final biological opinion on the management of the bottomfish and seamount groundfish fisheries in the Western Pacific region according to the *Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific*

Region. American Samoa and Guam bottomfish fisheries are part of a larger consultation that focused primarily on the bottomfish fisheries operating in the MHI and Northwestern Hawaiian Islands (NWHI) (NMFS 2002). In the 2002 biological opinion, NMFS had no records of observed or reported interactions between American Samoa and Guam bottomfish fisheries and threatened and endangered species and concluded that the ongoing operation of the bottomfish fisheries of the Pacific Islands, including American Samoa and Guam, is not likely to adversely affect the following species: loggerhead sea turtles (*Caretta caretta*), leatherback sea turtles (*Dermochelys coriacea*), olive ridley sea turtles (*Lepidochelys olivacea*), green sea turtles, (*Chelonia mydas*), hawksbill sea turtles (*Eretmochelys imbricata*), humpback whales (*Megaptera novaeangliae*), blue whales, (*Balaenoptera musculus*), fin whales (*B. physalus*), sei whales (*B. borealis*), right whales (*Eubalaena glacialis)* and sperm whales (*Physeter macrocephalus*). Subsequent to the issuance of this biological opinion, NMFS acknowledged that right whales comprised three separate species and that right whales in the North Pacific Ocean belonged to the species *E. japonica* (68 FR 17560; 2003).

The 2002 biological opinion concluded that the bottomfish fishery may incidentally hook Hawaiian monk seals, and identified seven instances of hookings that likely occurred in this fishery. The 2002 biological opinion also estimated that one seal would be hooked every 2.9 years, and that one serious injury/mortality would result from a hooking every 6.7 years. NMFS further concluded that few monk seals will be hooked or die as a result of interactions with the NWHI commercial bottomfish fishery, thus NMFS concluded that the action was not likely to jeopardize the continued existence of Hawaiian monk seals. At this time, the NWHI commercial bottomfish fishery is no longer operational due to the establishment of the Papahanaumokuakea Marine National Monument, which prohibits all commercial fishing within its boundaries, and as a result is no longer affecting the Hawaiian monk seal.

NMFS did not consider the bottomfish fisheries of the CNMI in the 2002 biological opinion because federal waters around the CNMI were not yet included under the fishery management plan for bottomfish fisheries of the Western Pacific Region.

On February 7, 2008, NMFS reinitiated consultation to evaluate the effects of implementing Amendment 14 to the Fishery Management Plan for the Bottomfish and Seamount Fisheries of the Western Pacific Region. The proposed action established regulations for a new management regime for the MHI bottomfish fishery. On March 18, 2008, NMFS issued a biological opinion that concluded the following species were not likely to be adversely affected by the proposed action: blue whales, fin whales, humpback whales, Northern right whales ("*E. glacialis"[recete, E. japonica]),* sei whales, sperm whales, hawksbill sea turtles, leatherback sea turtles, loggerhead sea turtles, olive ridley sea turtles (threatened and endangered), and Hawaiian monk seals (NMFS 2008). The consultation concluded that while green sea turtles would be adversely affected by the action, the action was not likely to jeopardize their continued existence in the wild. Adverse effects to green sea turtles were not attributed to interactions with fishing gear; adverse effects were attributed to an increased risk of being struck by a fishing vessel. In 2008, NMFS issued an incidental take statement for the death of two green sea turtles per year. At the time, the species was listed globally. Since 2016, the Hawaiian green sea turtle is listed as the Centeral North Pacific Distinct Population Segment of green sea turtles.

On May 29, 2008, NMFS requested reconsultation for the bottomfish and coral reef fisheries of the Marianas Archipelago. On June 3, 2008, NMFS concluded that fisheries managed under the Mariana Archipelago fishery management plan, the bottomfish fisheries of Guam and the CNMI, were not likely to adversely affect green, hawksbill, leatherback and olive ridley sea turtles, blue, fin, sei, humpback and sperm whales. NMFS concluded the action was unlikely to interact with these species due to their low densities, and the small-scale and seasonality of these fisheries,

On November 12, 2012, NMFS listed the MHI IFKW as endangered under the ESA (77 FR 70915). On July 19, 2013, NMFS requested reinitiation of consultation on the MHI bottomfish fisheries to address the newly listed critical habitat. On August 7, 2013, NMFS completed the reinitiated consultation by issuing a "modification (*sic*)" to the 2008 biological opinion to address the new listing and concluded that MHI bottomfish fisheries are not likely to adversely affect the MHI IFKW due to the spatial separation between the species and bottomfish fishing activities, the low likelihood of collisions, and the lack of observed or reported fishery interactions, among other reasons. NMFS also concluded that all previous determinations in the 2008 biological opinion for other ESA-listed species and critical habitat remained valid (NMFS 2013).

On April 9, 2015, NMFS responded to a request for consultation and concluded that the fisheries managed under the American Samoa FEP, specificallythe bottomfish fishery, the precious coral fishery, the crustatean fishery, and the coral reef ecosystem fishery were not likely to adversely affect the Indo-West Pacific distinct population segment of scalloped hammerhead shark (*Sphyrna lewini*) and six threatened reef-building corals: *Acropora globiceps*, *A. jacquelineae*, *A. retusa*, *A. speciosa*, *Euphyllia paradivisa*, and *Isopora crateriformis* (NMFS 2015a). NMFS reported that it expected the species would occur in low numbers or limited distribution and therefore would have a low risk of exposure due to the fishing techniques and small scale of the fisheries.

On April 2, 2015, NMFS requested reiniation of consultation on the continued authorization of the coral reef, bottomfish, crustacean, and precious coral fisheries under the Mariana Archipelago FEP (NMFS 2015c). On April 29, 2015, NMFS concurred that the Mariana Archipelago fisheries were not likely to adversely affect the Indo-West Pacific scalloped hammerhead shark and three threatened reef-building corals: *Acropora globiceps*, *A. retusa*, and *Seriatopora aculeata* (NMFS 2015b). NMFS concluded that the effects of the FEP were insignificant and discountable due to the limited distribution of these species, selective fishing techniques, and the small scale and scope of these fisheries.

On August 21, 2015, NMFS revised critical habitat for Hawaiian monk seals to include areas in the MHI extending 5 m inland from the shoreline out to the 200 m depth contour (80 FR 50926). The critical habitat designation also included the seafloor and all subsurface waters and marine habitat within 10 m of the seafloor. On March 1, 2016, NMFS concluded that the MHI bottomfish fisheries are not likely to adversely affect Hawaiian monk seal critical habitat in the MHI (NMFS 2016a). NMFS concluded that there would be spatial separation between the fishery and elements of monk seal critical habitat, and that harvest techniques are unlikely to result in any adverse effects to the designated critical habitat.

In 2018, NMFS issued final rules to list three species as threatened: the giant manta ray (*Manta birostris*; 83 FR 2916) on January 22, 2018; the oceanic whitetip shark (*Carcharhinus* *longimanus*; 83 FR 4153) on January 30, 2018; and the chambered nautilus (*Nautilus pompilius*; 83 FR 48976) on September 28, 2018. These three listings, as well as the designation of MHI IFKW critical habitat in Hawaii (83 FR 35062, 7/24/2018), triggered the requirement to reinitiate consultation due to their spatial overlap with the the bottomfish fisheries in Guam, CNMI, American Samoa, and Hawaii.

On February 1, 2019, NMFS Sustainable Fisheries Division (SFD) requested reinitiation of consultation on the MHI bottomfish fisheries and on June 5, 2019, NMFS SFD requested reinitiation of consultation on American Samoa, Guam, and CNMI bottomfish fisheries to address these new listings. NMFS Protected Resources Division (PRD) determined the requirements of 50 CFR 402.14 (c) were met and initiated consulation. This biological opinion batches these actions in a single document due to their similarities. This document represents the most recent of eight different consultation documents (biological opinions and letters of concurrence) that cover ESA consulation on the bottomfish fisheries under four FEPs that cover Hawaii, Guam and CNMI, American Samoa, and PRIAs since 2002. Some consultation documents have been superceded; eight remain valid in addition to this consultation document (See Appendix A for a table of bottomfish consultations).

2 DESCRIPTION OF THE PROPOSED ACTION

NMFS proposes to authorize the bottomfish fisheries as managed under the American Samoa FEP (WPFMC 2009a), Mariana Archipelago FEP (WPFMC 2009b), and the FEP for the Hawaii Archipelago (Hawaii FEP; WPFMC 2009c). The FEPs were developed by the Western Pacific Regional Fishery Management Council (Council) and approved by NMFS under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). NMFS and the Council manage the bottomfish fisheries in federal waters around American Samoa, Guam, CNMI, and the MHI under conservation and management measures contained in the FEPs and its implementing regulations at 50 CFR 665, and under general fisheries regulations at 50 CFR 600.

2.1 The American Samoa Bottomfish fishery

NMFS and the Council manage bottomfish fisheries in federal waters around the American Samoa, Guam and the Commonweath of the Northern Mariana Islands under conservation and management measures contained in the FEPs and implemented in regulations at 50 CFR 665, as well as general fisheries regulations at 50 CFR 600. The FEPs provide descriptions of the fisheries and resources of American Samoa, Guam and the Commonweath of the Northern Mariana Islands and the surrounding environment.

The American Samoa bottomfish fishery consists of part-time relatively small (less than 32 ft long) commercial vessels landing between 6,000–35,000 lbs annually (NMFS 2017). Most vessels are aluminum catamarans (alia) outfitted with outboard engines and wooden hand reels. Most fishermen fish during the day for safety reasons, although historically it was a night fishery. Because few boats carry ice, they typically fish within 20 miles of shore (WPFMC 2009c). The fishery captures a variety of snappers, jacks, and emperors. There are 11 American Samoa bottomfish management unit species (BMUS), which are the primary targets of the fishery and focus of federal conservation and management under the MSA (WPFMC and NMFS 2018). There are seven other fish species that are often caught in this fishery. These other species- termed ecosystem component species include other species of snapper, emporers and jacks.

In 2009, a tsunami struck American Samoa causing large-scale damage and impacts to the Territory's bottomfish fishing fleet resulting in the territorial government requesting disaster assistance under sections 312 and 315 of the Magnuson-Stevens Act. In 2008, 16 vessels participated in the fishery, however participation dropped in 2010 to just 8 vessels (WPFMC 2021a). Although there was a slight uptick from 2013 to 2017 when vessel participation was 10 or more, participation in the fishery remains low compared to past years, with only 6 vessels participating in 2020.

The American Samoa FEP regulations at (50 CFR 665.100 subpart B) prohibit the use of bottom trawls, bottom gillnets, explosives, and poisons in the bottomfish fishery. To prevent overfishing, NMFS manages the American Samoa bottomfish fishery through a system of annual catch limits (ACL) and accountability measures (AM). Since NMFS implemented the system of ACLs and AMs in 2012, the fishery has not exceeded an ACL.

Bottomfish are typically harvested in deep waters, though some species are caught over reefs at shallower depths. Most (85 percent) bottomfish habitat is in territorial waters (generally from the shoreline to 3 nautical miles (5.6 km) offshore), with the rest in Federal waters around offshore banks. Fishing for bottomfish in American Samoa primarily occurs within 20 mi (32.2 km) from shore using aluminum catamarans less than 32 ft (9.7 m) long, known locally as alia.

On February 10, 2020, NMFS notified the Council that the American Samoa bottomfish stock complex was overfished and subject to overfishing (85 FR 26940, May 6, 2020). Consistent with section 304(e) of the Magnuson-Stevens Act and implementing regulations at 50 CFR 600.310(j), the Council must prepare, and NMFS must implement, a rebuilding plan within two years of the notification 50 CFR 25594). Amendment 5 implements a rebuilding plan for the American Samoa bottomfish stock complex that consists of an ACL, and in-season AM, and a higher performance standard should the fishery exceed the ACL. The rebuilding plan implements an ACL of 5,000 lb (2,268 kg) starting in 2022. When NMFS projects the ACL will e reached, the Regional Administrator shall publish a document to that effect and use other means to notify permit holders. The document will include an advisement that the fishery will be closed, beginning at a specified date that is not earlier than sever days after the date of filing. If the ACl is exceeded in any year, then NMFS will publish an advisement that the fishery is closed not earlier than seven days after the date of filing. The fishery will remain closed until such time that NMFS can ensure catch in federal and territorial waters can be maintained at levels that all the stock to rebuild (50 CFR 25594).

There are no federal permit or reporting requirements for bottomfish fishing in federal waters around American Samoa. Monitoring of the American Samoa bottomfish fishery is dependent on the boat-based creel survey program and the commercial receipt book data collection program, both administered by the American Samoa Department of Marine and Wildlife Resources.

2.2 The Guam bottomfish fishery

Bottomfish fishing in Guam is a combination of recreational, subsistence, and small-scale commercial fishing. The fishery consists of approximately 35-45 unique vessels (in 2020, there were 35 vessels; WPFMC 2021b), mostly by people operating vessels less than 25 feet in length targeting the shallow water bottomfish complex (WPFMC 2021b). The fishery captures a variety of snappers, jacks, and emperors. There are 13 BMUS in the Mariana bottomfish fishery, which are the primary targets of the fishery and the focus of federal conservation and management under the MSA (WPFMC and NMFS 2018).

In addition to the BMUS, there are four fish species often caught by Guam bottomfish fishermen while targeting Mariana BMUS that are ecosystem component species. Mariana BMUS and ecosystem component species are generally stratified at different depths with a shallow-water assemblage and a deep-water assemblage. The shallow-water assemblage (< 500 ft) makes up the largest portion of the total bottomfish catch and is comprised primarily of reef-dwelling snappers (*Lutjanus kasmira* and *Aphareus rutilans*), lunar tail groupers (*Variola lauti*), jacks (*Caranx ignoblis* and *C. lugubris*), and emperors (*Lethrinus rubrioperculatus*). The deep-water fish assembledge (> 500 ft) consists primarily of snappers of the genera *Pristipomoides* and *Etelis*.

Vessels targeting the deep-water assemblage typically fish during the day, and fishing occurs year round. Commercial fishermen generally operate between two to six electric reels with one 6-lb weight on the end. The main line has several 1.5 ft branch lines with hooks attached at 1.5 to 3 ft intervals above the weight, although this configuration may vary. Fishermen also may suspend a light or a chum bag containing chopped bait above the highest hook to attract fish. Squid or cut fish are preferred baits. Shallow-water fishermen typically use two to four spinning reels with several hooks, generally size 8/0 circle hooks. Fishermen use a weighted (1-3 lb) fishing line, and position hooks at various depths in the water column above the ocean floor, targeting a mix of coral reef ecosystem and bottomfish species.

The banks offshore Guam are only accessible during calm weather, primarily in the summer months (May to August/September). Galvez Bank is the closest and most often fished. In contrast, the other banks (White Tuna, Santa Rose, and Rota) are remote and fishermen are able fish at these banks only during exceptionally good weather. However, the military also limits access to Area W-517, an irregular shaped polygon comprised of 14,000 square nautical miles (nm^2) of airspace that begins south of Guam and extends south-southwest in international waters and includes Galvez Bank and Santa Rosa Reef (U.S. Air Force 2014). Fishermen are restricted from fishing in this area during closures.

More fishermen participate in the shallow-water fishery than in the deep-water fishery, primarily because of the lower expenses of the fishery and relative ease of fishing close to shore (Myers 1997). Hospital and Beaver's (2012) survey results indicate that anglers targeting bottomfish fished solely in 0-3 nm waters on 35.5% of the trips, only in 3-200 nm on 19.9 % of the trips, and in both 0-3 nm and 3-200 nm waters on 44.5% of the trips. In a 12-month period, anglers on average made 42 fishing trips targeting bottomfish. Anglers targeting bottomfish were primarily fishing for deep-water bottomfish on 43.8% of the trips and for shallow water bottomfish on 23.7 % of the trips. Of fishing trips with bottomfish as the primary target, 87.8 % were single day trips, and 12.2 % were multiday trips (Hospital and Beaver 2012).

NMFS implemented regulations requiring the owners of all vessels 50 ft or greater in length fishing used to transship, receive, land or fish for bottomfish to obtain a federal bottomfish permit and report all catch, effort, and other data (71 FR 64474). Federal regulations also prohibit these vessels from fishing or anchoring within 50 nm around Guam. Since 2012, there have been two or fewer bottomfish permits issued annually. There were no federal permits issued in 2019 and 2020 for bottomfish fishermen using larger vessels, which have the ability to harvest higher numbers of bottomfish and farther out to sea and thus have a greater potential interaction rate with oceanic whitetip sharks than the smaller bottomfish vessels that fish far closer to shore. There have been no reported fishing trips from vessels greater than 50 ft in length since 2007 (NMFS Pacific Islands Fisheries Science Center (PIFSC), unpublished data). Federal requirements also prohibit the use of bottom trawls, bottom gillnets, explosives, and poisons. To prevent overfishing, NMFS manages the Guam bottomfish fishery through ACLs and AMs. All Mariana BMUS catches made from both nearshore and federal waters count toward the ACL.

In Guam, NMFS and the Council rely on reports from federally permitted bottomfish vessels, boat-based creel surveys, voluntary reporting program, and commercial receipt book programs administered by the Guam Division of Aquatic and Wildlife Resources to provide information on commercial and non-commercial catch and effort. Catch data from bottomfish fisheries are available about six months after the end of the fishing year. If NMFS and the Council determine after the end of a fishing year that the average catch from the most recent three-year period exceeds the specified ACL, NMFS reduces the ACL in the subsequent fishing years by the amount of the overage. Since NMFS implemented the system of ACLs and AMs in 2012, the fishery has not exceeded an ACL. In 2020, fishermen caught 25,555 lbs of the 27,000 lb Guam bottomfish ACL (WPFMC 2021b). Federal logbook catch data were added to reported catch for the first time in 2020 (WPFMC 2021b). In 2020, there were no federal bottomfish permits issued in Guam. Therefore, the primary source of information for catch, bycatch and effort in the Guam bottomfish fishery is from the boat-based creel surveys. Table 1shows the annual creel survey effort for Guam (WPFMC 2021b).

Table 1. Summary of creel survey effort for Guam (WPFMC 2021b)

Year	# Sample Days	# Catch Interviews	
		Regular	Opportunistic
1982	46	469	8
1983	47	431	34
1984	53	531	0
1985	66	812	0
1986	49	522	0
1987	48	612	0
1988	48	949	0
1989	48	931	2
1990	48	1,028	0
1991	48	1,019	1
1992	48	1,110	0
1993	52	1,119	0
1994	55	1,168	0
1995	96	1,613	4
1996	96	1,608	0
1997	96	1,358	0
1998	96	1,581	0
1999	96	1,367	3
2000	96	1,246	1
2001	96	908	6
2002	84	610	1
2003	78	446	0
2004	95	530	1
2005	97	552	0
2006	96	556	0
2007	96	500	0
2008	96	571	2
2009	96	803	0
2010	96	902	0
2011	96	645	0
2012	74	371	0
2013	96	561	1
2014	90	635	9
2015	97	651	13
2016	93	900	2
2017	92	820	10
2018	89	795	11
2019	93	786	3
2020	96	345	1
10-year avg.	**92**	**651**	**5**
10-year SD	**6**	**176**	**5**
20-year avg.	**92**	**644**	**3**
20-year SD	**6**	**168**	**4**

On February 10, 2020, NMFS notified the Council that the Guam bottomish stock complex was overfished. On February 18, 2022, NMFS published a final rule implementing a rebuilding plan that includes ACL limiting the fishery to 31.000 lbs and introduces accountability measures for the overfished bottomifhs stock complex in Guam (87 FR 9271). .Similar to the American

Samoa rebuilding plan, the Guam plan requires that the Regional Administrator close the fishery when the catch limit is reached.

2.3 CNMI Bottomfish Fishery

The CNMI bottomfish fishery occurs primarily around the populated islands of Saipan, Tinian, and Rota, and on banks adjacent to islands within the CNMI, extending northward from Rota to Zealandia Bank north of Sarigan (WPFMC 2011).

Vessels in the deep-water fishery typically fish during the day. Commercial fishermen generally operate between two to six electric reels with one 6-lb weight on the end. The main line has several 1.5 ft branch lines with hooks attached 1.5 to three ft intervals above the weight, although this configuration may vary. Fishermen also may suspend a light or a chum bag containing chopped bait above the highest hook to attract fish. Squid or cut fish are preferred baits. The fishing configuration used on shallow-water vessels smaller than 30 ft varies, and available information is mostly anecdotal. In most cases, there are two fishermen and two lines per boat

Hospital and Beavers (2014) survey results indicated that 39 fishermen make an average of 37 trips each year per fisher, where bottomfish were the primary target. Fishermen targeting bottomfish were primarily deep-water bottomfish fishing on 46.7% of the trips and shallow-water bottomfish fishing on 22.0% of the trips. Fishermen targeting bottomfish fished solely in 0- 3 nmi waters on 28.1% of the trips, only in the U.S.Exclusive Economic Zone (EEZ) beyond 3 nmi on 28.7% of the trips, and in both areas on 42.3% of the trips. Of the fishing trips with bottomfish as the primary target, 72.8% were single day trips and 27.2% were multiday trips (Hospital and Beaver 2014).

Mariana FEP bottomfish regulations require that the owner of any vessel used to commercially fish for, transship, receive, or land Mariana BMUS shoreward of the outer boundary of the CNMI management subarea must have a permit and submit their complete records of catch, effort, and other data to NMFS. Federal requirements also prohibit the use of bottom trawls, bottom gillnets, explosives, and poisons.

In 2020, 27 vessels fished for BMUS and 14 federal permits were issued (WPFMC 2020b). None of the 14 federal permits reported landings for 2020, which is consistent for five of the last seven years (WPFMC 2020b). Around Tinian, the amount of bottomfish fishing is very low with less than three participants and metrics are not available for Rota or Saipan. Due to data confidentiality, NMFS could not disclose the number of trips between 2009 and 2017 with Tinian as the fishing destination (PIFSC unpublished data).

To prevent overfishing, NMFS manages the CNMI bottomfish fishery through ACLs and AMs. All BMUS catches made from both nearshore and federal waters count toward the ACL. As with the other territories, NMFS and the Council rely on reports from federally permitted bottomfish vessels, boat-based creel surveys, voluntary reporting program, and commercial receipt book programs administered by the CNMI Division of Fish and Wildlife to provide information on commercial and noncommercial catch and effort. Since NMFS implemented the system of ACLs and AMs in 2012, the fishery has not exceeded an ACL. In 2020, fishermen caught 41,635 lb of the 84,000 lb CNMI bottomfish ACL (WPFMC 2021b). Federal logbook catch data were added to reported catch for the first time in 2020 (WPFMC 2021b). In 2020, there were 14 federal bottomfish permits issued however none of the federal bottomfish permit holders in CNMI reported any catch for the year. Therefore, the primary source of information for catch, bycatch and effort in the CNMI bottomfish fishery is from the boat-based creel surveys. Table 2 shows the annual creel survey effort for CNMI (WPFMC 2021b).

Table 2. Summary of CNMI boat-based creel survey effort from 2000 to 2020 (WPFMC 2021b).

Year	# Sample Days	# Catch Interviews	
		Regular	Opportunistic
2000	44	168	9
2001	67	285	0
2002	75	200	25
2003	90	299	40
2004	77	272	16
2005	78	417	29
2006	71	342	22
2007	62	314	1
2008	55	250	1
2009	64	241	25
2010	65	161	82
2011	67	162	87
2012	72	166	0
2013	71	191	0
2014	71	166	0
2015	57	119	2
2016	65	117	3
2017	66	120	6
2018	54	126	1
2019	33	65	8
2020	58	126	52
10-yr avg.	**61**	**136**	**16**
10-yr SD	**11**	**34**	**28**
20-yr avg.	**66**	**207**	**20**
20-yr SD	**11**	**89**	**26**

2.4 The Hawaii Bottomfish fishery

NMFS proposes to authorize the continued operation of the bottomfish fisheries in the MHI under the Fishery Ecosystem Plan for the Hawaii Archipelago (Hawaii FEP) (WPFMC 2009). Conservation and management measures for the MHI bottomfish fisheries are described in detail in Section 2.3.2 below. The Hawaii FEP was developed by the Council and approved by NMFS under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). NMFS and the Council manage the bottomfish fisheries in Federal waters around the MHI under the FEP and its implementing regulations at 50 CFR 665, and under general fisheries regulations at 50 CFR 600.

While transiting to and from bottomfish fishing grounds, some fishermen may engage in limited pelagic trolling for pelagic fish species. However, neither the Hawaii FEP nor the Pelagic FEP regulates this activity. This is because pelagic trolling is authorized and managed by the State of Hawaii, and pursuant to Federal regulations at 50 CFR 665.2, NMFS recognizes that any state law pertaining to vessels registered under the laws of that state while operating in the fisheries regulated by NMFS, and that is consistent with any FEP, shall continue in effect with respect to fishing activities regulated by NMFS.

For management purposes, the fishing year for the MHI Deep 7 bottomfish begins on September 1 and ends on August 31 the following year. For uku, the fishing year is the calendar year. See 50 CFR Part 665 – Subpart C for all federal regulations applicable to bottomfish fishing in Hawaii. Federal regulations for the MHI bottomfish fishery include the following requirements: vessel identification, a non-commercial fishing permit and trip reporting requirement, a non-commercial bag limit of five Deep 7 bottomfish per trip, and the specification of an ACL and AMs for MHI Deep 7 bottomfish species. When NMFS projects the fishery will reach the ACL, the commercial and non-commercial fisheries for MHI Deep 7 bottomfish in federal waters is closed for the remainder of the fishing year. Hawaii law authorizes the State to implement a complementary closure in State waters.Federal regulations prohibit the use of bottom trawls, bottom gillnets, explosives, and poisons. Federal permits are not required for commercial participants of either fishery because Hawaii already requires all commercial fishermen to obtain a commercial marine license, and report all catch (NMFS 2015a, 2015b).

Hawaii commercial and non-commercial bottomfish fisheries harvest a complex of 14 species that includes nine snappers, four jacks, and a grouper. The target species within that complex are six deep-water snappers and the grouper, which are referred to as the Deep 7 and are the most culturally important and highly valued of the deep-water bottomfish species in Hawaiʻi. Generally, the Deep 7 bottomfish are found along high-relief, deep slopes, ranging from 90-365 m (WPFMC 2021c).

Uku, also known the Hawaii blue-green snapper, is the primary non-Deep 7 bottomfish species harvested, and accounts for approximately 80% of the total commercial catch of non-Deep 7 bottomfish annually, followed by three jack species--white ulua, black ulua, and butaguchi (WPFMC 2018). The only non-Deep 7 bottomfish species classed as BMUS is uku, and all others are ECS. The predominance of uku in the catch is the result of fishermen who target this species, while other non-Deep 7 bottomfish are typically caught incidentally while fishing for uku or during Deep 7 bottomfish trips, although at shallower depths (NMFS 2015a). Uku is found at depths of 0-90 meters (WPFMC 2021c).

Fishermen in both the commercial and non-commercial bottomfish fishing sectors generally employ a vertical hook-and-line method of fishing, in which electric or hydraulic powered reels lower and raise weighted and baited lines to the desired fishing depths to target particular species. The main line is typically constructed of braided line made of polyester fibers (e.g. Dacron), or 150–200 lb test monofilament, with hook leaders of 80–120-lb test monofilament. The hooks are circle hooks, generally of sizes 11/0, 12/0, and 13/0, and a typical configuration uses six to eight hooks branching off the main line. The weight is typically 5–6 lb. The hook leaders are typically 2–6 ft long and separated by about 6 ft along the main line. Fishermen typically bait the hooks with squid, but may also use fish such as skipjack tuna or aku (*Katsuwonis pelamis*) and bigeye scad or akule (*Selar crumenopthalmus*). Some fishermen may also suspend a chum bag containing chopped fish or squid above the highest hook to attract fish (NMFS 2015b).

The typical vessel in the MHI bottomfish fleet is made of fiberglass and measures approximately 23 ft long, although there are a few larger full-time commercial vessels in the fishery (Chan and Pan 2017). In 2020, Hawaii issued 334 Deep 7 licenses, which is less than the 10-year average of 395. 161, 437 lbs of Deep 7 bottomfish were harvested in 2020, which is less than the 2020 ACL of 492,000 lbs (WPFMC 2021c). Specific bottomfish fishing locations favored by fishermen in the MHI vary seasonally according to sea conditions and the availability and price of target species. Reported commercial catches of MHI Deep 7 bottomfish for fishing years 1949-2013 indicate that catch from the island group of Maui, Lanai, and Molokai, including Penguin bank, located approximately 15 miles southeast of Oahu, accounts for 59% of the total catch. The remaining catch comes from waters offshore of the islands of Hawaii (22%), Oahu (8%), and Kauai (11%) (Brodziak et al. 2013). A 2014 survey of commercial and non-commercial bottomfish fishermen indicates that the majority of MHI bottomfish fishing trips (56 %) are limited to state waters, with the balance in the EEZ (Chan and Pan 2017). This is similar to the result of Hospital and Beavers (2012), which reported that the majority of bottomfish trips (66%) are limited to State waters only.

3 APPROACH TO THE ASSESSMENT

3.1 Overview of NMFS Assessment Framework

Biological opinions address two central questions: (1) has a Federal agency insured that an action it proposes to authorize, fund, or carry out is not likely to jeopardize the continued existence of endangered or threatened species and (2) has a Federal agency insured that an action it proposes to authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat that has been designated for such species. Every section of a biological opinion from its opening page and its conclusion and all of the information, evidence, reasoning, and analyses presented in between is designed to help answer these two questions. What follows summarizes how NMFS' generally answers these two questions; that is followed by a description of how this biological opinion will apply this general approach to these batched bottomfish fisheries.

Before we introduce the assessment methodology, we want to define the word "effect." An *effect* is a *change or departure* from a *prior state or condition* of a *system caused* by an *action or exposure* (Figure 1). Although Figure 1 depicts a negative effect, the definition itself is neutral: it applies to activities that benefit endangered and threatened species as well as to activities that harm them. Whether the effect is positive (beneficial) or negative (adverse), an "effect" represents a change or departure from a prior condition (a in Figure 1); in consultations, the prior global condition of species and designated critical habitat is summarized in the *Status of the Species* narratives while their prior condition in a particular geographic area (the *Action Area*) is summarized in the *Environmental Baseline* section of this opinion. Extending this baseline condition over time can be used to inform a *future without the project* condition (line b in Figure 1); this is alternatively called a counterfactual because it describes the world as it might exist if a particular action did not occur. Although consultations do not address it explicitly, the future without the project is implicit in almost every effects analysis.

As Figure 1 illustrates, effects have several attributes: *polarity* (positive, negative, or both), *magnitude* (how much a proposed action causes individuals, populations, species, and habitat to depart from their prior state or condition) and *duration* (how long any departure persists). The last of these attributes—*duration*—implies the possibility of recovery which has the additional attributes *recovery rate* (how quickly recovery occurs over time; the slope of line **c** in the figure) and *degree of recovery* (complete or partial). The recovery rate allows us to estimate how long it would take for listed species and the environment upon which they depend to recover after an effect.

As described in the following narratives, biological opinions apply this concept of effects to endangered and threatened species and designated critical habitat. Jeopardy analyses are designed to identify probable departures from the prior state or condition of individual members of listed species, populations of those individuals, and the species themselves. Destruction or adverse modification analyses are designed to identify departures in the area, quantity, quality, and availability of the physical and biological features that represent habitat for these species.

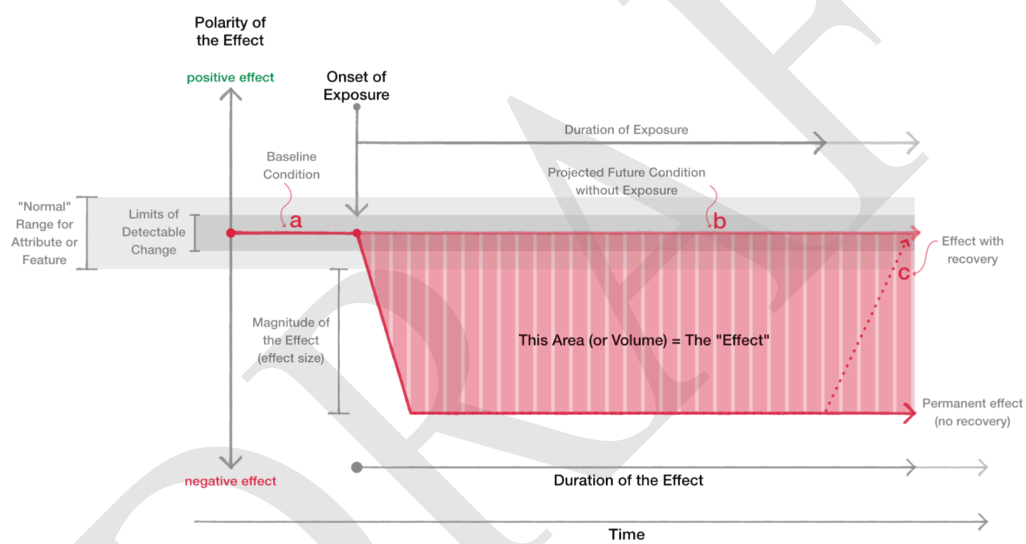

Figure 1. A schematic of the various elements encompassed by the word "effect." The vertical bars in the figure depict a series of annual "effects" (negative changes from a pre-existing or "baseline" condition) that are summed over time to estimate the action's full effect. See text for a more complete explanation of this figure.

3.2 Jeopardy analyses

The section 7 regulations define "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, *to reduce appreciably* the *likelihood of both the survival and recovery* of a listed species in the wild by reducing the *reproduction, numbers, or distribution* of that species" (50 CFR 402.02, *emphasis added*). This definition requires our assessments to address four primary variables:

1. Reproduction

2. Numbers
3. Distribution
4. the probability of the proposed action will cause one or more of these variables to change in a way that represents an appreciable reduction in a species' likelihood of surviving and recovering in the wild.

Reproduction leads this list because it is "the most important determinant of population dynamics and growth" (Carey and Roach 2020). *Reproduction* encompasses the reproductive ecology of endangered and threatened species; specifically, the abundance of adults in their populations, the fertility or maternity (the number of live births rather than the number of eggs they produce) of those adults, the number of live young adults produce over their reproductive lifespans, how they rear their young (if they do), and the influence of habitat on their reproductive success, among others. Reducing one or more of these components of a population's reproductive ecology can alter its dynamics so reproduction is a central consideration of jeopardy analyses.

The second of these variables—*numbers*—receives the most attention in the majority of risk assessments and that is true for jeopardy analyses as well. Numbers or abundance usually represents the total number of individuals that comprise the species, a population, or a sub-population; it can also refer to the number of breeding adults or the number of individuals that become adults. For species faced with extinction or endangerment several numbers matter: the number of populations that comprise the species, the number of individuals in those populations, the proportion of reproductively active adults in those populations, the proportion of sub-adults that can be expected to recruit into the adult population in any time interval, the proportion of younger individuals that can be expected to become sub-adults, the proportion of individuals in the different genders (where applicable) in the different populations, and the number of individuals that move between populations over time (immigration and emigration). Reducing these numbers or proportions can alter the dynamics of wild populations in ways that can reinforce their tendency to decline, their rate of decline, or both. Conversely, increasing these numbers or proportions can help reverse a wild population's tendency to decline or cause the population to increase in abundance.

The third of these variables—*distribution*— refers to the number and geographic arrangement of the populations that comprise a species. Jeopardy analyses must focus on populations because the fate of species is determined by the fate of the populations that comprise them: species become extinct with the death of the last individual of the last population. For that reason, jeopardy analyses focus on changes in the *number of populations*, which provides the strongest evidence of a species' extinction risks or its probability of recovery. Jeopardy analyses also focus on changes in the spatial *distribution of the populations* that comprise a species because such changes provide insight into how a species is responding to long-term changes in its environment (for example, to climate change). The spatial distribution of a species' populations also determines, among other things, whether all of a species' populations are affected by the same natural and anthropogenic stressors and whether some populations occur in protected areas or are at least protected from stressors that afflict other populations.

To assess whether reductions in a species' reproduction, numbers, or distribution that are caused by an action measurably reduce the species' likelihood of surviving and recovering in the wild, NMFS' first assesses the status of the endangered or threatened species that may be affected by an action. That is the primary purpose of the narratives in the *Status of the Species* sections of biological opinions. Those sections of biological opinions also present descriptions of the number of populations that comprise the species and their geographic distribution. Then NMFS' assessments focus on the status of those populations in a particular *Action Area* based on how prior activities in the *Action Area* have affected them. The *Environmental Baseline* sections of biological opinions contain these analyses; the baseline condition of the populations and individuals in an *Action Area* determines their probable responses to future actions.

To assess the effects of actions considered in biological opinions, NMFS' consultations use an *exposure–response–risk* assessment framework. The assessments that result from this framework begin by identifying the physical, chemical, or biotic aspects of proposed actions that are known or are likely to have individual, interactive, or cumulative direct and indirect effects on the environment (we use the term "potential stressors" for these aspects of an action). As part of this step, we identify the spatial extent of any potential stressors and recognize that the spatial extent of those stressors may change with time. The area that results from this step of our analyses is the *Action Area* for a consultation.

After they identify the *Action Area* for a consultation, jeopardy analyses then identify the listed species and designated critical habitat (collectively, "listed resources"; critical habitat is discussed further below) that are likely to occur in that *Action Area*. If we conclude that one or more species is likely to occur in an *Action Area* when the action would occur, jeopardy analyses try to estimate the number of individuals that are likely to be exposed to stressors caused by the action: the intensity, duration, and frequency of any exposure (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to an Action's effects and the populations or subpopulations those individuals represent.

Once we identify the individuals of listed species that are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those individuals are likely to respond given their exposure (these represent our *response analyses*). Our individual-level assessments conclude with an estimate of the probable consequences of these responses for the "fitness" of the individuals exposed to the action. Specifically, we estimate the probability that exposed individuals will experience changes in their growth, development, longevity, and the number of living young they produce over their lifetime. These estimates consider life history tradeoffs, which occur because individuals must allocate finite resources to growth, maintenance and surviving or producing offspring; energy that is diverted to recover from disease or injury is not available for reproduction.

If we conclude that an action can be expected to reduce the fitness of at least some individuals of threatened or endangered species, our jeopardy analyses then estimate the consequences of those changes on the viability of the population(s) those individuals represent. This step of our jeopardy analyses considers the abundance of the populations whose individuals are exposed to an action; their prior pattern of growth and decline over time in the face of other stressors; the proportion of individuals in different ages and stages; gender ratios; whether the populations are "open" or "closed" (how much they are influenced by immigration and emigration); and their ecology (for example, whether they mature early or late, whether they produce many young or a small number of them, etc.). Because the fate of species is determined by the fate of the populations that comprise them, this is a critical step in our jeopardy analyses.

Our risk analyses normally conclude by assessing how changes in the viability of populations of threatened or endangered species affect the viability of the species those populations comprise (measured using probability of demographic, ecological, or genetic extinction in 10, 25, 50 or 100 years). This step of our analyses considers data available on the particular populations and species affected by an action. However, this step of our analyses is also informed by empirical information on (1) species that have become extinct—they became endangered but did not "survive" endangerment and, therefore, could not "recover" from it; (2) species whose abundance and distribution has declined and collapsed but whose future—their likelihood of continuing to persist over time (survive) or recovering them from endangerment—remains uncertain; (3) species that have declined and collapsed, but have begun the process of recovering from endangerment although they have not yet "recovered" in the wild; and (4) species that have survived endangered and subsequently recovered from it. The second of these categories includes species that have been extinct in the wild, but "survive" in captivity.

Section 7(a)(2) requires us to insure that threatened or endangered species are not likely to become extinct in the wild and, instead, insure that they are likely to end up in the fourth category (survived and recovered). We fulfill that mandate by studying data and other information on how and why species ended up in these four categories, identifying common patterns in the data, and using the knowledge those studies produce to inform our jeopardy determinations.

3.3 **Destruction or adverse modification analyses**

The section 7 regulations define "destruction or adverse modification" as "a direct or indirect alteration that appreciably diminishes *the value of critical habitat as a whole for the conservation* of a listed species. (50 CFR 402.02). This definition focuses on how federal actions affect the quantity, quality, and availability of the physical or biological features of the designated critical habitat.

NMFS uses the same *exposure–response–risk* assessment framework for designated critical habitat that it uses for jeopardy analyses. Exposure analyses first determine if designated critical habitat occurs in the *Action Area* for a consultation. If it does, those analyses identify the physical or biological features of critical habitat that are likely to be exposed to an action's effects.

Our analyses then consider how those features are likely to respond to that exposure, which requires us to consider the habitat's probable condition when the exposure occurs (that is, the impact of the *Environmental Baseline* on the value of the habitat); the ecology of the habitat at the time of exposure; where the exposure is likely to occur; and when the exposure is likely to occur; and the intensity, duration, and frequency of exposure.

If our analyses lead us to expect the quantity, quality, or availability of the physical or biological features of an area of designated critical habitat to decline because of a proposed action, we ask if those reductions are likely to be sufficient to reduce the value of the designated critical habitat for the conservation of listed species in the *Action Area*. By *value*, we mean the probability that the habitat designated in the *Action Area* will be occupied by and provide utility to individuals of the endangered or threatened species it was designated to help conserve. In this case, *occupancy* only means that individuals of the species are likely to use the habitat, even if they only use it intermittently; *utility* means that the individuals that occupy the habitat receive measurable improvement in their fitness (as defined earlier) as a result of using the habitat.

NMFS' destruction or adverse modification analyses are based on whether any reductions in the value of designated critical habitat in an *Action Area* is likely to be sufficient to *reduce the value of the entire critical habitat designation*. In this final step of our assessment, we combine information about the essential features of critical habitat that are likely to experience changes in quantity, quality, and availability given exposure to an action with information on the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the *Action Area*. We use the conservation value of the entire designated critical habitat (as described in the *Status of the Species and Designated Critical Habitat* subsections of biological opinions) as our point of reference for this comparison.

3.4 **Application of this Approach in this Consultation**

NMFS identified several aspects of the American Samoa, Guam, CNMI, and MHI bottomfish fisheries that represent potential stressors to the environment, to threatened or endangered species, and/or to critical habitat that has been designated for them. Sources of the stressors associated with this action are primarily vessels and vessel operations, and the fishing gear used.The specific stressors addressed in this consultation include:

- Interaction with and potentiallycapture of non-target species, such as listed species or their prey,
- derelict gear,
- vessel strike,
- introduction of waste into marine waters, including fuel and oil, plastics, and other waste materials, and
- vessel emissions.

3.4.1 Action Area

The *Action Area* for this consultation encompasses all areas to be affected directly or indirectly by the Federal action and is not merely the immediate area involved in the action. Vessel operations and fishing activities, and the noise, disturbance and capture resulting from these vessels, define the *Action Area* for this batched consultation. This includes state and territorial waters, where bottomfish vessels transit to and from port, and the areas within the US EEZ where bottomish fishing occurs. Therefore the *Action Area* for this batched consultation includes waters around American Samoa, Guam, CNMI and the MHI. Areas where fishing is prohibited, like the waters around Papahanaumokuakea Marine National Monument are not part of the *Action Area* for this batched consultation.

3.4.2 Evidence Available for this Consultation

This consultation relies upon the data and other information contained in SFD's biological evaluation of the potential effects of Main Hawaiian Islands Bottomfish Fisheries on the Oceanic Whitetip Shark, Giant Manta Ray, and Critical Habitat of the Main Hawaiian Islands Insular False Killer Whale Distinct Population Segment (NMFS 2019b); potential effects of Bottomfish Fisheries in American Samoa, Guam and Northern Mariana Islands on Oceanic Whitetip Shark, Giant Manta Ray, and Chambered Nautilus (NMFS 2019a); the Council's 2020 Stock Assessment and Fishery Evaluation Reports (WPFMC 2021a, b, c), NMFS marine mammal stock assessment reports, available recovery plans for affected species, the 2016 *Report of the Rare Events Bycatch Workshop Series* (WPRFMC 2016), and the Bycatch Management Information System (BMIS). We supplemented this information by conducting electronic searches of literature published in English or with English abstracts to cross search multiple databases for relevant scientific journals, open access resources, proceedings, web sites, doctoral dissertations and master's theses. Particular databases we searched for this consultation included *Aquatic Sciences and Fisheries Abstracts*, *First Search*, *Toxnet*, *Science Direct, BioOne, Conference Papers Index, JSTOR, Google Scholar,* and *Web of Science*.

3.4.3 Approach to Evaluting Effects

We started our analysis by describing where the American Samoa, Guam, CNMI, and MHI bottomfish fisheries activities are likely to occur over time and where the potential effects of the proposed action are expected to occur. This forms the *Action Area* for this consultation. Within this *Action Area*, we identify those activities and associated stressors that are likely to co-occur with (a) individuals of endangered or threatened species or areas designated as critical habitat for threatened or endangered species; (b) species that are food for endangered or threatened species; or (c) species that prey on or compete with endangered or threatened species. The latter step represents our exposure analyses, which are designed to identify:

- the exposure pathway (the course the stressor takes from the source to the listed resource or its prey or predators or competetors?);
- the exposed listed resource (what life history forms or stages of listed species are exposed; the number of individuals that are exposed; which populations the individuals represent); and
- the timing, duration, frequency, and severity of exposure.

We also describe the how exposure might vary depending on the characteristics of the environment (for example, the occurrence of oceanic fronts or eddies) and seasonal differences in those characteristics, behavior of individual animals, etc. Our exposure analyses require knowledge of the action, and a species' population structure and distribution, migratory behaviors, life history strategy, and abundance.

We began by parsing species by the general location of their exposure, whether there were unique temporal characteristics to their potential exposure for instance, would exposure likely occur only when a vessel was transiting to and from harbor . We do not know to what degree listed resources interact with waste or derelict gear from the American Samoa, Guam, CNMI, and MHI bottomfish fisheries. We discuss potential exposures to these diffuse sources of stressors like waste and derelict gear briefly, and through our analyses we conclude that there is a low likelihood of exposure so we focus our attention on the primary threat, the observed interactions, and characterizing the effects of those interactions on listed resources.

We then evaluated the likelihood that each species and designated critical habitat would be exposed to the stressers described above. Where we concluded that that there is a low likelihood of exposure or that the potential for an adverse reponse is unlikely to result in adverse effects to listed species in the *Action Area*, we do not include them further in our exposure or response analyses.

The stressors associated with the American Samoa, Guam, CNMI, and MHI bottomfish fisheries produce responses that range from likely exposed and not likely adversely affected—opportunistic successful depredation of bait or catch; interactions with predators and prey; accidentally being hooked and then released alive unharmed; hooked and released injured, and death (immediate, or later in time following injury). Survival from injury is a function of an individual's prior health condition, environmental conditions, severity of injury, indicators of the severity of stress and injury (such as manner of capture, handling and release) and other variables (Swimmer and Gilman 2012). We lay the foundation for our risk assessment and our understanding of the animal's pre-existing physical, physiological, or behavioral state in the *Status of Listed Resources* and the *Environmental Baseline* using qualitative and quantitative analytical methods.

3.4.4 Climate Change

As discussed in the *Environmental Baseline* section of this opinion, future climate will depend on warming caused by past anthropogenic emissions, future anthropogenic emissions and natural climate variability. NMFS' policy (NMFS 2016b) is to use climate indicator values projected under the Intergovernmental Panel on Climate Change (IPCC)'s Representative Concentration Pathway (RCP) 8.5 when data are available, or best available science that is as consistent as possible with RCP 8.5. RCP 8.5, like the other RCPs, were produced from integrated assessment models and the published literature; RCP 8.5 is a high pathway for which radiative forcing reaches >8.5 watts/m^2 by 2100 (relative to pre-industrial values) and continues to rise for some amount of time. A few projected global values under RCP 8.5 are noted in Table 3. Presently, the IPCC predicts that climate-related risks for natural and humans systems are higher for global warming of 1.5 ºC but lower than the 2 ºC presented in Table 3 (IPCC 2018). Changes in parameters will not be uniform, and IPCC projects that areas like the equatorial Pacific will likely experience an increase in annual mean precipitation under scenario 8.5, whereas other mid-latitude and subtropical dry regions will likely experience decreases in mean precipitation. Sea level rise is expected to continue to rise well beyond 2100 and while the magnitude and rate depends upon emissions pathways, low-lying coastal areas, deltas, and small islands will be at greater risk (IPCC 2018).

Table 3. Projections for certain climate parameters under Representative Concentration Pathway 8.5 (values from IPCC 2014).

Projections	Scenarios (Mean and likely range)	
	Years 2046-2065	Years 2081-2100
Global mean surface temperature change (ºC)	2.0 (1.4-2.6)	3.7 (2.6-4.8)
Global mean sea level increase (m)	0.30 (0.22-0.38)	0.63 (0.45-0.82)

We address the effects of climate, including changes in climate, in multiple sections of this assessment: *Status of Listed Resources*, *Environmental Baseline*, and the exposure, response, and risk analyses. In the *Status of Listed Resources* and the *Environmental Baseline* we present an extensive review of the best scientific and commercial data available to describe how the listed species and its designated critical habitat are affected by climate change—the status of individuals, and its demographically independent units (subpopulations, populations) if applicable, and range wide.

We do this by identifying species sensitivities to climate parameters and variability, and focusing on specific parameters that influence a species health and fitness, and the conservation value of their habitat. We examine habitat variables that are affected by climate change such as sea level rise, temperatures (water and air), and changes in weather patterns (precipitation), and we try to assess how species have coped with these stressors to date, and how they are likely to cope in a changing environment. We look for information to evaluate whether climate changes effects the species' ability to feed, reproduce, and carry out normal life functions, including movements and migrations.

We review existing studies and information on climate change and the local patterns of change to characterize the *Environmental Baseline* and *Action Area* changes to environmental conditions that would likely occur under RCP 8.5, and where available we use changing climatic parameters (magnitude, distribution, and rate of changes) information to inform our assessment. In our exposure analyses we try to examine whether changes in climate related phenomena will alter the timing, location, or intensity of exposure to the action. In our response analyses we ask, whether and to what degree a species' responses to anthropogenic stressors would change as they are forced to cope with higher background levels of stress cause by climate-related phenomena.

4 STATUS OF LISTED RESOURCES

NMFS proposes to authorize the American Samoa, Guam, CNMI, and MHI bottomfish fisheries. Together, these fisheries may affect threatened oceanic whitetip shark, giant manta ray, and chambered nautilus. Additionally, the MHI bottomfish fishery may affect designated MHI IFWK critical habitat

Table 4. Listed resources within the *Action Area* that may be affected by the proposed actions and are evaluated in this consultation. A complete list of species that may be affected by the proposed actions is included in Appendix A.

Species	Scientific Name	Location	ESA Status	Listing Date	Federal Register

Oceanic Whitetip Shark	*Carcharhinus longimanus*	American Samoa Hawaii Marianas	Threatened	1/30/2018	83 FR 4153
Giant Manta Ray	*Manta birostris*	American Samoa Hawaii Marianas	Threatened	1/22/2018	83 FR 2916
Chambered Nautilus	*Nautilus pompilius*	American Samoa	Threatened	9/28/2018	83 FR 48976
Critical Habitat: Main Hawaiian Island Insular False Killer Whale	*Pseudorca crassidens*	Hawaii	Designated Critical Habitat	7/24/2018	83 FR 35062

4.1 Listed Resources and Stressors Not Considered Further

As described in the *Approach to the Assessment* section of this biological opinion, NMFS uses two criteria to identify those endangered or threatened species or critical habitat that are not likely to be adversely affected by the American Samoa, Guam, CNMI and MHI bottomfish fisheries. The first criterion was exposure or some reasonable expectation of a co-occurrence between one or more potential stressors association with the American Samoa, Guam, CNMI, and MHI bottomfish fisheries and a particular listed species. If we conclude that a listed species or designated critical habitat is not likely to be exposed to the American Samoa, Guam, CNMI, and MHI bottomfish fisheries, we must also conclude that the species and critical habitat is not likely to be adversely affected by those activities. The second criterion is the probability of a response given exposure, which considers susceptibility: species that may be exposed to a stressor (e.g., vessel noise from fishing vessels operating near them), but are likely to be unaffected by that stressor (e.g., noise is at levels that are not expected to affect them) are also not likely to be adversely affected by the American Samoa, Guam, CNMI, and MHI bottomfish fisheries.

We began by parsing species by the general location of their exposure (coastal or pelagic), whether there were unique temporal characteristics to their potential exposure, for instance would exposure likely occur only when a vessel was transiting to and from harbor. Next we reviewed whether we had data (observations) on the species exposure, or reasoned information that exposure could occur (potential) to one or more of the action's stressors: fishery interactions (e.g., vessel noise, vessel collision, hooking or entanglement in gear); vessel waste, discharge, and emissions. Each exposure profile that results for each species is unique, and may represent different combinations of stressors of a different magnitude or exposure to those stressors. Given the nature of vessel waste, discharge and emissions, these stressors have the potential to affect all species. In this section, we briefly describe the stressors that are not likely to adversely affect listed species, and the species that are not likely to be adversely affected by the bottomfish fisheries and our reasoning for these conclusions. Vessel Strikes

The proposed action would expose oceanic whitetip sharks and giant manta rays to the risk of collision with vessels. While specific studies have not been conducted for oceanic whitetip sharks or giant manta rays for vessel avoidance, they are highly mobile species likely capable of vessel avoidance to some degree. Although there is evidence that larger, slower moving marine species (e.g., large whales, whale sharks) are at risk of vessel strikes, there is no data available to suggest that oceanic whitetip sharks are at potential risk of vessel strikes. Unlike whale sharks and other slower moving relatives (bull and tiger sharks), oceanic whitetip sharks are capable of making short bursts of incredible speed (Papastamatiou et al. 2018); therefore they are likely very capable of avoiding fishing vessels.

Giant manta rays are known to rest near the surface, where they are at potential risk of being struck and killed by boats. Mooring and boat anchor line entanglement may also wound manta rays or cause them to drown (Deakos et al. 2011; Heinrichs et al. 2011). For example, in a population of the closely related reef manta (*M. alfredi*) in Maui, Hawaii (n= 290 individuals), Deakos et al. (2011) observed that 1 out of 10 reef manta rays had an amputated or disfigured non-functioning cephalic fin, likely a result of line entanglement. Internet searches also reveal photographs of mantas with injuries consistent with boat strikes and line entanglements, and manta researchers report that such injuries may affect manta fitness in a significant way (Deakos et al. 2011; Heinrichs et al. 2011; Couturier et al. 2012; CMS 2014; Germanov and Marshall 2014; Braun et al. 2015), potentially similar to the impacts of shark or orca attacks. However, there is very little information on the frequency of these occurrences and no information on the impact of these injuries on the overall health of the population. Additionally, while the function of the lateral line in manta rays is poorly understood, they also have a suite of other biological functions which are considered highly sophisticated sensory systems (Bleckmann and Hoffmann 1999; Deakos 2010). This suggests that they possess capabilities of detection and could avoid slow moving vessels. Finally, recent research indicates rapid wound healing and high healing capacity of the closely related reef manta (McGregor et al. 2019).

As previously described, fishing effort for these fleets are relatively small, with the largest of the four bottomfish fisheries occurring in MHI The American Samoa bottomfish fishery is small, with only 6 vessels participating in the fishery in 2020 and completing a total of 43 trips (WPFMC 2021a); 127 trips was the highest number of trips and was achieved in 2007. Most boats do not carry ice, and are restricted to daylight fishing. In Guam, 35 vessels took 42 trips in 2020, with the highest number of trips (139) taken in 1985 (WPFMC 2021b. In CNMI, 27 vessels took 30 trips in 2020; the highest number of trips taken was 85 trips in 2005 (WPFMC 2021b). In the MHI, deep-sea handline and non-deep-sea handline bottomfish fishermen took approximately 1,842 trips in 2020 (WPFMC 2021c).

Given the small number of vessels participating in the fisheries, the small number of anticipated vessel trips, the slow vessel speeds during fishing operations and vessel transiting, the expectation that ESA-listed marine species would be widely scattered throughout the proposed *Action Area*, the expected preferred depth range of the species, the potential for an incidental vessel strike is extremely unlikely. Thus, NMFS expects vessel strikes of oceanic whitetip sharks and giant manta rays are extremely unlikely to occur and therefore discountable.

4.1.1 Vessel Noise

Man-made sounds can affect animals exposed to them in several ways such as non-auditory damage to gas-filled organs, hearing loss expressed in permanent threshold shift (PTS) or temporary threshold shift (TTS) hearing loss, and behavioral responses. They may also experience reduced hearing by masking (i.e. the presence of one sound affecting the perception of another sound). Masking and behavioral avoidance are the most likely responses of animals in the vicinity of bottomfish fishing vessels. A small vessel (ranging from 5-20 m, or 16-66 feet) typically operates at a frequency around 300 Hz with continuous sound source levels around 156 dB re 1 µPa rms underwater (Richardson et al. 1995).

Given the size of the vessels used in the American Samoa, Guam, CNMI, and MHI bottomfish fisheries, which are predominantly less than 30 feet in length,, the level of sound produced by the vessels in the fisheries is relatively small. Additionally, vessels and animals are transient, vessel transit vectors would be predictable, sudden or loud noises would be unlikely or infrequent, and generally the sound field will be in motion. Exposure to noises generated by vessels in these fisheries would be short-term, transient, and animals are not expected to respond to temporary sounds emanating from the vessels in these fisheries. Although hydraulics may have the potential to create loud noises; due to the expected above water operations, frequency and duration of time these species spend at the surface, dissipation of sound from the source, and the poor transference of airborne generated sounds from the vessel to ocean water through the hull, it is highly unlikely noises generated from vessel operations would elicit behavioral reactions from ESA-listed species considered in this consultation.

<u>Oceanic Whitetips and Giant Manta Rays</u>. Free-ranging sharks are attracted to sounds possessing specific characteristics: irregularly pulsed, broad-band (most attractive frequencies: below 80Hz), and transmitted without a sudden increase in intensity. Such sounds are reminiscent of those produced by struggling prey. A sound, however, can also result in immediate withdrawal by sharks from a source (Myrberg 2001). NMFS has determined a threshold to noise-induced behavioral impacts for fish, which includes oceanic whitetip sharks and giant manta rays, at 150 dB re 1 µPa rms based on available literature for fish behavior (Stadler and Woodbur 2009, Mueller-Blenkle et al. 2010). Underwater noise is expected to attenuate to that behavioral threshold for fish at 2 meters for noise generated by small vessels. Due to the temporary and transitory nature of the sound generated by small vessels, the short distance over which sound generated by a smaller vessel will attenuate,and because we anticipate false killer whales will swim away from vessels, we conclude that the potential effects of noise generate by the bottomfish fishing vessels are insignificant and will never reach the level that would cause an adverse response that would rise to the level of take.

<u>Chambered nautilus</u>. Chambered nautilus are mollusks that are found at depths of 100-300 meters in American Samoa. Vessel noise will not affect the mollusks, which cannot hear, although may be able to sense vibrations. Given the depth distance between the vessel and mollusk, it is highly unlikely the chambered nautilus can detect a fishing vessel.

<u>MHI IFKW Critical Habitat</u>. Mid-frequency cetaceans hear at frequencies of 150 Hz to 160 kHz (NMFS 2018b). Underwater noise is expected to attenuate to the behavioral response threshold for whales (120 dB re 1 µPa rms for continuous sound) at 251 m (820 ft) from the vessels, assuming practical sound propagaion which is a balance between spherical propagation and relatively rapid sound attenuation and cylindrical spreading associated with relatively slow attenuation. NMFS identified habitat free of anthropogenic noise that would significantly impair the value of the habitat for MHI IFKW use or occupancy as one of the physical and biological features required for MHI IFKW critical habitat. Noise that would significantly impair use or occupancy is that which inhibits the ability of MHI IFKW to receive and interpret sound for the purposes of navigation, communication, and detection of predators and prey (83 FR 35062).

MHI IFKW have a foraging strategy adapted to the shelf and slope habitat of the MHI; these large marine predators travel in subgroups that are dispersed from each other but converge when prey resources are found. Accordingly, these animals rely on their ability to receive and interpret acoustic cues to find prey at a distance and convey information about available prey resources to other dispersed subgroups of IFKWs. The presence of anthropogenic noise can adversely affect the value of marine habitat to MHI IFKWs (Shannon et al. 2015; Erbe et al. 2016; Gedamke et al. 2016; Hatch et al. 2016). Of particular concern are noises that are chronic or persistent and cause cumulative interference such that the animals' ability to receive benefits (e.g., opportunities to forage or reproduce) from these habitats is sufficiently inhibited.

With respect to the MHI bottomfish fishery, the density of MHI IFKW is expected to be very low along the transit routes since these whales are generally found in deeper areas just offshore, (median preferred depth is 1679 m) rather than the shallower areas fished by the bottomfish fishery (< 365 m; Baird et al. 2010; Baird et al. 2012).

Given the short distance of 251 m for the sound generated by the bottomfish vessel to attenuate to the behavioral response threshold for MHI IFKW, the transitory nature of both MHI IFKW and the bottomfish vessels, and the lack of spatial overlap between MHI IFKW preferred habitat and the bottomfish fishing, we do not anticipate that the MHI bottomfish fishery will generate vessel sounds that would adversely affect MHI IFKW critical habitat.

In conclusion, NMFS expects this stressor would have insignificant effects on the ESA-listed giant manta ray, oceanic whitetip shark, chambered nautilus, and designated MHI IFKW critical habitat.

4.1.2 Introduction of vessel wastes and discharges, gear loss and vessel emissions

The diffuse stressors associated with the bottomfish fisheries: vessel waste discharge, gear loss, and carbon emissions and greenhouse gasses, can affect both pelagic and coastal areas. ESA-listed resources and critical habitats could be exposed to discharges, and run-off from vessels that contain chemicals such as fuel oils, gasoline, lubricants, hydraulic fluids and other toxicants. Although local and federal regulations prohibit the intentional discharge of toxic wastes and plastics into the marine environment, accidental discharge may occur. The amount of vessel waste discharge from the bottomfish fleets is difficult to quantify with any accuracy and is presumably quite small relative to other sources of similar wastes. Additinally, while accidental loss and breakage of gear is also common while fishing and lost gear can continue to fish and incidentally hook and entangle marine species, the amount of gear lost in these small fisheries is presumably quite small relative to other sources of fishing gear.

American Samoa, Guam, CNMI, and Hawaii bottomfish vessels, which use outboard diesel engines, burn fuel and emit carbon into the atmosphere during fishing operations and transiting. Parker et al. (2018) estimates that in 2011, the world's fishing fleets burned 40 billion liters of fuel and emitted 179 million tons of carbon dioxide greenhouse gasses into the atmosphere. Between 1990 and 2011, emissions grew by 28% primarily due to increased harvests of crustaceans, a fuel intensive fishery (Parker et al. 2018). While we don't have an accurate estimate of the carbon footprint of the bottomfish fisheries, we expect the contribution to global greenhouse gases to be relatively inconsequential based on the low number of participants in each of the fisheries.

Diesel fuel is a light refined petroleum product with a relatively narrow boiling range. When it is spilled on water, most of the oil will evaporate or naturally disperse within a few days or less, which is particularly true of typical spills from a fishing vessel (500-5,000 gallons). Diesel spreads very quickly to a thin film when it spills on water and is dispersed quickly into the water column when winds reach 5-7 knots or sea conditions are 2-4 feet. Although diesel is considered to be one of the most acutely toxic oil types, small spills in open waters are so rapidly diluted that fish kills have never been reported (NOAA 2020). The probability of a small spill occurring as a result of the continued operation of the bottomfish fishery is small and thus adverse effects on ESA-listed species from a small spill are extremely unlikely to occur.

Oceanic whitetip sharks and giant manta rays can be exposed to oil and its associated chemical components either through ingestion of prey or when contaminated water travels across the surface of their gills. Sampling of sharks exposed to oil during Deep Water Horizon discovered physiological signs of elevated polycyclic aromatic hydrocarbons (PAHs) exposure but showed no evidence for chromosomal or higher level impacts to sharks (Heithaus et al. 2014). However, some shark species exhibited greater effects of PAH exposure to oil, likely due to remaining in the area over longer periods than other species (Walker 2011). Kibria and Haroon (2015) and Lee et al. (2015) provided an extensive literature review of pollutant bioaccumulation in sharks and described a range of effects from cardiac and birth defects to infertility, endocrine disruption and immune system. Cardiac development was also shown to be affected in other fish species (e.g. tuna; Incardona et al. 2014).

Plastics within the marine environment may also pose a threat to ESA-listed marine species and critical habitats, including giant manta rays. Filter feeders such as the giant manta ray are particularly susceptible to ingesting high levels of microplastics (Germanov et al. 2018) and being exposed to toxins (Worm et al. 2017), due to their feeding strategies (Paig-Tran et al. 2013) and target prey (Setala et al. 2014). Jambeck et al. (2015) found that the Western and Indo-Pacific regions are responsible for the majority of plastic waste. These areas also happen to overlap with some of the largest known aggregations of giant manta rays.

Giant manta rays must filter hundreds to thousands of cubic meters of water daily to obtain adequate nutrition (Paig-Tran et al. 2013); therefore, they can ingest microplastics directly from the water or indirectly through their contaminated planktonic prey (Setala et al. 2014). Not only can microplastics prohibit adequate nutrient absorption and physically damage the digestive track (Germanov et al. 2018), they can harbor high levels of toxins and persistent organic pollutants and transfer these toxins to the animal once ingested (Worm et al. 2017). These toxins are known to bioaccumulate and have been shown to alter the functioning of the endocrine system of aquatic animals (Rochman et al. 2014). In addition, these toxins can be passively transferred from mother to embryo through yolk or milk production (Lyons et al. 2013) and species that have delayed sexual maturity, have more opportunities to accumulate toxins and are expected to offload higher levels of contaminants to their offspring (Lyons et al. 2013).

Plastic additives and persistent organic pollutants have been found in the muscles of basking sharks (Fossi et al. 2014), the blubber of fin whales (Fossi et al. 2014) and the skin of whale sharks (Fossi et al. 2017). However, studies have yet to confirm that filter feeders are directly affected by microplastic ingestion and plastic-associated toxins and additives (Germanov et al. 2018). While the ingestion of plastics is likely to negatively impact the health of the species, the levels of microplastics in manta ray feeding grounds, frequency of ingestion and the transfer of toxins are presently being studied to evaluate the impact on these species (Germanov 2015a, 2015b). BMPs and US Coast Guard requirements for vessels, such as the Marpol Annex 5 that regulates trash and debris from commercial vessels (33 CFR Subpart A), reduce the probability of introducing plastics and other pollutants to the marine environment. In addition, given the size of these fisheries it would be unlikely to occur or so small that they would be difficult to meaningfully detect such that the potential effects of wastes on giant manta rays, oceanic whitetip sharks, and the chambered nautilus are both discountable and insignificant.

With respect to critical habitat for the MHI IFKW, the transit route for vessels is within the bathymetric profile of the designated critical habitat (45 m to 3,200 m; 83 FR 35062). This stressor has the potential to affect the physical and biological feature defined as waters free of pollutants of a type and amount harmful to MHI IFKWs. When considering MHI IFKW critical habitat, the broad geographic expanse and depth range of the critical habitat, measurable effects from the small number of vessels used in the MHI fleet would be inconsequential. Spills will occur at the surface of the ocean and would be distributed by wind, waves, and other environmental conditions (NOAA 2020) and would be of small quantities. The probability of a small spill occurring as a result of the continued operation of the bottomfish fishery is small and thus adverse effects on MHI IFKW critical habitat from a small spill are extremely unlikely to occur.

Although leakage, wastes, gear loss and vessel emissions may occur as a result of the bottomfish fisheries, given the small number of vessels participating in each of the fisheries, the small number of anticipated vessel trips, the small chance that ESA-listed resources would be exposed to measurable or detectable amounts of wastes, gear, or emissions from this fishery, and considering the ESA-listed species ecology – primarily low abundance and widespread distribution, and the small probability of a spill occurring, we expect that this stressor will have discountable effects on the ESA-listed giant manta ray, oceanic whitetip shark, chambered nautilus, and designated MHI IFKW critical habitat.

4.1.3 Alterations to Prey

The removal of potential prey resources may affect the physical and biological features of MHI IFKW designated critical habitat, defined as prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth. Although the action does overlap with MHI IFKW critical habitat, the whales are generally found in deeper areas offshore (median preferred depth is 1679 m) rather than the shallower areas fished by the bottomfish fishery (< 365 m). In other words, the fishery is generally outside of the area where false killer whales are more likely to be feeding.

MHI IFWKs are top predators that feed on a variety of large pelagic fish and squid. Commonly described prey species from observations include large game fish such as mahi mahi, wahoo, yellowfin tuna, albacore tuna, skipjack tuna, broadbill swordfish, and threadfin jack. Squid may play a role in their diet. Current information suggests that these whales travel great distances throughout the MHI (Baird et al. 2012), and their prey species are also known to be broadly ranging, widely migratory species that are patchily distributed throughout the whales range (Oleson et al. 2010). NMFS expects sufficient alternate prey resources are present in the surrounding area and throughout the designated critical habitat for MHI IFKW, and that that the size of this fishery is sufficiently small that we would not be able to detect any meaningful changes in prey availability within designated critical habitat as a result of these fisheries.

Furthermore, we expect that the bottomfish fisheries discussed in this biological opinion would not remove prey species for any of the listed species considered herein in sufficient quantity or quality to adversely affect those species, and all three species, oceanic whitetip sharks, giant manta rays and chambered nautalis would be able to move to other areas to forage if there were localized or short-term changes in prey composition and abundance. However, given the small size of these fisheries, we expect that changes in prey availability would be so small that they would not be detected. Therefore, we expect that this stressor will have discountable effects on the threatened giant manta ray, oceanic whitetip shark, and chambered nautilus.

4.1.4 Oceanic Whitetip Sharks and the Amercian Samoa Fishery

While the data on interactions in the American Samoa bottomfish fishery is poor, this fishery is very small (6 vessels in 2020) compared to the other bottomfish fisheries and creel survey data has never recorded an interaction with any shark. Based on a 33-year time series of information, interactions with oceanic whitetip sharks in the American Samoa bottomfish fishery have not been documented to date and are extremely unlikely to occur due to the small size of the fishery and the limited distribution of the species. Therefore, we expect this fishery would have a discountable effect on the oceanic whitetip shark.

4.1.5 .Summary of Stressors and Listed Resources Not Considered Further

In the preceding sections, we described that vessel strikes, vessel noise, the introduction of wastes from vessel operations, and alterations to the prey resulting from the proposed actions are expected have discountable and insignificant effects on oceanic whitetip sharks, giant manta rays, chambered nautalis, and MHI IFKW critical habitat. For these reasons, we concur that the proposed actions are not likely to adversely affect giant manta rays, chambered nautalis, and MHI IFKW critical habitat. We also conclude that the effect of the American Samoa bottomfish fishery is extremely unlikely to occur and is therefore discountable. However, because interactions with bottomfish fishing gear are observed for oceanic whitetip sharks in Guam, CNMI, and the MHI, we discuss this species in greater detail later in this biological opinion (see section 6, *Effects of the Action*)

4.2 **Introduction to the Status of Listed Species**

The rest of this NMFS biological opinion focuses on the threatened oceanic whitetip shark, and the effects that the Guam, CNMI, and MHI bottomfish fisheries have on the species.

4.2.1 Oceanic Whitetip Shark

4.2.1.1 Distribution and Population Structure

Oceanic whitetip sharks are distributed in circumtropical and subtropical regions across the world, primarily between 30° North and 35° South latitude (Compagno 1984; Baum et al. 2015; Young et al. 2017), although the species has been reported as far as 45°N and 40°S in the

Western Atlantic (Lessa et al. 1999). These sharks occur throughout the WCPO, including Australia, China, New Caledonia, the Philippines, Taiwan, and the Hawaiian Islands south to Samoa Islands, Tahiti and Tuamotu Archipelago and west to the Galapagos Islands. In the eastern Pacific, they occur from southern California to Peru, including the Gulf of California and Clipperton Island (Compagno 1984). In the western Atlantic, oceanic whitetips occur from Maine to Argentina, including the Caribbean and Gulf of Mexico. In the central and eastern Atlantic, the species occurs from Madeira, Portugal south to the Gulf of Guinea, and possibly in the Mediterranean Sea. In the western Indian Ocean, the species occurs in waters of South Africa, Madagascar, Mozambique, Mauritius, Seychelles, India, and within the Red Sea.

Abundance of oceanic whitetips appears to be the highest in pelagic waters in a 10° band centered on the equator; their abundance decreases with increasing distance from the equator and increasing proximity to continental shelves (Backus et al. 1956; Strasburg 1958; Clarke et al. 2011a; Hall and Roman 2013; Tolotti et al. 2013; Young et al. 2017).

Only two studies have been conducted on the global genetics and population structure of the oceanic whitetip shark, which suggest there may be some genetic differentiation between various populations (Camargo et al. 2016; Ruck 2016). Camargo et al. (2016) compared the mitochondrial control region in 215 individuals from the Atlantic and Indian Oceans. They found evidence of moderate levels of population structure resulting from restricted gene flow between the western and eastern Atlantic Ocean; they also found evidence of connectivity between the eastern Atlantic Ocean and the Indian Ocean (although the sample size from the Indian Ocean was only 9 individuals). This study only used mitochondrial markers, meaning male-mediated gene flow is not reflected in these relationships (Young et al. 2017), although other species in the Carcharhinus genus are known to exhibit male-mediated gene flow between populations (Portnoy et al. 2010). Ruck (2016) compared samples of 171 individual sharks from the western Atlantic, Indian, and Pacific Oceans specifically looking at the mitochondrial control region, a protein-coding mitochondrial region, and nine nuclear microsatellite loci and found no fine-scale matrilineal structure within ocean basins. Ruck (2016) did detect weak but significant differentiation between the Atlantic and Indo-Pacific Ocean populations. An additional analysis of the sample from both studies (Camargo et al. 2016; Ruck 2016) did detect matrilineal population structure within the Atlantic Ocean basin with three lineages, the Northwest Atlantic, the rest of the Western Atlantic, and the Eastern Atlantic Ocean (C. Ruck, personal communication, 2016 as cited in Young et al. 2017).

Tagging studies have also provided information on potential population structure (reviewed in Young and Carlson 2020). Two studies have found evidence of site fidelity in the Atlantic Ocean (Howey-Jordan et al. 2013; Tolotti et al. 2015). Howey-Jordan et al. (2013) found that oceanic whitetip sharks tagged in the Bahamas (1 male and 10 females tagged but the tag on the male shark failed) stayed within 500 km of their tagging site for at least 30 days, at which point they dispersed in different directions across a wide area, with some sharks travelling more than 1,500 km from their tagging site. The six tagged sharks that retained their tags for longer than 150 days (n = 6) were all located within 500 km of their tagging site when their tags popped off. Similarly, Tolotti et al. (2015) tagged 8 oceanic whitetip sharks (sex of sharks was not reported) and found that the tagging and pop-up locations were relatively close to each other, but some individuals traveled long distances (up to 2,500 km) in between these events. Together, these studies suggest that oceanic whitetip sharks can be philopatric (Howey-Jordan et al. 2013; Tolotti et al. 2015;

Young and Carlson 2020) however it is not clear if this is a result of females exhibiting site fidelity to pupping areas or if the species has an underlying subpopulation structure (Young and Carlson 2020).

4.2.1.1 Status and Trends

Oceanic whitetip sharks were globally listed as threatened in 2018. Historically, the oceanic whitetip shark was described as one of the most abundant species of shark found in warm tropical and sub-tropical waters of the world (Backus et al. 1956; Strasburg 1958). Oceanic whitetip sharks occur throughout their range with no evidence of range contraction or range erosion (gaps within the species' range that form when populations become extinct locally or regionally; Lomolino and Channell 1998; Collen et al. 2011). However, recent estimates of their abundance suggest the species has experienced significant historical and continued declines throughout its distribution. Declines in abundance range from 80-96% across the Pacific Ocean (Clarke et al. 2012; Rice and Harley 2012; Brodziak et al. 2013; Hall and Roman 2013; Rice et al. 2015), 50-88% across the Atlantic Ocean (Baum and Meyers 2004; Santana et al. 2004; Cortes et al. 2007; Driggers et al. 2011); and have been variable across the Indian Ocean, ranging from 25-40% (IOTC 2014, 2015; Ramos-Cartelle et al. 2012; Yokawa and Semba 2012).

Two stock assessments have been conducted for the oceanic whitetip shark in the WCPO to date and the conclusions have been reinforced by additional studies (Clarke et al. 2011a; Brodziak et al. 2013; Rice et al. 2015; Tremblay-Boyer et al. 2019). The most recent assessment concluded that total biomass in 2010 was 19,740 metric tons and that biomass declined to 9,641 metric tons by 2016. An analysis of the population models used in Tremblay-Boyer et al. (2019) suggest that the median value of the total number of individuals in the WCPO was 775,214 as of 2016 (NMFS 2020). They also concluded that the population is overfished and is experiencing overfishing while using a wider range of variables than originally considered in Rice and Harley (2012). However, Tremblay-Boyer et al. (2019) also noted that the rate of overfishing has declined since the Western and Central Pacific Fisheries Commission (WCPFC) adopted CMM 2011-04 in 2013, which prohibits the retention of oceanic whitetip sharks, in whole or in part and requires the release of any oceanic whitetip that is caught as soon as possible. The significant decline in abundance of WCPO oceanic whitetip sharks is attributable to impacts from pelagic fisheries, both longline and purse seine fisheries.

In a preliminary report to the WCPFC's SC, Rice et al. (2020) presented projection estimates that the population in the western Pacific will decline by 13.3% over the next 10 years. To be precautionary to the species, we used the median value of 14.6% over 10 years presented by Rice et al. (2020) which equates to a decline of 1.6% per year as a worse-case scenario. If longline fishery mortalities are decreased by 10% across the WCPO, Rice et al. (2020) estimate that the WCPO population will only decline by an additional 0.4% (mean; 1.2% median) which equates to annual declines of 0.04% (mean; 0.13% median). If longline fishery mortalities are decreased further, by 20% across the WCPO, Rice et al. (2020) estimate that the WCPO population will increase by 3.3% (mean; 4.2% median) over the next 10 years. Rice et al. (2020) indicate that recent catch is likely bounded by the latter two scenarios, or reductions of between 10% and 20% due to adoptions of CMMs and slight decreases in the amount of longline fishing effort. For our assessment we will assume the population is continuing to decline at a rate of 0.13% per year which assumes a 10% reduction in fishery mortalties based on implementation of CMMs. We believe this strikes a balance between the rate of decline based on no mitigation in mortality (up to 1.6% per year) and the scenario of a 20% reduction in mortality that would result in increasing population size.

Rice et al. (2020) further estimated that cumulatively, the U.S. longline fisheries in the WCPO are responsible for upwards of 9% of this decline to the species' spawning potential ratio (the ratio of the average lifetime production of mature eggs per recruit in a fished population to what it would have been if the population had never been fished (i.e. its reproductive potential)) (Rice et al. 2020). We note that Rice et al. (2020) used a post-release mortality value of 25% from Hutchinson and Bigelow (2019), which contains selection bias for alive and healthy sharks and may not be representative of all interactions in that specific fishery (see limitations presented by Hutchinson and Bigelow 2019). Also, we recognize that Rice et al. (2020) was presenting unpublished results that may change (e.g. if they include other variables not considered therein). However, it is the only estimate of population decline for the oceanic whitetip shark and is considered the best scientific data in the available literature found during the course of this consultation.

As noted above in section 3.3.9.1– *Distribution and Population Structure*, it is possible that oceanic whitetip sharks are philopatric; therefore, the decreases in biomass may have resulted in localized depletions resulting in a loss of genetic diversity as well as abundance.

4.2.1.2 Population Dynamics

Oceanic whitetip sharks are a relatively long-lived, late maturing species with low-to-moderate productivity. These sharks are estimated to live up to 19 years (Seki et al. 1998; Lessa et al. 1999a; Joung et al. 2016), although their theoretical maximum age may be 36 years. Female oceanic whitetip sharks reach maturity between 6 and 9 years of age, although this varies with geography (Seki et al. 1998; Lessa et al. 1999a; Joung et al. 2016) and give birth to live young after a very lengthy gestation period of 9 to 12 months (Bonfil et al. 2008; Coelho et al. 2009). The reproductive cycle is thought to be biennial, with sharks giving birth every one or two years in the Pacific Ocean (Seki et al. 1998; Chen 2006 as cited in Liu and Tsai 2011) and alternate years in other ocean basins. Litters range from 1 to 14 pups with an average of 6 (Seki et al. 1998; Lessa et al. 1999a; Juong et al. 2016). Their generation time has been estimated to range between 7 and 11 years (Cortes 2002; Smith et al. 2008).

4.2.1.3 Diving and Social Behavior

Oceanic whitetip sharks are generally associated with mixed surface layers where temperatures typically remain greater than 20°C, but they can occur at depths of about 150 m with brief deep dives into deeper waters (Howey-Jordan et al. 2013; Howey et al. 2016; Tolotti et al. 2017; Young et al. 2017). To date, the maximum recorded dive of the species was to a depth of 1,082 m (Howey-Jordan et al. 2013). Aggregations (formations or clusters of individuals which have gathered which may or may not have distinct demographic characteristics) of oceanic whitetip sharks have been observed in the Bahamas (Madigan et al. 2015; Young et al. 2017), but there is no evidence of social interactions between individuals or groups of individuals.

4.2.1.4 Threats to the Species

The primary threat to oceanic whitetip sharks worldwide is incidental bycatch in commercial fisheries, including both U.S. and foreign fisheries (Young et al. 2017; Young and Carlson 2020). Because of their preferred distribution in warm, tropical waters, and their tendency to remain at the surface, oceanic whitetip sharks have high encounter and mortality rates in fisheries throughout their range. They are frequently caught as bycatch in many global fisheries, including pelagic longline fisheries targeting tuna and swordfish, purse seine, gillnet, and artisanal fisheries. They are also a preferred species for the international fin trade, discussed in more detail below. Impacts to the species from fisheries (U.S. and foreign) that overlap the *Action Area* will be discussed in the *Environmental Baseline*, as appropriate.

The most significant threat to the species result from the combined effect from fisheries bycatch and exploitation for the fin trade. Bycatch-related mortality in longline fisheries are considered the primary drivers for these declines (Clarke et al. 2011; Rice and Harley 2012; Young et al. 2017), with purse seine fisheries being secondary sources of mortality. In addition to bycatch-related mortality, the oceanic whitetip shark is a preferred species for opportunistic retention because its large fins obtain a high price in the Asian fin market, and comprises approximately 2% of the global fin trade (Clarke et al. 2006). Despite finning bans and retention prohibitions both domestically and internationally, this high value and demand for oceanic whitetip fins incentivizes the opportunistic retention and subsequent illegal finning of oceanic whitetip sharks when caught, and thus represents the main economic driver of mortality of this species in commercial fisheries throughout its global range. As a result, oceanic whitetip biomass has declined by 88% since 1995 (Tremblay-Boyer et al. 2019). Currently, the population is overfished and overfishing is still occurring throughout much of the species' range (Rice and Harley 2012; Tremblay-Boyer et al. 2019; 83 CFR 46588). As a result, catch trends of oceanic whitetip shark in both longline and purse seine fisheries have significantly declined, with declining trends also detected in some biological indicators, such as biomass and size indices (Clarke et al. 2011; Young et al. 2017).

U.S. fisheries in the Pacific that capture oceanic whitetip sharks include the Hawaii shallow-set longline fishery and deepset longline fishery, and American Samoa longline fisheries, as well as the U.S. purse seine fishery. The Hawaii shallow-set longline fishery is estimated to interact with 102 oceanic whitetip sharks in a given year (95^{th} percentile; NMFS 2019c). The Hawaii deepset longline fishery is estimated to interact with 3,185 oceanic whitetip sharks annually (95^{th} percentile; McCracken 2019; NMFS 2018a). These, the American Samoa longline fishery, and other fisheries that occur within the *Action Area* for this consultation are discussed in the *Environmental Baseline* section of this biological opinion. No interactions have been noted with oceanic whitetip sharks in any West Coast Highly Migratory Species fishery to date (C. Villafana and C. Fahy pers. comm. to J. Rudolph; March 7, 2019).

Overall, the species has experienced significant historical and ongoing abundance declines in all three ocean basins (Atlantic, Pacific, and Indian Oceans) due to overutilization from fishing pressure and inadequate regulatory mechanisms to protect the species (Hazin et al. 2007; Lawson 2011; Clarke et al. 2012; Hasarangi et al. 2012; Hall and Roman 2013; Young et al. 2017; Tremblay-Boyer et al. 2019). Their population dynamics –long-lived and late maturing with low-to-moderate productivity– makes this species particularly vulnerable to harvests that target adults and limits their ability to recover from over-exploitation.

4.2.1.5 Conservation

Due to reported population declines driven by the trade of oceanic whitetip shark fins, the oceanic whitetip shark was listed under Appendix II of CITES in 2013. This listing went into effect as of September 2014.

Within the WCPO, finning bans have been implemented by the United States, Australia, Cook Islands, Micronesia New Zealand, Palau, Republic of the Marshall Islands and Tokelau, as well as by the Inter-American Tropical Tuna Commission (IATTC) and the WCPFC. These finning bans range from requiring fins remain attached to the body to allowing fishermen to remove shark fins provided that the weight of the fins does not exceed 5% of the total weight of shark carcasses landed or found onboard. The WCPFC has implemented several conservation and management measures for sharks with the following objectives (Clarke 2013): (1) promote full utilization and reduce waste of sharks by controlling finning (perhaps as a means to indirectly reduce fishing mortality for sharks); (2) increase the number of sharks that are released alive (in order to reduce shark mortality); and (3) increase the amount of scientific data that is collected for use in shark stock assessments. Also, specific to oceanic whitetip sharks, CMM 2011-04 prohibits WCPFC vessels from retaining onboard, transshipping, storing on a fishing vessel, or landing any oceanic whitetip shark, in whole or in part, in the fisheries covered by the Convention. This CMM was later replaced in 2019 by CMM-2019-04 for all sharks, which retains the retention prohibition for oceanic whitetip sharks, and includes additional measures on minimizing bycatch (including some gear restrictions) and implementing safe release practices.

4.2.1.6 Summary of the Status of the Oceanic Whitetip Shark

In this section of this biological opinion, we explained that the oceanic whitetip shark is threatened, and that the species' numbers appear to be declining. We used our knowledge of the species' demography and population ecology to capture the primary factors that appear to determine the oceanic whitetip shark population dynamics. Primary threats that have contributed to the species' decline and listing include overutilization due to fisheries bycatch and opportunistic trade of the species' fins, as well as inadequate regulatory mechanisms related to commercial fisheries management and the international shark fin trade (Young et al. 2017).

As a result of fishing mortality, oceanic whitetip biomass declined by 86% in the Western and Central Pacific with an estimated decline of 1.6% per year (Young et al. 2017; Rice et al. 2020). Currently, the population is overfished and overfishing is still occurring (Rice and Harley 2012; Trembolay-Boyer et al. 2019; 83 CFR 46588). As a result, catch trends of oceanic whitetip shark in both longline and purse seine fisheries have significantly declined, with declining trends also detected in some biological indicators, such as biomass and size indices. Currently, the biggest threat to oceanic whitetip sharks is bycatch in longline and purse-seine fisheries (Rice and Harley 2012; Tremblay-Boyer et al. 2019).

5 ENVIRONMENTAL BASELINE

By regulation, the *Environmental Baseline* refers to the condition of the listed species or its designated critical habitat in the *Action Area*, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the *Action Area*, the anticipated impacts of all proposed Federal projects in the *Action Area* that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the *Environmental Baseline.*

The Consultation Handbook further clarifies that the *Environmental Baseline* is "an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the *Action Area*" (FWS and NMFS 1998). The purpose of describing the *Environmental Baseline* in this manner in a biological opinion is to provide context for effects of the proposed action on listed species.

The past and present impacts of human and natural factors leading to the status of threatened oceanic whitetip sharks addressed in this biological opinion within the *Action Area* are a primarily a result of fisheries interactions. We also acknowledge that global climate change may have contributed to the species status in the *Action Area*.

5.1 **Fisheries**

Past and present fisheries interactions have been, and continue to be the single most important threat to oceanic whitetip sharks within the *Action Area*. Bycatch of oceanic whitetip sharks occurs in many fisheries throughout the broad geographic oceanic range of this species. Currently, the primary fishing activity in the *Action Area* is longline fishing; in the MHI an exception is present for nearshore fisheries that operate within longline prohibited areas around the Hawaiian Islands. In the past, drift gillnetting also occurred on a large scale within the *Action Area*, but because of high bycatch rates of protected species, a United Nations resolution banned this fishing method, instituting a global prohibition in 1992. Other types of fishing may occur in the *Action Area* outside of longline prohibited areas (e.g., main Hawaiian Islands offshore handline mixed gear).

5.1.1 Non-United States WCPO Longline Fisheries

Longline fishing is conducted by many countries in this region and some of it occurs in the *Action Area* but there is also a great deal of fishing that occurs adjacent or further away from the *Action Area* (Figure 2). The *Action Area* is in the management area of one tuna regional fishery management organization (RFMO), the Western and Central Pacific Fisheries Commission (WCPFC). In the Western Pacific, the WCPFC is comprised of 26 nations, with seven participating territories and seven cooperating non-member nations. We include available bycatch information on oceanic whitetip sharks from the WCPFC but those estimates do not include the number of interactions that occur specifically in the *Action Area* , insteady only summarizing the number of interactions that occur in the North Pacific Ocean. Lastly, the American Samoa, Guam, CNMI, and MHI bottomfish fisheries are not known to actively fish or traverse east of the 150°W latitude (IATTC convention area) and therefore we do not consider fisheries that occur in that area in this assessment.

There are two types of vessels: (1) large freezer vessels that undertake long voyages (months) and operate over large areas of the region; and (2) smaller vessels with ice or chill capacity that typically undertake trips of about one month (like the Hawaii longline fleet). The total annual number of longline vessels in the western central Pacific region has fluctuated between 3,000 and 6,000 for the last 30 years, this includes the 100-145 vessels (WPRFMC 2018) in the Hawaii longline fisheries (the majority of which are involved in the deep-set fishery). The four main target species are yellowfin tuna, bigeye and albacore tuna, and swordfish. The distribution of longline effort from 2000-2016 is shown in Figure 2.

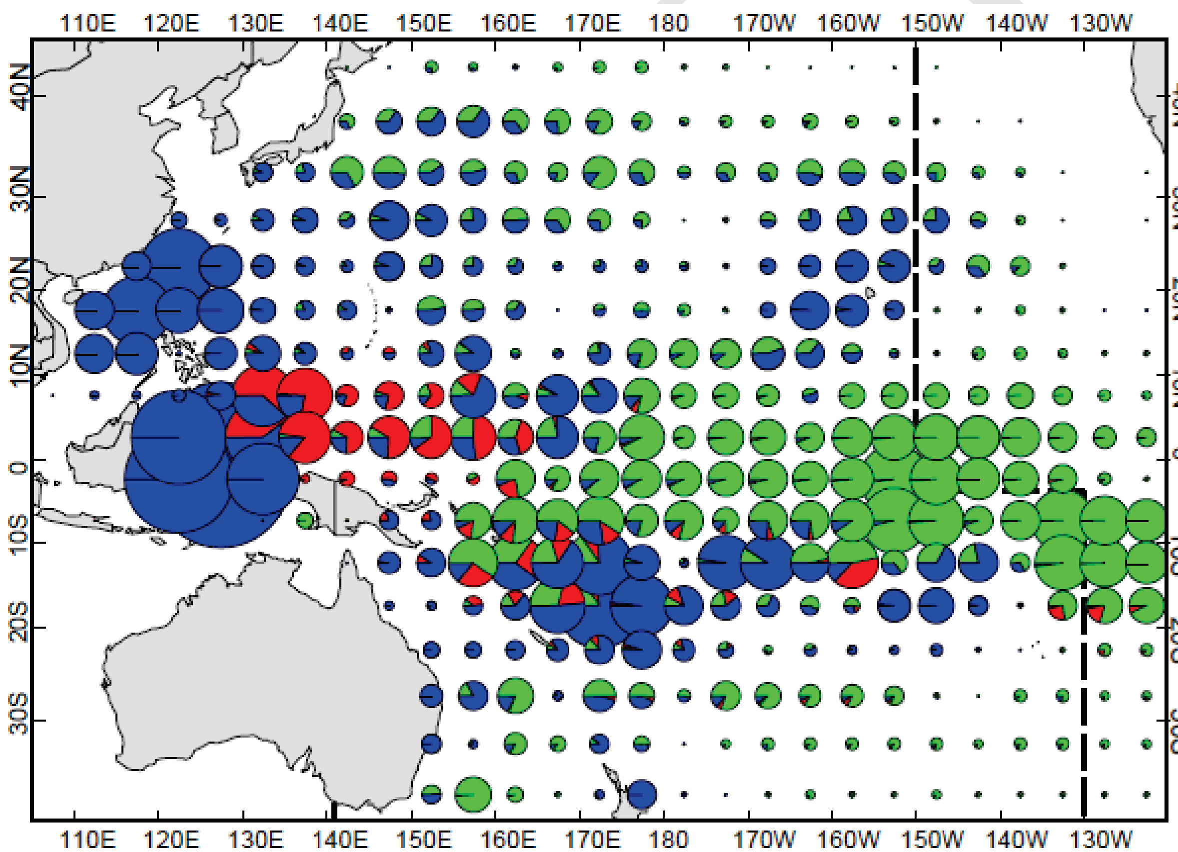

Figure 2. Distribution of longline effort for distant water-fleets (green), foreign-offshore fleets (red) and domestic fleets (blue) for the period of 2000-2016. Vertical dashed black line is the separation in RMFO boundaries. Source: Williams et al. 2017.

While mitigation and minimization measures have reduced fisheries bycatch in the U.S. in recent years, oceanic whitetip sharks are still routinely captured in federal and state commercial fisheries that target other species. Oceanic whitetip sharks also interact with recreational hook-and-line fisheries.

In the Western Pacific, annual reports provided to the Commission from the member countries, lack species-specific data and do not provide sufficient data to allow assessments of shark stocks (Clarke and Harley 2014; Harley and Piling 2016). Furthermore, some of the world's leading shark fishing nations fail to provide aggregated annual catch data in their annual reports (Clarke and Harley 2014). Young et al. (2017) summarized the status snapshot provided by Clarke (2011), showing reduced trends in catch per unit effort (CPUE) across the entire Western Pacific. Portions of the *Action Area* are considered within the WCPFC boundaries.

Oceanic whitetip sharks were once one of the most abundant pelagic shark species encountered in the western and central Pacific Ocean (Molony 2007). Substantial and sustained declines in catch-per-unit-of-effort have been documented for the oceanic whitetip shark population within the western and central Pacific region and have been reported to exceed 90% declines (Clarke et al. 2011a, 2011b, 2012; Lawson 2011; Rice and Harley 2012; Rice et al. 2015; Young et al. 2017). To attach numbers to these declines, Peatman et al. (2018a) estimated that about 1,470,000 oceanic whitetip sharks were captured in longline fisheries in the area managed by the WCPFC between 2003 and 2017. Peatman et al. (2018b) estimated that about 13,882 (median estimate) oceanic whitetip sharks were captured by the purse seine fleet managed by the WCPFC from 2003 to 2017. These are median catch estimates based on data collected from fisheries with limited observer coverage, so the estimates have wide confidence intervals. Nevertheless, these estimates capture the approximate scale of the interactions between longline and purse seine fisheries and oceanic whitetip sharks in portions of the *Action Area*. Again, as these numbers represent the entire WCPFC boundaries, we cannot parse out the number of bycaught, harmed or killed oceanic whitetip individuals in the *Action* Area by this fishery. However at this time, this is the best available information to describe the numbers of sharks harvested within the western and central Pacific region.

Although the IATTC fishery occurs in the Eastern Pacific, outside of the *Action Area* for this batched consultation, bycatch of oceanic whitetip sharks in the IATTC in the Eastern Pacific has likely also contributed to the species current status in the *Action Area* due to their movements within the Pacific.

5.1.2 Non-United States WCPO Purse Seine Fisheries

The international purse seine fishery in the WCPO operates in a tightly concentrated area in the equatorial band, with the highest catches in the zone 5N - 10S. The Guam, CNMI, and Hawaii bottomfish fisheries are north of the operational range of the international purse seine fisheries and are therefore not expected to overlap with the *Action Area.* Like the IATTC, even though these fisheries occur outside of the *Action Area*, past and on-going effects of these fisheries have led to the current status of the oceanic whitetip shark within the *Action Area*.

Between 2008 and 2015, there were approximately 68,000 to 142,000 annual sets by the international purse seine fleet operating in the WCPO exclusive of those by the United States fleet (data from the Western and Central Pacific Fisheries Commission website**Error! Bookmark not defined.**). The WCPO purse seine fishery as a whole, exclusive of the United States fleet, was observed at rates between 44-69% from 2013–2017. In contrast, the United

States fleet has, since 2010, received 100% coverage, although not all data are available (see discussion in the *Effects Analysis section*). We note that much of the best scientific and commercial data available in the literature based on WCPO data is inclusive of United States data and we generally cannot separate the United States portion from the greater WCPO data.

From 2009 to 2016, the average median number of oceanic whitetip shark captures per year in this fishery was 493 (range: 469 to 5,20l individuals; Figure 3; Peatman et al. 2017). We note that these data reviews all fisheries in the WCPFC's convention area, which includes United States fisheries. Since 2009, bycatch levels have been relatively low and stable (Figure 3; Peatman et al. 2017).

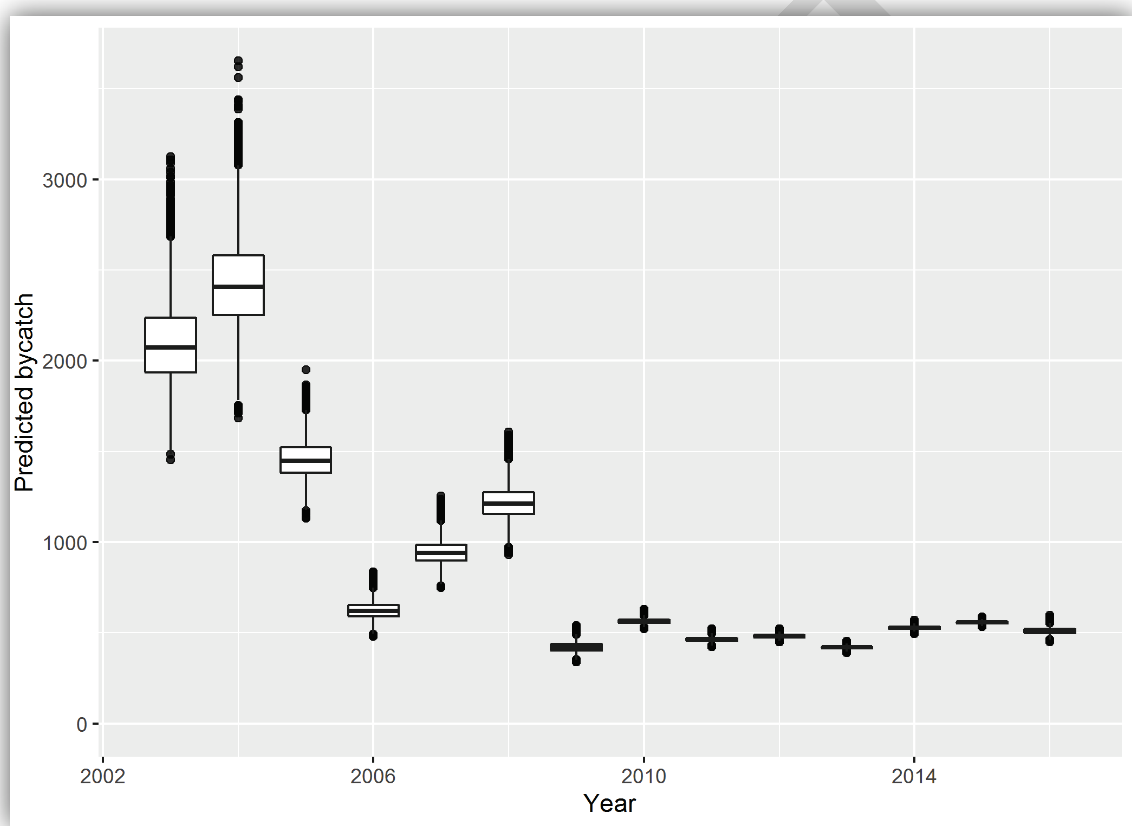

Figure 3. Predicted total annual oceanic whitetip bycatch (numbers) by year for large-scale purse seine fleets. Source Peatman et al. 2017.

Peatman et al. (2017) provided modeled estimations of oceanic whitetip shark catches due to the lack of record submissions to the WCPFC by several nations in the smaller purse seine vessel fleet, and due to lower than mandated observer coverage rates. Actual observed numbers of individuals caught for this period (n = 1,822), for the large-scale purse seine fleet, are provided in (Peatman et al. 2017). An update was provided by Peatman et al. (2018a) for the 2017 fishing season and reported 721 oceanic whitetip sharks, resulting in total median bycatch estimate of 13,882 from 2003 to 2017. As Peatman et al. (2018a) discusses, observer coverage was low for vessels of some nations, and the bycatch estimates should be considered preliminary. However, at this time, this is considered the best scientific data available for this fishery and Region.

5.1.3 Other U.S. Fisheries

From 2008-2018 the U.S. purse seine fleet operating in the WCPO caught approximately 1,330 oceanic whitetip sharks (WCPFC Regional Observer Program unpublished data). However, we would only expect geographical overlap between this fishery and a portion of the *Action Area* in waters of American Samoa. The majority of the U.S. WCPO and international purse seine fisheries occur outside of the *Action Area*.

Other U.S. fisheries that interact with oceanic whitetip sharks in the Pacific are the Hawaii deep-set and shallow-set longline fisheries. The Hawaii shallow set fishery has an observer coverage rate of 100%. Between 2004 and 2018, 875 oceanic whitetip sharks were caught in the Hawaii shallow-set longline fishery (NMFS 2019c). The Hawaii deepset fishery coverage is approximately 20% and the total number of observed sharks caught in the fishery between 2002 and 2017 was 5,815 individuals with an expanded estimate of 26,967 sharks (McCracken 2019).

Finally, the total number of observed oceanic whitetip shark interactions in the U.S. American Samoa longline fishery from 2010-2017 was 918 with an estimated 5,020 sharks captured over this time (McCracken 2019). Observer coverage data for 2018 was not included. Like with the Hawaii deep-set, expansions were provided to estimate the number of sharks caught in the fishery as they have less than 100% observer coverage.

There were approximately 167 oceanic whitetip sharks commercially landed in Hawaii from 1999 to 2015 according to commercial fishing reports provided by Hawaii Department of Aquatic Resources (DAR) (2019). The oceanic whitetip was not differentiated to species prior to 1999. Additionally, three years had insufficient data to report landings for the species; 2009, 2014, and 2016 (Hawaii DAR 2019). These are likely the minimum number of oceanic whitetip sharks taken due to the inconsistency and underreporting in State fisheries.

Overall, oceanic whitetip sharks were generally not landed, or are rarely landed in the U.S. Pacific Islands Region. Brodziak et al. (2013) concluded that the relative abundance of oceanic whitetip declined within a few years of the expansion of the longline fishery, which suggests those fisheries are contributing to the overutilization of oceanic whitetip within this portion of its range (Young et al. 2017). The majority of oceanic whitetip sharks are now released alive in this fishery, and the number of individual sharks retained by the fishery has declined.

Young et al. (2017) indicated that the oceanic whitetip shark population in the operational range of the Hawaii fishery might have stabilized in recent years based on a preliminary analysis of annual standardized CPUE from 1995-2014. Since then, observer data from 2015 and 2016 shows nominal CPUE was approximately same or slightly higher than 2014 (NMFS Observer Program unpublished data), however these are unstandardized data and should be interpreted with caution.

5.2 Global Climate Change

Global annually averaged surface air temperature has increased by about 1.8 ºF (1.0 ºC) over the last 115 years (1901 to 2016) (Wuebbles et al. 2017). This period is now the warmest in the history of modern civilization. It is extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming since the mid-20th century. For the warming over the last century, there is no convincing alternative explanation supported by the extent of the observational evidence (Wuebbles et al. 2017). These global trends are expected to continue over climate timescales. The magnitude of climate change beyond the next few decades will depend primarily on the amount of greenhouse gases (especially carbon dioxide) emitted globally. Without major reductions in emissions, the increase in annual average global temperature relative to preindustrial times could reach 9 ºF (5 ºC) or more by the end of this century (Wuebbles et al. 2017). With significant reductions in emissions, the increase in annual average global temperature could be limited to 3.6 ºF (2 ºC) or less (Wuebbles et al. 2017). The global atmospheric carbon dioxide concentration has now passed 400 parts per million, a level that last occurred about three million years ago, when both global average temperature and sea level were significantly higher than today. There is broad consensus that the further and the faster the earth warms, the greater the risk of potentially large and irreversible negative impacts (Wuebbles et al. 2017).

Increases in atmospheric carbon and changes in air and sea surface temperatures can affect marine ecosystems in several ways including changes in ocean acidity, altered precipitation patterns, sea level rise, and changes in ocean currents. Global average sea level has risen by about seven to eight inches since 1900, with almost half of that rise occurring since 1993. It is very probable that human-caused climate change has made a substantial contribution to sea level rise, contributing to a rate of rise that is greater than during any preceding century in at least 2,800 years (Wuebbles et al. 2017). Global average sea levels are expected to continue to rise by at least several inches in the next 15 years, and by one to four feet by 2100 (Wuebbles et al. 2017). Climate change can influence ocean circulation for major basin wide currents including intensity and position of western boundary currents (Gennip et al. 2017). These changes have the potential to effect species distribution (Gennip et al. 2017).

Specific studies on the potential impacts of climate change to the oceanic whitetip (and pelagic sharks in general) are limited. While their broad distribution and ability to move to areas that suit their biological and ecological needs may buffer the effects of climate change, climate change still has the potential to pose a threat to oceanic whitetips in the future, including habitat changes (e.g., changes in currents and ocean circulation, compression of habitat zone) and potential impacts to prey species. For example, a study from the Northwest Atlantic suggests oceanic whitetips may face metabolic challenges in having to cope with habitats close to upper thermal limits and potential overheating. If ocean warming continues to increase thermal habitat to upper thermal limits in the future, potential habitat mismatches may occur between oceanic whitetip sharks and their prey, reducing the overall habitat in which they can feed (Andrejaczek et al. 2018). Additionally, while avoidance of surface waters will reduce the vulnerability of these sharks to fishing gears targeting this zone, it may increase their vulnerability to deeper-set longlines by minimizing the available habitat and magnifying the spatial overlap of the species' distribution with pelagic longline fisheries that already occur on a horizontal scale latiduinally (Andrejaczek et al. 2018). Overall, the effects of climate change on the oceanic whitetip shark and their habitat are highly uncertain, yet are likely already occurring and may pose an increasing threat to the species in the future.

5.3 Synthesis of Baseline Impacts

Oceanic whitetip sharks are exposed to a wide variety of past and present state, federal, and private actions in the *Action Area*, which includes all proposed federal projects in the *Action Area* that have already undergone formal or early consultation, and state or private actions that are contemporaneous with this consultation. However, the impacts of those activities on the status, trend or the demographic processes on oceanic whitetip sharks are largely unknown. The preceding section of this biological opinion addresses global climate change and the effects of fisheries and fisheries bycatch on oceanic whitetip sharks. Fishing has resulted in mortality and injury to individual animals, and may also induce sub-lethal responses, such as modification of feeding or breeding activities. Various fisheries within the *Action Area,* as well as those on the fringe of the *Action Area,* have likely had the most serious and lasting effects on oceanic whitetip sharks, and the populations that comprise the species within the *Action Area*. The number of individuals that continue to be captured as bycatch and die in fisheries in the *Action Area* contributes to the increased extinction risk of the species.

6 EFFECTS OF THE ACTION

In this section of the biological opinion, we present the results of our assessment of the probable direct and indirect effects of federal actions that are the subject of this consultation as well as the direct and indirect effects of interrelated, and interdependent actions on threatened and endangered species and designated critical habitat. As we described in the *Approach to the Assessment* section of this biological opinion, we organize our effects' analyses using a stressor identification—exposure—response—risk assessment framework. The *Integration and Synthesis* section of this opinion follows the *Effects of the Action*, and integrates information we presented in the *Status of Listed Resources* and *Environmental Baseline* sections of this biological opinion with the results of our exposure and response analyses to estimate the probable risks the proposed action poses to oceanic whitetip sharks. NMFS has concluded in previous consultations that the proposed action is not likely to adversely affect several listed species and areas designated as critical habitat for listed species, these listed resources are not considered in this biological opinion but are summarized in Appendix A. Additionally, NMFS concludes in section 4.1 of this biological opinion that this proposed action is not likely to adversely affect giant manta rays and chambered nautilus, as well MHI insular false killer whale critical habitat. We also concluded that the American Samoa bottomfish fishery is not likely to adversely affect oceanic whitetip sharks. Vessel noise, vessel strikes, introduction of discharges and other wastes, gear loss, and vessel emissions were covered earlier in this biological opinion (See section 4.1, Listed Resources Not Considered Further), and are not discussed below. In this section, we focus on the stressors associated with the action that adversely affect oceanic whitetip sharks.

6.1 Potential Stressors

The stressors analayzed for this proposed action include:

1. capture (hooking) in fishing gear,
2. entanglement in fishing gear, and

3. interactions with derelict fishing gear (lines, and hooks that have been lost, abandoned or discarded into marine waters),

6.2 Exposure Analyses

As discussed in the *Approach to the Assessment* section of this biological opinion, exposure analyses are central to our assessment of the effects of actions. Exposure analyses are designed to identify which listed resources are likely to co-occur with stressors caused by an action, the nature of that co-occurrence, and interactions that result from that co-occurrence. As part of these analyses, we try to estimate the number, age (or life stage), and gender of the individuals that are likely to be exposed and identify the populations or subpopulations those individuals represent.

With the limited data currently available, we cannot predict the number of threatened oceanic whitetip sharks that are likely to be exposed to the American Samoa, Guam, CNMI, and MHI bottomfish fisheries. All of the exposures occur underneath the ocean's surface where they are unobserved. Furthermore, we cannot predict the exact number of sharks that are hooked or entangled by fishing gear and escape before they are observed. Our exposure analysis focuses on hooking and entanglement of oceanic whitetip sharks that have been observed and reported, and we supplement this with information from published reports and studies.

6.2.1 Hooking and Entanglement of Oceanic whitetip sharks

Data on hooking and entanglements in the Guam, CNMI, and MHI bottomfish fisheries almost certainly underestimate the actual number of interactions because they cannot account for individuals that were hooked or entangled but either escaped or were never brought aboard a ship (for example, because of a line break). Despite several efforts to assess the significance of unobserved interactions (for example, Moyes et al. 2006; Murray 2011; Warden and Murray 2011; Gilman et al. 2013), the difference between the number of observed interactions and the actual number of interactions remains unknown. As noted in the Status of Listed Resources section 4.1.4, the American Samoa bottomfish fishery is not likely to adversely affect oceanic whitetip sharks as the likihood of an interaction is discountable.

6.2.1.1 Guam and the CNMI

Although the geographic distribution of oceanic whitetips overlaps with the bottomfish fisheries of Guam and the CNMI, the habitat overlap of oceanic whitetip sharks and bottomfish fisheries is limited. Oceanic whitetip sharks have a strong preference for the surface mixed layer (upper 150 m of the water column) in offshore deep waters of the open ocean (Young et al. 2017), while bottomfish gear fishes closer to the ocean floor. While there are extremely low numbers of reported hookings of oceanic whitetip sharks in the bottomfish fishery as discussed below, even one hooking means that while spatial overlap is rare, it does happen.

There are limited data on fishery interactions with oceanic whitetip sharks in Pacific Island bottomfish fisheries. As noted in *Description of the Proposed Action,* creel surveys are the primary source of information on catch any bycatch for the Guam and CNMI bottomfish fisheries. In these datasets, oceanic whitetip shark captures may be identified to the species level, or they may categorized oceanic whitetip sharks and whitetip reef sharks together as "whitetip shark." For example, in the CNMI and Guam creel surveys, surveyors have identified several instances of oceanic whitetip sharks at the species level. However, in the case of the self-reported CNMI logbook data, fishermen reported captures of "whitetip sharks" instead of a species-specific categorization.

Therefore, in the Pacific Islands region, reported interactions with "whitetip sharks" could be either oceanic whitetip sharks or whitetip reef sharks. Whitetip reef sharks are closely associated with the bottom, and have been captured at depths ranging from 8 to 110 m in Madagascar and at a depth of 330 m in Ryukyu Islands (Randall 1977 as reported by NMFS 2019a). CNMI and Guam bottomfish boat-based creel surveys indicate that fishermen catch whitetip reef sharks more frequently than oceanic whitetip sharks. From 1982 to 2017, fishermen recorded 39 whitetip reef sharks in the Guam boat-based creel survey. During bottomfish stock assessment surveys conducted in the MHI (PIFSC unpublished survey) and Guam (Kendall Enterprise Inc. 2014 as cited in NMFS 2019a) whitetip reef shark captures have been recored, however there have not been any oceanic whitetip sharks recorded during these fishery surveys or other PIFSC research activities.

In addition to the bottomfish surveys, PIFSC researchers have conducted limited bottomfish fishing in the Pacific Islands region for life history research purposes since 2007. They typically fish once to twice a year and land a maximum of 1,200 kg of bottomfish each time they fish. In the last five years (2013-2018), there was one trip each to Johnston Atoll, the CNMI, Guam, and American and (Independent) Samoa. NMFS researchers have not caught oceanic whitetip sharks while conducting these activities. Researchers observed an oceanic whitetip shark depredating hooked fish on a research fishing trip, but the shark was not hooked or entangled (H. Johnson pers. comm. 2018).

Guam Bottomfish Fishery

In Guam, the best available information to estimate interactions with oceanic whitetip sharks are boat-based creel surveys, which started in 1982. This program, administered by the Guam Department of Agriculture, Division of Aquatic Resources, reported three oceanic whitetip sharks caught during bottomfish fishing between 1993 and 2017.

CNMI Bottomfish Fishery

In the CNMI, the best available information to estimate interactions with oceanic whitetip sharks are boat-based creel surveys (available from 2000–2017) administered by CNMI Division of Fish and Wildlife and the federal logbook program (2009–2017) administered by NMFS. There have been no records of oceanic whitetip sharks in the CNMI boat-based creel surveys since the creel surveys began in 2000.

The federal commercial bottomfish logbook form in the CNMI has a write-in space for recording catch by species under the shark category. Between 2009, when logbooks were implemented, and 2017, fishermen recorded 33 sharks as "whitetip shark", which may be whitetip reef sharks or oceanic whitetip sharks. To ascertain whether "whitetip sharks" could be oceanic whitetip sharks, Council staff looked at the catch composition associated with the whitetip shark (*Triaenodon obesus*) capture. Most of the records of whitetip shark captures are associated with shallow-water fish species captures, and thus are more likely to be whitetip reef sharks rather than oceanic whitetip sharks. After removing those records, from 2009 to 2017, there were 12 whitetip shark captures associated with deep-water bottomfish species that could potentially be oceanic whitetip sharks.

Between 2009 and 2020, in addition to overall fewer trips targeting deep-water species, the boat-based creel surveys indicate that fishing effort in terms of number of trips and hours fished steeply declined over time, until the number of trips and fishing effort increased in 2020 (WPFMC 2021c). Present effort, however, is not as high as it was in 2010 when only two sharks were recorded in the creel survey forms. Neither was identified as a oceanic whitetip shark, although one was listed in the generic category of shark (misc.).

6.2.1.2 Main Hawaiian Islands

Cooperative research fishing surveys that were part of the MHI bottomfish fishery independent survey contracted local Deep-7 commercial fishermen to collect data using a standardized traditional fishing method (Kendall 2014 as cited in NMFS 2019b). In the 2016 to 2017 surveys which comprised 814 fishing samples (each sample being 30 minutes in duration) and 2,545 records of fish catch, three whitetip reef sharks and no oceanic whitetip sharks were recorded (PIFSC unpublished data).

In addition to the bottomfish surveys, NMFS researchers have conducted limited bottomfish fishing in the Pacific Islands region for life history research and fishery-independent survey purposes. There have been seven such cruises in the MHI since 2007. To date, NMFS researchers have not caught oceanic whitetip sharks while conducting these activities (H. Johnson pers. comm. 2018).

The Hawaii DAR commercial fishing reports include all fish caught, including sharks and other incidentally caught species, even if anglers do not retain them. These reports also include reporting of fish lost to predation and identification of predators, if possible. However, commercial marine license reports combine oceanic whitetip shark and whitetip reef shark under a single reporting code. Therefore, reported interactions with "whitetip sharks" could be either oceanic whitetip sharks or whitetip reef sharks. In the Hawaii commercial catch database, bottomfish fishermen recorded 23 sharks under the single "whitetip sharks" reporting code between 2000 and 2017. DAR staff reviewed these records to help ascertain which "whitetip sharks" were likely to be oceanic whitetip sharks based on the area fished, the catch composition associated with the captured sharks, and the size of the shark. Oceanic whitetip sharks are associated with offshore fishing activities, and bottomfish landed in deeper waters, such as opakapaka, ehu, onaga. In comparison, the catch composition associated with whitetip reef shark are usually reef fish, smaller-size opakapaka, and uku. As reef sharks tend to be smaller, DAR also assumed that sharks under 40 lbs. were whitetip reef shark.

Using these criteria, of the 23 sharks recorded under the single reporting code, DAR ascertained that eight were likely oceanic whitetip sharks based on the criteria described above (area fished, catch composition and size of shark). Of the 23 sharks assessed using these criteria, only one did not have sufficient associated data to assign it to species, therefore there is one additional shark that may or may not be an oceanic whitetip shark. Given that approximately 61% of "whitetip sharks" are reef sharks, the unknown shark is more likely to be a reef shark than an oceanic whitetip shark. Of the eight captured whitetip sharks that are believed to be oceanic whitetip sharks, four occurred in the NWHI (R. Kokubun pers. comm. 2018). NMFS SFD included the remaining four interactions with whitetip sharks in the biological evaluation for the MHI. The data do not indicate whether these sharks were hooked while actually bottomfish fishing, or whether fisherman were trolling on their way to bottomfish grounds and encountered a shark while retrieving alternate catch (ex: mahi, billfish, etc.). Notwithstanding the sparsity of data and potential for species misidentification in self-reported data, available information suggests that it is rare for MHI bottomfish fishermen to capture oceanic whitetip sharks. The species can be difficult to locate when target fishing for scientific purposes in this region (M. Hutchinson pers. comm. 2018).

Patterns of Exposure

In the bottomfish fisheries, sharks may not be landed for a number of reasons, including poor weather, the shark's size and condition at landing, efficiency of maintaining fishery operations, concern for the safety and stress on the animal, and for the crew's safety. Considering the type of gear used in these fisheries, the sharks may also escape the line before reaching the vessel. The small number of interactions with oceanic whitetip sharks in the subject bottomfish fishery suggests that, although the species does occur in the action area, exposure is rare. We lack information on life history characteristics of those few animals that are exposed.

Predicted Future Exposure to the Fishery

Due to the scarcity in reliable data for the species in the Guam, CNMI, and MHI bottomfish fisheries, NMFS SFD pro-rated the number of interactions over a time span to develop a prediction of future interaction levels. The predictions were based on the recorded bycatch of oceanic whitetip sharks in these fisheries. Table 5 contains the resulting predictions of future interactions for oceanic whitetip sharks for the four bottomfish fisheries.

Guam bottomfish fishery
NMFS SFD estimated the effect of the Guam bottomfish fishing on oceanic whitetip sharks as 0.125 shark/year based on three interactions over 24 years. Expanding this interaction rate over a five-year timescale, NMFS SFD estimated this fishery will catch one (rounding up from the calculated 0.625) oceanic whitetip shark every five years.

CNMI bottomfish fishery
NMFS SFD estimated the effect of the CNMI bottomfish fishing on oceanic whitetip sharks, as 0.67 shark/year based on 12 interactions over an eight-year period. Expanding this interaction rate over a five-year timescale, NMFS SFD estimated this fishery will catch four (rounding up from the calculated 3.33) oceanic whitetip shark every five years.

MHI bottomfish fishery
NMFS SFD estimated the effect of Hawaii bottomfish fishing on oceanic whitetip sharks, as 0.236 sharks/year based on four interactions over 17 years. Expanding this interaction rate over a five-year timescale, NMFS SFD estimated this fishery will catch that up to two (rounding up from the calculated 1.18) oceanic whitetip shark every five years.

Table 5. Consolidated estimates for number of pro-rated interactions of oceanic whitetip sharks with Guam, CNMI, and MHI bottomfish fisheries rounded to account for the individual.

Bottomfish Fishery	Predicted Number of Shark Interactions (# INDVs)	Time Span (Years)
Guam	1	5
CNMI	4	5
MHI	2	5

6.3 Response Analyses

As discussed in the *Approach to the Assessment* section of this biological opinion, response analyses determine how listed resources are likely to respond after being exposed to an Action's effects on the environment or directly on listed species themselves. For the purposes of consultations on fishing, our assessments try to detect the probability of responses that would result in reducing the fitness of listed individuals. Ideally, our response analyses consider and weigh evidence of adverse consequences, beneficial consequences, or the absence of such consequences.

The most significant hazard the Guam, CNMI, and MHI bottomfish fisheries present to the oceanic whitetip shark results from hooking and entanglement by gear that can injure or kill them. Sharks may not immediately die from their wounds but may suffer impaired swimming or foraging, altered migratory behavior, and altered breeding or reproductive patterns, and latent mortality from their interactions.

Although survivability studies have been conducted on some listed species captured in comparable fisheries, long-term effects are nearly impossible to monitor; therefore, a quantitative measure of the effect of bottomfish fishing on oceanic whitetip sharks is very difficult. Even if listed species are not injured or killed after being entangled or hooked, these interactions can be expected to elicit stress-responses that can have longer-term physiological or behavioral effects. The following discussion summarizes the information on how oceanic whitetip sharks likely respond to these interactions with fishing gear.

6.3.1 Entanglement in Bottomfish Gear

Although most sharks tend to be hooked by gear, they can also become entangled in the line by rolling or wrapping as they struggle to free themselves from the hook. An entanglement could cause the shark to die if it is unable to circulate water through its gills. The literature on sharks captured on gear is primarily focused on the effects of hooking, post-release handling, and post-hooking mortality, not entanglement in gear. However, marine debris data compiled in NOAA's 2014 Marine Debris Program Report reveals several accounts of sharks entangled in natural fiber rope and monofilament. A shortfin mako shark entangled in natural fiber rope, resulted in scoliosis, abrasions, malnourishment (Wegner and Cartamil 2012), and the monofilament found encircling a blacknose shark caused its spine to be deformed (Schwartz 1984). In general, entanglement could directly or indirectly interfere with the shark's mobility, causing impairment in feeding, breeding, or migration.

6.3.2 Hooking

Sharks are incidentally captured when they bite baited hooks or depredate on catch. Sharks are considered rare bycatch in the Guam, CNMI, and MHI bottomfish fisheries. Injuries to sharks from hooks can be external-generally in the mouth, jaw, gills, roof of mouth, tail or fin, or ingested internally, which is considered deeply-hooked or gut-hooked.

Circle hooks, which are used in these fisheries, tend to hook animals in the mouth or jaw, as opposed to the gut or esophagus, and are intended to limit injury and be more easily removed (Cooke and Suski 2004). As with other marine species, even if the hook is removed, which is often possible with a lightly hooked shark, the hooking interaction is believed to be a significant event. As previously mentioned, capture is a stressful experience that can potentially last a couple of hours and can result in physiological recovery lasting many days wherein individuals exhibit changes in swimming and diving behaviors (Campana et al. 2009; Bowlby et al. 2021). In addition, sharks are vulnerable to predation when captured due to their restricted mobility, and after their release due to exhaustion and injury. Furthermore, handling procedures can cause additional damage (e.g. cutting the jaw, tail, gaffing, etc.), stress, or death.

A gut-hooked shark is at risk of severe damage to vital organs and excessive bleeding. Campana et al. (2009) found in a longline post-release mortality study that 33% of tagged blue sharks with extensive trauma such as a gut-hooking died. Campana et al. (2009) attribute rapid post-release mortality of sharks to occur as a result of the trauma from the hooking rather than any interference with digestion or starvation.

6.3.3 Trailing Gear (Line)

Members of the Western and Central Pacific Fisheries Commission are required to regulate their vessels consistent with the conservation and management measures for the oceanic whitetip shark. Pursuant to CMM 2011-04, NMFS has implemented regulations (50 CFR 300.226) requiring 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. In accordance with this measure, the amount of trailing gear shall be minimal as to cause as little harm as possible. Excessive trailing gear could directly or indirectly interfere with the shark's mobility, causing impairment in feeding, breeding, or migration (Hutchinson and Bigelow 2019). Further, trailing line can also become snagged on a floating or fixed object, further entangling the shark or the drag from the float can cause the line to constrict around the body of the shark or its fins.

6.3.4 Post Interaction Survival

At this time, metrics related to post-release mortality have been determined for oceanic whitetip sharks only in the pelagic longline fishery. However, no information currently exists for the at-vessel mortality rate in the Guam, CNMI, or MHI bottomfish fisheries. To date, only three interactions have occurred in Guam, an estimated 12 interactions in CNMI, and four interactions in the MHI. Based on the best scientific literature for surrogate species and the fisheries that best exemplify the same operational methods that are practiced in the bottomfish fisheries, post-release mortality ranges from 10 to 25% in these fisheries (Gurshin and Szedlmayer 2004; Kneebone et al. 2013; Danylchuk et al. 2014; French et al. 2015; Whitney et al. 2016, 2017). These studies examined various shark species including shortfin mako, lemon shark, sand tiger, and blacktip reef shark. Kneebone et al.'s (2013) study had the highest post-release mortality value of 25% for sand tiger sharks.

Many studies in the available literature do not quantify at-vessel mortality for recreational or bottomfish fisheries using comparable gear configurations. However some have noted mortality rates of zero (ex: French et al. 2015) or noted that all subjects arrived alive to the vessel. As fight times for these types of fisheries are minimal, it would be expected that all individuals should arrive alive at the vessel. Therefore we looked at the number of individuals that would die from the proposed action with a range of up to 25% (based on Kneebone et al. 2013).

Caution should be taken in the assessment of the data as post-release survival rates are species-specific with much of the research focusing on underlying physiology pertaining to how sharks handle stress, these studies include species in other locations of the world, and some species may not be physiologically similar in resilience. Nonetheless, we are using this information as the best available scientific and commercial data to predict effects to oceanic whitetip sharks caught in Guam, CNMI, and MHI bottomfish fisheries operates in the *Action Area*.

Table 6. Number of expected oceanic whitetip shark mortalities over five years, based on the estimate of anticipated future exposures in the Guam, CNMI, and MHI bottomfish fisheries (see also Table 5), and the estimated post-release mortality values.

Fishery	Predicted number of interactions over 5 years	Mortality estimate (25%)
Guam	1	(0.25) 1
CNMI	4	(1.00) 1
MHI	2	(0.50) 1

Table 6 shows the number of predicted interactions per fishery over five years, and applies a mortality value of 25% based on the best available scientific and commercial data. Applying the 25% overall mortality rate to the number of predicted interactions results in a mortality estimate of one individual each for the Guam, CNMI, and MHI bottomfish fisheries for a total of three mortalities over the five year interval. While these results are in decimals, rounding occurred at the very end of our calculations in order to properly account for the individual. These three predicted mortalities are a very small proportion of the population, as discussed in *Integration and Synthesis* below, and are not expected to substantively diminish the population.

6.4 Cumulative Effects

Cumulative effects, as defined in the ESA implementing regulations, are limited to the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the *Action Area* considered in this opinion (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. NMFS searched for information on future State, tribal, local, or private actions that were reasonably certain to occur in the *Action Area*. Most of the *Action Area* is outside of territorial waters of the United States of America, which would preclude the possibility of future state, tribal, or local action that would not require some form of federal funding or authorization. NMFS conducted electronic searches of business journals, trade journals, and newspapers using Google, *WorldCat*, and other electronic search engines. Those searches produced no evidence of future private action in the *Action Area* that would not require federal authorization or funding and is reasonably certain to occur. As a result, NMFS is not aware of one action of this kind that is likely to occur in the *Action Area* during the foreseeable future.

7 INTEGRATION AND SYNTHESIS OF EFFECTS

The purpose of this opinion is to determine if the proposed action is likely to have direct or indirect effects on threatened and endangered species that appreciably reduce their likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (50 CFR 402.02), otherwise known as the jeopardy determination. This is done by considering the effects of the action within the context of the *Status of Listed Resources* together with the *Environmental Baseline* and the *Cumulative Effects*, as described in the *Approach to the Assessment* section.

We determine if mortality of individuals of listed species resulting from the proposed action is sufficient to reduce the viability of the populations those individuals represent (measured using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the population's extinction risks).

In order to make that determination, we use a population's base condition (established in the *Status of Listed Resources* and *Environmental Baseline* sections of this opinion) as context for the overall effects of the action on affected populations. Finally, our opinion determines if changes in population viability, based on the *Effects of the Action* and the *Cumulative Effects* sections, are likely to be sufficient to reduce viability of the species those populations comprise. The following discussion summarizes the probability of risk the proposed action poses to the listed species identified in the *Status of Listed Resources* section.

7.1 **Oceanic Whitetip Shark**

Oceanic whitetip sharks are listed as threatened throughout their range. They are exposed to fishing activities throughout the *Action Area* for the Guam, CNMI, and MHI bottomfish fisheries. As discussed in the *Status of Listed Species,* two stock assessments have been completed to date for the Western Pacific (Rice and Harley 2012; Tremblay-Boyer et al. 2019). Tremblay-Boyer et al. (2019) estimate the 2016 total biomass of WCPO oceanic whitetip sharks was 9,641 t. NMFS (2020) estimated, based on the work of Tremblay-Boyer et al. (2019) that the portion of the population represented by the West Pacific stock is composed of about 775,214 oceanic whitetip sharks and we use this abundance in our assessment as the minimum population size of Pacific Ocean oceanic whitetip sharks. Stock assessments have not been conducted for either the Eastern Pacific or for the global population. Overall, the species has experienced significant historical and ongoing abundance declines in all three ocean basins due to overutilization from fishing pressure and inadequate regulatory mechanisms to protect the species (based on CPUE). The significant declining trends observed in all available abundance indices (e.g. standardized CPUE, biomass, and median size) of oceanic whitetips occurred as a result of increased fishing effort in the longline fisheries, with lesser impacts from targeted longline fishing and purse-seining and is not believed to be a result of the bottomfish fisheries considered herein.

The most significant threat to the species are impacts from fisheries bycatch and exploitation for the fin trade. Bycatch-related mortality in longline fisheries are considered the primary drivers for these declines (Clarke et al. 2011a; Rice and Harley 2012; Young et al. 2017), with purse seine fisheries also being a source of mortality. In addition to bycatch-related mortality, the oceanic whitetip shark is a preferred species for retention because its large fins obtain a high price in the Asian fin market, and this species comprises approximately 2% of the global fin trade (Clarke et al. 2006). This high value and demand for oceanic whitetip fins incentivizes the illegal retention and subsequent finning of oceanic whitetip sharks when caught. As a result, observed oceanic whitetip biomass has declined by 86% since 1995 (Rice and Harley 2012; Young et al. 2017; Tremblay-Boyer et al. 2019). Currently, the population is overfished and experiencing overfishing (Rice and Harley 2012; Tremblay-Boyer et al. 2019). As a result, catch trends of oceanic whitetip sharks in both longline and purse seine fisheries have significantly declined, with declining trends also detected in some biological indicators, such as biomass and size indices (Young et al. 2017).

As described in the *Environmental Baseline*, effects from international and U.S. fisheries have resulted in interactions with the oceanic whitetip shark population. These activities are reasonably likely to continue, and may increase over time due to the effects of increased human population, increased human consumption of fish products, and the international trade of shark fins. Likely the most influential management measure for the conservation of oceanic whitetip sharks in the Western and Central Pacific is CMM 2011-04, which prohibits WCPFC vessels from retaining onboard, transshipping, storing on a fishing vessel, or landing any oceanic whitetip shark, in whole or in part, in the fisheries covered by the Convention. Overall, while it is likely that existing controls on shark finning and species retention bans are reducing fishing mortality of oceanic whitetip sharks in the Western and Central Pacific to some degree, these conservation measures appear only partially effective, and implementation, and enforcement rates are likely variable and are discussed in further detail by Young et al. (2017). Additionally, Rice et al. (2020) further estimated that cumulatively, the U.S. longline fisheries in the WCPO are responsible for upwards of 9% of this decline to the species' Spawning Potential Ratio (SPR) (Rice et al. 2020).

The potential impacts from climate change on oceanic whitetip shark habitat are highly uncertain, but given their broad distribution in various habitat types, these species can move to areas that suit their biological and ecological needs. Therefore, while effects from climate change have the potential to pose a threat to sharks in general, including habitat changes such as changes in currents and ocean circulation and potential impacts to prey species, species-specific impacts to oceanic whitetip sharks and their habitat are currently unknown, but Young et al. (2017) believe they are likely to be minimal.

Although spatio-temporal trends are not apparent due to the scarcity of data in these fisheries as discussed in the *Exposure* analysis, based on the best available scientific and commercial data, we conclude that there may be interactions between the Guam, CNMI, and MHI bottomfish fisheries and oceanic whitetip sharks. Furthermore, in cases where sharks survive the interaction, the shark may still experience adverse effects after they are released. Physiological responses and effects to sharks from stress associated with capture have been extensively studied. These studies reveal adverse reactions to an individual sharks' fitness after interaction with the gear (Beerkircher et al. 2002, Mandelman and Skomal 2009, Marshall et al. 2012, Hutchinson et al. 2021). Sudden and delayed mortality in individuals of multiple other species of sharks across different ocean basins have been quantified; however, data for the oceanic whitetip shark are lacking, specifically metrics pertaining to delayed post-release mortality. Whether those studies are applicable to oceanic whitetips is not certain because some species may not be physiologically similar in resilience. However, the literature reveals that sharks generally respond adversely to capture.

At this time, post-release mortality statistics are limited for the oceanic whitetip shark and have been identified by multiple sources as a significant data gap. Hutchinson et al. (2021) found that the oceanic whitetip shark had a post-release mortality rate of 16% in the Hawaii deepset longline fishery (n = 25) and 13% (n=31) in the American Samoa longline fishery. Bayesian survival analysis showed that the condition at release (good vs. injured), branchline leader material, and the amount of trailing fishing gear left on the animals were among the most significant factors affecting post-release fate (Hutchinson et al. 2021). The literature also suggests that hooking location is a predictor of fate, with internal hooking having increased deleterious effects. Some sharks that interact with the fishing gear may have had prior interactions with the fishery and may alter their foraging dynamics to avoid capture, while other individuals may continue to depredate bait or catch, which may result in additional hookings.

Given the number of interactions with oceanic whitetip sharks in these bottomfish fisheries as described in the *Effects Analysis*, NMFS estimates that these batched fisheries would interact with a total of 7 oceanic white tip sharks over 5 years as follows: one oceanic whitetip shark in the Guam bottomfish fishery, four oceanic whitetip sharks in the CNMI bottomish fishery, and two in the MHI bottomfish fishery. On average, therefore, we anticipate 1.4 sharks (7 sharks/5 years) to be captured each year. Over a 40 year time frame, we expect that 56 sharks would be captured in these bottomfish fisheries. The at-vessel or post-release mortality rates for all interactions in these fisheries is unknown. Six studies in the literature provide a representative estimate of post-release mortality metrics ranging from 10 to 25% (Gurshin and Szedlmayer 2004; Kneebone et al. 2013; Danylchuk et al. 2014; French et al. 2015; Whitney et al. 2016, 2017). However, without a reliable at-vessel mortality, we cannot accurately determine the total mortality in these fisheries. Many studies in the available literature do not quantify at-vessel mortality for recreational or comparable fisheries. However some have mortality rates of zero (ex: French et al. 2015), while others suggest all subjects arrived alive to the vessel. As fight times for recreational fisheries are minimal, it would be expected that all individuals should arrive alive at the vessel. Therefore we estimated the number of individuals that would die from the proposed action to be up to 25% (Kneebone et al. 2013).

Of the three bottomfish fisheries in this proposed action, the CNMI bottomfish fishery has the largest number of predicted interactions (four over 5 years or 0.8 per year) with oceanic whitetip sharks. Assuming a 25% mortality rate, one oceanic whitetip shark could die in any five-year period as a result of the CNMI bottomfish fishery.

As noted in the *Status of Listed Resources*, for our assessment we are assuming a population abundance of 775,214 in 2016 (Tremblay-Boyer et al. 2019, NMFS 2020) and a population decline of 0.13% per year (Rice et al. 2020). Assuming there are approximately 769,190 oceanic whitetip sharks in the western Pacific as of 2022 (775,215 sharks in 2016 projected with a decline of 0.13% per year), and we apply all seven five-year interactions from *all* bottomfish fisheries under consideration in this biological opinion to the western Pacific population, then the aggregate total of the Guam, CNMI, and MHI bottomfish fisheries may interact with up to 0.00018% of the oceanic whitetip shark population in the western Pacific per year or 0.00092% over 5 years. The mortality estimate of 25% results in a mortality impact of 0.00005% of the population per year or 0.00026% of the population over 5 years (Table 7)..

Finally, we examined the effect of maintaining the same number of interactions with the species as its numbers declined by 0.13% annually, as estimated by Rice et al. (2020). In ten years (i.e. 2032), the total oceanic whitetip shark population in the western Pacific would be expected to be 759,255 sharks. The 14 interactions estimated to occur over 10 years represents interactions with 0.0018% of the population and the mortality of 0.00053% of the population (Table 7). In 40 years the western Pacific population would be estimated to be 730,214 sharks and the fishery would interact with 0.00192% of the population and kill 0.00055% of the population (Table 7).

Table 7. Oceanic whitetip shark projected abundances in the West Pacific Ocean based on Tremblay-Boyer et al. (2019) through 2062, and the proportion of the abundances anticipated to be captured and killed in the bottomfish fisheries

	Year	Oceanic Whitetip Sharks in the West Pacific Ocean		
		Estimated Population Abundance	**Estimate of percent captured**	**Estimate of percent killed**
Annual Captures	Present (2022)	769,190	0.00018	0.00005
Captures over 5 years	2027	764,207	0.00092	0.00026
Captures over 10 years	2032	759,255	0.00184	0.00053
Captures over 10 years Projected 20	2042	749,449	0.00187	0.00053

years				
Captures over 10 years projected 30 years	2052	739,769	0.00189	0.00054
Captures over 10 years projected 40 years	2062	730,214	0.00192	0.00055

The proposed action is expected to reduce the abundance of individuals in the population. However, when we take into account the low number of expected interactions with the bottomfish fisheries, the number of sharks estimated to be present within the Western Pacific (769,190 individuals), which likely represents only a portion of the population, we conclude that the number of oceanic whitetip sharks these fisheries interact with would not be expected to appreciably reduce the oceanic whitetip sharks' likelihood of survival and recovery. Even under the most extreme scenario of 100% mortality associated with the estimated seven oceanic whitetip shark interactions, seven mortalities over five years for all bottomfish fisheries combined divided by a minimum population estimate of 769,190 individuals provides a mortality estimate of 0.00018% of the Western Pacific oceanic whitetip shark population. Quantification of the species' abundance through other portions of its range would further reduce our estimate of the proportion of the species seven sharks represent. We know the species is present in the other ocean basins due to continued harvest of the species by various countries fishing those waters, as discussed in the *Status of Listed Species*; however, we do not have population abundance estimates worldwide at this time. Therefore, the incidental take and resulting mortality of oceanic whitetip sharks associated with the direct and indirect effects of NMFS' authorization of the Guam, CNMI, and MHI bottomfish fisheries is not likely to reduce the reproduction, numbers or distribution of oceanic whitetip sharks, and there is not likely to appreciably reduce the likelihood of both the survival and recovery of oceanic whitetip sharks in the wild.

8 CONCLUSION

After reviewing the current oceanic whitetip shark *Status*, the *Environmental Baseline* for the *Action Area*, the *Effects of the Proposed Action*, and the *Cumulative Effects*, it is our biological opinion that NMFS' continued operation of the batched bottomfish fisheries in Guam, CNMI, and MHI is not likely to jeopardize the continued existence of the threatened oceanic whitetip shark.

9 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and protective regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species without a special exemption. "Incidental take" is defined as take that is results from, and is not the purpose of carrying out of an otherwise lawful activity. 50 CFR 402.02. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the reasonable and prudent measures and terms and conditions of the Incidental Take Statement (ITS).

The measures described below are nondiscretionary and must be undertaken by NMFS for the exemption in section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this ITS. If NMFS fails to assume and implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, NMFS must monitor the progress of the action and its impact on the species as specified in the ITS (50 CFR 402.14(i)(3)).

The proposed action results in the incidental take of threatened oceanic whitetip sharks. Currently there is no take prohibition for oceanic white tip sharks, thus an ITS is not required to provide an exemption to the prohibition of take under section 9 of the ESA for this species. However, consistent with the decision in *Center for Biological Diversity v. Salazar*, 695 F.3d 893 (9th Cir. 2012), we have included an ITS to serve as a check on the no-jeopardy conclusion by providing a reinitiation trigger so the action does not jeopardize the species if the level of take analyzed in the biological opinion is exceeded.

9.1 **Amount or Extent of Take**

The following levels of incidental take may be expected to result from the proposed action for each of the three fisheries considered in this biological opinion. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS uses causal inference to determine if individual threatened and endangered species, or their designated critical habitat, would likely be taken by harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting or attempting to engage in any such conduct. If take is anticipated to occur, then NMFS must describe the amount or extent of such anticipated take and the reasonable and prudent measures, and terms and conditions necessary to minimize the impacts of incidental take (FWS and NMFS 1998). If, during the course of the action, the specified level of incidental take for each fishery is exceeded for any of the species as listed by an individual fishery, NMFS SFD must immediately reinitiate formal consultation with NMFS PRD pursuant to the section 7 regulations (50 CFR 402.16) for that fishery. NMFS PRD anticipates that the number of oceanic whitetip sharks that could be taken as a result of the proposed action by each fishery is as follows:

Table 8. The number of oceanic whitetip shark interactions expected from the proposed action over any *five consecutive years* with predicted mortalities based on the best available scientific data for comparable fisheries.

Fishery	Expected number of Interactions (over 5 years)	Predicted Mortalities
Guam	1	1
CNMI	4	1
MHI	2	1

9.2 Reasonable and Prudent Measures

Reasonable and prudent measures are actions the Director believes necessary or appropriate to minimize the impacts, i.e., amount or extent, of incidental take (50 CFR 402.02). These measures should minimize the impacts of incidental take to the extent reasonable and prudent. The Services must specify reasonable and prudent measures and their implementing terms and conditions to minimize the impacts of incidental take that do not alter the basic design, location, scope, duration, or timing of the action, and that involve only minor changes.

NMFS PRD has determined that the following reasonable and prudent measures, as implemented by the terms and conditions that follow, are necessary and appropriate to minimize the impacts of the bottomfish fisheries, as described in the proposed action, on threatened and endangered species and to monitor the level and nature of any incidental takes. These measures are non-discretionary—they must be undertaken by NMFS SFD for the exemption in ESA section 7(o)(2) to apply. NMFS has determined the following reasonable and prudent measure:

> NMFS shall monitor the take of threatened oceanic whitetip sharks in the Guam, CNMI and MHI bottomfish fisheries.

9.2.1 Terms and Conditions

NMFS SFD shall monitor the take of threatened oceanic whitetip sharks in the Guam, CNMI and MHI bottomfish fisheries on an annual basis to serve as a check on the agency's decision that the incidental take of oceanic whitetip sharks is not likely to jeopardize their continued existence. Unidentified animals should be prorated to account for any unidientified oceanic whitetip sharks affected by the batched bottomfish fisheries by applying ratios of identified sharks. For example if 5% of all identified sharks are oceanic whitetip sharks, 5% of all unidentified sharks shall be considered to be oceanic whitetip sharks. A report of the previous year's observed and estimated take should be provided to NMFS PRD annually, after a reasonable time to assemble and analyse annual data has elapsed.

9.3 Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or designated critical habitat (50 CFR 402.02).

1. NMFS should work with fishermen and local applicable natural resource entities to disseminate species identification materials, and support consistent and accurate reporting of oceanic whitetip shark bycatch in the American Samoa, Guam, CNMI, and MHI bottomfish fisheries.
2. NMFS SFD should establish methods to improve the accuracy and frequency of reporting of oceanic whitetip shark bycatch in the Guam, CNMI, and MHI bottomfish fisheries to better understand interactions of oceanic whitetip sharks with these fisheries and to ensure the estimated take in the ITS is not exceeded.

9.4 Reinitiation Notice

This concludes formal consultation on the continued operation of the bottomfish fisheries in American Samoa, Guam, the Commonwealth of the Northern Marianas Islands, and the Main Hawaiian Islands. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law, and if:

1. The amount or extent of incidental take for any species is exceeded;
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;
3. The agency action is subsequently modified in a manner that may affect listed species or critical habitat to an extent or in a way not considered in this biological opinion or written concurrence; or
4. A new species is listed or critical habitat designated that may be affected by the action.

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Appendix A. Consultation History for Bottomfish Fisheries

Table 9. Consultations on Bottomfish Fisheries arranged by date completed, covered area/FEP, and species addressed. Conclusions for each species are either Likely to Adversely Affect (LAA) or Not Likely to Adversely Affect (NLAA)

Date Signed	Title	Covered Area	Covered species	Conclusion
3/8/2002	Endangered Species Act Section 7 Consultation on the Fishery Management Plan for the Bottomfish and Seamount Groundfish Fisheries in the Western Pacific Region	Hawaii, Guam, American Samoa	Hawaiian monk seal	LAA
			monk seal critical habitat	LAA
			blue whale	NLAA
			fin whale	NLAA
			sei whale	NLAA
			right whale	NLAA
			sperm whale	NLAA
			green sea turtle	NLAA
			hawksbill sea turtle	NLAA
			leatherback sea turtle	NLAA
			loggerhead sea turtle	NLAA
			olive ridley sea turtle	NLAA
6/3/2008	Reinitiation of ESA Consultation for the Bottomfish and coral reef fisheries of the Marianas	CNMI, Guam	green sea turtle	NLAA
			hawksbill sea turtle	NLAA

Date Signed	Title	Covered Area	Covered species	Conclusion
	Archipelago		leatherback sea turtle	NLAA
			olive ridley sea turtle	NLAA
			blue whale	NLAA
			fin whale	NLAA
			sei whale	NLAA
			sperm whale	NLAA
3/18/2008	Implementation of Bottomfish Fishing Regulations within Federal Waters of the Main Hawaiian Islands	MHI	blue whale	NLAA
			fin whale	NLAA
			humpback whale	NLAA
			northern right whale	NLAA
			sei whale	NLAA
			sperm whale	NLAA
			green sea turtle	LAA
			loggerhead sea turtle	NLAA
			leatherback sea turtle	NLAA
			olive ridley sea turtle	NLAA
			hawksbill sea turtle	NLAA

Date Signed	Title	Covered Area	Covered species	Conclusion
			Hawaiian monk seal	NLAA
8/7/2013	Re-initiation of Endangered Species Act Consultation for Main Hawaiian Island Bottomfish Fisheries	MHI	Insular false killer whale	NLAA
4/9/2015	Reinitiation of ESA Consultation on the coral reef, bottomfish, crustacean and precious coral fisheries under the Fishery Ecosystem Plan (FEP) for American Samoa	American Samoa	IndoWest Pacific scalloped hammerhead shark	NLAA
			Acropora globiceps	NLAA
			A. jacquelineae	NLAA
			A. retusa	NLAA
			A. speciose	NLAA
			Euphyllia paradivisa	NLAA
			Isopora crateriformis	NLAA
4/29/2015	Reinitation of consultation under the ESA on the coral reef, bottomfish, crustacean, and precious coral fisheries under the Fishery Ecosystem Plan (FEP) for the Mariana Archipelago	Guam, CNMI	IndoWest Pacific scalloped hammerhead shark	NLAA
			Acropora globiceps	NLAA
			Seriatopora aculeata	NLAA

Date Signed	Title	Covered Area	Covered species	Conclusion
			A. retusa	NLAA
3/1/2016	Reinitation of consultation on the bottomfish fishery in the Hawaiian Archipelago	MHI	monk seal critical habitat	NLAA
This document	Reinitiation of consultation on the bottomfish fisheries of American Samoa, Guam, the Northern Mariana Islands and the Main Hawaiian Islands as managed under the American Samoa, Mariana Archipelago and Hawaii Archipelago Fishery Ecosystem Plans	MHI, Guam, American Samoa, CNMI	Oceanic whitetip shark	LAA
			giant manta ray	NLAA
			chambered nautilus	NLAA
			Insular false killer whale critical habitat	NLAA

Table 10. Consultations on Bottomfish fisheries arranged by species addressed.

Species	Covered species by FEP	Consultation
Loggerhead sea turtle	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam	March 8, 2002
Leatherback sea turtle	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam and CNMI	June 8, 2008
Olive ridley sea turtle	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam and CNMI	June 3, 2008
Green sea turtle	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam and CNMI	June 8, 2008
Hawksbill sea turtle	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam and CNMI	June 8, 2008
Blue whale	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam and CNMI	June 8, 2008
Fin whale	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam and CNMI	June 8, 2008
Sei whale	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam and CNMI	June 8, 2008
Sperm whale	American Samoa	March 8, 2002
	MHI	March 18, 2008
	Guam and CNMI	June 8, 2008

Species	**Covered species by FEP**	**Consultation**
Northern right whale	American Samoa and Guam	March 8, 2002
	MHI	March 18, 2008
MHI insular false killer whale	MHI	August 7, 2013
MHI insular false killer whale critical habitat	MHI	This document
Hawaiian monk seals	MHI	3/18/2008
Hawaiian monk seal critical habitat	MHI	3/1/2016
Scalloped hammerhead sharks	American Samoa	04/09/2015
	Guam and CNMI	4/29/2015
Acropora globiceps	American Samoa	4/9/2015
	Guam and CNMI	4/29/2015
Acropora jacquelineae	American Samoa	4/9/2015
Acropora retusa	American Samoa	4/9/2015
	Guam and CNMI	4/29/2015
Acropora speciose	American Samoa	4/9/2015
Euphyllia paradivisa	American Samoa	4/9/2015
Isopora craterformis	American Samoa	4/9/2015
Seriatopora aculeata	Guam and CNMI	4/29/2015
Giant manta ray	MHI, American Samoa, Guam, CNMI	This document
Chambered nautalis	MHI, American Samoa, Guam, CNMI	This document
Oceanic whitetip shark	MHI, American Samoa, Guam, CNMI	This document