Endangered Species Act – Section 7 Consultation

Action Agency:	National Marine Fisheries Service, Pacific Islands Regional Office, Protected Resources Division, Conservation Planning and Rulemaking Branch
Activity:	PIFSC Oceanic Whitetip Shark Research and Data Collection
Consultation Conducted by:	National Marine Fisheries Service, Pacific Islands Region, Protected Resources Division, Intergovernmental Coordination and Conservation Branch
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ACRONYMS

BE	Biological Evaluation
BREP	NOAA Bycatch Reduction Engineering Program
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPR	Conservation Planning and Rulemaking Branch
CPUE	Catch Per Unit Effort
cm	Centimeter(s)
CO_2	Carbon Dioxide
dB	Decibel(s)
DPS	Distinct Population Segment
DSLL	Deep-set longline fishery
DQA	Data Quality Act
EEZ	U.S. Exclusive Economic Zone
ESA	Endangered Species Act
FAD	Fish Aggregating Devices
ft	Feet
FR	Federal Register
FWS	US Fish and Wildlife Service
Hz	Hertz
ICCB	Intergovernmental Coordination and Conservation Branch
in	Inch(es)
ITS	Incidental Take Statement
ITP	Incidental Take Permit
kg	Kilogram(s)
kHz	Kilo hertz(s)
m	Meter(s)
mm	Millimeter(s)
nm	Nautical Mile(s)
NMFS	National Marine Fisheries Service (aka NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Islands Regional Office
PSAT	Pop-off Satellite Archival Transmitting Tag
PTS	Permanent Threshold Shift
SPL	Sound Pressure Level
SSLL	Shallow-set longline fishery
TTS	Temporary Threshold Shift
U.S.	United States
WCPFC	Western and Central Pacific Fisheries Commissions
WCPO	United States Western Central Pacific Ocean
ºC	Degrees Celsius
ºF	Degrees Fahrenheit

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" a listed species or its designated critical habitat, that agency is required to consult formally with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (FWS), depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR 402.14(a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species or their designated critical habitat, and NMFS or the FWS concur with that conclusion (50 CFR 402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS provides an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If NMFS determines that the action is likely to jeopardize listed species or destroy or adversely modify critical habitat, in accordance with the ESA Subsection 7(b)(3)(A), NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If an incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts and terms and conditions to implement the reasonable and prudent measures. NMFS, by regulation has determined that an ITS must be prepared when take is "reasonably certain to occur" as a result of the proposed action. 50 C.F.R. 402.14(g)(7).

Take" is defined by the ESA as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, any threatened or endangered species, or to attempt to engage in any such conduct. NMFS defines "harass" as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016). NMFS defines "harm" as "an act which actually kills or injures fish or wildlife." Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Take of species listed as endangered is prohibited at the time of listing, while take of threatened species may not be specifically prohibited unless NMFS has issued regulations prohibiting take under section 4(d) of the ESA.

The action agency and consulting agency for this consultation is NMFS. Three different branches in NMFS/Pacific Islands cooperated to complete this consultation. Protected Resources Division's (PRD) Conservation Planning and Rulemaking (CPR) Branch intends to fund these proposed actions. The Pacific Islands Fisheries Science Center (PIFSC) is considered the cooperating agency and will conduct the tagging, tracking, and biological sampling of oceanic whitetip sharks (*Carcharhinus longimanus*) by spearfishing and incidentally captured in the Hawaii small-boat tuna fishery throughout the western Pacific. The consulting agency for this proposal is PRD's Intergovernmental Coordination and Conservation Branch (ICCB). This document represents NMFS' biological opinion on the effects of the proposed action on the threatened oceanic whitetip shark. This biological opinion has been prepared in accordance with the requirements of section 7 of the ESA, the implementing regulations (50 CFR 402), agency policy, and guidance and considers and is based on information contained in NMFS's biological evaluation (BE) (NMFS 2021), NMFS and FWS recovery plans and status reviews for elasmobranchs (Miller and Klimovich 2016; Young et al. 2017), and other sources of information as cited herein.

1.1 Consultation History

On January 30, 2018, NMFS published a final rule (83 FR 4153) listing the oceanic whitetip shark as threatened under the ESA. Section 7(a)(2) of the ESA requires that each federal agency ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species. When the action of a federal agency may affect a protected species, that agency is required to consult with either the NMFS or the U.S. Fish and Wildlife Service, depending upon the protected species that may be affected. While there are no take prohibitions for this threatened shark species, consultation is required to ensure activities will not jeopardize the continued existence of the species. This rule became effective March 1, 2018.

On September 16, 2019 NMFS PIFSC requested technical assistance from NMFS PRD ICCB regarding concurrent shark tagging studies in the Hawaii deep-set, American Samoa longline fisheries, and Hawaii State managed fisheries.

On October 17, 2019 NMFS PIFSC met with NMFS PRD ICCB to discuss concurrent sampling activities in the various fisheries. Specifically pertaining to 7(a)(2) 7(d) requirements. The project was previously funded by NOAA Bycatch Reduction Engineering Program (BREP) through the University of Hawaii Institute of Marine Biology.

On June 2020, PIRO PRD CPR became the lead action agency after allocating funds for these research activities.

On February 12, 2021, NMFS PIFSC in cooperation with the CPR branch of NMFS PRD, requested consultation on the effects to the oceanic whitetip shark from biological sampling activities throughout the western Pacific. NMFS PRD ICCB acknowledged receipt of this consultation packet.

On April 23, 2021, NMFS PRD ICCB sent PIFSC a request for additional information via email to clarify project time frame. NMFS PRD ICCB received a response the same day and PIFSC confirmed an end date of September 30, 2026 (the end of the next five-year Joint Institute of Marine and Atmospheric Research cycle).

On May 18, 2021, NMFS PRD ICCB sent PIFSC a second request for additional information via email to clarify project funding history. NMFS PRD received a response the same day via email confirming that the project was previously funded by NOAA BREP to the University of Hawaii Institute of Marine Biology and PIRO funds first came through in June 2020.

As of May 18, 2021, NMFS PRD ICCB determined we have sufficient information to complete consultation and agreed to initiate informal consultation.

After initiation of consultation, NMFS PRD ICCB sent PIFSC a request for additional information on September 9, 2021, to clarify the spearfishing component of the proposed action and the potential re-use of tags. PIFSC responded on the same day and confirmed that spearfishing is directed take, and that tags are not re-usable.

2 DESCRIPTION OF THE PROPOSED ACTION

The proposed action will include NMFS funding and conducting research activities on the threatened oceanic whitetip shark, and is described in detail in NMFS BE (NMFS 2021). This monitoring project began in 2017 under the direction of Dr. Melanie Hutchinson and has been awarded additional funding annually since then.

The research described below includes activities conducted opportunistically when individual oceanic whitetip sharks are captured incidentally under normal, otherwise lawful fishing operations. That is, tagging and sampling of sharks occurring opportunistically when an individual is caught incidentally as bycatch in the small boat fishery. This project will not increase the number of sharks caught in the fishery. Funding is expected to last until September 2026. We estimate this research to interact with a total of 135 individuals over the five years between 2021 and 2026 (27 sharks annually for 5 years). In addition, no other ESA-listed species or designated critical habitat will be affected by the research activities covered under this opinion. This consultation does not cover the effects of Hawaii's small boat fishery. An effect is caused by the proposed action if it will not occur but for the proposed action. These fisheries will occur regardless of the proposed research project.

Fishing will occur in the U.S. Exclusive Economic Zone (EEZ, or Federal waters) around the Main Hawaiian Islands as well as the nearshore waters (generally considered territorial waters) within three nautical miles (nm) of the shoreline around Hawaii. Many fishers use State of Hawaii fish aggregation devices (FADs) to catch tuna and other pelagic teleosts (Refer to Figures 1-4 below for maps of FAD locations within Hawaiian waters from the Hawaii Department of Land and Natural Resources Division of Aquatic Resources). Further information regarding FADs can be found here: http://www.himb.hawaii.edu/FADS/ (Accessed 07.27.2021). Ika-shibi fishing (nighttime handline fishery) locations depend on weather, sea surface temperatures, current speed, and direction. Many fishers, including ika-shibi fishers, will identify a bottom depth (depending on what they are fishing for) of 80 to 1,000 m and follow the topographic line. Many oceanic whitetip shark interactions occur over deeper water from 600 to 1,000 m.

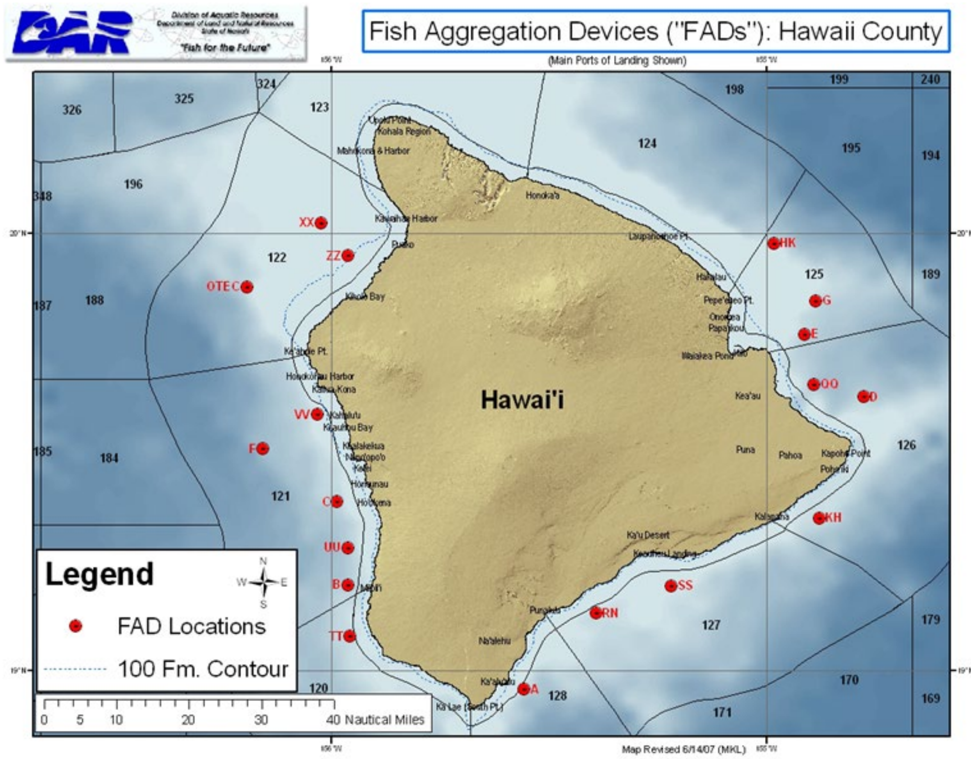

Figure 1. FAD locations around Hawaii Island.

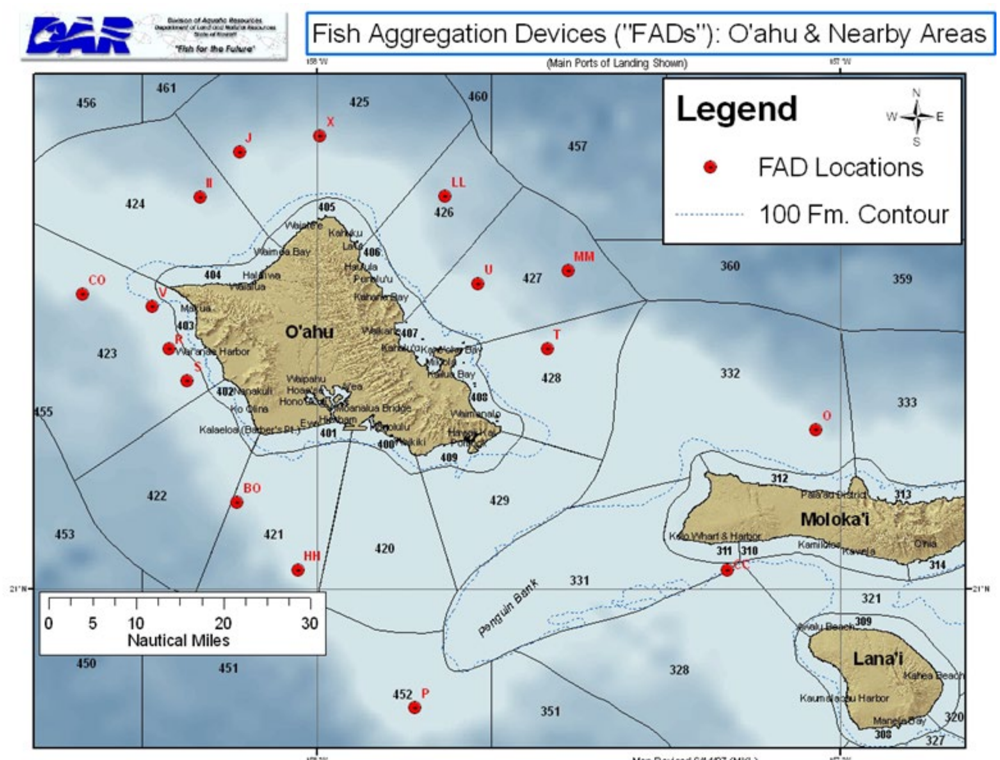

Figure 2. FAD locations around Oahu and nearby areas.

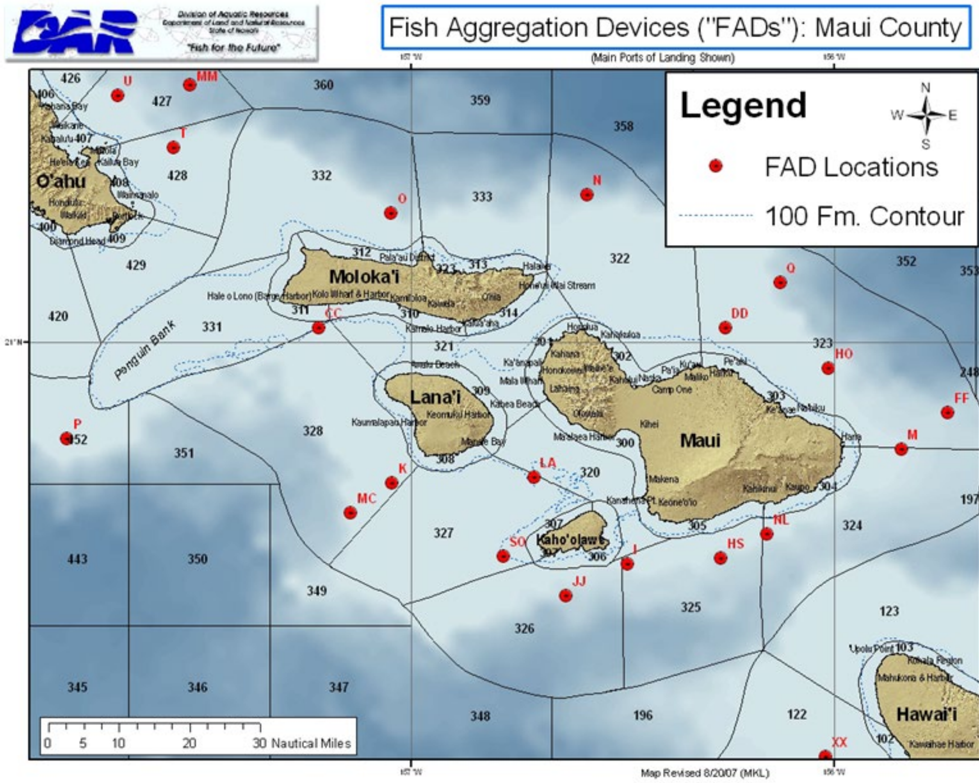

Figure 3. FAD locations around Maui, Lanai, Kahoolawe, and Molokai.

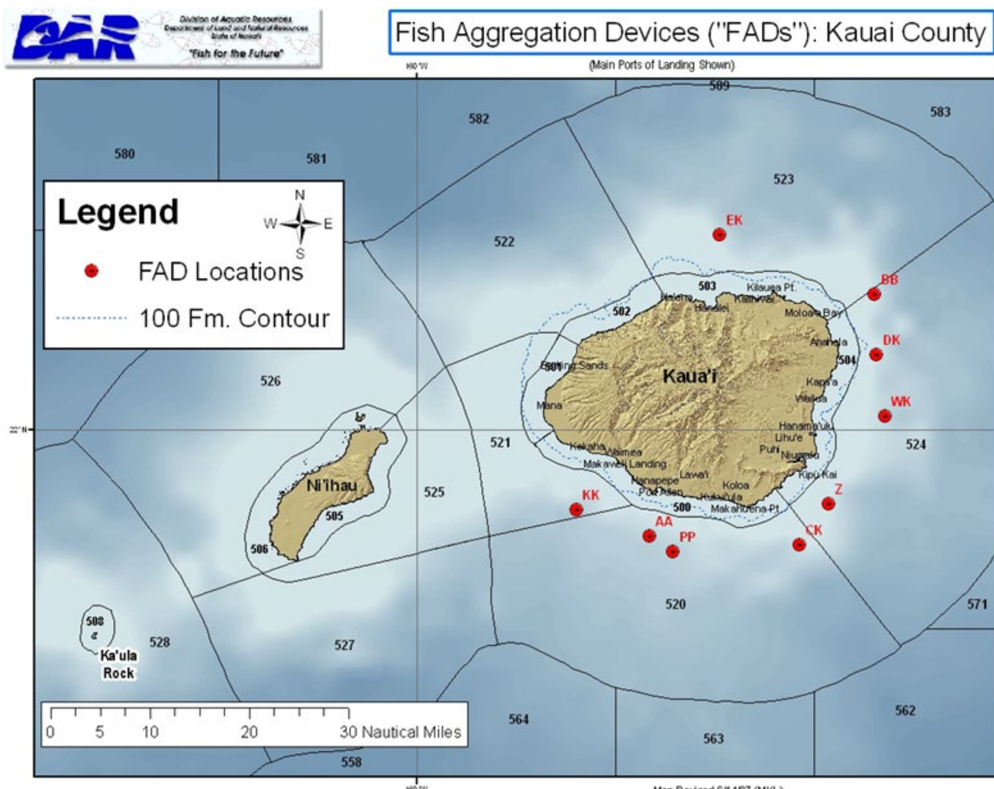

Figure 4. FAD locations around Kauai.

Background
The Hawaii small boat fishery is complex and consists of commercial and non-commercial (recreational, subsistence, artisanal, sustenance, etc.) sectors. The 'small boat' characterization includes vessels under 40 feet (ft) in length that typically range from 12 - 37 ft. This fishery supports small-scale fishing businesses and local seafood production, and is important in the continuation of traditional Hawaii fishing practices. Both commercial and non-commercial sectors are represented with vessels fishing mainly for pelagic species but also includes bottomfish and coral reef fishes. Gears and fishing methods primarily include trolling and handline, with specialized handline methods of Ika Shibi and Palu Ahi almost exclusively used by commercial fishermen. The fishery operates in both state waters (0-3 miles [mi]) and Federal waters (3 - 200 mi) with offshore areas (e.g., Cross Seamount and Middle Bank) important for the handline fisheries, as well as at NOAA weather buoys throughout the archipelago. Fish caught in the small-boat fishery stay in Hawaii, feeding families, community members, and visitors. There are over 1,000 State of Hawaii-issued commercial licenses issued in Hawaii for the commercial small boat fishery and may be at least equal, if not more participation by the non-commercial fishery. The State of Hawaii does not require permits/licenses or logbooks for non-commercial fishing (http://www.wpcouncil.org/wp-content/uploads/2020/01/HI-Small-Boat-Fisheries-Fact-Sheet_Aug2016.pdf. Last accessed 07.27.21).

Fishing Methods
Research activities under this project will be directed by (or managed by) PIFSC and include training commercial and recreational fishers participating in the Hawaii Community Tagging Program to tag, photograph, collect tissue samples, and/or collect interaction data from oceanic whitetip sharks captured incidentally during fishing operations targeting pelagic tuna, billfish and bottomfish teleost species (see fishing methods 1-4 below), and tagged/sampled during spearfishing activities (fishing method #5 below). Fishers involved in the program attend a training workshop and are provided with tagging poles, electronic and identification tags, data cards and training materials (including; the set-up of the tag on the tagging pole, shark species identification guides, handling and release guidelines to improve survival). Fishers that request tagging packets online are given the training materials and identification tags.

Fishers may interact with oceanic whitetip sharks while utilizing many different fishing techniques, which include the following:

1. Ika-shibi fishing - The ika-shibi fishing technique is a night-time small boat fishery that uses handlines composed of mainline, leader and a single circle hook baited with squid or opelu and set at depths between 15 - 35 meters (m). A sea anchor is set to slow a drift in a current line over a favorable depth or topographic feature where chum is thrown in the line of the drift to attract tuna and billfish (http://www.soest.hawaii.edu/pfrp/nov05mtg/glazier_ika_shibi.pdf. Last accessed 07.27.21).

2. Trolling - The trolling fishing technique involves rigging up to six lines with artificial lures (or live or dead bait) that may be trolled when outrigger poles are used to keep the lines from tangling. Trolling gear usually consists of short, stout fiberglass rods and lever-drag hand-cranked reels. Trollers frequent anchored fish aggregation devices (FADs), drifting logs or flotsam, and areas where the bottom drops off sharply that may

aggregate fish (https://www.hawaii-seafood.org/hawaii-fishing-industry/how-we-fish/ Last accessed 07.27.21).

3. Palu-ahi (jigging near FADs) -The Palu-ahi fishing technique is the Hawaiian adaptation of the "drop-stone" method. The principle behind the drop-stone method is to wrap chum bait and a baited hook to a rock with a leaf. The rock is used as a sinker to take the parcel to the desired depth where the chum is released by tugging on a slip knot used to tie the parcel together. The chum bait scatters down current to attract fish to the baited hook at the end of the mainline. The stone sinker then falls loose and sinks, while the baited hook floats free with the scattered chum bait and dangles down current where fish will bite (https://pacific-data.sprep.org/system/files/Sokimi_10_FishingWithLights_1.pdf. Last accessed 07.27.21).

4. Bottom-fishing – Bottom-fishing is a hook and line technique that uses baited hooks on weighted lines. In this technique, a sinker (lead weight) is used to sink the baited hooks to the desired depth where target fish species occur. Terminal gear usually consists of light tackle with four to ten baited hooks, a large lead weight, and a chum (palu) bag. (https://issuu.com/wpcouncil/docs/bottomfish_id_card/1?e=7174896/10924991. Last accessed 07.27.21)

5. Spearfishing - Spearfishing is typically conducted by snorkeling and free-diving with a Hawaiian sling (refer to Figure 5 below), which operates much like a bow and arrow on land. A Hawaiian sling is a pole, about six to eight feet long with a spear head on one end and an elastic rubber tube connected to the other end. To shoot a fish, the fisherman grabs the rubber tube and pulls down towards the spear head. When released, the spear 'shoots' forward because of the rubber tube contracting.

Incidentally caught sharks will be either tagged or tissue sampled. For all gear types, samples obtained will include a fin clip and/or small skin and muscle tissue sample for population genetic analyses. In total, we anticipate that up to 27 individuals will be either tagged or genetically sampled in a given year. At present, there are 14 acoustic tags and five Pop-off Satellite Archival Transmitting Tag (PSATs) available for deployment.

Tagging

Only oceanic whitetip sharks captured incidentally in gear types 1 - 4 during normal otherwise lawful operations above will be brought to the side of the vessel and tagged externally in the dorsal musculature using a tagging pole. Individuals will be tagged with either a PSAT, or an acoustic tag rigged with an external casing and small titanium anchor for external attachment, or a conventional identification tag.

The tags that will be used in this project include V16 coded transmitters by Vemco and MiniPATs or SPATs by Wildlife Computers (see Figure 6 and Figure 7 below, respectively). The tags are small compared to the size of the targeted shark species and attachment of external tags typically involves placement of a single-barb dart into the base of the dorsal fin.

Figure 5. Hawaiian sling with purpose built tag adaptor and tag anchor.

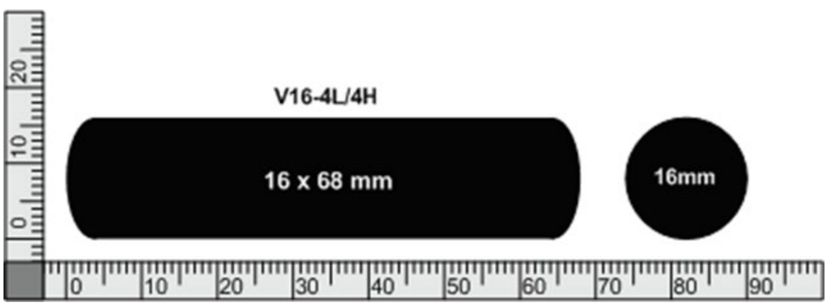

Figure 6. Vemco V16 coded transmitter dimensions (see https://support.fishtracking.innovasea.com/s/downloads?tabset-59625=b2e65. Last accessed 07.27.21).

Figure 7. Wildlife Computers MiniPAT and SPAT. Dimensions: 124 millimeters (mm) (length) x 38 mm (diameter) and weigh 60 grams in air (see https://wildlifecomputers.com/our-tags/pop-up-satellite-tags-fish/minipat/ (Last accessed 07.27.21) for more details. SPATs are dimensionally the same but configured electronically differently for a cheaper tag that delivers survivorship data.

For the duration of the tagging event, sharks remain in the water (swimming) thus reducing stress, and exposure to air and handling. The amount of time that the animals are on the gear prior to tagging depends on how active the shark is (for all four fishing methods). This is called fight time and usually varies from one to 15 minutes as fishers try to get as much of their gear back prior to cutting sharks free from the gear. Tagging may add another one to two minutes to get the animal close to the vessel and well oriented to facilitate proper tag placement. Fishers are instructed to make no more than three attempts at tagging prior to releasing the animal if they are unsuccessful. Most fishers are able to bring the sharks near the vessel and tag each individual in less than ten minutes.

For gear type 5, several spearfishers have been trained to place electronic and identification tags on sharks. Sharks encountered by spearfishers trained in tagging will not be hooked; rather, they will be tagged using a Hawaiian sling with a purpose built adaptor for the tag anchors used in this study (Figure 5.).

Adaptors attach tag anchors to poles, and if sharks approach them they are able to tag the animals without any gear remaining on the animal. These interactions are typically less than one minute and sharks usually appear unaffected by the tagging event and remain while some may leave the area.

At present, there are 14 acoustic tags and five PSATs available for deployment over the course of the project. However, there is the potential for additional tags to be added to the study to improve our understanding of habitat use, movement behavior and interaction rates. Our analysis below accounts for additional tags (which would decrease the number of samplings).

Genetic sampling
Incidentally caught sharks that are not tagged will be tissue sampled. If there are presently 19 available tags, we would anticipate that up to 116 sharks could be tissue sampled over the course of the five-year project (135 total sharks – 19 tagged sharks = 116 maximum sampled sharks). In order to characterize the genetic make-up and level of diversity within the oceanic whitetip shark, a small sample (1 cc) of shark fin tissue would be collected using surgical scissors or a tissue plug. The tissue plug can be taken from the dorsal musculature while fin clips using

surgical scissors may come from any fin (pectoral, caudal, dorsal, second dorsal, or pelvic). For all gear types, tissue sampling will occur in a very similar fashion, where fishers will be given a specialized pole with a tissue plug. Tissue plugs will also be taken from the dorsal musculature. Interaction times should be about the same for tagging as the methods are consistent.

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 the proposed tagging and genetic sampling activities.

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 8). Although Figure 8 depicts a negative effect, the definition itself is neutral: it applies it 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 8); 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 to form a *future without the project* condition (line b in Figure 8); 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 project is implicit in almost every effects analysis.

As Figure 8 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).

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.

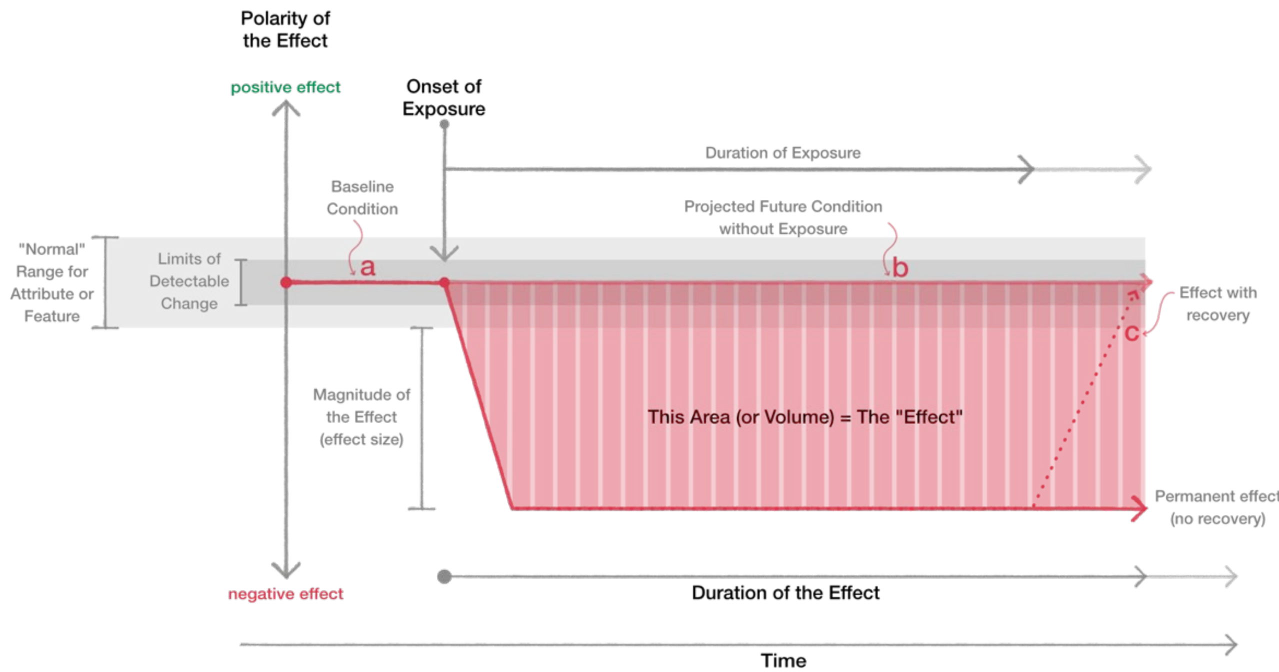

Figure 8. A schematic of the various elements encompassed by the word "effect."

3.1.1 Jeopardy Analysis

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") 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 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.

The final step of our analyses assesses the probability of changes in the number of populations that comprise the species, the spatial distribution of those populations, and their expected patterns of growth and decline over time. In this step of our jeopardy analyses, we consider population-level changes based on our knowledge of the patterns that have led to the decline, collapse, or extinction of populations and species in the past as well as patterns that have led to their recovery from extinction. These patterns inform our jeopardy determinations.

3.2 Action Area

The action area is defined by regulation as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). The action area for the proposed project is the EEZ around the Main Hawaiian Islands where the direct and indirect effects of spearfishing occurs nearshore, generally within territorial waters (three nm of the shoreline), and where the small-boat tuna fishing will occur (Figure 9).

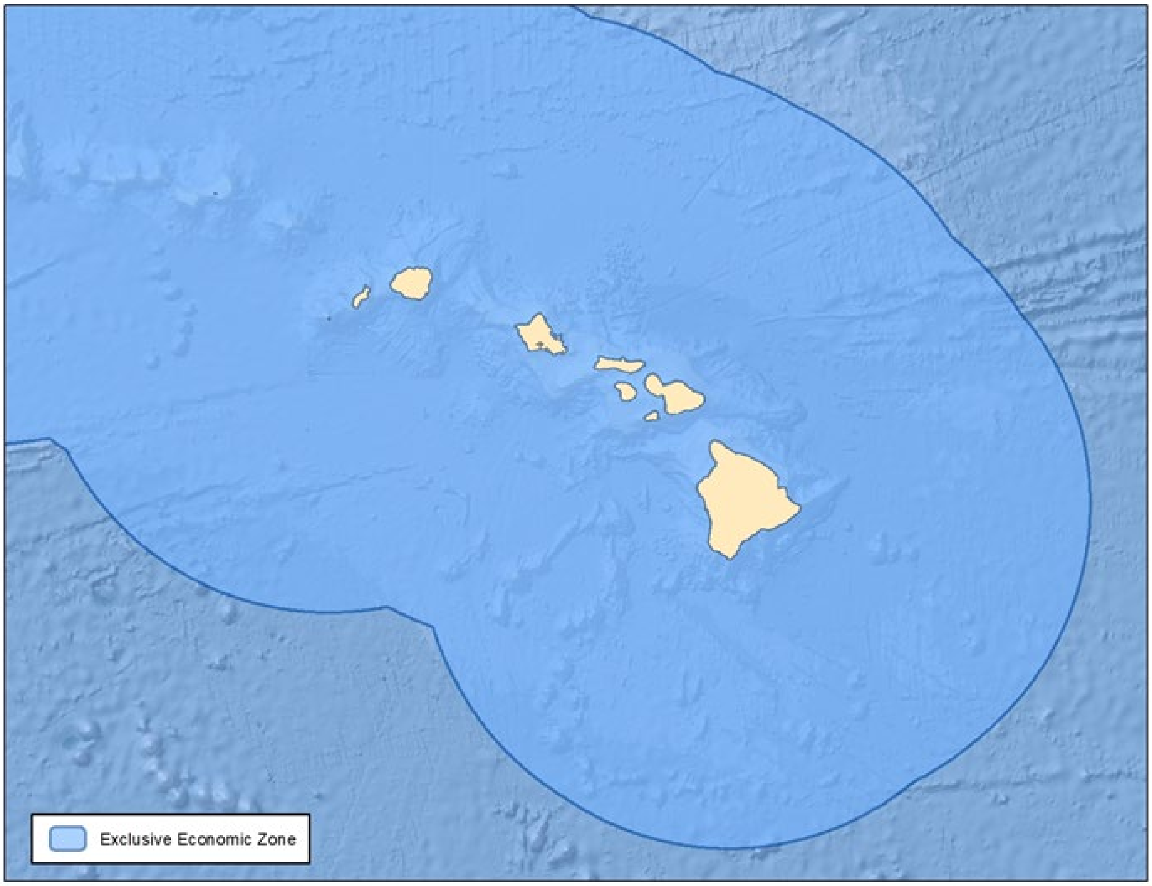

Figure 9. Map of Main Hawaiian Islands with overlay of the EEZ boundary (200 nm).

4 STATUS OF LISTED RESOURCES

NMFS has determined that the proposed action may affect the threatened oceanic whitetip shark (Table 1).

Table 1. Listed resources within the action area that may be affected by the proposed action.

Species	Scientific Name	ESA Status	Listing Date	Federal Register Reference
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Threatened	1/30/2018	83 FR 4153

The oceanic whitetip shark does not have any designated critical habitat at this time; as such, this opinion does not analyze effects to any critical habitat. No designated critical habitat will be affected but for the proposed activities.

4.1 Introduction to the Status of Listed Species

The rest of this section of NMFS biological opinion consists of a narrative for the oceanic whitetip shark that occurs in the *Action Area* and that may be adversely affected by the tagging and sampling activities associated with the Hawaii small-boat tuna fisheries. This status assessment provides the point of reference for our analyses of whether or not the action's direct and indirect effects are likely to increase the species' probability of surviving and recovering in the wild. To fulfill that purpose, the species' narrative presents a summary of: (1) the species' *distribution* and population structure (which are relevant to the distribution criterion of the jeopardy standard); (2) the status and trend of the abundance of those different populations (which are relevant to the *numbers* criterion of the jeopardy standard); (3) information on the dynamics of those populations where it is available (which is a representation of the *reproduction* criterion of the jeopardy standard); and (4) natural and anthropogenic threats to the species, which helps explain our assessment of a species' likelihood of surviving and recovering in the wild. This information is integrated and synthesized in a summary of the status of the species.

Following the narratives that summarize information on these three topics, the species narrative provides information on the diving and social behavior of the species because that behavior helps assess a species' probability of being captured by fishing gear. Anyone interested in more detailed background information on the general biology and ecology of these species can be found in status reviews and recovery plans for the various species[1] as well as the public scientific literature.

4.1.1 Oceanic Whitetip Shark

4.1.1.1 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. 1999b). 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

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[1] Status reviews and recovery plans are generally accessible through NMFS' endangered species conservation website: https://www.fisheries.noaa.gov/topic/endangered-species-conservation#conservation-&-management (Last accessed 07.27.21) and NatureServe Explorer: http://explorer.natureserve.org/servlet/NatureServe?init=Species (Last accessed 07.27.21).

increasing proximity to continental shelves (Backus et al. 1956; Strasburg 1958; Clarke et al. 2011; 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). It should be noted that 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).

4.1.1.2 Status and Trend

Oceanic whitetip sharks were globally listed as threatened in 2018. Historically, 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 1995, 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, (Anderson et al. 2011; IOTC 2011, 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. 2011; Brodziak et al. 2013; Rice et al. 2015; Tremblay-Boyer et al. 2019). Rice and Harley (2012) estimated the 2010 total biomass at 7,295 metric tons. FAO (2012) suggests this represents approximately 200,000 individuals assuming an average individual body weight of 80.4 pounds (36.5 kilograms [kg]). Rice and Harley (2012) concluded that the oceanic whitetip shark is not only experiencing overfishing in the WCPO, but the population is currently in an overfished state. Tremblay-Boyer et al. (2019) updated the stock assessment of Rice and Harley (2012) and concluded that total biomass in 2010 was 19,740 metric tons and that biomass declined to 9,641 metric tons by 2016. This resulted in a greater spawning biomass used by Tremblay-Boyer et al. (2019) for the analysis of WCPO oceanic whitetip sharks than was used in Rice et al. (2015). Using the same assumptions as FAO (2012), this biomass would equate to approximately 264,318 individuals. Tremblay-Boyer et al. (2019) also concluded that the population is overfished and continues to undergo overfishing while using a higher spawning biomass estimate and a wider range of variables than originally considered in Rice and Harley (2012). However, Tremblay-Boyer et al. (2019) also note that the rate of overfishing has declined since the Western & Central Pacific Fisheries Commission (WCPFC) adopted Conservation and Management Measure (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 caught as soon as possible. Both stock assessments attributed the significant decline of WCPO oceanic whitetip shark to impacts from the pelagic longline fishery, with secondary impacts from the purse seine fishery.

In a preliminary report to the WCPFC's SSC, 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. 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 the *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.

4.1.1.3 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).

4.1.1.4 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.

4.1.1.5 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. Impacts to the species from fisheries (U.S. and foreign) that overlap the *Action Area* will be discussed in the *Environmental Baseline*, as appropriate.

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 (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).

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). This high value and demand for oceanic whitetip fins incentivizes the opportunistic retention and subsequent 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 85 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 (see the casual loop diagram in the *Status of Listed Resources*). Their population dynamics–long-lived and late-maturing with low-to-moderate productivity–would make this species particularly vulnerable to harvests that target adults and would limit their ability to recover from over-exploitation (Crouse 1999).

U.S. fisheries in the Pacific that capture oceanic whitetip sharks include the WCPO Purse seine fishery, the Hawaii shallow-set longline (SSLL), Hawaii deep-set longline (DSLL), and American Samoa longline fisheries, as well as the U.S. purse seine fishery. The SSLL and DSLL longline fisheries will be discussed in the *Environmental Baseline*, as they overlap the *Action Area*. 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). Lastly, the U.S. fisheries in Alaska are not expected to overlap with the species range.

Between 2008 and 2018, 680 U.S. WCPO purse seine sets have interacted with oceanic whitetip sharks resulting in the capture of 1,330 observed individuals (NMFS 2019). It's estimated the fishery caught a total of 2,284 (95% CI: [1,983, 2,569]) oceanic whitetip sharks during that time. We expect 183 (95th percentile: 220) individual oceanic whitetip sharks will interact with the US WCPO purse seine fishery in a given year, and of those, 154 (95th percentile: 185) would be expected to die from their interactions (NMFS 2019).

Oceanic whitetip sharks are also captured in the American Samoa longline fishery which is managed under the Pelagics FMP. NMFS developed predictions of future interaction levels (McCracken 2019) using Bayesian statistical inference techniques for the America Samoa longline fishery biological opinion. Between 2006 and 2019 (2nd quarter), 1,344 confirmed oceanic whitetip sharks were observed caught in the American Samoa longline fishery (NMFS Observer program unpublished data). In total, we estimate the American Samoa longline fishery had 1,418 interactions with oceanic whitetip sharks from 2006-2019 (2nd quarter). Most oceanic whitetip sharks are released alive (68%) and only two sharks were recorded as retained in 2007(1) and 2011(1). The average at-vessel mortality in the American Samoa longline fishery for oceanic whitetip sharks is 32% (95% CI: 0.29, 0.34) with an unknown post release mortality rate.

4.1.1.6 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 the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2013. This listing went into effect as of September 2014.

Within the WCPO, finning bans have been implemented by the U.S., 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.

4.1.1.7 Summary of the Status

In this section of this biological opinion, we explained that the oceanic whitetip shark is threatened, and that the species' numbers appear to be decreasing. 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. The significant declining trends observed in all available abundance indices (e.g., standardized CPUE, biomass, and median size) of oceanic whitetip sharks occurred as a result of increased fishing effort in domestic and foreign longline fisheries, with lesser impacts from targeted longline fishing and purse-seining (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. 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 the oceanic whitetip shark within the *Action Area* include fishery interactions, vessel strikes, climate change, pollution, and marine debris. The *Environmental Baseline* for this species addressed by this biological opinion is described below.

5.1 Global Climate Change

Climate change on a global scale has consequences within the *Action Area*, however to understand the consequences of climate change we need to look at what is occurring globally. Global annually averaged surface air temperature has increased by about 1.8 degrees Fahrenheit (ºF) (1.0 degrees Celsius [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 [CO_2]) 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 CO_2 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 potential for impact to the rest of the biological ecosystem in terms of nutrient availability as well as phytoplankton and zooplankton distribution (Gennip et al. 2017).

Effects of climate change on marine species include alterations in reproductive seasons and locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors or predators. Variations in sea surface temperature can affect an ecological community's composition and structure, alter migration and breeding patterns of fauna and flora and change the frequency and intensity of extreme weather events. For species that undergo long migrations (e.g., sea turtles), individual movements are usually associated with prey availability or habitat suitability. If either is disrupted, the timing of migration can change or negatively impact population sustainability (Simmonds and Eliott 2009). Over the long term, increases in sea surface temperature can also reduce the amount of nutrients supplied to surface waters from the deep sea leading to declines in fish populations (EPA 2010), and, therefore, declines in those species whose diets are dominated by fish. Acevedo-Whitehouse and Duffus (2009) proposed that the rapidity of environmental changes, such as those resulting from global warming, can harm immunocompetence and reproductive parameters in wildlife, to the detriment of population viability and persistence.

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the community structure and function of marine, coastal, and terrestrial ecosystems in the near future (McCarty 2001; IPCC 2014). Climate change will likely have its most pronounced effects on vulnerable species whose populations are already in tenuous positions (Williams et al. 2008). As such, we expect the risk of extinction for ESA-listed species to rise with the degree of climate shift associated with global warming. Increasing atmospheric temperatures have already contributed to documented changes in the quality of freshwater, coastal, and marine ecosystems and to the decline of endangered and threatened species populations (Mantua et al. 1997; Karl et al. 2009).

Elasmobranch species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2012). Climate-related shifts in range and distribution have already been observed in some marine mammal populations (Silber et al. 2017). Marine mammal species often exhibit strong dependence on or fidelity to particular habitat types, oceanographic features, and migration routes (Sequeira et al. 2018). Specialized diets, restricted ranges, or reliance on specific substrates or sites (e.g., for pupping) make many marine mammal populations particularly vulnerable to climate change (Silber et al. 2017). Marine mammals with restricted distributions linked to water temperature may be exposed to range restriction (Learmonth et al. 2006; Isaac 2009). MacLeod (2009) estimated that, based upon expected shifts in water temperature, 88% of cetaceans would be affected by climate change, 47% would be negatively affected, and 21% would be put at risk of extinction. Hazen et al. (2012) examined top predator distribution and diversity in the Pacific Ocean in light of rising sea surface temperatures using a database of electronic tags and output from a global climate model. Hazen et al. (2012) predicted up to a 35% change in core habitat area for some key marine predators in the Pacific Ocean, with some species predicted to experience gains in available core habitat and some predicted to experience losses.

Significant impacts to elasmobranch species from ocean acidification may be indirectly tied to foraging opportunities resulting from ecosystem changes (Busch et al. 2013; Haigh et al. 2015; Chan et al. 2017). Nearshore waters off California have already shown a persistent drop in pH from the global ocean mean pH of 8.1 to as low as 7.43 (Chan et al. 2017). The distribution, abundance and migration of baleen whales reflects the distribution, abundance and movements of dense prey patches (e.g., copepods, euphausiids or krill, amphipods, and shrimp), which have in turn been linked to oceanographic features affected by climate change (Learmonth et al. 2006). Ocean acidification may cause a shift in phytoplankton community composition and biochemical composition that can impact the transfer of essential nutrients to predators that eat plankton (Bermudez et al. 2016). Increased ocean acidification may also have serious impacts on fish development and behavior (Raven et al. 2005), including sensory functions (Bignami et al. 2013) and fish larvae behavior that could impact fish populations (Munday et al. 2009) and piscivorous ESA-listed species that rely on those populations for food.

Other climatic aspects, such as extreme weather events, precipitation, ocean acidification and sea level rise also have potential to affect elasmobranch species. Changes in global climatic patterns will likely have profound effects on the coastlines of every continent, thus directly impacting marine species that use these habitats (Wilkinson and Souter 2008).

Because habitat for many shark and ray species is comprised of open ocean environments occurring over broad geographic ranges, large-scale impacts such as climate change may impact these species. Chin et al. (2010) conducted an integrated risk assessment to assess the vulnerability of several shark and ray species on the Great Barrier Reef to the effects of climate change. Scalloped hammerheads for instance were ranked as having a low overall vulnerability to climate change, with low vulnerability to each of the assessed climate change factors (i.e., water and air temperature, ocean acidification, freshwater input, ocean circulation, sea level rise, severe weather, light, and ultraviolet radiation). In another study on potential effects of climate change to sharks, Hazen et al. (2012) used data derived from an electronic tagging project and output from a climate change model to predict shifts in habitat and diversity in top marine predators in the Pacific out to the year 2100. Results of the study showed significant differences in habitat change among species groups but sharks as a whole had the greatest risk of pelagic habitat loss.

Environmental changes associated with climate change are occurring within the *Action Area* and are expected to continue into the future. Marine populations that are already at risk due to other threats are particularly vulnerable to the direct and indirect effects of climate change. The oceanic whitetip shark considered in this opinion have likely already been impacted by this threat through the pathways described above.

5.2 Fisheries Interactions

Past and present fisheries interactions have been, and continue to be, a threat to oceanic whitetip sharks within the *Action Area* (specifically, the DSLL, SSLL, and bottomfish fisheries). Bycatch of ESA-listed species 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.

Longline fishing is conducted by many countries in this region and some of it occurs in the baseline for the *Action Area* but there is also a great deal of fishing that occurs adjacent or further away from the *Action Area* (Figure 10). The *Action Area* is in the management areas of one tuna Regional Fishery Management Organization (RFMO). 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 from the RFMO because the genetic research indicates gene flow throughout the Pacific Ocean, meaning what happens outside the action area also has an impact inside of it. Furthermore we cannot estimate the number that occur in the *Action Area* with any precision and therefore can only summarize the number of interactions that occur in the North Pacific Ocean.

There are two types of vessels: (1) large distant-water freezer vessels that undertake long voyages (months) and operate over large areas of the region; and (2) smaller offshore 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 10.

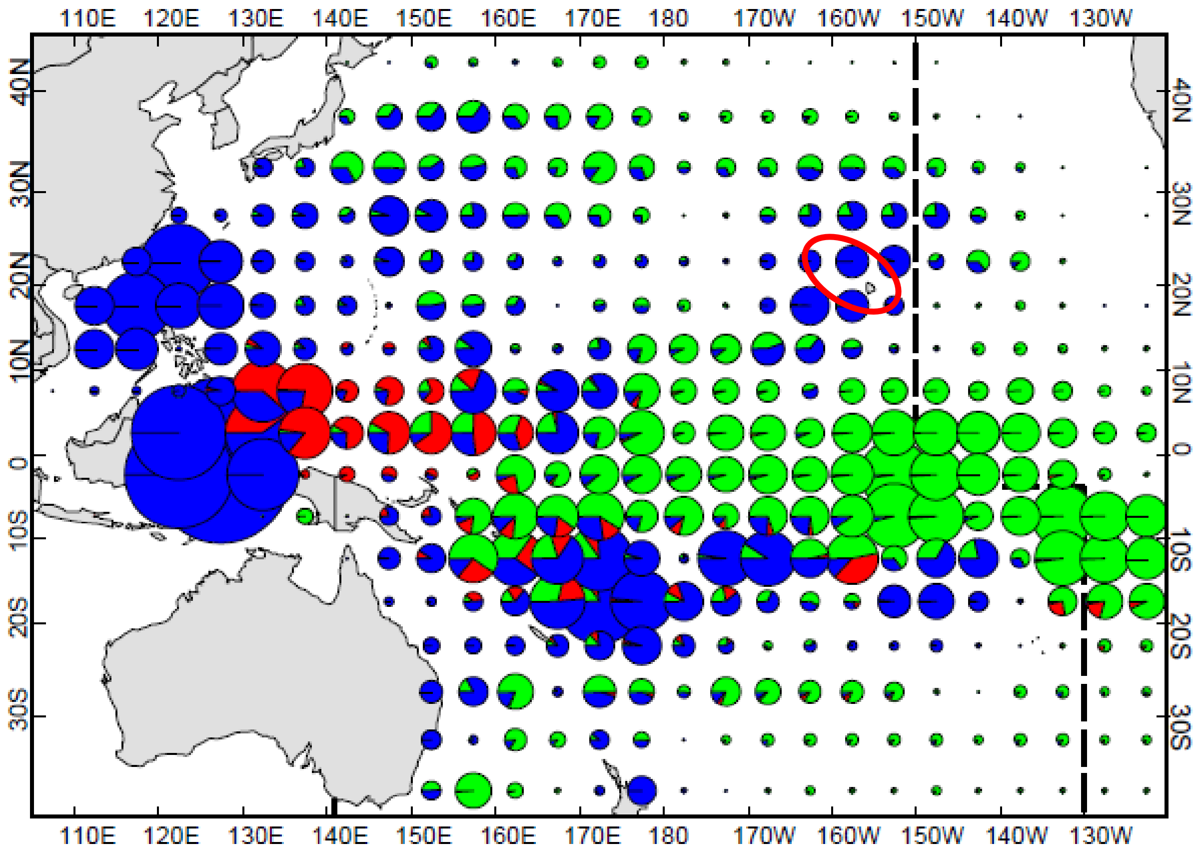

Figure 10. Distribution of longline effort for distant water-fleets (green), foreign-offshore fleets (red) and domestic fleets (blue) for the period of 2000-2016. Action area outlined in red. Vertical dashed black line is the separation in RFMO boundaries (Williams et al. 2017).

While mitigation and minimization measures have reduced fisheries bycatch in the U.S. and in the action area, in recent years, large numbers of 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.

Fisheries management plans developed for federally regulated fisheries with ESA-listed species bycatch are required to undergo ESA section 7 consultations, including a NMFS issued biological opinion and incidental take statement (ITS). The ITS includes the anticipated amount of take (lethal and nonlethal) and reasonable and prudent measures with specific terms and conditions for mitigating and minimizing the adverse effects of the proposed action on ESA-listed species and designated critical habitat. Some state-managed fisheries with ESA-listed species bycatch have also been the subject of section 7 consultations with NMFS for issuance of ESA section 10(a)(1)(B) incidental take permits (ITPs). ITPs are issued based on NMFS approval of a state's Conservation Plan, which includes ESA-listed species mitigation and minimization measures.

5.2.1 International Fisheries Oceanic Whitetip Shark Bycatch

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. To date, two stock assessment has been completed for the oceanic whitetip shark and only pertains to the Western Pacific. Tremblay-Boyer et al. (2019) updated the stock assessment of Rice and Harley (2012) and concluded that total biomass in 2010 was 19,740 metric tons and that biomass declined to 9,641 metric tons by 2016. Using the same assumptions as FAO (2012), this biomass would equate to approximately 264,318 individuals. Stock assessments have not been conducted for either the Eastern Pacific or for the global population, therefore this number would be considered a minimum.

5.2.2 Other U.S. Fisheries Oceanic Whitetip Shark Bycatch

U.S. fisheries which interact with oceanic whitetip sharks in the Pacific (that specifically overlap with the *Action Area*) are the Hawaii deep-set longline, shallow-set longline, and bottomfish fisheries. The shallow set fishery has an observer coverage rate of 100%, while the deep-set fishery coverage is approximately 20% (McCracken 2019). The total number of observed interactions with oceanic whitetip sharks that have occurred in the Hawaii deep-set fishery between 2002 and 2017 was 5,815 individuals with an expanded estimate of 26,967 sharks over this time period (McCracken 2019). Furthermore, the SSLL fishery was estimated to interact with 102 oceanic whitetip sharks per year (95th percentile; NMFS 2019).

Furthermore, although spatio-temporal trends are not apparent due to the scarcity of data in the bottomfish fisheries, based on the available evidence, NMFS concluded that fishing activities of the MHI bottomfish fishery were likely to adversely affect the population dynamics, behavioral ecology, or social dynamics of oceanic whitetip sharks through the loss of individuals. Given the number of interactions with oceanic whitetip sharks in these fisheries, NMFS predicted future interaction levels of two oceanic whitetip sharks in the MHI over the course of a five-year interval.

There were approximately 167 oceanic whitetip shark commercially landed in the State of Hawaii from 1999 to 2015 according to commercial fishing reports provided by Hawaii 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 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.

5.3 Synthesis of Baseline Impacts

The listed resources considered in this biological opinion have been exposed to a wide variety of the past and present state, federal, and private actions in the *Action Area*, which includes of 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. While the impact of those activities on the status, trend or the demographic processes of threatened and endangered species is largely unknown, some are likely to have had and will continue to have lasting effects on the oceanic whitetip shark.

The preceding section of this biological opinion addresses global climate change, fisheries and fisheries bycatch, vessel strikes, pollution from chemicals and marine debris, and ocean noise from variety of sources and effects these stressors have on listed resources. Some of these stressors have resulted in mortality or serious injury to individual animals (e.g., fishing), whereas other stressors (e.g., noise) may induce sub-lethal responses like changes in behavior that could impact important biological functions such as feeding or breeding.

Of the stressors considered herein, the cumulative effect of fisheries in the *Action Area* likely has had some of the most serious and lasting effects on oceanic whitetip sharks, and the populations that comprise the species. This is because of the scale and the magnitude of the impact of the stressor—fisheries capture and injure or kill more individuals of this listed species, than we expect would be injured or die from vessel strikes. The number of individuals that continue to be captured and killed in fisheries in the *Action Area* contributes to the increased extinction risk of the species.

Of the other activities and their associated stressors, the propensity of vessel strikes to go unnoticed or unreported by vessel operators impedes an accurate assessment of the magnitude this threat poses to oceanic whitetip sharks. However, these sharks occur in the pelagic waters within the *Action Area* where their density is sparse. These sharks are also large agile animals and capable of moving quickly if approached by a vessel. Therefore, we do not expect vessel strikes to contribute to the increased extinction risk of the species in the pelagic environment or nearshore areas.

6 EFFECTS OF THE ACTION

In *Effects of the Action* sections of biological opinions, NMFS presents the results of its assessment of the probable effects of federal actions on threatened and endangered species and designated critical habitat that are the subject of a consultation. According to 50 CFR 402.02, *Effects of the Action* "are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. *A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur.* Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. Furthermore, 50 CFR 402.17 defines reasonably certain to occur as "A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available." Factors to consider when evaluating whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur include, but are not limited to: (1) past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;(2) existing plans for the activity; and (3) any remaining economic, administrative, and legal requirements necessary for the activity to go forward (50 CFR 402.02). The effects of the action are considered within the context of the *Status of the Species*, together with the *Environmental Baseline* and *Cumulative Effects* sections of this opinion to determine if the proposed action can be expected to have direct or indirect effects on the oceanic whitetip shark 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.

6.1 Potential Stressors

Potential stressors associated with the proposed action include:

1. Tagging
2. Genetic sampling

This list includes all of the stressors from the proposed actions that may adversely affect the oceanic whitetip shark.

6.2 Exposure Analyses

As discussed in the *Approach to the Assessment* section of this 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.

6.2.1 Tagging/Genetic Sampling of Oceanic whitetip sharks

As noted in the *Description of the Proposed Action* section, it is anticipated that up to 27 sharks will be exposed to tagging or sampling activities per year (135 individuals over the course of the project [five years]). The research activities described below will be conducted opportunistically either by spearfishing or when individual oceanic whitetip sharks are captured incidentally under normal, otherwise lawful fishing operations. In addition, no other ESA-listed species or designated critical habitat will be affected by the research activities covered under this opinion.

Attachment of the external tags will typically involve placement of a single-barb dart into the base of the dorsal fin. Acoustic tags are programmed for three to five years but can remain on the animal for up to 10 years, and PSATs are programmed for a year. Tissue samples obtained will involve a fin clip and/or small skin and muscle tissue sample for population genetic analyses. See the *Proposed Action* section for a detailed description of tagging and tissue sampling methods.

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 consultation, our assessment tries to detect the probability of responses that might 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 proposed activities present to the oceanic whitetip shark are from injury and potential death from tagging and genetic sampling. Sharks may not immediately die from their wounds but can suffer impaired swimming or foraging abilities, altered migratory behavior, and altered breeding or reproductive patterns, and latent mortality from their interactions.

6.3.1 Post Tagging/Genetic Sampling Survival

It is possible that oceanic whitetip sharks could experience stress and infection from tagging activities. Elasmobranchs regenerate tissue and heal incredibly fast (Heupel and Bennett 1997; Chin et al. 2015; McGregor et al. 2019), so minor injuries associated with tagging are expected to heal quickly. We conducted a thorough literature and data search for information on the effects of tagging to elasmobranchs, and to date, there is no published information to suggest that proper tagging techniques will cause mortality to oceanic whitetip sharks. The electronic tags are small compared to the size of the targeted shark species, and, based on observations by Dr. Melanie Hutchinson and researchers in this program previously, only one in more than 100 tagged oceanic whitetip sharks experienced mortality following tagging (NMFS 2021). This is the best available information we have to date for estimating the effects of tagging on this species. It is possible that individual sharks will experience some lethargy due to stress related to handling, but, given their physiological resiliency, this effect would be a temporary condition. Additionally, it is possible that the tagging site could become infected, but this would be an incredibly rare occurrence. In summary, it would be rare that tagging would result in any long-term injury or adverse effects to the long-term health or fitness of any tagged individuals; however, it is possible and must be considered.

Furthermore, the proposed tissue sampling procedure is common and accepted practice in elasmobranch research. The effects of collection of tissue are expected to be similar to those experienced from tagging. Tissue sample sites are known to heal quickly and completely when used on a variety of vertebrates such as sharks, rays, teleosts, and marine mammals (Weller et al.

1997; Krutzen et al. 2002). To date, there is no information to suggest that these activities cause serious injury or mortality to oceanic whitetip sharks. While the shark will also experience some level of stress, it is unlikely that genetic sampling conducted under the auspices of this project will result in any long-term injury or adverse effects to the long-term health or fitness of any sampled individuals. Despite this information, there is the small possibility that the biopsy site could become infected, but this would be an incredibly rare occurrence.

As discussed above, the effects from tagging or genetic sampling would be minor for most individuals; however, it is possible that some animals may experience more adverse effects, potentially leading to death as a result of injury, infection, or stress from handling. Therefore, based on the best available information, and taking into account that each interaction will result in harm (whether it is tagged or genetically sampled), we assume that 27 oceanic whitetip sharks will be harmed each year (135 individuals over the five-year time frame). Of those individuals tagged, we are reasonably certain no more than one individual will die from tagging (using PIFSC information in NMFS [2021]). We are reasonably certain genetic sampling will not result in mortality for any sampled shark. One death constitutes the loss of 0.004% of the WCPO stock. We will use this estimate to analyze the effect to the WCPO population as there are no global abundance estimates for this species. This analysis certainly overestimates the risk to the population as it is likely much larger than just the WCPO stock. We found no analyses or models that demonstrate death of 0.004% of a population will meaningfully effect its reproduction rates, numbers, or distribution.

7 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 scientific journals, internal databases, 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. However, currently there are various recreational and non-federal commercial fishing occurring within and near the action area (such as the Hawaii small boat fishery), as well as commercial shipping.

However, we do note, increased recreational fishing and boating may occur in the *Action Area* due to population growth. At this time we do not have sufficient information to understand the full effect and the extent or magnitude of such activities. Although, these activities are expected to have a greater impact over time (https://dlnr.hawaii.gov/dobor/boating-in-hawaii/ Last accessed 07.27.21).

All of these activities are reasonably certain to exert an influence on oceanic whitetip sharks in the *Action Area* due to the effects of increased human population, increased human consumption of fish products, the international trade of shark fins, and increased military activities. 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).

Interest in oceanic whitetip species recovery and conservation efforts are increasing, therefore resulting in more public awareness. When we consider all these influences collectively, we expect the rate of declining trends in population numbers to be slowed. In turn, this trend will, at best, have a positive influence on the species' abundance and productivity. In a worst-case scenario, we expect the cumulative effects will have a relatively neutral or negative effect on population abundance trends.

8 INTEGRATION AND SYNTHESIS OF EFFECTS

The purpose of this opinion is to determine whether the proposed action is likely to have direct or indirect effects on the oceanic whitetip sharks 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.

As described in the *Effects of the Action* section, up to 135 oceanic whitetip sharks will be harmed during the five-year time frame, and of those, based on observations by researchers in this program previously, up to one individual will die as a result of being tagged.

Oceanic whitetip sharks are listed as threatened throughout their range. Outside the scope of this proposed action, they are exposed to fishing activities throughout the *Action Area*. As discussed in the *Status of Listed Resources,* genetic and tagging studies suggest that oceanic whitetip sharks may be philopatric exhibiting regional site fidelity, which may lead to localized depletions of the species (Howey-Jordon et al. 2013; Tolotti et al. 2015; Camargo et al. 2016; Ruck 2016; Young and Carlson 2020). Only two stock assessments have been completed to date which both only pertain to the WCPO. Rice and Harley (2012) estimated the 2010 total biomass at 7,295 metric tons. FAO (2012) suggest this represents approximately 200,000 individuals assuming and average individual body weight of 80.4 pounds (36.5 kilograms). Tremblay-Boyer et al. (2019) updated the stock assessment of Rice and Harley (2012) and concluded that total biomass in 2010 was 19,740 metric tons and that biomass declined to 9,641 metric tons by 2016. Using the same assumptions as FAO (2012), this biomass would equate to approximately 264,318 individuals. Stock assessments have not been conducted for either the Eastern Pacific or for the global population, therefore this number would be considered a minimum.

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). However, Young et al. (2017) believe CPUE may have stabilized at a depressed state in the Pacific. 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.

The most significant threats to the species are cumulative 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. 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 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). This high value and demand for oceanic whitetip fins incentivizes the retention and subsequent finning of oceanic whitetip sharks when caught, and thus represents the main 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; 85 CFR 46588). Catch per unit effort 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 (See the casual loop diagram in the *Status of Listed Specie*s).

As described in the *Environmental Baseline*, effects from other fisheries, pollution, and anthropogenic sounds have resulted in interactions with the oceanic whitetip shark in the *Action Area*, and will likely continue over time. The potential impacts from climate change on oceanic whitetip shark habitat are also 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.

Finally, our analysis examines the effect of the action against a portion of the Pacific population, represented by the western Pacific. If abundance values were available for the eastern Pacific we would combine these numbers with the western Pacific to better describe the current status of the Pacific population, which would undoubtedly combine to produce a larger estimated population size. We would then compare that number to our estimates of the number of interactions and mortalities, which would result in much lower estimated effect to the Pacific population of oceanic whitetip sharks.

The oceanic whitetip shark is globally listed. In our analysis, we assessed the impact of interactions on the estimated size of the population in the WCPO (264,318 individuals) as it represents the best available data for this consultation. There are no global abundance estimates for this species but it is reasonable to assume that it is much larger than 264,318 individuals.

Given the number of interactions with oceanic whitetip sharks as described in the *Effects Analysis*, NMFS predicts future interaction levels of 27 individuals in the action area on an annual basis and of those up to one individual is expected to die from tagging. Funding is expected to last until September 2026. Every interaction includes data collection (tagging or genetic sampling) resulting in harm. These individuals may suffer from impaired swimming, foraging abilities, altered migratory behavior, and altered breeding or reproductive patterns as a result of these interactions. We are reasonably certain these effects will reduce the individuals' fitness, but be minor and temporary on most. The action will harm less than 0.05% of the WCPO stock, and only kill 0.004%. We found no analyses or models that demonstrate death of 0.004% of a population will meaningfully effect its reproduction rates, numbers, or distribution. Thus, we are reasonably certain it will not measurably reduce the population's abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures.

9 CONCLUSION

After reviewing their current status, the *Environmental Baseline* for the *Action Area*, the *Effects of the Proposed Action* and the *Cumulative Effects*, it is NMFS' biological opinion that PIFSC's oceanic whitetip shark research and data collection is not likely to jeopardize the continued existence of the oceanic whitetip shark.

10 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 incidental to, and not the purpose of, the 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).

Currently there are no take prohibitions for oceanic whitetip sharks, so an exemption from the take prohibitions of ESA section 9 is neither necessary nor appropriate. Because we found this action does not jeopardize the continued existence of the oceanic whitetip shark, NMFS PRD CPR has fulfilled their obligations under ESA section 7. NMFS PRD CPR may implement the proposed action until we promulgate an ESA section 4(d) rule prohibiting take.

Tagging and sampling during the proposed action results in the directed take of 135 threatened oceanic whitetip sharks in the form of wounding them. This take is not incidental, as tagging and sampling for scientific research is the purpose of the activity. For threatened species with protective regulations under 4(d) and an associated prohibition on taking under section 9, we could permit taking for scientific research purposes under section 10 of the ESA. Because no section 9 prohibitions apply to oceanic whitetip sharks currently, NMFS cannot apply for a section 10 scientific research permit. At the time we issue protective regulations under 4(d) and prohibit taking under section 9, NMFS may apply for a section 10 scientific research permit to cover take from wounding during the tagging and sampling.

The proposed action results in the incidental take of one threatened oceanic whitetip shark in the form of killing it. The amount and extent incidental take will serve as one of the criteria for reinitiation of consultation pursuant to 50 C.F.R. § 402.16(a), if exceeded. 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.

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. In order 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)).

10.1 Anticipated Amount or Extent of Incidental Take

The following levels of incidental take may be expected to result from the proposed action. 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. We use 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 the Services 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, this level of incidental take is exceeded for any of the species as listed, NMFS PRD CPR must immediately reinitiate formal consultation with us pursuant to the section 7 regulations (50 CFR 402.16). We anticipate the following take as a result of the proposed action:

Death of one individual oceanic whitetip shark as a result of tagging.

10.2 Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take." (50 CFR 402.02). We have determined that the following reasonable and prudent measure, as implemented by the terms and conditions that follow, is necessary and appropriate to minimize the impacts of the tagging and genetic sampling activities, as described in the proposed action, on threatened oceanic whitetip shark and to monitor the level and nature of any incidental takes.

1. NMFS shall ensure that PIFSC establishes record keeping and reporting standards for these data collections and provide an annual summary to NMFS PRD to track the take of oceanic whitetip sharks.

10.3 Terms and Conditions

NMFS is required to issue Terms and Conditions including, but not limited to, reporting requirements, that must be complied with by the Federal agency or applicant (if any), or both, to implement" the RPMs. 16 U.S.C. 1536(b)(4)(iv); see also 50 C.F.R. 402.14(i)(4). The Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. NMFS PRD CPR shall undertake and comply with the following terms and conditions to implement the reasonable and prudent measures identified in section 10.2 above. These terms and conditions are non-discretionary.

1. The following terms and conditions implement Reasonable and Prudent Measure No. 1.

    a. NMFS shall ensure PIFSC immediately begins monitoring the actual take from the research activities against the anticipated take in this opinion. This report should be provided to NMFS PRD annually, by the end of each calendar year.

11 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. NMFS should continue to promote reduction of oceanic whitetip shark bycatch by supporting:
    a. The wide dissemination and implementation of oceanic whitetip shark handling guidelines that decrease post-release mortality
    b. Outreach and education to teach fishermen about the conservation status of the species and implement best handling practices
2. NMFS should provide educational materials to fishermen containing guidelines for handling oceanic whitetip sharks, including removal of hooks as quickly and carefully as possible to avoid injuring or killing the animal, as practicable, and in consideration of best practices for safe vessel and fishing operations.
3. NMFS should collect information on length, weight, sex, and take biopsy samples when possible.

11.1 Reinitiation Notice

This concludes formal consultation on the implementation of the oceanic whitetip tagging and genetic sampling activities within the Hawaii small boat fishery. 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 anticipated incidental take (one dead shark) is exceeded;
2. New information reveals that the action may affect ESA-protected marine species or critical habitat in a manner or to an extent not considered in this opinion;

3. The action is subsequently modified in a manner that may affect ESA-protected marine species or critical habitat to an extent, or in a manner not considered in this opinion; or
4. A new species is listed or critical habitat designated that may be affected by the action.

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