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

Action Agency:	National Marine Fisheries Service, Pacific Islands Regional Office. International Fisheries Division
Federal Action:	Supplement to the Authorization of the U.S. West and Central Pacific Purse Seine Fishery; Effects on Oceanic Whitetip Sharks
Consultation Conducted by:	National Marine Fisheries Service. Pacific Islands Region, Protected Resources Division
NMFS File No. (ECO):	PIRO-2024-01810
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Approved By:	Sarah Malloy Regional Administrator, Pacific Islands Region
Date Issued:	March 06, 2025

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1 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1536(a)(2)) requires each federal agency to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. The ESA requires federal action agencies to consult with National Marine Fisheries Service (NMFS) when the action may affect a listed species or its designated critical habitat under our jurisdiction (50 CFR 402.14(a)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, we provide a biological opinion (opinion) stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If we determine that the action is likely to jeopardize listed species or destroy or adversely modify critical habitat, in accordance with the ESA section 7(b)(3)(A), we provide a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If incidental take[1] is reasonably certain to occur, section 7(b)(4) requires us 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.

We prepared this opinion and ITS in accordance with section 7(b) of the ESA and implementing regulations at 50 CFR part 402. We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). Following signature and finalization, this document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome].

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

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[1] Under the ESA, the term "take" is defined by the ESA as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. We further define "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" (Application and Interpretation of the Term Harass Pursuant to the Endangered Species Act: NMFS Guidance Memo May 2, 2016). NMFS defines harm as "an act which actually kills or injures fish or wildlife." 50 C.F.R. 222.102. 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.

1.1 Consultation History

NMFS completed the initial biological opinion for the U.S. West and Central Pacific (U.S. WCPO) purse seine fishery on November 1, 2006 (NMFS 2006) however oceanic whitetip sharks were not listed under the ESA at this time.

On January 30, 2018, NMFS published a final rule to list the oceanic whitetip shark as a threatened species under the ESA (83 FR 4153). The rule became effective March 1, 2018.

On July 16, 2018, NMFS reinitiated consultation on the U.S. WCPO purse seine fishery due to the recent listing of the Indo-west Pacific scalloped hammerhead shark, the giant manta ray, and the oceanic whitetip shark. This consultation was completed on September 15, 2021, through the publication of a biological opinion with a finding of no jeopardy for the 15 ESA species and Distinct Population Segments (DPSs) likely to be adversely affected by the action, including the oceanic whitetip shark (NMFS 2021). The biological opinion included ITS for those species, including the oceanic whitetip shark.

On March 18, 2024, NMFS Protected Resources Division (PRD), the consulting agency, began providing technical assistance to NMFS International Fisheries Division (IFD), the action agency, to start the process for re-initiation after the fishery exceeded the 2021 biological opinion's ITS for oceanic whitetip sharks.

On July 31, 2024, IFD requested reinitiation of consultation on the oceanic whitetip shark. NMFS PRD reinitiated ESA Section 7 consultation on the same day. No other re-initiation triggers have been met and therefore the current biological opinion will supplement the 2021 biological opinion with new information and analyses on oceanic whitetip sharks. The 2021 biological opinion remains valid for all other ESA-listed species under NMFS jurisdiction occurring in the action area.

1.2 Proposed Federal Action

Under the ESA (50 CFR 402.02), the term "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the U.S. or upon the high seas (see 50 CFR 402.02). NMFS IFD proposes to authorize the operation of the U.S. WCPO purse seine fishery, as currently managed under the existing regulatory framework of all applicable laws. In this biological opinion we consider activities directly associated with the fishing operation (setting and retrieving gear) as well as vessel operation and transit to ports.

NMFS proposes to continue to authorize the U.S. WCPO purse seine fishery as currently managed, including through the maintenance/issuance of regulations under the authorities described below. This fishery is governed in part by the "Treaty on Fisheries between the Governments of Certain Pacific Island States and the Government of the U.S. of America" also known as the South Pacific Tuna Treaty (Treaty), an international agreement to which the U.S. is a party. NMFS implements the terms of the Treaty by issuing regulations under the authority of the South Pacific Tuna Act of 1988 (SPTA) (16 U.S.C. Chapter 16C). The regulations considered as part of this action include both regulations currently in effect (50 CFR 300 Subpart D) and new regulations that may be developed to implement technical modifications under the Treaty and Treaty amendments including those agreed to in 2016. The action also includes regulation of the U.S. WCPO purse seine fishery under the Western and Central Pacific Fisheries Convention Implementation Act (WCPFCIA; 16 U.S.C. 6901 *et seq*.) and implementing regulations (50 CFR Subpart O), High Seas Fishing Compliance Act (HSFCA; 16 U.S.C. 5501 *et* *seq*.) and implementing regulations (50 CFR 300 Subpart R), Tuna Conventions Act, as amended, and implementing regulations (50 CFR Subpart C), and regulations implementing the Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region (Pelagics FEP) pursuant to the MSA (50 CFR Part 665). Accordingly, this consultation includes the effects of the authorization of all purse seine fishing in or transiting through the action area by U.S.-flagged vessels as currently managed.

U.S. purse seine sets can be divided into two general types - those made on drifting fish aggregating devices (FADs) (artificial or natural), also known as "associated sets", and those made on free-schools of tuna, also known as "unassociated sets". In this supplemental biological opinion we refer to these as FAD or free sets. Manmade or artificial FADs are small rafts, often made of bamboo, plastic pipe or wood. The Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC or Commission), recently adopted measures for non-entangling FADs, discussed in more detail below. These FADs are typically outfitted with a tracking buoy. Natural FADs include natural logs and other objects.

As of June 25, 2024, 13 U.S. purse seine vessels were authorized to fish in the action area, which is five vessels fewer than the number of vessels in the fleet at the time of publication of the 2021 biological opinion. Although NMFS has no information regarding additional vessels that may enter the fleet at this time, NMFS continues to believe the fishing operations, including effort, analyzed in the 2021 biological opinion represent a reasonable characterization of fleet operations for the reasonably foreseeable future for the reasons set forth in the 2021 biological opinion. The 2021 biological opinion analyzed a maximum fishing effort of 3,100 sets per year with 1,581 (51%) of them being FAD sets.

NMFS published a final rule to implement WCPFC decisions on International Maritime Organization Numbers (CMM 2018-06), FAD design requirements (CMM 2018-01, superseded by CMM 2020-01 and now superseded by CMM 2023-01, see below), and bycatch mitigation measures for sharks and mobulid rays (CMM 2019-04; CMM 2019-05 now superseded by CMM 2022-04; see 88 FR 30671; published May 12, 2023). This final rule implements new requirements for U.S. purse seine fishing vessels operating in the Convention Area. These requirements include:

- Specific design requirements for lesser entangling FADs at 50 CFR 300.223(b)(4).
    - If the FAD design includes a raft (e.g., flat raft or rolls of material) and if mesh netting is used as part of the structure of the raft, the mesh netting shall have a stretched mesh size of less than 7 centimeters and the mesh net must be tightly wrapped such that no netting hangs below the raft when deployed; and
    - Any netting used in the subsurface structure of the FAD must be tightly tied into bundles ("sausages"), or if not tightly tied into bundles, then must be made of stretched mesh size less than 7 centimeters and be configured as a panel that is weighted on the lower end with enough weight to keep the netting vertically taut in the water column.
- A specific exemption at 50 CFR 300.226(e) for purse seine vessels to the prohibition on retention of silky sharks and oceanic whitetip sharks, if the shark is not seen prior to being delivered into the vessel hold and frozen.
- Specific shark handling and release requirements at 50 CFR 300.230.

- Prior to releasing any shark that is caught during fishing operations and not brought on board the fishing vessel, the owner and operator, without compromising the safety of any persons, shall ensure that the shark is brought alongside the vessel for identification purposes.

Since the publication of the rule described above, WCPFC Conservation and Management Measure 2023-01 (superseding 2018-01 and 2020-01) also sets forth specific requirements for non-entangling FADs that went into effect on January 1, 2024. NMFS is working on regulations to implement those requirements. Those requirements state:

- To reduce the risk of entanglement of sharks, sea turtles, or any other species, CCMs shall ensure that the design and construction of any new FAD to be deployed in the WCPFC Convention Area from 1 January 2024 shall comply with the following specifications:
    - The use of mesh net shall be prohibited for any part of a FAD.
    - If the raft is covered, only non-entangling material and designs shall be used.
    - The subsurface structure shall only be made using non-entangling materials.

Since January 1, 2010, the observer coverage rate in the U.S. purse seine fishery in the Convention Area has been 100%. Data previously collected by Pacific Islands Forum Fisheries Agency (FFA)-deployed and currently by PNA-deployed observers are provided directly to the WCPFC.

The WCPFC requirements for 100% observer coverage on purse seine vessels was temporarily suspended during part of 2020, and all of 2021 and 2022 due to the COVID pandemic. The 100% requirement resumed on January 1, 2023. Observers on U.S. purse seine vessels are currently sourced through the Parties to the Nauru Agreement (PNA) observer program.

NMFS published a final rule to implement recent changes to WCPFC FAD closure periods (89 FR 70120; published and effective August 29, 2024). Under the final rule, the FAD closure period for the high seas and U.S. EEZ in the WCPFC area has been reduced from three months to one-and-a-half months (from July 1 through August 15 each calendar year). The end of the year FAD closure on the high seas has been reduced from two months to one month (from November and December to December in each calendar year). As stated in Section 1.2 of the 2021 biological opinion the proportion of FAD sets varies considerably from year to year. Although it is likely that the reduced FAD closure periods could lead to some increase in the proportion of FAD sets made by the fleet each year, such an increase is not possible to quantify at this time. Thus, NMFS believes that, given the reduced size of the fleet compared to that analyzed in the 2021 biological opinion, the number of 1,581 FAD sets per year is a reasonable estimate of the number of FAD sets per year for the reasonably foreseeable future. Moreover, there are currently fewer vessels in the fleet than the number analyzed in the 2021 biological opinion, so there would likely be a general reduction in the overall fishing effort as well as a reduction in total effort on FAD sets.

The 2021 biological opinion assumed that the distribution of fishing effort would be concentrated further to the east than the historic effort (Table 1; T. Graham memo to A. Garrett on April 2, 2021). This assumption was due to the large number of vessels that left the fishery between 2018 and 2021 that used fishing grounds and ports further to the west than the rest of the fleet that primarily uses Pago Pago for offloading and fishes closer to American Samoa in the eastern part of the U.S. WCPO. Based on the distribution of fishing effort from 2019 to 2022, this assumption has been supported with 58.2% of sets occurring between 175°W and 130°W from 2019 to 2022 compared to 26% from 2008 to 2018 (Table 1, Figure 1). More recently, from 2021 to 2023, 87.1% of U.S. WCPO purse seine sets have occurred between 175°W and 130°W (Table 1). Figure 2 shows the distribution of WCPO purse seine effort for the U.S. compared to the international fleet, demonstrating that U.S. WCPO purse seine vessels are fishing much farther to the east than the rest of the WCPO purse seine fisheries.

Table 1. Expected change in the longitudinal distribution of fishing effort for the U.S. WCPO purse seine fishery (T. Graham memo to A. Garrett on April 2, 2021) and observed distribution from 2019 to 2022.

Geographical Range	135E-160E	160E-175E	175E-175W	175W-130W
Expected distribution (percent)	7%	20%	27%	45%
Observed distribution (2019 to 2023; percent)	8.1%	17.6%	16.1%	58.2%
Observed distribution (2021 to 2023; most vessels now also permitted to fish the IATTC[1]; percent)	0%	0.4%	12.5%	87.1%
2008-2018 distribution (for reference; percent)	19%	33%	22%	26%

[1] Inter-American Tropical Tuna Commission

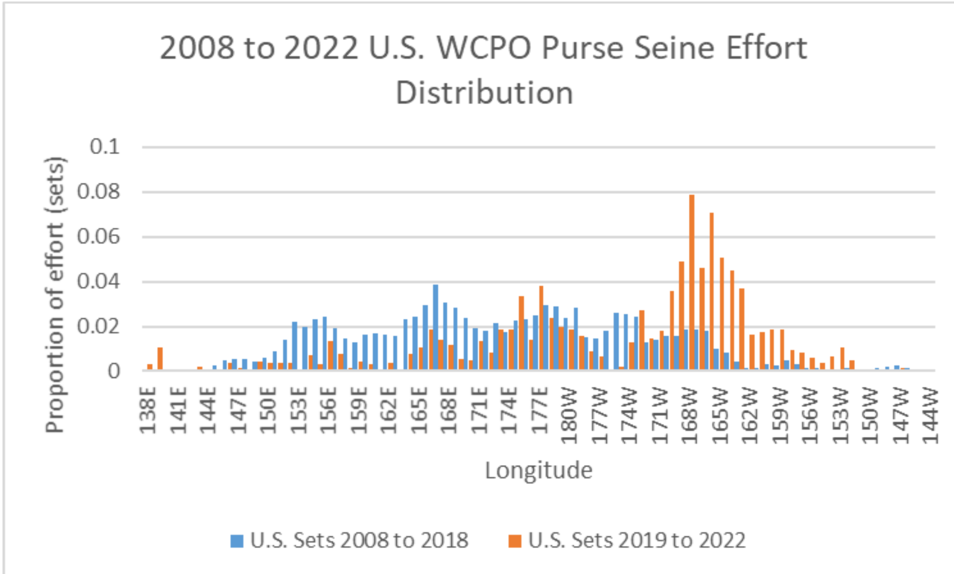

Figure 1. Distribution of fishing effort for the U.S. WCPO purse seine fishery, comparing distribution from 2008 - 2018 (blue bars) to 2019 - 2022 (orange bars). Note that 1° bins with three or fewer sets were removed from the analysis for confidentiality.

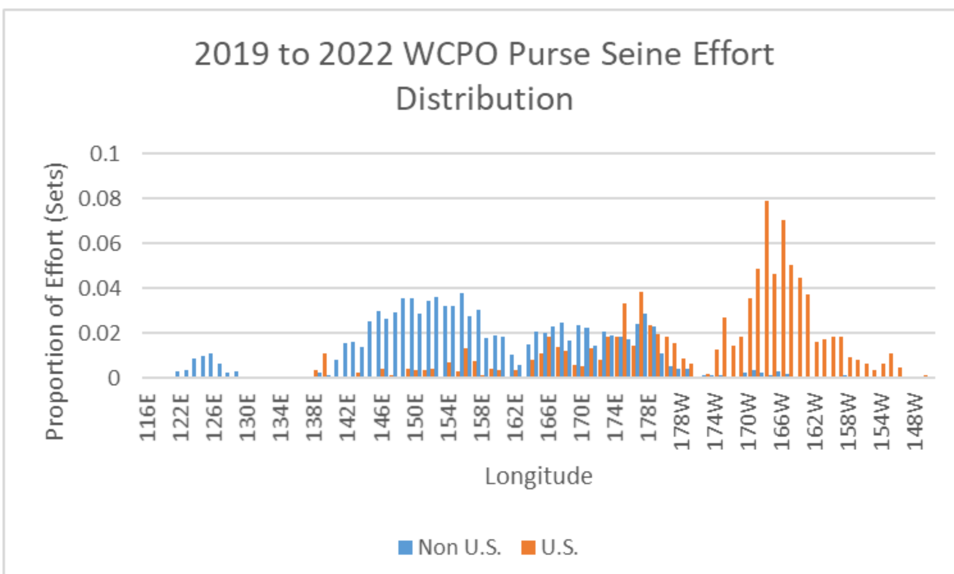

Figure 2. Distribution of fishing effort for the international portion of the WCPO purse seine fishery (blue bars) compared to the U.S. portion of the WCPO purse seine fishery (orange bars). Note that 1° bins with three or fewer sets were removed from the analysis for confidentiality.

<u>Vessel Offloading</u>

The purse seine catch is stored on board as a frozen whole product, typically in large brine wells although some may store the fish in refrigerated spaces called "dry wells". Most of the catch of the U.S. WCPO purse seine fleet was historically offloaded to canneries in Pago Pago, American Samoa, located slightly beyond the southeastern limit of the fishery's main fishing grounds.

In 2008 a component of the U.S. WCPO purse seine fleet began adopting an alternative business model, which called for vessels to transship to carrier vessels at the closest possible port in the shortest possible time (Gillett et al., 2002; Hamilton et al., 2011). These vessels are not based out of a single specific port in the region, rather they maintain the flexibility to transship in ports depending on where they are fishing. Vessels that are part of the U.S. WCPO purse seine fleet may also fish in the eastern Pacific Ocean (EPO) on the same trip. These vessels may land catch caught on the same trip in the WCPO and in the EPO in ports in both the WCPO and in the EPO (Table 2).

NMFS manages the fishing activities of U.S. purse seine vessels fishing in the EPO under a separate management regime. This U.S. EPO purse seine fishery is managed under the West Coast Highly Migratory Species Management Plan and its implementing regulations (See 50 CFR 660 Subpart K), as well NMFS regulations implementing decisions of the Inter-American Tropical Tuna Commission (IATTC) under the Tuna Conventions Act (16 U.S.C. 951 et seq.) (See 50 CFR 300 Subpart C) and NMFS regulations implementing the Agreement of the International Dolphin Conservation Act under the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.) (See 50 CFR 200 Subpart C). NMFS completed ESA Section 7 consultation for the U.S. EPO purse seine fishery in 2004 (NMFS 2004). Hence, while the fishing operations that may occur in the EPO are not part of the action considered in this supplemental biological opinion, any transit and offloading activities of U.S. vessels carrying catch from operations in the WCPO to ports outside of the WCPO are being considered. EPO fishing activities and impacts from those fisheries are considered in the *Environmental Baseline* if they are present in the action area for the proposed action. As shown in Table 2, since 2008, most of the catch of the U.S. fleet has been offloaded in foreign ports, from which it is eventually transported to canning facilities in Southeast Asia, Latin America, and the U.S. (U.S. Coast Guard and NMFS 2021, 2022, 2023, 2024). An increased proportion of catch has been offloaded in Pago Pago, American Samoa in recent years (Table 2).

The definition of "effects of the action" (50 CFR 402.02) includes the consequences of other activities that are caused by the proposed action. An activity is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. For this proposed action, we determined the proposed action will not cause any other activities.

Table 2. Retained Tuna Catch (mt) of U.S. WCPO Purse Seine Vessels, by port where landed or transshipped, 2019-2023. Country/territory abbreviations are as follows: American Samoa (AS), Federated States of Micronesia (FSM), Papua New Guinea (PNG), Republic of the Marshall Islands (RMI), Solomon Islands (SI) (U.S. Coast Guard and NMFS 2021, 2022, 2023, 2024). Locations with no data received landings between 2008 and 2018 as reported in Table 1 of NMFS (2021). We keep them here as they may receive landings in the future and still be considered part of the action area.

Port	2019	2020	2021	2022	2023
Pago Pago, AS	74,828	76,094	37,287	38,835	57,639
Foreign Ports					
Pohnpei, FSM	32,185	6,803	–	–	–
Christmas Island, Kiribati	13,360	7,778	–	–	4,198
Tarawa, Kiribati	–	15,128	–	–	–
Rabaul, PNG	–	4,090	–	–	–
Majuro, RMI	51,289	8,753	1,167	–	–
Honiara, SI	–	–	–	–	–
Wewak, PNG	–	–	–	–	–
Noro, SI	–	–	–	–	10,018
Bangkok, Thailand		–	–	–	–
Funafuti, Tuvalu	2,725	7,415	–	–	–
Manta, Ecuador	29,823	–	24,826	51,696	–
Mazatlán, Mexico	5,127	7,780	7,898	7,965	–
Chiapas, Mexico	–	–	3,345	–	–
Manzanillo, Mexico	–	47,331	3,849	–	–
Paita, Peru					11,636
Other	9,551[1]	8,245[2]	21,589[3]	8,669[4]	8,156[5]
Foreign Ports Total	144,060	113,323	62,674	68,330	34,008
Total	218,888	189,418	99,961	107,165	91,647
Foreign Ports %	66%	60%	63%	64%	37%

[1]Combined data from the following ports: Apia, Samoa, Kaosiung, Taiwan, Manzanillo, Mexico, Paita, Peru, Tarawa, Kiribati, and Noro, Solomon Islands.
[2]Combined data from the following ports: Kaohsiung, Taiwan, Manta, Ecuador, Paita, Peru, and Noro, Solomon Islands
[3]Combined data from the following ports: Kaohsiung, Taiwan, Paita, Peru, and Funafuti, Tuvalu
[4]Combined data from the following ports: Chiapas and Manzanillo, Mexico and Paita, Peru
[5] Combined data from the following ports: La Union, Philippines, Manta, Ecuador, and Papeete, French Polynesia.

1.3 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 activities encompasses the full extent of the action's modifications to land, water, and air. For this action, the full extent of direct and indirect effects includes all areas where the U.S. WCPO purse seine fishery vessels operate, including transiting, fishing, and transshipping.

The action area shown in Figure 3 depicts the area where the fishery has operated since the mid to late 1970s to the present and where the fishery is expected to continue to operate. This area is equivalent to the WCPFC Convention Area between 11°N and 18°S. Specifically, the action area is a generally rectangular shaped area bounded on the west by 129°E longitude running from 11°N latitude to 18°S latitude (with 11°N and 18°S being the northern and southern boundary lines, respectively), and on the East by 150°W longitude down to 4° S latitude and then by 130°W longitude. A portion of the action area for the proposed action overlaps with the IATTC convention area east of 150°W, as shown in Figure 3.

The fishery operates in the EEZs of the Pacific Island parties to the Treaty and that of the U.S. including the portions of the U.S. EEZ around American Samoa and the U.S. possessions of Howland, Baker, and Jarvis, as well as on the high seas in the WCPO. The portion of the U.S. EEZ around Jarvis is not available to fishing by the U.S. WCPO purse seine fishery. Figure 4 shows locations where purse seine fishing sets occurred in the action area from 2008 through 2016 where the logbook data are presented in terms of density and depict the average sets per square mile within a 5° × 5° radius of each 1° × 1° block for confidentiality purposes (NMFS 2017).

During the 1997-2015 period, the fleet spent about 5% of its total annual effort in the U.S. EEZ, 19% on the high seas, and the remainder in the EEZs of the Pacific Island Parties. The percentages for any given year during that period ranged from 0 to 21% for the U.S. EEZ, 5% to 29% for the high seas, and 60% to 95% for the EEZs of the Pacific Island Parties. In contrast, based on the data available to date for 2019, 2020 and 2023, the fishery spent 52% of its effort on the high seas, 2% in the US EEZ and 46% in the EEZs of the Pacific Islands Parties.

American Samoa is the home port for many of the vessels operating in this fishery and this port, together with Majuro, Republic of Marshall Islands, and Pohnpei, Federated States of Micronesia, are the most common ports for offloading and transshipping, although ports throughout the action area, and several outside, are also used (Table 2). Therefore, the action area includes vessel transits routes between the fishing grounds and ports outside of the fishing area, including Bangkok, Thailand; Manta, Ecuador; La Union, El Salvador, Paita, Peru, and Manzanillo and Mazatlán, Mexico.

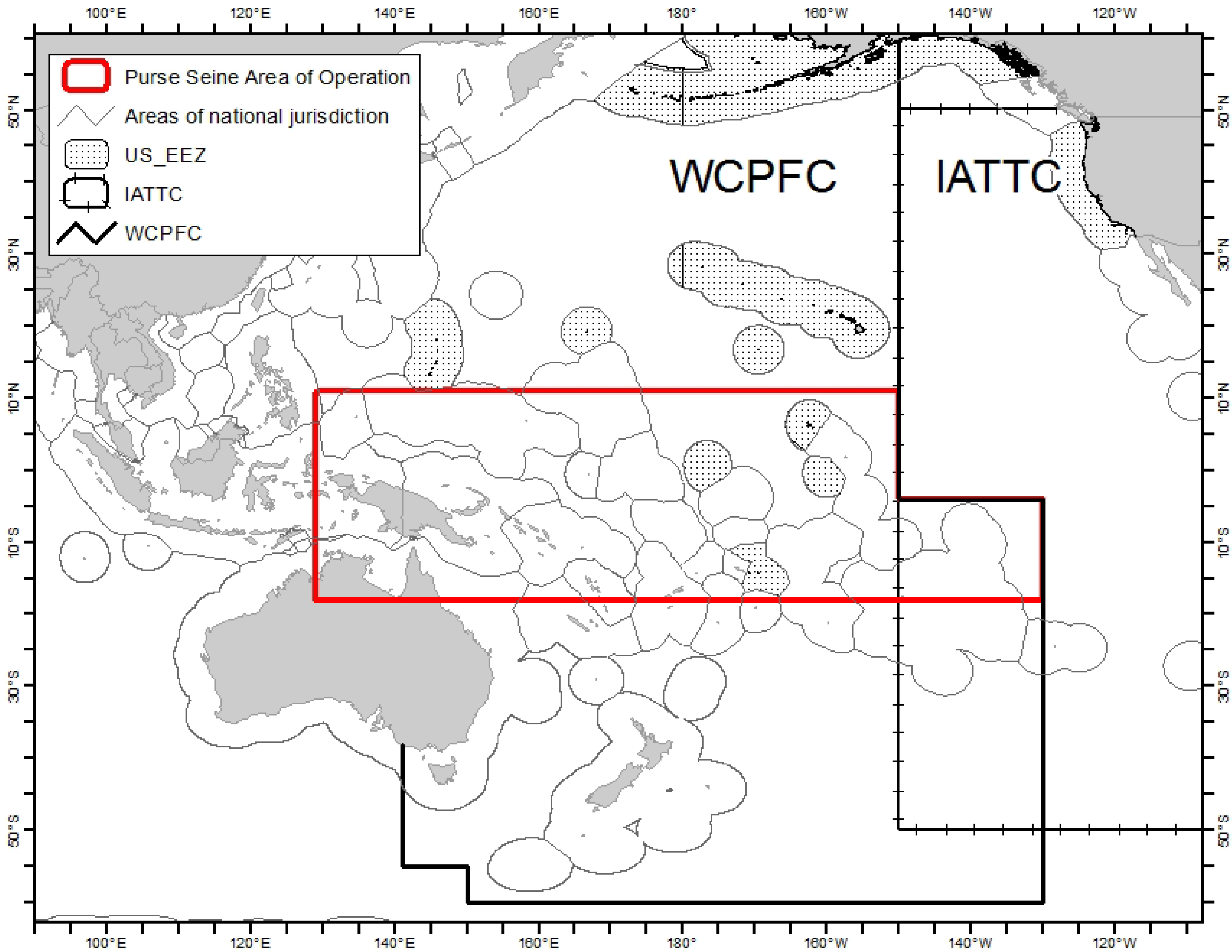

Figure 3. Portion of the action area where active fishing by the U.S. WCPO purse seine fishery occurs (outlined in red). Also depicted are exclusive economic zones (gray lines) and regional fishery management organization (RFMO) boundaries (solid black line for the WCPFC and hatched black line for the IATTC). The action area also includes transit routes from the fishery area to offloading ports outside of the fishing area including Bangkok, Thailand; Manta, Ecuador; La Union, El Salvador, Paita, Peru, and Mazanillo and Mazatlán, Mexico (see Table 2).

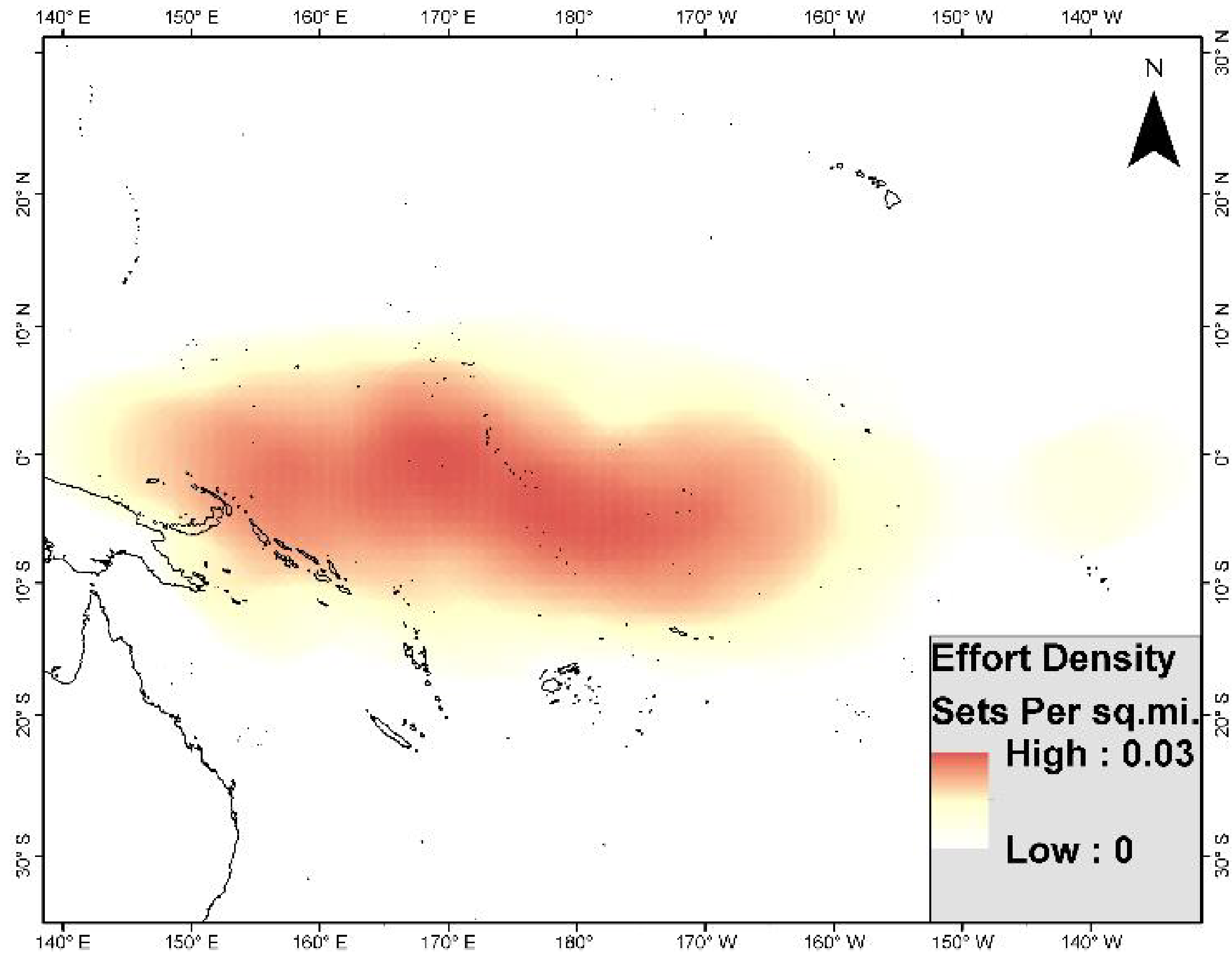

Figure 4. U.S. WCPO purse seine effort density from 2008-2016 from logbook data (NMFS 2017).

As previously noted, there has been a shift to the east for the proportion of sets by the U.S. WCPO purse seine fishery. This does not mean that there are more sets occurring in the eastern portion of the action area, only that the vessels that previously used more western fishing areas have left the fishery. Figure 5 shows the total sets binned by 1° longitude (with bins containing three or fewer sets removed for confidentiality) for the time period of 2015 to 2018 compared to 2019 to 2022, showing similar magnitudes of sets occurring in the eastern portion of the action area (east of 165°W).

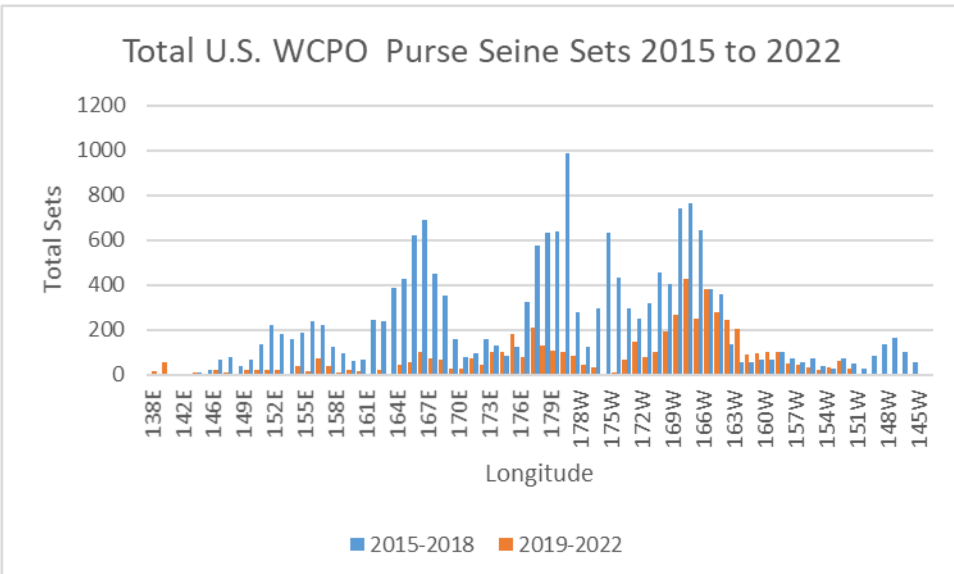

Figure 5. Number of sets by longitude for 2015-2018 (blue bars) compared to 2019 to 2022 (orange bars) for the U.S WCPO purse seine fishery. Note that 1° bins with three or fewer sets were removed from the analysis for confidentiality.

1.4 Analytical Approach

Table 3 in the 2021 biological opinion (NMFS 2021) specified those species and critical habitats that may be affected by the proposed action. Of those, the leatherback sea turtle, the hawksbill sea turtle, the South Pacific loggerhead sea turtle, the olive ridley sea turtle (both threatened and endangered populations), the green sea turtle (five specified DPSs), the oceanic whitetip shark, the Indo-West Pacific scalloped hammerhead shark, the giant manta ray, the fin whale, the sei whale, and the sperm whale are likely to be adversely affected and with the exception of the oceanic whitetip shark, the ITS for these species specified in the 2021 biological opinion (NMFS 2021) remains valid. The remaining species in Table 3 of NMFS (2021) were determined to not likely be adversely affected by the proposed action and those determinations are still valid. As noted previously, the U.S. WCPO purse seine fishery exceeded the oceanic whitetip shark 5-year running sum ITS of the 2021 biological opinion (NMFS 2021) in 2023 (the sum of captures in 2021, 2022 and 2023 exceeded the 5-yr running sum) and we focus this supplemental biological opinion on that species.

This supplemental biological opinion includes a jeopardy analysis which relies upon the regulatory definition of “jeopardize the continued existence of” a listed species, which is “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). Therefore, the jeopardy analysis considers both survival and recovery of the species.

50 CFR 402.14(h) details the requirements of biological opinions. 50 CFR 402.14(g)(2-4) identify the requirements for formulating our opinion as to whether the action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. We summarize and supplement these regulations in the following approach for this supplemental biological opinion:

- Evaluate the range wide status of the oceanic whitetip shark
- Evaluate the environmental baseline of the oceanic whitetip shark
- Evaluate the effects of the proposed action on the oceanic whitetip shark using an exposure–response approach
- Evaluate cumulative effects
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to directly or indirectly reduce appreciably the likelihood of both the survival and recovery of the oceanic whitetip shark in the wild by reducing the reproduction, numbers, or distribution of that species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action

We used available data to describe the U.S. WCPO purse seine fishery location and its stressors. Interactions by entrapment, entanglements, and landings represent the best data available on the U.S. WCPO purse seine fishery because it has been collected by observer data (under 20% observer coverage prior to 2010, with 100% coverage afterwards). The 100% observer coverage requirement was waived in part of 2020, 2021 and 2022 due to the Covid-19 pandemic. No data are available to characterize exposure to vessel strikes or discharges of waste.

We obtained observer data for the period 2019-2023 (partial only) from IFD to supplement the 2008 to 2018 data analyzed in the previous biological opinion (NMFS 2021). For 2019, part of 2020, and 2023, IFD received the data from the WCPFC. Observers in the fishery were deployed by the FFA and, are currently deployed by the PNA. The observer data are stored and maintained by the WCPFC. For 2021 and 2022, when there was limited or no observer coverage in the WCPO, IFD relied on observed IATTC trips, filtering those data for sets that occurred within the boundary of the WCPO or the WCPO/East Pacific overlap area (Figure 3).

1.4.1 Use of Bayesian Inference to Estimate Annual Interactions

In the previous biological opinion for the U.S. WCPO purse seine fishery (NMFS 2021), we employed a Bayesian Markov Chain Monte Carlo method (Martin et al., 2015) to estimate annual interaction rates and used these interaction rates to estimate captures for unobserved or unreported sets, along with estimating future interactions. We again followed this method in our current assessment and briefly describe the process here.

Interaction rates were estimated for each set type (FAD or free) and combined as total interactions per year for oceanic whitetip sharks.

We used the Bayesian analysis approach of Martin et al. (2015) to estimate interaction rates in the fishery. Briefly, the method assumes that there is a consistent and species-specific interaction rate coefficient describing the expected number of interactions at a given fishing effort level, equivalent to saying there is a linear relationship between the amount of effort and the number of expected interactions by species:

$$Int_i = \theta_i \cdot E_i$$

Where Int_i is the number of interactions occurring with species i, theta (θ_i) is the interaction rate coefficient for species i, and E_i is the measure of effort that could result in an interaction with species i. Effort in this fishery is most often the number of purse seine sets. The method estimates the posterior probability distribution of θ_i from annual total observed numbers of interactions (Int_i) by species and fishing effort (E_i) using the 2008 – 2018 observer data. The model assumes the observations of interactions occur following a Poisson distribution with an uninformative gamma prior for rarely encountered species and a normal distribution with uninformative mean (normal) and precision (gamma) priors for more commonly encountered species. More technical details related to the model and model selection are provided in NMFS (2019a).

The estimates of the interaction rates, theta, across these different interaction classes were used in two ways in our analysis. First, they were used to estimate the number of interactions that occurred in fishing activities that were not observed, or for which we did not have observer data in the 2008 – 2023 data set. Second, we used these interaction rates to estimate what the potential future impact of the fishery on ESA-listed species would be given anticipated numbers of FAD, free school, and total sets in future years. The species-specific estimates of interaction rates across all interaction classes were summed to generate species-specific interaction rate estimates for both past unobserved and future interactions. We projected future fishing effort as advised by IFD (see Section 1.2, Proposed Federal Action). It is anticipated that up to 3,100 sets will be made each year, with up to 1,581 of them being FAD sets, for the reasonably foreseeable future, and we use this effort level – in combination with our estimates of interaction rates – to estimate future ESA-species interactions.

2 STATUS OF THE LISTED RESOURCES

This opinion examines the status of oceanic whitetip sharks that are likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. This section also helps to inform the description of the species' reproduction, numbers, or distribution for the jeopardy analysis.

2.1 Climate Change

Future climate will depend on warming caused by past anthropogenic emissions, future anthropogenic emissions and natural climate variability. NMFS' policy (NMFS 2016) is to use climate indicator values projected under the Intergovernmental Panel on Climate Change (IPCC)'s Representative Concentration Pathway (RCP) 8.5 when data are available or best available science that is as consistent as possible with RCP 8.5. RCP 8.5, like the other RCPs, were produced from integrated assessment models and the published literature; RCP 8.5 is a high pathway for which radiative forcing reaches >8.5 W/m^2 by 2100 (relative to pre-industrial values) and continues to rise for some amount of time. A few projected global values under RCP 8.5 are noted in Table 3. The IPCC predicts that climate-related risks for natural and humans systems are higher for global warming of 1.5 ºC compared to present conditions but the risks associated with a 1.5 ºC warming are lower than the 2 ºC warming presented in Table 3 (IPCC 2018, 2022). Changes in parameters will not be uniform, and IPCC projects that areas like the equatorial Pacific will likely experience an increase in annual mean precipitation under scenario 8.5, whereas other mid-latitude and subtropical dry regions will likely experience decreases in mean precipitation. Sea level rise is expected to continue to rise well beyond 2100 and while the magnitude and rate depends upon emissions pathways, low-lying coastal areas, deltas, and small islands will be at greater risk (IPCC 2018, 2022).

Table 3. Projections for certain climate parameters under Representative Concentration Pathway 8.5 (values from Table 2.1 IPCC 2014; see Figure 3.4 in IPCC 2022).

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

In this assessment, we rely on systematic assessments of available and relevant information to incorporate climate change in a number of ways. We address the effects of climate, including changes in climate, in multiple sections of this assessment: Status of the Listed Resources (Section 2), Environmental Baseline (Section 3), and Integration and Synthesis (Section 6). In the Status of Listed Resources and the Environmental Baseline we present an extensive review of the best scientific and commercial data available to describe how the oceanic whitetip shark is affected by climate change.

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

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

2.2 Status of the Species

This section consists of a narrative for the oceanic whitetip shark that is adversely affected by the proposed action. This status summary provides the point of reference for our analyses of whether the action's direct and indirect effects are likely to appreciably reduce the oceanic whitetip shark's probability of surviving and recovering in the wild. The narrative presents a summary of:

1. Distribution and population structure (which are relevant to the distribution criterion of the jeopardy standard)
2. Status and trend in abundance of the species and affected populations (which are relevant to the numbers criterion of the jeopardy standard)
3. Information on the reproduction of the species and affected populations (which is a representation of the reproduction criterion of the jeopardy standard)
4. Natural and anthropogenic threats to the species and/or affected population(s) (which helps explain our assessment of a species' likelihood of surviving and recovering in the wild)
5. Recent conservation activities for the species and/or affected population(s) (which also helps explain our assessment of a species' likelihood of surviving and recovering in the wild)

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 as well as the public scientific literature.

2.2.1 Oceanic Whitetip Shark

We listed oceanic whitetip sharks globally as threatened on January 30, 2018 (83 FR 4153). On May 14, 2024 we proposed a 4(d) Rule for Protective Regulations for the oceanic whitetip shark (89 FR 41917). On July 11, 2024, a three-part Recovery Plan was adopted and published (89 FR 56865) and includes a Recovery Status Review (NMFS 2024a), a Recovery Implementation

Strategy (NMFS 2024b), and the Recovery Plan itself (NMFS 2024c). A 5-year status review was initiated in 2024 (89 FR 56865).

Distribution and Population Structure

We incorporate by reference pages 12-14 (distribution) and 25-27 (population structure) of the Recovery Status Review (NMFS 2024a). We briefly summarize the information here along with information not included in the review.

Oceanic whitetip sharks are globally distributed in tropical and subtropical waters, primarily between 30° N and 35° S latitude but with a preference for open ocean waters between 10° N and 10° S latitude (Figure 6). Within this region they are generally found in surface mixed layers above 20° C, although they are known to make brief foraging dives to deeper and colder waters. Their intolerance of exposure to sustained cold waters suggests a thermal barrier to inter-ocean movements between the Atlantic Ocean and the Indian and Pacific Oceans due to the southern extents of South American and African continents.

Tagging studies have provided information on potential population structure and have found evidence of site fidelity. Together, these studies suggest that oceanic whitetip sharks can display a high degree of philopatry to certain sites and may not mix with other regional populations. More recently, Shen et al. (2024) assessed ontogenetic movement patterns of central and eastern Pacific oceanic whitetip sharks using vertebral microchemistry. They found a degree of separation, providing further evidence of site fidelity, however some sampled individuals had overlap which suggests some connectivity between the two regions.

Few studies have been conducted on the global genetics and population structure of the oceanic whitetip shark. Those few suggest there may be some genetic differentiation between the Indo-Pacific and the Atlantic, but limited structuring between adjacent ocean basins such as the East Atlantic and the Indian Ocean. A recent global assessment confirmed the distinction between the Western Atlantic and the Indo-Pacific Ocean basins but the continued limited sampling within the Pacific Ocean makes the connectivity dynamics uncertain for this region (Ruck et al., 2024; Figure 7).

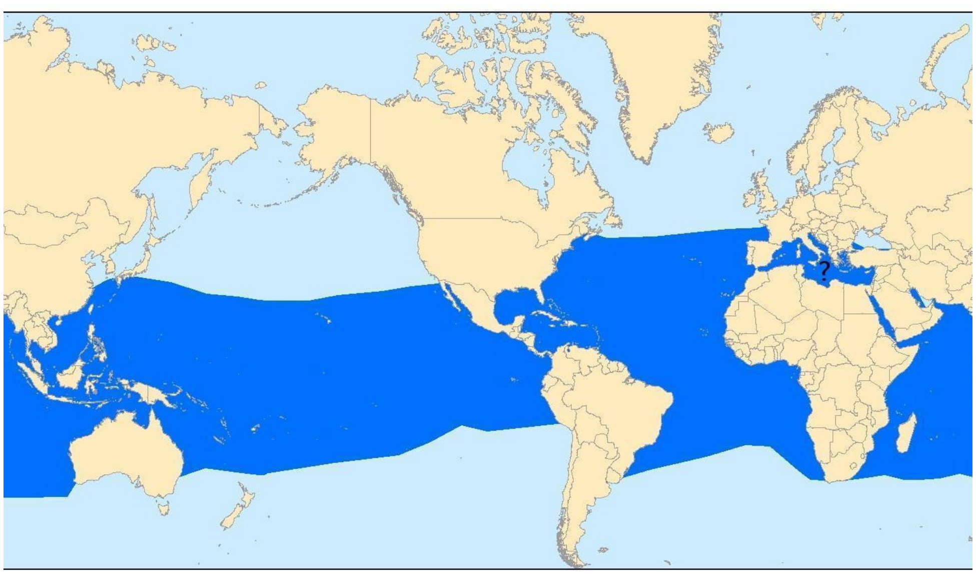

Figure 6. Geographical distribution of the oceanic whitetip shark (Young and Carlson 2020).

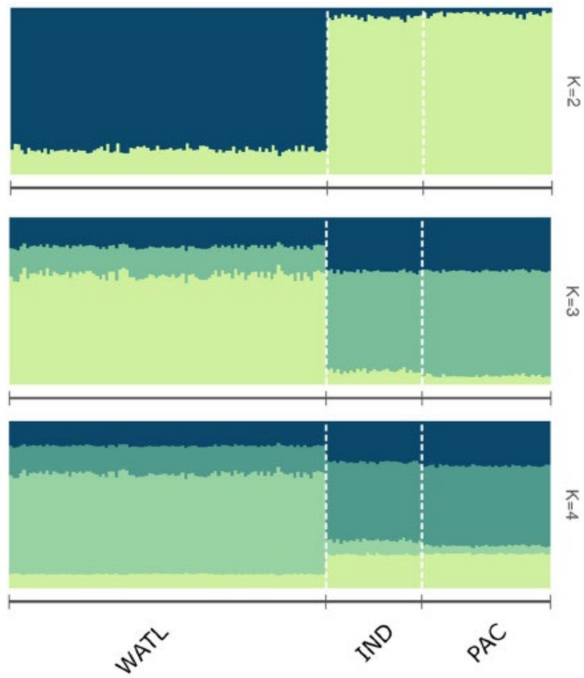

Figure 7. Structure clustering biplot results for assumptions of two (k=2) to four (k=4) global populations using all genotyped samples with individual collection locations within the Western North Atlantic (WATL), Indian (IND) and Pacific (PAC) ocean basins (from Figure 3 of Ruck et al., 2024).

While much more work is needed to fully understand the species population structure, NMFS (2024a) concluded that current studies do not provide "unequivocal evidence for genetic discontinuity or marked separation between Atlantic and Indo-Pacific subpopulations." It is unclear if the recent work by Ruck et al. (2024) would change that assessment but the evidence indicates oceanic whitetip sharks in the Pacific Ocean may be their own population. Frequently, distinctions are made between the oceanic whitetip sharks in the East Pacific and the West Central Pacific; however, this distinction may be one of convenience based on fishery management areas. As noted, Shen et al. (2024) found some connectivity between the Central and East Pacific suggesting oceanic whitetip sharks in the Pacific Ocean may be one population (NMFS 2024a).

Status and Trends of Abundance

We incorporate by reference pages 29-30 (global trends) and 30 to 35 (Pacific Ocean trends) of the Recovery Status Review (NMFS 2024a). We briefly summarize the information here along with information not included in the review.

It is estimated that globally the oceanic whitetip shark declined by 80 to 99% from the mid-1990s to the mid-2010s which, in part, led to the ESA listing determination. These declines were largely due to both targeted fishing and fisheries bycatch where sharks were often retained whole or finned. In the East Pacific, an estimated 80 to 95% decline in catch per unit effort (CPUE) occurred in the tropical tuna fishery between 1994 and 2009. As a result of these declines, both the WCPFC and the Inter-American Tropical Tuna Commission (IATTC) initiated conservation measures (CMM 2011-04, now superseded by CMM 2022-04 for the WCPFC) and resolutions

(C-11-10 for the IATTC) for oceanic whitetip sharks in the early to mid-2010s, prohibiting finning and retention. Since these measures went into place, the CPUE for oceanic whitetip sharks in both the WCPFC and IATTC purse seine fisheries have been increasing, suggesting increasing trends in the population (see Figure 8 and Figure 10 below).

Two stock assessments have been conducted for the oceanic whitetip shark in the WCPO and a new stock assessment is being developed by the WCPFC with expected completion in 2025 (Hill-Moana et al., 2024). The most recent 2019 stock assessment, using data up to 2016, found that the WCPO population was overfished and continued to be overfished, with an estimate that the current spawning stock biomass was below 5% of the unfished spawning biomass as of 2016. This assessment concluded that total biomass in 2010 was 19,740 metric tons and that biomass declined to 9,641 metric tons by 2016. While the conclusions of the 2019 stock assessment were valid for the timeframe included in the analysis, we do not believe the results now represent the best available scientific information as the analysis timeframe did not include enough years after the conservation measures were implemented to see their effects. In addition, we have new information on trends in fishery captures that indicate population increases; we detail this information in the following sections.

Current Oceanic Whitetip Shark Trends Inferred from Fishery Captures

Based on recent data from the IATTC (IATTC 2023, 2024), both capture numbers and captures per set for oceanic whitetip sharks in the East Pacific purse seine fisheries have been increasing since 2013 (Figure 8). An exponential growth function fit to the CPUE data from 2013 to 2022 suggests a mean 19.5% per year increase (95% CI: 12.1% to 27.4%) in oceanic whitetip shark CPUE over that time (Figure 9). Retaining oceanic whitetip sharks captured in IATTC fisheries was prohibited by IATTC Resolution C-11-10 in 2012.

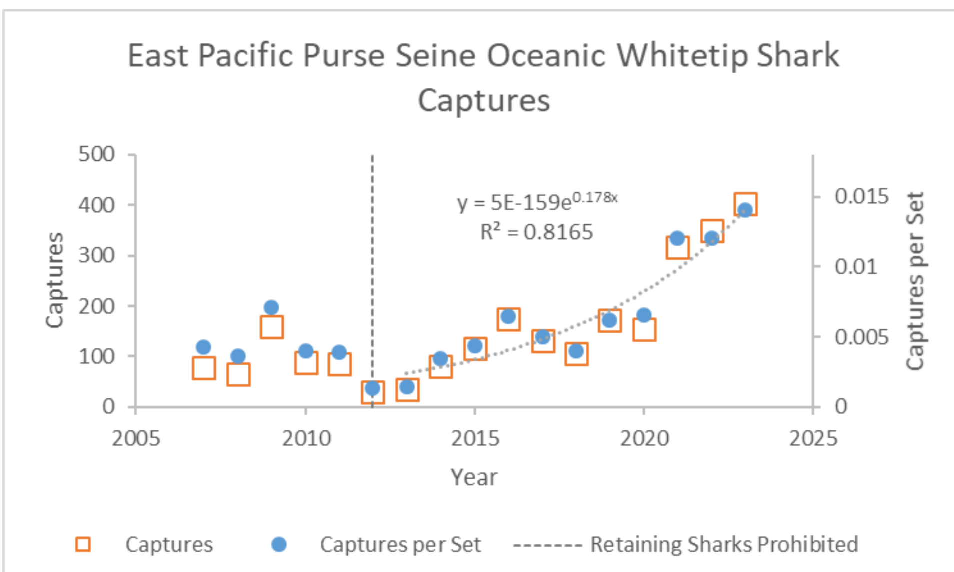

Figure 8. Annual captures (open orange squares and left axis) and captures per set (blue circles and right axis) for estimated oceanic whitetip captures in the East Pacific purse seine fisheries reported in IATTC (2023; Table L-4a for captures and Table A-7 for effort in IATTC 2023). The vertical gray dashed line represents when IATTC Resolution C-11-10 prohibiting the retention of oceanic whitetip sharks was implemented.

In the WCPO, Peatman et al. (2024) estimated total oceanic whitetip captures for the WCPO purse seine fisheries from 2003 to 2022, and captures have been generally increasing since 2013 (Figure 9). For the 2023 data, the WCPFC reports 1,526 observed oceanic whitetip shark captures with an observer coverage rate of 57%; using the expansion factor we estimate 2,677 (1,526/0.57) total captures (WCPFC 2024; Figure 9). An exponential trend fit to the 2013 to 2023 data suggests a mean increase of 14.0% per year over this timeframe (Figure 10; 95% CI: 5.3% to 22.7%). Peatman et al. (2024) also report total WCPO purse seine effort in terms of reported sets per year and we used these values with the estimated annual captures to infer captures per set (CPUE; Figure 10). For 2023, WCPFC (2024a) reports a total effort of 52,154 sets for the WCPO purse seine fisheries for 2023 and from that we estimate 0.051 captures per set (Figure 10). Combining the two data sets, CPUE shows a similar trend as the raw captures, with an increasing rate of 15.6% per year from 2013 to 2023 (Figure 10; 95% CI: 6.7% to 25.5%). Retaining oceanic whitetip sharks in WCPO purse seine fisheries was prohibited by the WCPFC in CMM 2011-04 (now superseded by CMM 2022-04) which went into effect in May of 2012. Retaining oceanic whitetip sharks in the U.S. WCPO purse seine fishery was prohibited by regulation starting in 2015 (80 FR 8807).

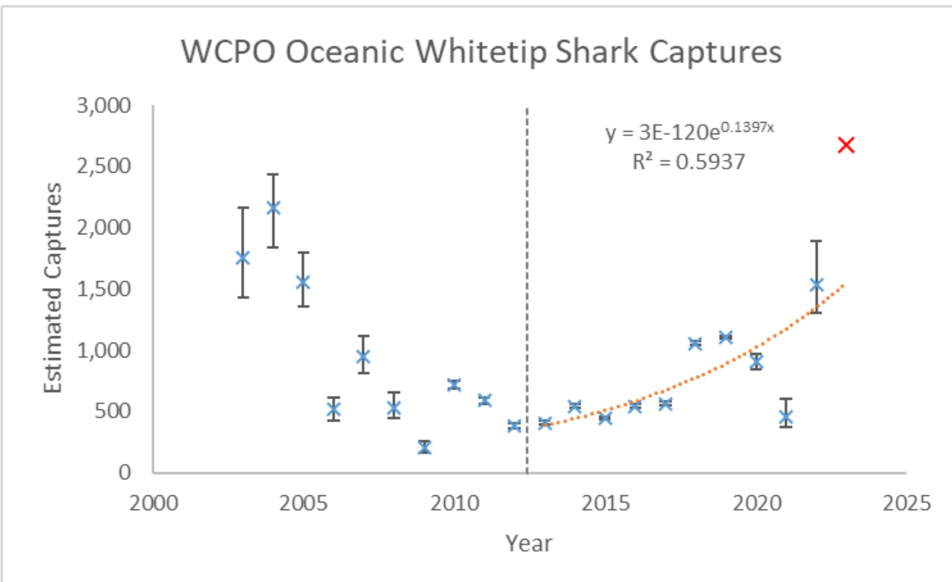

Figure 9. Estimated oceanic whitetip shark captures in the WCPO purse seine fishery inclusive of both international and U.S. fleets. Vertical bars represent the 95% CI and blue x's represent the mean estimate from Peatman et al. (2024) for 2003 to 2022. The red x is our estimate based on WCPFC (2024a) data for 2023. The orange dashed line is the fitted exponential regression from 2013 to 2023 described by the equation. The vertical gray dashed line represents when CMM 2011-04 (now superseded by CMM 2022-04) prohibiting the retention of oceanic whitetip sharks was implemented.

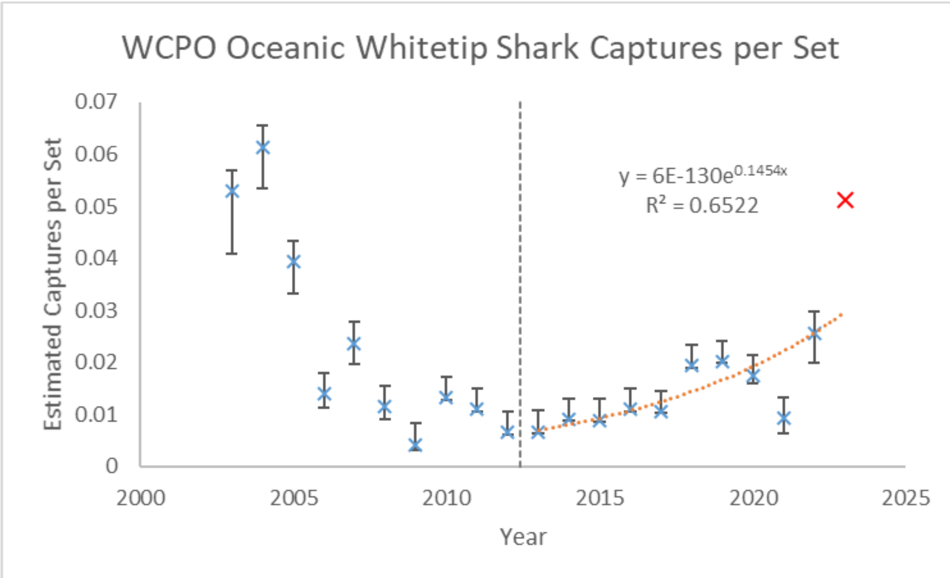

Figure 10. Oceanic whitetip shark CPUE (captures per set) based on estimated oceanic whitetip shark captures in the WCPO purse seine fishery (international and U.S. fleets) and effort reported in Peatman et al. (2024) for 2003 to 2022. Vertical bars represent the 95% CI and blue x's represents the mean estimate from Peatman et al. (2024) for 2003 to 2022. The red x is our estimate based on WCPFC (2024a) data for 2023. The orange dashed line is the fitted exponential regression from 2013 to 2023 described by the equation. The vertical gray dashed line represents when CMM 2011-04 (now superseded by CMM 2022-04) prohibiting the retention of oceanic whitetip sharks was implemented.

Silky Sharks as a Surrogate Species

While the new stock assessment is not yet complete for the oceanic whitetip shark, the WCPFC has completed a recent stock assessment for silky sharks (Neubauer et al., 2024). Silky sharks are the most common shark species captured in the WCPO purse seine fisheries and, similar to oceanic whitetip sharks, previous stock assessments have found that they were either overfished and overfishing was still occurring (Rice et al., 2013) or that silky shark biomass within the Pacific Ocean had substantially declined and fishing mortality had considerably increased over the last two decades (Clarke et al., 2018).

Silky sharks are generally less productive than oceanic whitetip sharks with an estimated R_{max} of 0.049 (Beerkircher et al., 2003), compared to the estimate of 0.135 for oceanic whitetip sharks (NMFS 2024a) which implies we would expect slower recovery rates for silky sharks. Figure 11 and Figure 12 show the estimated trend in spawning stock biomass from the 2018 and 2024 stock assessments, respectively. Silky shark trends appear to be increasing in the WCPO, especially since the implementation of CMM 2013-08 in February of 2014 (currently superseded by CMM 2022-04) which prohibited retaining silky sharks in WCPO fisheries. We consider it likely that the Pacific oceanic whitetip shark population is on a similar upward trend, as evidenced through the increase in CPUE in East Pacific and WCPO purse seine fisheries.

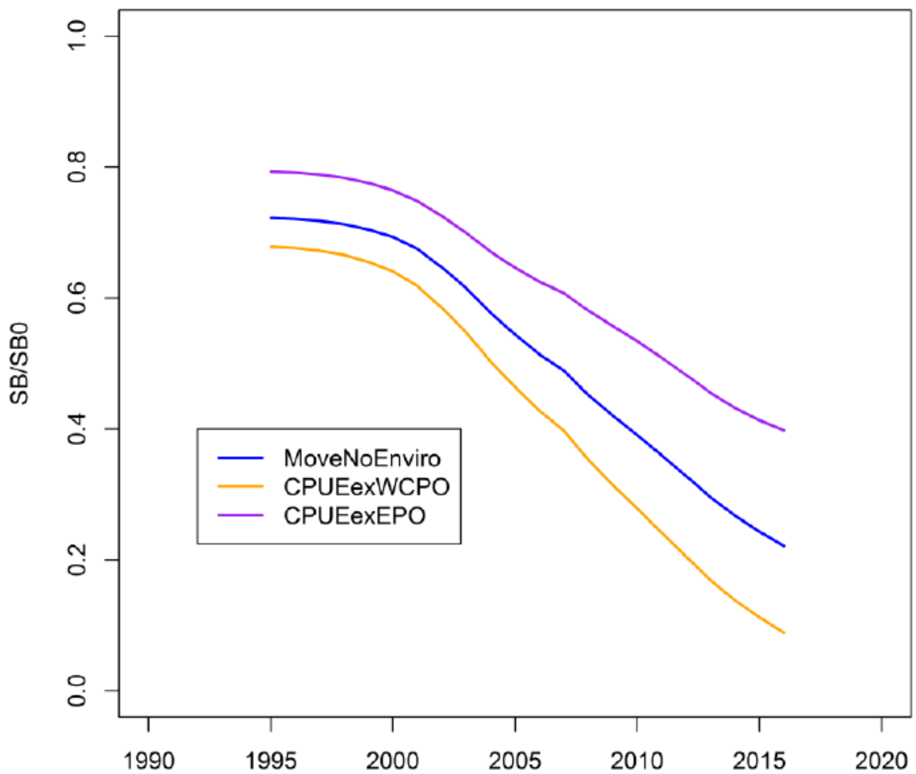

Figure 11. Estimated trend in spawning stock biomass (relative to virgin spawning biomass) for silky sharks in the 2018 stock assessment for three modeling scenarios (Figure 33 in Clarke et al., 2018).

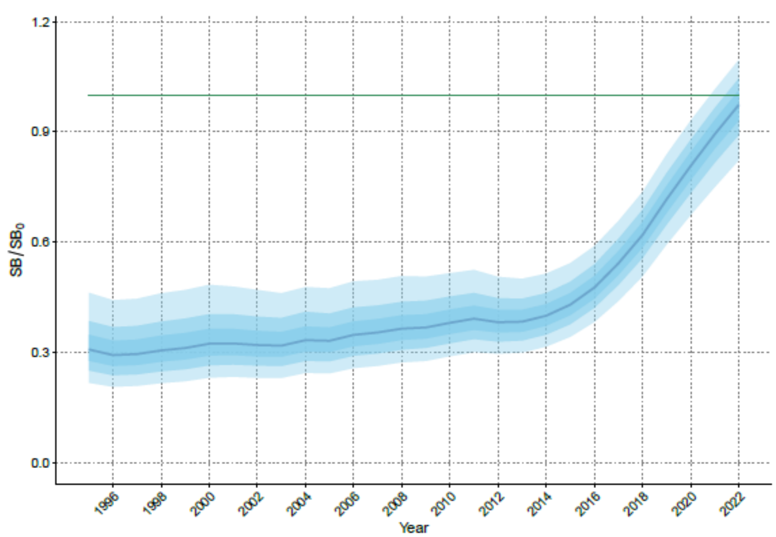

Figure 12. Estimated trend in spawning stock biomass (relative to virgin spawning biomass) for silky sharks from the 2024 stock assessment (Figure 39 in Neubauer et al., 2024). The dark blue line is the mean trend and the shaded areas are the 90%, 95% and 99% prediction intervals.

Results of Update to 2019 WCPO Stock Assessment for Oceanic Whitetip Sharks

Bigelow et al. (2022) conducted updated projections of spawning biomass ratios of WCPO oceanic whitetip sharks based on the modeling scenarios of Tremblay-Boyer et al. (2019) but with contemporary estimates of at-vessel and post-release mortality rates in longline fisheries, and catch reductions facilitated by switching from wire to monofilament leaders in longline fisheries and banning shark lines. Their results are summarized by projections of the ratio of spawning biomass (projected to 2031) to the equilibrium unfished spawning biomass (i.e., the biomass of an unfished population). This provides a relative measure of the size of the spawning biomass of a population whereby increasing ratios indicate higher biomass. The mean values of these ratios increase from 0.039 estimated for 2016 to 0.118 in 2031 with updated assumptions regarding at-vessel and post-release mortality reductions and prohibition of wire leaders and shark lines (Table 4; Figure 13). These results are based on post-interaction mortality rates of 3.4 to 8.1% with an at-vessel mortality rate of 19.2% (see Table 1 of Bigelow et al., 2022). The implementation of CMM-2022-04 is anticipated to improve the survival of released sharks throughout the WCPO by eliminating wire leaders and shark lines. The most recent stock assessment for WCPO oceanic whitetip sharks (Tremblay-Boyer et al., 2019) used data up to 2016, before the implementation of CMM-2022-04 and only three full years after the implementation of CMM-2011-04 in May 2012, before the benefits of these measures would be evident in the data. The updates of Bigelow et al. (2022) incorporate these conservation measures and revise the projections. The upcoming 2025 stock assessment will use data up to 2022 and assess current trends in the spawning stock biomass. In the absence of this stock assessment, we believe the new projections provided by Bigelow et al. (2022) constitutes the best available scientific information on the trends of WCPO oceanic whitetips sharks because it incorporates the recent protective measures discussed previously.

We use the start and end points of the spawning stock ratio from Bigelow et al. (2022) to fit exponential growth curves to estimate the population growth rate (*r*) implied by these start and end points (Table 4) using the exponential growth equation:

$$SBR_t = SBR_0 \mathrm{e}^{-(\mathrm{r}*\mathrm{t})}$$

In this equation SBR_t is the spawning stock biomass ratio in 2031, SBR_0 is the spawning stock biomass ratio in 2016, t is the time in years between these dates and e is the natural log or about 2.71828. This results in an estimate of *r*, or population growth rate, of 0.0738 for the mean values (Table 4). As a comparison, the maximum population growth rate (R_{max}; in the absence of fishery mortality) is estimated at 0.135 (NMFS 2024a). The term *r* is the instantaneous rate of increase of a population. The percent change from year to year is described by the finite rate of increase (λ) which is calculated as e^r. In this case, λ is 1.0766 and we anticipate an increase of 7.66% per year.

We place the results of Bigelow et al. (2022) in context with the observed CPUE for the East Pacific and WCPO purse seine fisheries in Figure 14. The relationship between CPUE and abundance can be characterized as $C = qEN$ where C is catch, E is effort, N is abundance and q is catchability (Forrestal et al., 2019). This equation can be rewritten as $C/E = qN$ where C/E is CPUE. Therefore, the relationship between CPUE and abundance is driven by the term catchability which can include a variety of factors that can vary spatially and temporally, including changes in fishing methods or target species, variation in spatial distribution, and environmental variability (Forrestal et al., 2019). The upcoming stock assessment will incorporate this variability and provide insights on how these changes in CPUE may be related to species abundance and trends (Hill-Moana 2024). For the purposes of our analysis, we can readily infer that the current increases in CPUE are not in line with the population growth potential of the oceanic whitetip shark based on their life history that includes late maturity and low fecundity relative to other shark species (NMFS 2024a). We therefore consider the mean growth rate of 7.66% per year based on the projections of Bigelow et al. (2022) the most reasonable estimate of the current trend for oceanic whitetip sharks because it incorporates the best estimates of the reduction in fishery mortality for each of the protective measures described above and is consistent with the R_{max} of 0.135 (which translates to 14.5% per year increase) which is the maximum growth rate anticipated for this species in the absence of fishery mortality.

Table 4. Start (2016) and end (2031) modeled estimates of spawning stock biomass relative to the unfished spawning biomass for oceanic whitetip sharks under assumptions of wireless leaders and no shark lines resulting in reduced capture rates and increased post-interaction survival for 2016 and 2031 from Table 3 of Bigelow et al. (2022). Also shown are our calculated implied population growth rates based on these start and end points as described in the text. For comparison the R_{max} from NMFS (2024a) is 0.135, or 14.5% per year.

Year	**Mean**	**Median**	**Min**	**10%**	**90%**	**Max**
2016	0.039	0.037	0.019	0.038	0.040	0.064
2031	0.118	0.093	0.033	0.092	0.124	0.355
Implied Population growth rate (r)	0.0738	0.0614	0.0368	0.0589	0.0738	0.1142
Implied Percent per Year Increase (exp^r)	7.66%	6.33%	3.75%	6.07%	7.66%	12.10%

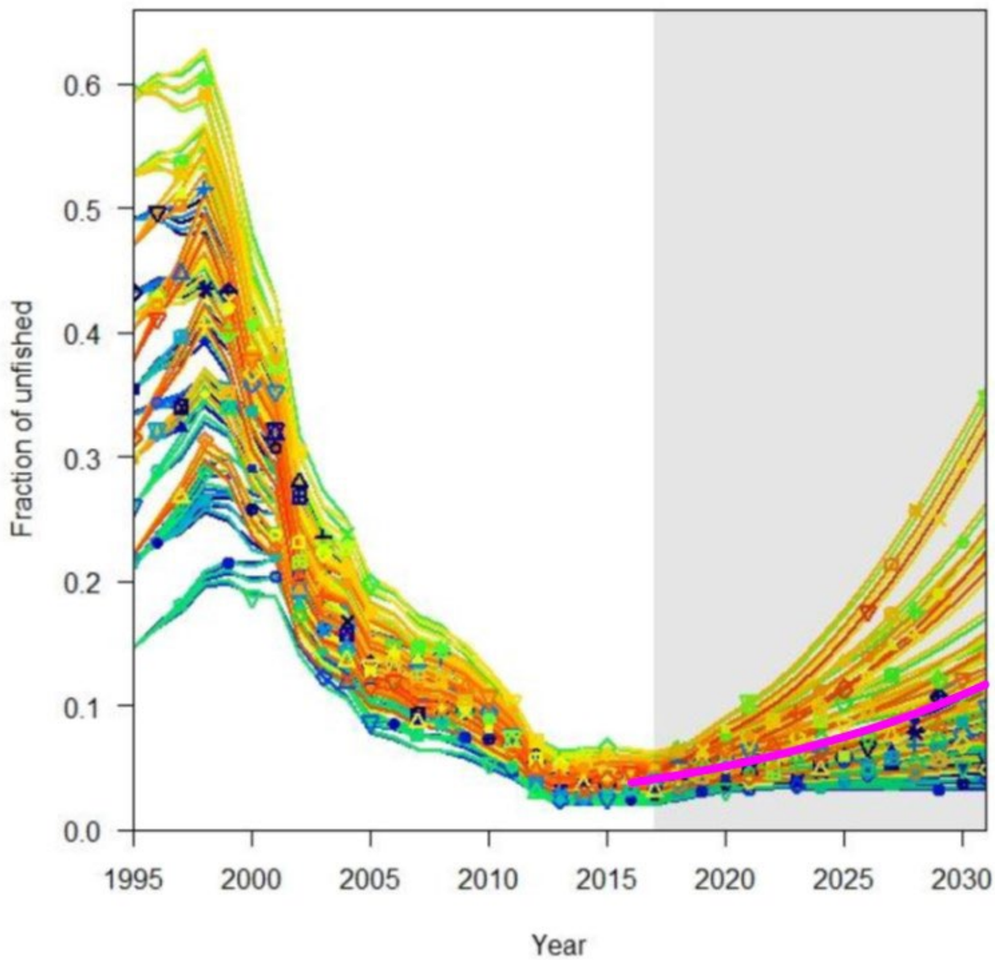

Figure 13. Projected ratios of spawning biomass (projected to 2031) to the equilibrium unfished spawning biomass for WCPO oceanic whitetip sharks with updated at-vessel and post-release mortality rates and the prohibition of wire branchlines and shark lines (Figure 7 in Bigelow et al., 2022). Colors indicate the individual 108 runs covering the uncertainty grid. For comparison, we have overlaid the resulting trend for our implied population growth rate of 0.0738 (7.66% per year) for the mean values in Table 4 (pink line).

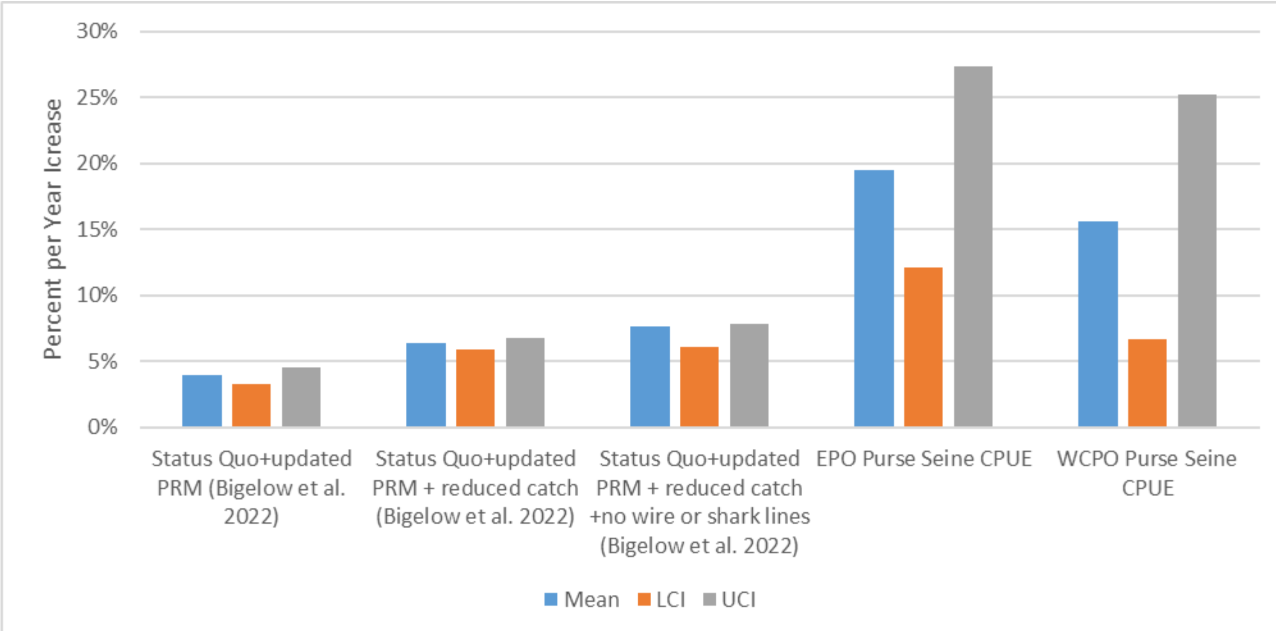

Figure 14. Resulting mean and lower (LCI) and upper (UCI) confidence intervals for percent per year increases in spawning stock biomass ratios for the three scenarios in Bigelow et al. (2022) and the same metrics for the East Pacific (EPO) and WCPO purse seine fisheries.

Conclusion on Current Trend

In previous biological opinions NMFS has assumed that the current trend in oceanic whitetip sharks is bounded by a slight decline to a slight increase (NMFS 2023a; NMFS 2023b). However, we now have new evidence for increasing abundance in oceanic whitetip sharks in the East Pacific and WCPO, and an increasing trend modeled for silky sharks in the WCPO (Neubauer et al., 2024) with similar conservation efforts being made for both species. Therefore, for our analysis in this supplemental biological opinion, we use the data from Bigelow et al. (2022) to calculate a mean growth rate of 7.66% ($r = 0.0738$) per year increase as the most reasonable estimate of the current trend for oceanic whitetip sharks (Table 4). While the trends in CPUE suggest much higher growth rates, these do not seem feasible given what is understood regarding the life history of oceanic whitetip sharks including late maturation and low fecundity.

Abundance

The only formal stock assessments for the Pacific represent a portion of the total Pacific Ocean population–the West Pacific portion of the population's range (aka. the West Pacific stock). Unfortunately, it remains unclear how much of the total Pacific Ocean oceanic whitetip population this one population assessment covers. As noted above, oceanic whitetip sharks occur primarily between 30° North and 35° South latitude. We used ArcGIS to estimate the area of the Pacific Ocean between these latitudes as well as the area of the WCPO between these latitudes. From this assessment, we estimate that the area of oceanic whitetip shark habitat in the WCPO represents about 60% of the total habitat within the Pacific Ocean.

The most recent 2019 stock assessment (Tremblay-Boyer et al., 2019) concluded that total biomass in 2010 was 19,740 metric tons and that biomass declined to 9,641 metric tons by 2016.

This stock assessment included 648 model runs accounting for assumptions about life history parameters and impacts of fishing underpinning the assessment. Using the underlying data from these 648 models in their structural uncertainty grid in Tremblay-Boyer et al. (2019), the authors subsequently estimated the median value of the current total number of individuals in the WCPO (n= 775,214) (see NMFS 2020). We consider this estimate as the best available scientific information for population size in 2016 (the end of the time series analyzed in Tremblay-Boyer et al., 2019) and use it as our best estimate of the size of the WCPO portion of the Pacific Ocean population of oceanic whitetip sharks. This estimate is also in alignment with previous consultations (see NMFS 2023a, 2023b).

Assuming a similar density of oceanic whitetip shark in the East Pacific to that of the WCPO, and using the proportion described above that the area of the WCPO between the latitudes where oceanic whitetip sharks are found represents 60% of habitat in the entire Pacific Ocean, we estimate a total population size of 1,292,023 ([775,214/60] x100) oceanic whitetip sharks in the Pacific Ocean. However, given that this estimate requires an assumption regarding the density of oceanic whitetip sharks in the East Pacific, in our analysis we consider both 775,214 as a minimum population estimate and 1,292,023 as an upper estimate of the population size in 2016, assuming the densities of sharks in the East Pacific is similar to that of the WCPO.

Based on the estimate of 775,214 WCPO oceanic whitetip sharks in 2016, at a 7.66% rate of population growth based on the exponential growth function ($N_t = N_{t-1} * e^r$), we estimate a population of 1,399,036 sharks in 2024 in the WCPO and 2,334,728 in the Pacific Ocean. Exponential growth equations describe the growth rates of depleted but recovering populations well, however, eventually density-dependent factors will slow rates of recovery. We therefore limit our projections to 20 years which is slightly less than two generations for this species (see Reproduction section below) and should be a reasonable timeframe for the exponential growth equations to continue to describe population trajectories.

<u>Reproduction</u>
We incorporate by reference pages 20- 25 of the Recovery Status Review (NMFS 2024a). We briefly summarize the information here.

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, although their theoretical maximum age has been estimated to be approximately 36 years. Female oceanic whitetip sharks reach maturity between four and nine years of age, although this varies with geography, and give birth to live young after a gestation period of nine to 12 months. Reproductive periodicity is every year or every other year. Litters range from one to 14 pups with an average of six. Generation time is estimated at 10.4 to 11.1 years.

<u>Threats to Species</u>
We incorporate by reference pages 40-117 of the Recovery Status Review (NMFS 2024a) and refer the reader to see Table 6 on pages 118-121 for a complete synopsis for each ocean basin management unit. Below we list the impacts identified as threats to oceanic whitetip shark and provide specific page numbers wherein details, references, and justifications may be found:

- Loss of habitat due to climate change (NMFS 2024a concluded a low-moderate level of threat)

    - Climate change has the potential to pose a threat to oceanic whitetip shark habitat, including habitat changes (e.g., changes in currents and ocean circulation, compression of habitat zone) and potential impacts to prey species (pages 43-44).
- Fishery bycatch; NMFS (2024a) concluded that mortality resulting from fisheries bycatch is the single most important threat contributing to the extinction risk of the oceanic whitetip shark globally. Below we detail Pacific Ocean fisheries (see pages 103-107 and Table 6 of NMFS 2024a):
    - East Pacific
        - Commercial purse seine fisheries managed by IATTC – moderate-high threat
        - Commercial longline fisheries managed by IATTC – moderate-high threat
        - Artisanal fisheries – low threat
        - Illegal retention for meat or fins in any of the above fisheries – moderate threat
        - Inadequacy of fisheries regulations – moderate threat (pages 92-93)
    - Western and Central Pacific
        - Commercial purse seine fisheries managed by WCPFC – moderate-high threat
        - Commercial longline fisheries managed by WCPFC –high threat
            - U.S. Hawaii deep-set longline fishery anticipates 10,586 oceanic whitetip shark captures over five years (NMFS 2023a)
            - American Samoa longline fishery anticipates 3,520 oceanic whitetip shark captures over five years (NMFS 2023b)
            - U.S. Hawaii shallow-set longline fishery anticipates 102 oceanic whitetip shark captures each year (NMFS 2019b)
        - U.S. Pacific Islands bottomfish fisheries (NMFS 2022; not specified in NMFS 2024a)
            - The Guam bottomfish fishery anticipates one interaction over five years
            - The Commonwealth of the Northern Mariana bottomfish fishery anticipates four interactions over five years
            - The Hawaii bottomfish fishery anticipates 2 interactions over five years
        - Artisanal fisheries – moderate threat
        - Illegal retention for meat or fins in any of the above fisheries – moderate threat
        - Inadequacy of fisheries regulations – moderate threat (pages 92-93)
- Disease or Predation; NMFS (2024a) could not conclude that either disease or predation is an operative threat to the oceanic whitetip shark (pages 90-91).
- Other Natural and Manmade Factors; NMFS (2024a) concluded threats ranged from low to moderately-high (pages 115-117). Final rankings shown below are from Table 6 on page 117.
    - Climate change (low-moderate)

- Pollution and toxins (low)
- Illegal fin trade (moderate-high)
- Inadequacy of fin trade regulations (moderate high)
- Emerging threats (aquaculture, tourism; low).

Overall, the species has experienced significant historical abundance declines in all three ocean basins (Atlantic, Pacific, and Indian Oceans) due to overutilization from fishing pressure and inadequate regulatory mechanisms to protect the species. Their population dynamics–long-lived and late maturing with low-to-moderate productivity– makes this species particularly vulnerable to harvests that target adults and limits their ability to recover from over-exploitation. However, given the information presented in the Status and Trends in Abundance section, the species appears to be responding to recent conservation efforts.

Recent Conservation Activities

Due to reported population declines driven by the trade of oceanic whitetip shark fins, the oceanic whitetip shark was listed under Appendix II of CITES in 2013. This listing went into effect as of September 2014. Considerable national and international regulations regarding shark fishing/retention and bycatch in fisheries have been implemented. These have been summarized by NMFS (2024a) and we incorporate by reference the following information from that recovery status review: pages 143 through 152 for the U.S., pages 153 through 155 for other countries, and pages 156 through 159 for international shark finning regulations.

Also, specific to oceanic whitetip sharks, CMM 2011-04 prohibits WCPFC vessels from retaining onboard, transshipping, storing on a fishing vessel, or landing any oceanic whitetip shark, in whole or in part, in the fisheries covered by the Convention. This CMM was later replaced in 2019 by CMM-2019-04 which was in-turn was replaced in 2022 by CMM-2022-04 for all sharks. The measure retains the retention prohibition for oceanic whitetip sharks, and includes additional measures on minimizing bycatch (including some gear restrictions), implementing safe release practices, and prohibiting wire leaders and shark lines for longline fishing.

3 ENVIRONMENTAL BASELINE

The environmental baseline is defined by regulation (50 CFR 402.02). 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 completed formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

3.1 Climate Change

For climate change impacts within the action area, we incorporate by reference pages 43 to 44 of the status review and the references therein (NMFS 2004a). Briefly, given the broad distribution of oceanic whitetip sharks and their ability to make long-distance movements, the impacts from climate change is uncertain. The most likely threats would come from habitat impacts due to changes in currents and oceanic currents and impacts to prey species.

3.2 Fishery Interactions

The main fisheries that occur in the action area and that have measurable effects on oceanic whitetip sharks are fisheries for highly migratory species using longline and purse seine gear. Key target species for these fisheries are tuna (albacore, bigeye, skipjack, and yellowfin), swordfish, and marlin. Fisheries that use both types of gear have occurred in the western and central Pacific Ocean since the 1950s for longline fisheries and the 1980s for purse seine fisheries.

3.2.1 U.S. WCPO Purse Seine Fishery

From 2006 to 2015, the size of the United States WCPO purse seine fleet increased markedly mainly based on newly constructed vessels entering the fishery (Figure 15; Hamilton et al., 2011). This upturn in fleet size is reflected in the sharp increase in the United States purse seine catch in the WCPO. From 2007 to 2009, the tuna catch more than tripled (Hamilton et al., 2011). The increase in the size of the United States WCPO purse seine fleet was mirrored by an increase in fishing effort (NMFS 2021). There has been a downward trend in effort since 2015 and in 2024 only 13 vessels remained in the fleet (Figure 15). This fishery is limited to a maximum of 40 vessels by the South Pacific Tuna Treaty (SPTT). As noted previously, fishing effort is expected to be no more than 3,100 sets per year with an expectation that 1,581 of those will be FAD sets for the foreseeable future.

Historically, to summarize the past impacts of the U.S. WCPO purse seine fishery on oceanic whitetip sharks, 1,801 individuals have been observed captured from 2008 to 2022. It is estimated the fishery caught a total of 3,103 (95% CI: 2,781 to 3,437) oceanic whitetip sharks during that time.

The effect of this continuing action on oceanic whitetip sharks is addressed in Section 3, Effects of the Action, of this supplemental biological opinion in greater detail.

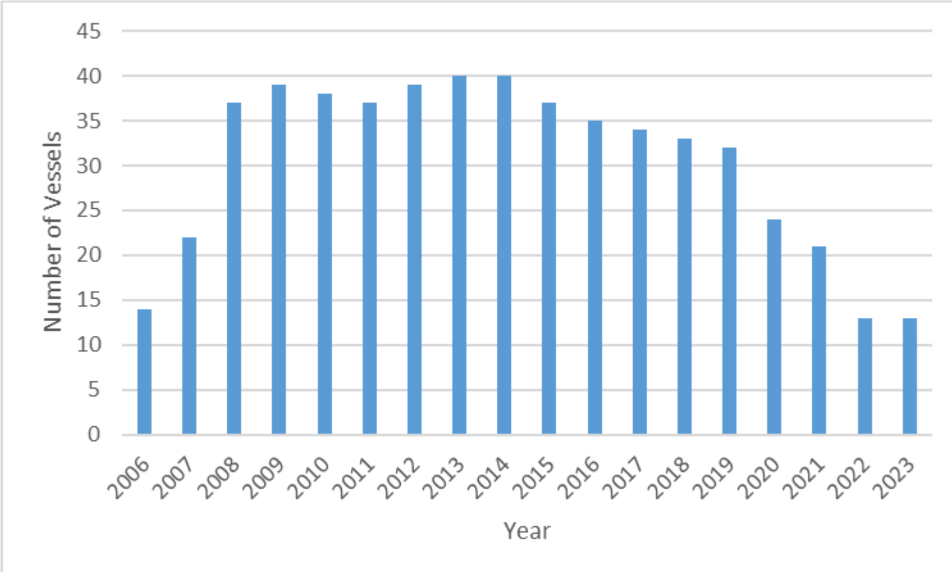

Figure 15. Number of vessels participating in the U.S. WCPO purse seine fishery.

3.2.2 United States Fisheries Managed under the Pelagics Fisheries Ecosystem Plan

Fisheries managed under the Pelagics FEP that occur in the action area include the American Samoa-based pelagic longline (ASLL) and troll fisheries. The pelagic troll fishery is not expected to interact with oceanic whitetip sharks. The ASLL is expected to capture up to 3,520 oceanic whitetip sharks every five years with 1,809 mortalities (NMFS 2023b).

There is also an American Samoa bottomfish fishery that occurs in the action area, however, this fishery is not expected to interact with oceanic whitetip sharks (NMFS 2022).

3.2.3 Non-U.S. Longline Fisheries

WCPO

Median shark and ray catch estimates for some species were modeled by Peatman et al. (2018) for multiple regions of the WCPO using longline observer data. Table 5 displays statistics relevant to the oceanic whitetip shark south of 10°S from 2003 to 2017 which includes a portion of the U.S. WCPO purse seine fishery's action area and is an excerpt from Peatman et al. (2018). It should be noted that these data already include U.S. data and the proportion of overlap from other international fisheries with the action area is unknown. Additionally, caveats apply as observer coverage ranges from one to 4.5% of the total hooks set, particularly north of 10°N; and has a wide confidence interval for key shark species (Peatman et al., 2018). For more updated data, we accessed the public domain bycatch data maintained by the WCPFC (2023) to estimate the numbers of annual interactions and mortalities of oceanic whitetip sharks from 2013 to 2018 (Table 6).

Table 5. Mean (95% confidence interval) of the annual median oceanic whitetip shark catch estimates between 10°S and 10°N, and South of 10°S in the WCPO longline fisheries from 2003 to 2017. Includes both United States and foreign data (Peatman et al., 2018).

Year	10°S to 10°N	South of 10°S
2003 - 2017	43,873 (32,247 – 55,500)	16,349 (12,461 – 20,236)
Totals	658,100	245,230

Table 6. Mean and 95% confidence interval in parentheses of annual numbers of oceanic whitetip sharks reported captured/killed by participating countries reporting catch data to the WCPFC for longline fisheries operating in the action area from 2013 to 2022. Data were reported in 5° x 5° bins, and data were restricted to those that overlap with the action area as closely as possible (WCPFC 2023). Estimated interactions were calculated based on annual observer coverage[1].

Species	Observed Interactions	Observed Mortalities	Estimated Interactions	Estimated Mortalities	Total Est Captures 2013 to 2022	Total Est Mortalities 2013 to 2022
Oceanic Whitetip Shark	841 (730 – 952)	211 (179 – 242)	27,516 (24,974-30,058)	6,993 (5,916 – 8,069)	275,160	69,926

[1]Percent Observer Coverage (2013-2022): 3.1% (2.6% – 3.7%)

3.2.4 Non-U.S. Purse Seine Fisheries

WCPO

Between 2008 and 2022, there were between 33,000 and 55,000 annual sets by the international purse seine fleet operating in the WCPO exclusive of those by the United States fleet (Peatman et al., 2024). The WCPO purse seine fisheries as a whole were observed at rates between 67-86% from 2013–2019. Due to the Covid-19 pandemic, observer coverage levels dropped to 38% in 2020 and 13% in 2021 and 2022 (WCPFC 2023).

Based on estimates of total shark captures by Peatman et al. (2024), from 2003 to 2022, oceanic whitetip sharks represented about 1.3% of total shark captures in the WCPO purse seine fisheries for sharks identified to species. From 2003 to 2022 an estimated total of 16,930 oceanic whitetip sharks were captured in the WCPO purse seine fisheries. Annual estimated captures have been increasing since about 2015 (Figure 9). Similarly, CPUE in terms of captures per set has been increasing since 2015 (Figure 10). These data reviews all fisheries in the WCPFC's convention area and includes United States data.

East Pacific

While the East Pacific fisheries, managed by the IATTC, are, by definition, not in the action area (Figure 15), we consider the impacts of this fishery here given the proximity of the U.S. WCPO purse seine fishery's current core fishing area to the boundary with the IATTC and the likelihood that these fisheries are impacting the same population.

Between 2007 and 2022, there were between 27,000 and 34,000 annual sets by the international purse seine fleet operating in the East Pacific for all vessels or between 22,000 and 28,000 for vessels greater than 363 tonnes (IATTC 2023). During that same time period, oceanic whitetip sharks represented about 0.5% of total shark captures in the East Pacific purse seine fisheries for sharks identified to species.

From 2007 to 2022 an estimated total of 2,146 oceanic whitetip sharks were captured in the East Pacific purse seine fisheries. Similar to the WCPO purse seine, captures and CPUE have been increasing since about 2013 (Figure 8).

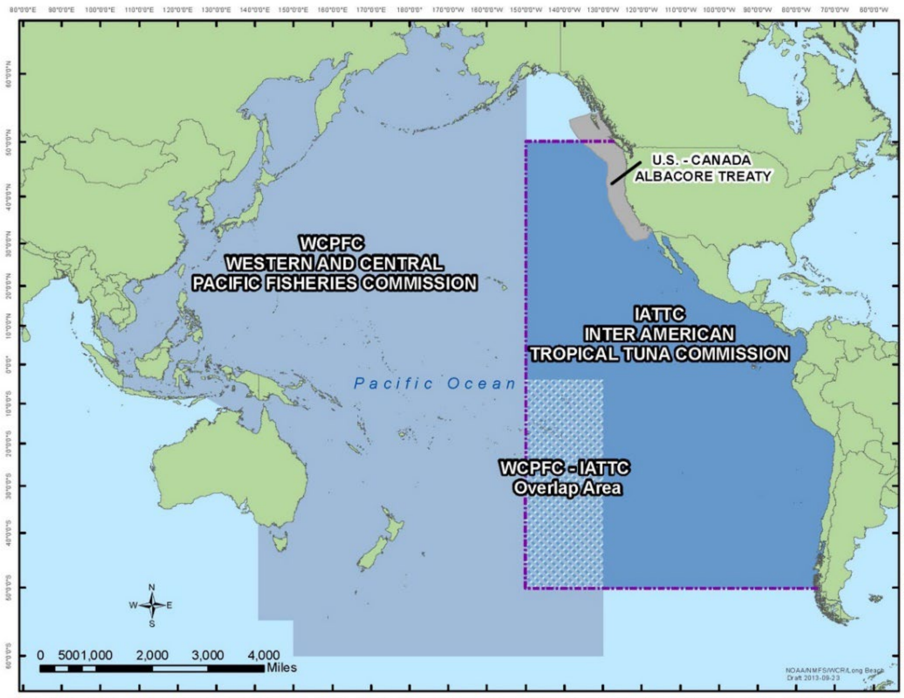

Figure 16. The boundaries of the WCPFC (west of the line) and the IATTC (east of the line), including the area of overlapping jurisdiction (Overlap Area).

3.3 Surface Vessel Traffic

Marine habitats occupied by ESA-listed species under NMFS' jurisdiction often feature both heavy commercial and recreational vessel traffic. Vessel strikes represent a recognized threat to large, air-breathing marine species. However, given the lower vessel traffic in oceanic habitats and the lack of the use of surface habitats by oceanic whitetip sharks, we do not expect negative impacts to this species from vessel traffic. Similarly, the Recovery Status Review (NMFS 2024a) did not consider vessel traffic a threat to recovery.

3.4 Anthropogenic Noise

Oceanic whitetip sharks in the action area are regularly exposed to multiple sources of anthropogenic sounds. Anthropogenic noises that could affect ambient noise arise from the following general types of activities in and near the sea, any combination of which can contribute to the total noise at any one place and time. These noises include transportation, dredging, construction; oil, gas, and mineral exploration in offshore areas; geophysical (seismic) surveys; sonars; explosions; and ocean research activities (Richardson et al., 1995). Very little research has been done on the impacts of anthropogenic noise on sharks and the Recovery Status Review (NMFS 2004a) did not consider anthropogenic noise a threat to the recovery of the species.

Recent studies on other species of sharks have found that anthropogenic noise can cause behavioral changes (Chapuis et al., 2019; de Vincenzi et al., 2021). Overall there is not sufficient information to understand the impact of anthropogenic sound on oceanic whitetip sharks.

3.5 Pollution and Marine Debris

Many different types of pollution can adversely affect oceanic whitetip sharks within the action area. There are three main categories of marine pollution: oil pollution, contaminants and pesticides, and marine debris. In this section, we describe these three pollution categories, the exposure pathways and anticipated effects on endangered and threatened resources.

3.5.1 Oil Pollution

Oil released into the marine environment contains aromatic organic chemicals known to be toxic to a variety of marine life (Yender et al., 2002). Oil spills can impact wildlife directly through three primary pathways: (1) ingestion—when animals swallow oil particles directly or consume prey items that have been exposed to oil; (2) absorption—when animals come into direct contact with oil; and (3) inhalation—when animals breath volatile organics released from oil or from "dispersants" applied by response teams in an effort to increase the rate of degradation of the oil in seawater.

Direct exposure to oil can cause acute damage including skin, eye, and respiratory irritation, reduced respiration, burns to mucous membranes such as the mouth and eyes, diarrhea, gastrointestinal ulcers and bleeding, poor digestion, anemia, reduced immune response, damage to kidneys or liver, cessation of salt gland function, reproductive failure, and death (NOAA 2003, 2010). Nearshore spills or large offshore spills that reach shore can oil beaches on which sea turtles lay their eggs, causing birth defects or mortality in the nests (NOAA 2003, 2010). Disruption of other essential behaviors, such as breeding, communication, and feeding may also occur.

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

3.5.2 Contaminants and Pesticides

For impacts from pollutants and toxins within the action area, we incorporate by reference pages 115 to 116 of the status review and the references therein (NMFS 2024a). Briefly, while many pollutants in the environment, including brevotoxins, heavy metals, and polychlorinated biphenyls are known to accumulate in fish species, the specific impacts on oceanic whitetip sharks have not been well studied.

3.5.3 Marine Debris

Marine debris has become a widespread threat to a wide range of marine species that are increasingly exposed to it on a global scale. Plastic is the most abundant material type worldwide, accounting for more than 80% of all marine debris (Poeta et al., 2017). The most common impacts of marine debris are associated with ingestion or entanglement and both types of interactions can cause the injury or death of animals of many different species. Ingestion occurs when debris items are intentionally or accidentally eaten (e.g., through predation on already contaminated organisms or by filter feeding activity, in the case of large filter feeding marine organisms, such as whales) and enter in the digestive tract. Ingested debris can damage digestive systems and plastic ingestion can also facilitate the transfer of lipophilic chemicals (especially POPs) into the animal's bodies. An estimated 640,000 tons of fishing gear is lost, abandoned, or discarded at sea each year throughout the world's oceans (Macfadyen et al., 2009). These "ghost nets" drift in the ocean unattended for decades (ghost fishing), killing large numbers of marine animals through entanglement.

As noted above, FADs have also become a growing concern. A recent study estimated that over 20,000 FADs were deployed in the region in 2018 and that 51.8% were classified as lost; 10.1% were retrieved; 6.7% were beached; 15.4% were sunk, stolen, or had a malfunctioning buoy; and 10.4% were deactivated by the fishing company and left drifting (Escalle et al., 2019). These FADs continue to aggregate fish for an unknown period of time until they decompose, sink, or ground. We note that CMM 2021-01 and new U.S. regulations for non-entangling FAD construction should help to minimize this issue in the future.

Parton et al. (2019) conducted a global review of shark and ray entanglement in marine debris that included one record of an oceanic whitetip shark in the Atlantic Ocean. Overall they found that derelict fishing gear accounted for 74% of reported entanglements, follow by polypropylene strapping bands accounting for 11%. Afonso and Fidelis (2023) summarized the effects of entanglement in circular plastic strapping for tiger sharks. They found that 3% of encountered sharks were entangled in plastic strapping, resulting in severe lacerations and/or abnormal growth. Given these studies, it is clear that marine debris may entangle or be ingested by oceanic whitetip sharks (Compango 1984), leading to injury or possibly starvation, and derelict fishing gear may cause entanglement and possibly drowning. However, data are not available to estimate the number of oceanic whitetip mortalities resulting from marine debris in the action area. The Recovery Status Review (NMFS 2024a) did not consider entanglement of ingestion of marine debris to be a threat to recovery of the species

4 EFFECTS OF THE ACTION

Under the ESA regulations (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 but that are not part of the 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. For this proposed action, we determined it will not cause any other activities.

We use a stepwise approach to analyze effects to oceanic whitetip sharks:

1. Identify those physical, chemical, or biotic effects of the proposed action that directly or indirectly affect the action area (hereafter using the term stressors).
2. Identify the oceanic whitetip shark habitats likely to co-occur with these stressors in space and time (exposure).
    a. Estimate the number, age or life stage, and other pertinent characteristics (e.g., gender) of the individuals and the populations or subpopulations those individuals represent.
        i. If estimating the number is not possible, use a habitat-based analysis.
3. Determine if/how oceanic whitetip sharks will likely respond to the exposure.
    a. Determine the individual's probable response and if it is likely to have consequences on its fitness (growth, survival, annual reproductive success, etc.).
        i. If using a habitat-based analysis, explain the changes in habitat and the consequences to individuals.
        ii. Determine what consequences the effects on individuals have on the populations those individuals represent (changes in the population' abundance, reproduction, spatial structure and connectivity, growth rates, etc.).

4.1 Stressors

Stressors associated with the proposed action include:

1. Interaction with fishing gear;
2. Entanglement risk from gear loss including FADs, that have been lost, abandoned or discarded into marine waters;
3. Collisions with vessels;
4. Vessel noise; and
5. Introduction of vessel wastes, which includes oils, cardboard, air emissions, etc.

4.1.1 Insignificant or Discountable Stressors

We determined that vessel noise, collisions with vessels, introduction of discharges and other wastes, and derelict gear have effects on oceanic whitetip sharks that are either discountable or insignificant. Discountable effects are those extremely unlikely to occur. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. The rationale for these determinations is documented below.

While individually we found these stressors to have discountable or insignificant effects on oceanic whitetip sharks, we consider the effects of the action as a whole, inclusive of the insignificant or discountable stressors and interaction with gear in Section 6, Integration and Synthesis.

Vessel Noise

Man-made sounds can affect animals exposed to them in several ways such as: non-auditory damage to gas-filled organs, hearing loss expressed in permanent threshold shift (PTS) or temporary threshold shift (TTS) hearing loss, and behavioral responses. They may also experience reduced hearing by masking (i.e., the presence of one sound affecting the perception of another sound). Masking and behavioral avoidance are the most likely responses of animals in the vicinity of U.S. WCPO purse seine fishing vessels. However, NMFS expects that vessel noises would have an insignificant effect on listed species because they would not be expected to result in measurable responses (should never reach the scale where take occurs).

Given the size of the U.S. WCPO purse seine fishery (the small number of vessels in the fishery and the wide area they cover), the fact that the sound field produced by the vessels in the fishery is relatively small and would move with the vessel, the animals would be moving as well, vessel speeds would be slow, vessel transit vectors would be predictable, sudden or loud noises would be unlikely or infrequent, and generally the sound field would be in motion, we would expect that any exposure to noises generated by this fishery would be short-term and transient and would generally be ignored by animals that are temporarily exposed to sounds emanating from the vessels in this fishery. Numerous studies demonstrate that fish in general and sharks specifically are unlikely to change their behavior when confronted with stimuli with these attributes (see Popper et al., 2014 for a review, Rider et al., 2021). Although hydraulics may have the potential to create loud noises, due to the expected above water operations, frequency and duration of time these species spend at the surface, dissipation of sound from the source, and the poor transference of airborne generated sounds from the vessel to ocean water through the hull, it is highly unlikely noises generated from vessel operations would elicit behavioral reactions from ESA-listed species considered in this consultation. Thus, NMFS expects this stressor would have insignificant effects on oceanic whitetip sharks.

Collision with vessels

The proposed action would expose oceanic whitetip sharks to the risk of collision with vessels. The vessels in the U.S. WCPO fishery range in size from 53-79 m (WCPFC 2024b). They are steel or fiberglass-hull vessels that travel at speeds less than 10 kt (NMFS 2017). Since 2009, the number of active vessels has remained relatively consistent at 39 vessels (NMFS 2017) until a marked decline was noted in 2019. As previously discussed, only 13 vessels are currently authorized to fish in this fishery and we do not expect any additional entrants into the fishery at this time.

Given the small number of vessels participating in the fishery, the small number of anticipated vessel trips, the slow vessel speeds during fishing operations and vessel transiting, the expectation that oceanic whitetip sharks would be widely scattered throughout the proposed action area and occur well below the surface, the potential for an incidental vessel strike is extremely unlikely to occur. Thus, NMFS expects this stressor would have discountable effects on oceanic whitetip sharks.

Introduction of Vessel Wastes and Discharges, Gear Loss, and Vessel Emissions

The diffuse stressors associated with the purse seine fisheries: vessel waste discharge, gear loss, and carbon emissions and greenhouse gasses, can affect both pelagic and coastal areas. ESA-listed resources could be exposed to discharges, and run-off from vessels that contain chemicals such as fuel oils, gasoline, lubricants, hydraulic fluids and other toxicants. Richardson et al. (2017) assessed Secretariat of the Pacific Community/FFA data specifically looking at the GEN-6 reporting form and found marine pollution attributed to purse seine fleets in the WCPO was mostly composed of plastic waste and discarded fishing gear. Between 2003 and 2015, the distant water fleets were responsible for 71% of the total reported incidents with the U.S. WCPO fleet accounting for upwards of 15% of these events (Richardson et al., 2017). In December 2017, the WCPFC adopted CMM 2017-04, which was implemented on January 1, 2019, and engages in various pollution prevention techniques to reduce discharges and wastes into marine waters.

U.S. WCPO purse seine fishery vessels also burn fuel and emit carbon into the atmosphere during fishing operations and transiting. Parker et al. (2018), estimate that in 2011, the world's fishing fleets burned 40 billion liters of fuel and emitted 179 million tons of carbon dioxide greenhouse gasses into the atmosphere. Between 1990 and 2011, emissions grew by 28% primarily due to increased harvests of crustaceans, a fuel intensive fishery (Parker et al., 2018). While we don't have an accurate estimate of the carbon footprint of the U.S. WCPO purse seine fishery, we expect the contribution to global greenhouse gases to be relatively inconsequential based on the low number of participants in the fishery.

The primary source of gear loss for the U.S. purse seine fishery is from drifting FADs. New regulations require design requirements for lesser entangling FADs (50 CFR 300.223(b)(4)) that should minimize the impact of this source of debris on oceanic whitetip sharks.

Although leakage, wastes, gear loss and vessel emissions would occur as a result of the U.S. WCPO purse seine fishery, given the small number of vessels participating in the fishery, the small number of anticipated vessel trips, the small chance that ESA-listed resources would be exposed to measurable or detectable amounts of wastes, gear, or emissions from this fishery, NMFS expects that this stressor would have discountable effects on oceanic whitetip sharks.

4.2 Interaction with Fishing Gear

4.2.1 Exposure

Oceanic whitetip sharks have been observed captured in the U.S. WCPO purse seine fishery every year from 2008 to 2023 (only partial data available for 2023). Over that time period, a total of 2,112 oceanic whitetip sharks were observed captured, 1,652 on FAD sets and 359 on free sets (Figure 16). Adjusting for unobserved sets or when observer data were not available, the 2021 biological opinion (NMFS 2021) estimated total captures of 2,284 (95% CI: 1,984 to 2,596) oceanic whitetip sharks from 2008 to 2018. Applying the same methods from NMFS (2021) to the data from 2019, 169 sharks were observed captured and we estimate 238 (95% CI: 221 to 255) total sharks were captured (Figure 16).

In April of 2020, due to the COVID-19 pandemic, the requirement for 100% observer coverage on WCPO purse seine vessels was suspended and WCPFC coverage on U.S. WCPO purse seine vessels did not resume until January 1, 2023. Below we detail the information available on oceanic whitetip shark captures in the fishery in the intervening years.

In 2020, WCPFC observer data was available on approximately 35% of sets. On these sets, 50 oceanic whitetip sharks were observed captured. Using the same methods from NMFS (2021) we estimate 112 (95% CI: 107 to 117) total sharks were captured in 2020 (Figure 16).

In 2021 and 2022, no WCPFC observer data were available, however, in these years most (2021) or all (2022) U.S. WCPO purse seine vessels were also listed on the IATTC Regional Vessel Register and fished in both the WCPO and East Pacific (USCG and NMFS 2023). Some observer coverage continued under the IATTC in these years and observers recorded data when the U.S. vessels were fishing in the WCPO. Extracting these records from the IATTC observer data, we have coverage for 57% and 63% of sets in 2021 and 2022 respectively. Based on these data, 121 and 185 oceanic whitetip sharks were observed captured in 2021 and 2022, respectively. The captures per unit effort (CPUE, defined as captures per set) for FAD sets for both of these years were outside of the range analyzed in NMFS (2021; Figure 17), and we, therefore, could not use the methods from NMFS (2021) to estimate total captures for these years. Instead, using the CPUE for FAD and free sets from the observed portion of the effort and expanding that to the unobserved portion, we estimate total captures of 208 and 261 sharks for each year, respectively (Figure 16).

Finally, in 2023 there were a total of 1,724 sets; observer data was reported by PNA for 1,705 sets. There were 502 observed oceanic whitetip shark captures on those 1,705 sets, representing the highest recorded number of observed annual captures (Figure 16). Again, the CPUE for this year is higher than previously analyzed and has the highest recorded values for both FAD and free sets (Figure 17). We estimate a total of 508 oceanic whitetip sharks captured by the U.S. WCPO purse seine fishery in 2023 based on the CPUE for the sets with observer data.

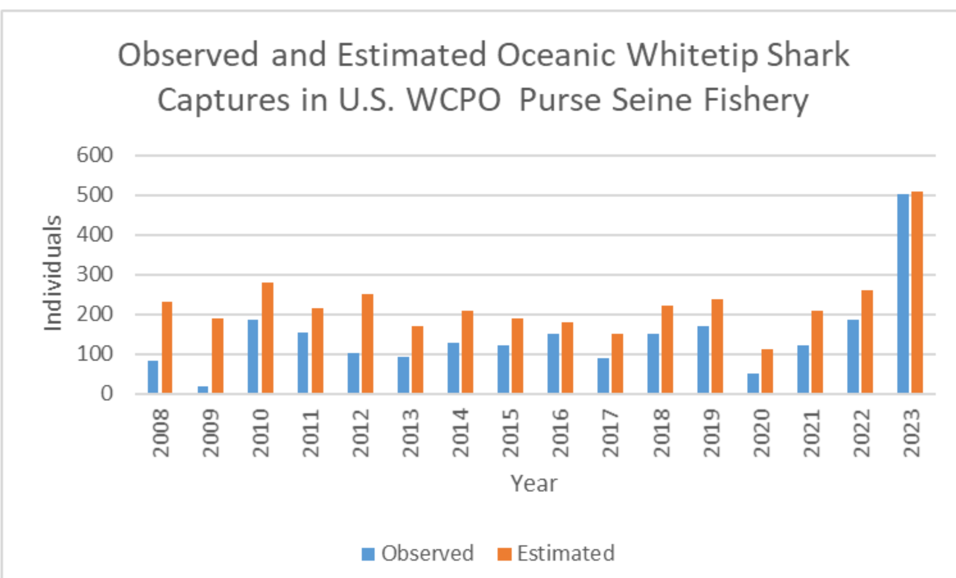

Figure 17. Observed and estimated oceanic whitetip shark captures in the U.S. WCPO purse seine fishery from 2008 to 2023.

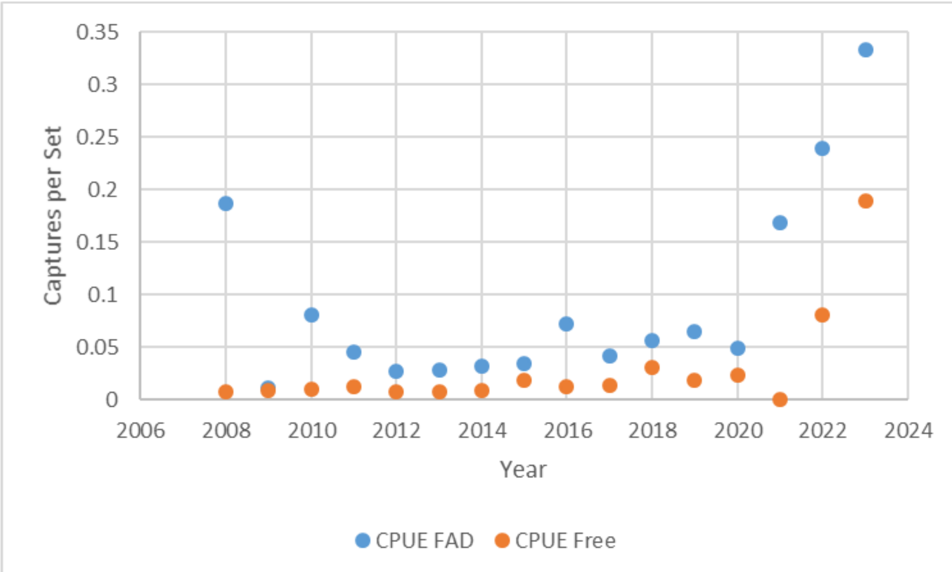

Figure 18. Oceanic whitetip shark observed CPUE from 2008 to 2023 in the U.S. WCPO purse seine fishery.

As seen in Figure 17, oceanic whitetip shark CPUE for both FAD and free sets have increased sharply since 2020. Similar trends are reflected in the IATTC data for 2021 and 2023 (Figure 8) and for the WCPO data (Figure 10). However, trends in oceanic whitetip shark CPUE vary across longitude, whereby CPUE peaks from 162.5°W to 147.5°W while the majority of the effort of the WCPO purse seine fisheries occurs from about 152.5°E and 177.5°E (Figure 18). As we noted in Section 1.2, Introduction - Proposed Federal Action, the majority of the U.S. WCPO purse seine fishery effort is now in the eastern area of the WCPO and generally coincides with the higher oceanic whitetip shark CPUE (Figure 19). This pattern likely explains why capture rates in the U.S. WCPO purse seine fishery are higher than the overall WCPO and East Pacific/IATTC purse seine fisheries (Figure 8 and Figure 10).

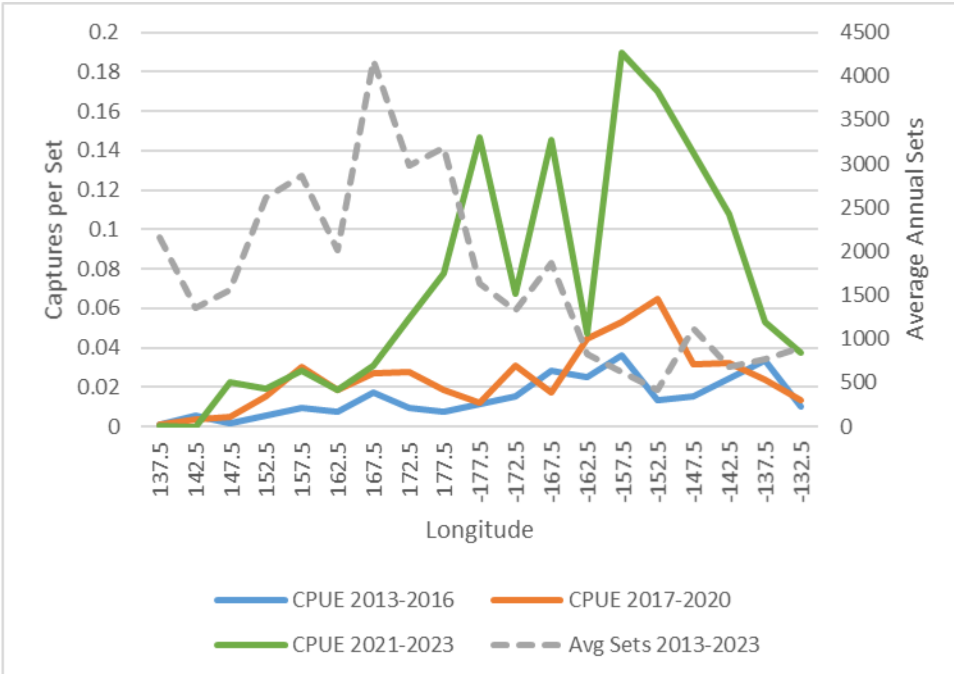

Figure 19. Captures of oceanic whitetip sharks per set (CPUE) in 5° longitude bins (x-axis goes from the West Pacific to the Central Pacific left to right). Data are from WCPFC (2024a) and inclusive of U.S. and international effort and captures. CPUE is binned into years, 2013-2016 (blue line), 2017 to 2020 (orange line), 202-2023 (green line). Also shown is the average number of annual sets (all WCPO purse seine fisheries including U.S.) per longitude bin from 2013 to 2022 (dashed gray line and right axis).

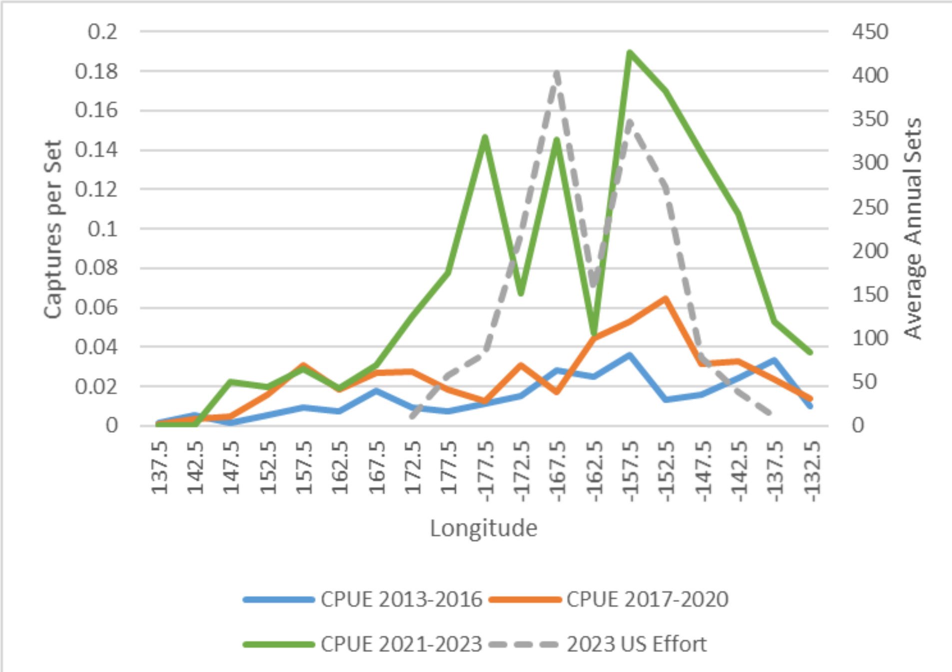

Figure 20. Captures of oceanic whitetip sharks per set (CPUE) in 5° longitude bins (x-axis goes from the West Pacific to the Central Pacific left to right). Data are from WCPFC (2024a) and inclusive of U.S. and international effort and captures. CPUE is binned into years, 2013-2015 (blue line), 2016 to 2018 (orange line), 2019-2022 (green line). Also shown is the average number of annual sets for the U.S. WCPO purse seine per longitude bin for 2023 (dashed gray line and right axis).

As noted in the Section 2, Status of the Listed Resources, from multiple lines of evidence we assess that the current population trend for oceanic whitetip sharks is increasing, and specifically we use the mean value we derived from the start and end points of the projections from Bigelow et al. (2022) of 7.66% per year as the most reasonable estimate. We compare this rate of increase to that of the current trends in CPUE by linearizing the trend of total CPUE (FAD and free sets combined) by taking the natural log of CPUE for each year to identify the best inflection point for the start of the increasing trend (Figure 20). The trend from 2013 to 2023 is well described by a linear regression. The fitted regression model was log (CPUE) = 0.274*year-556.71 and was statistically significant ($F(1,9) = 50.28$, $p<0.001$). We focus on this timeframe for our analysis and projections of CPUE. We note that 2013 was the first full year after the retention of oceanic whitetip sharks in WCPO purse seine fisheries was prohibited.

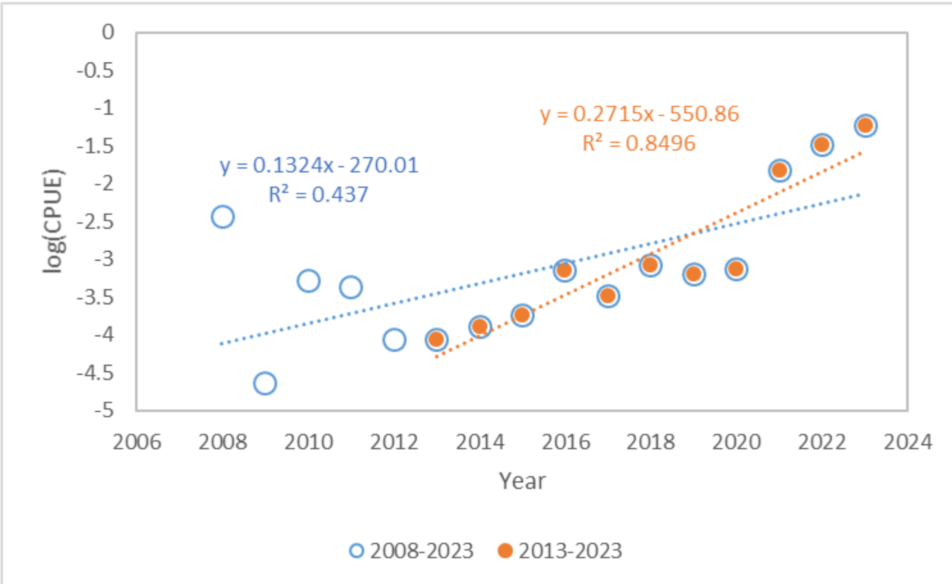

Figure 21. Total CPUE (FAD and free combined) from 2008 to 2023, CPUE has been linearized by a log transformation. The full dataset (2008 to 2023) is shown in blue with a linear regression (blue dashed line). The data from 2013 to 2023 are shown in orange with a linear regression (orange dashed line).

We used the package ggplot2 in the statistical software R to assess the mean and 95th CI for the rate of increase in oceanic whitetip shark CPUE from 2013 to 2023. We estimated the rate of increase at a mean of 31.2% per year (95% CI: 20.4% to 43.0%; Figure 21).

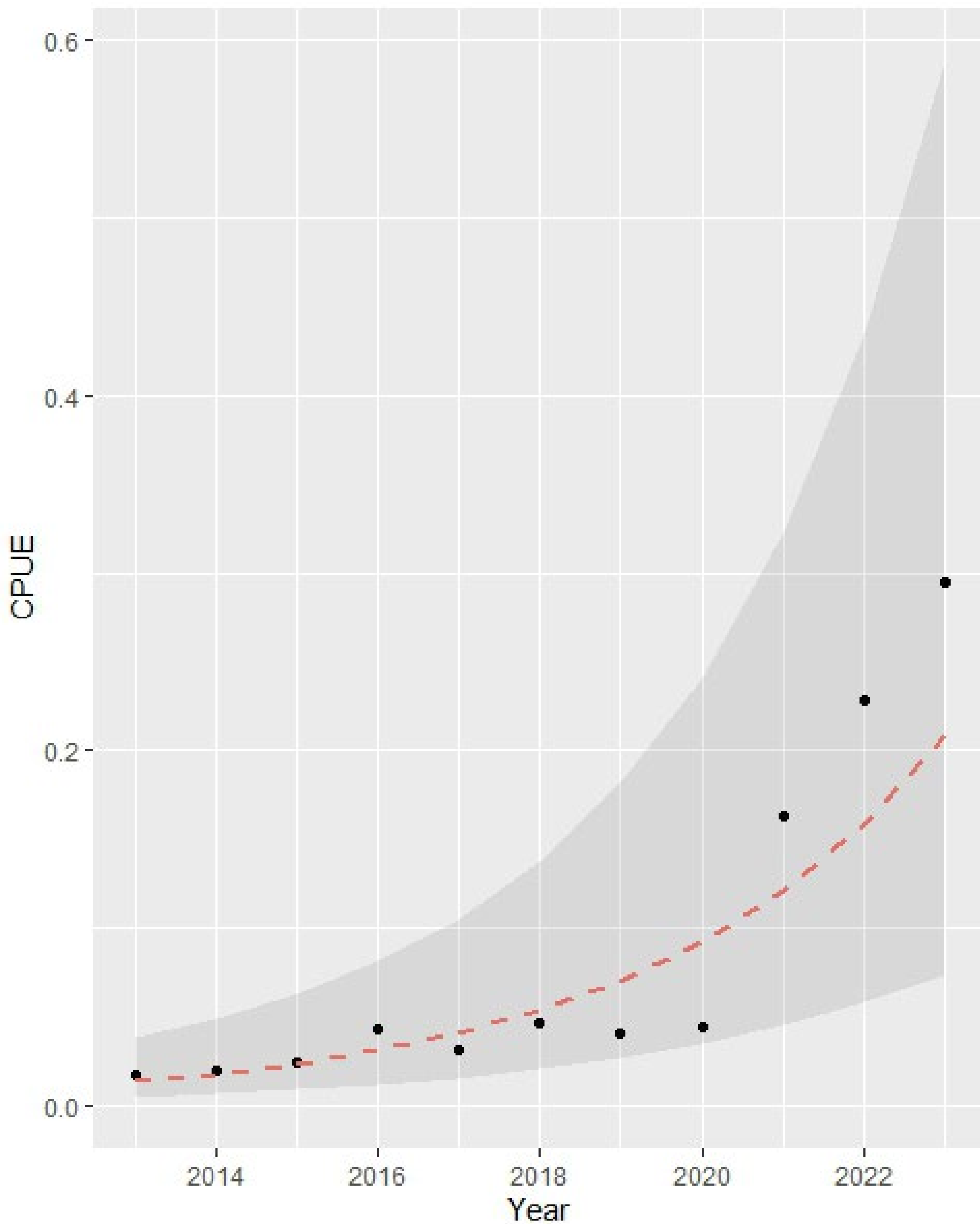

Figure 21. Exponential model fit to oceanic whitetip shark CPUE in the U.S. WCPO purse seine fishery from 2013 to 2023. Data are shown as black circles, the mean of the fit is a dashed red line and the 95% CI is shaded in dark gray.

As noted in Section 2, Status of the Listed Resources, the relationship between CPUE and abundance is driven by a catchability term which can include a variety of factors that can vary spatially and temporally including changes in fishing methods or target species, variation in spatial distribution, and environmental variability (Forrestal et al., 2019). The upcoming stock assessment will incorporate this variability, standardizing the CPUE and providing insights on how these changes in CPUE may be related to species abundance and trends (Hill-Moana 2024). For the purposes of this evaluation, we can infer that the recent increases in CPUE are likely reflective of the direction of the population abundance trend. As noted previously, maximum growth potential for this species indicates that oceanic whitetip shark populations should only be able to increase at a maximum rate of 14.4% per year in the absence of fishery mortality (NMFS 2024a). Given that the actual trend is greater than the population growth potential of the oceanic whitetip shark based on their life history (NMFS 2024a), we can also infer that the raw CPUE trend is not reflective of the population growth rate and we do not expect this rate of increase to continue into the future. The CPUE trends are a function of the population increases but are also driven by external factors such as ocean conditions influencing species distribution and/or fishery effort distribution and so are not a direct measure of changes in abundance (Maunder et al., 2006). That said, we do acknowledge that if oceanic whitetip shark populations are increasing as we assume, continued increases in captures over time can be expected. To account for this, we apply our assumed population growth rate of 7.66% per year and to simplify this analysis, we combine FAD and free sets to total sets. We anticipate interannual variability in CPUE due to changes in the distribution of fishing effort and the species distribution, with some years having higher than normal captures and other years having lower. We therefore use the 5-year running sum that we have used in other recent biological opinions to account for this variability allowing years with higher than normal captures to be balances with years of lower than normal captures (NMFS 2021; NMFS 2023a,b; NMFS 2024d; see the Incidental Take Statement in Section 8.1 for further details on the 5-year running sum).

Using our assumed population growth rate and applying this value to captures, we make projections out to 20 years acknowledging that these projections assume 1) the population is increasing at 7.66% per year and will continue to do so over the next 20 years; and 2) capture rates in the fishery will be consistent with this rate of increase over the next 20 years.

To project future captures, we first develop a 5-yr running sum CPUE by generating 5-yr running sums of observed captures and observed sets (Table 7). The 5-yr running sum CPUE is then the 5-yr running sum of observed captures divided by the 5-yr running sum of observed sets (Table 7). Next, we project the final 5-yr running sum CPUE (i.e. 2019-2023) forward for 20 years using the exponential growth equation $N_{5t} = N_{5t-1}e^{r}$. In this case, N_{5t} is the CPUE in the current 5-yr time step, N_{5t-1} is the CPUE in the previous 5-yr time step and r is our assumed growth rate of 0.0738 (or 7.66% per year; Table 8). We estimate total captures by multiplying the 5-yr CPUE by the maximum estimated sets (3,100 per year or 15,500 over five years; Table 8).

Table 7. Calculation of the 5-yr running sums (RS) of CPUE using observed captures and sets from 2008 to 2023. Blank cells indicate that there are not enough data to calculate the 5-yr running sum.

Year	Observed Captures	Observed Sets	Annual CPUE	5-yr RS Years	Observed Captures; five yr RS	Observed Set; five yr RS	5-yr CPUE
2008	82	933	0.0879	-	-	-	-
2009	19	1933	0.0098	-	-	-	-
2010	187	4926	0.0380	-	-	-	-
2011	154	4453	0.0346	-	-	-	-
2012	102	5856	0.0174	2008-2012	544	18101	0.0301
2013	93	5323	0.0175	2009-2013	555	22491	0.0247
2014	128	6269	0.0204	2010-2014	664	26827	0.0248
2015	121	5026	0.0241	2011-2015	598	26927	0.0222
2016	151	3512	0.0430	2012-2016	595	25986	0.0229
2017	89	2865	0.0311	2013-2017	582	22995	0.0253
2018	150	3246	0.0462	2014-2018	639	20918	0.0305
2019	169	4090	0.0413	2015-2019	680	18739	0.0363
2020	50	1130	0.0442	2016-2020	609	14843	0.0410
2021	121	742	0.1631	2017-2021	579	12073	0.0480
2022	185	809	0.2287	2018-2022	675	10017	0.0674
2023	502	1705	0.2944	2019-2023	1027	8476	0.1212

Table 8. Projection of 5-yr running sum CPUE and Captures for 20 years.

5-yr RS Years	5-yr CPUE	5-yr Sets	5-yr Captures
2024-2028	0.175	15500	2716
2025-2029	0.189	15500	2924
2026-2030	0.203	15500	3148
2027-2031	0.219	15500	3389
2028-2032	0.235	15500	3649
2029-2033	0.253	15500	3928
2030-2034	0.273	15500	4229
2031-2035	0.294	15500	4553
2032-2036	0.316	15500	4902
2033-2037	0.340	15500	5277
2034-2038	0.367	15500	5682
2035-2039	0.395	15500	6117
2036-2040	0.425	15500	6585
2037-2041	0.457	15500	7090
2038-2042	0.492	15500	7633
2039-2043	0.530	15500	8217
2040-2044	0.571	15500	8847

4.2.2 Response

The stressors associated with the U.S. WCPO purse seine fishery produce responses that range from behavioral impacts (i.e., from presence of the vessel) to more stressful impacts such as from being encircled by the net and then released alive unharmed, to injurious impacts that stem from being landed on deck through brailing process and released injured, to death (immediate, or later in time following injury). For WCPFC observed interactions with the U.S. WCPO purse seine fishery, observers recorded the release condition of animals at the conclusion of interactions. For records during fishing sets, the animal's condition at the start and end of the interaction as well as ultimate fate were generally recorded; although condition records were often missing. We used condition codes at the end of the interaction for our analysis where they existed in the data. Condition codes in the observer data included:

A0 – Alive, condition unknown;

A1 – Alive and healthy;

A2 – Alive, but injured or distressed;

A3 – Alive, but unlikely to live;

A4 – Alive, entangled in the net, released untangled;

D – Dead;

U – Unknown.

As noted in the 2021 biological opinion, there has only been one record of an oceanic whitetip shark with a condition code of A4, and we follow that opinion by classifying that shark to A2.

The proportion of known-fate oceanic whitetip sharks that were either dead at release or retained (and therefore also dead) has decreased since 2015 (Figure 22) while the proportion of captured sharks assigned a known fate has increased over this same time period. The decrease in mortality is likely due primarily to regulations prohibiting the retention, transshipment, storage or landing of oceanic whitetip sharks in March 2015 (80 FR 8807). We summarize captured oceanic whitetip sharks by condition codes for FAD and free sets in Table 9 and Table 10.

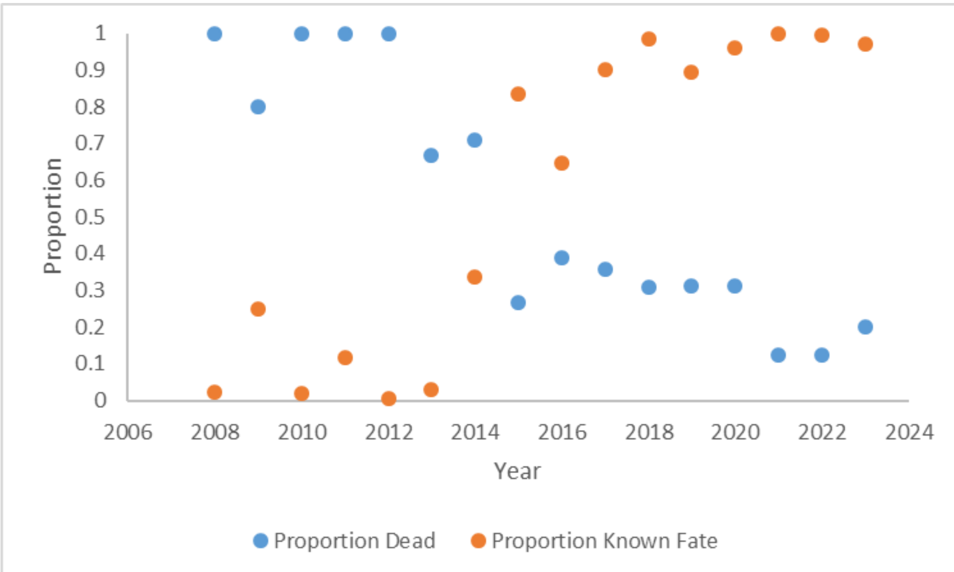

Figure 23. For those oceanic whitetip sharks released with condition codes of A0, A1, A2, A3 or D, the proportion dead (D) each year are shown with blue circles (this represents the at-vessel mortality). The orange circles indicate the proportion of total oceanic whitetip shark captures that received one of these alive condition codes (i.e., was not classified as unknown fate).

Table 9. Number of sharks associated with each release code for oceanic whitetip sharks captured on FAD sets in the U.S. WCPO purse seine fishery.

Year	A0	A1	A2	A3	D	U	Total
2008	-	-	-	-	1	77	78
2009	-	-	-	-	2	8	10
2010	-	-	-	-	4	155	159
2011	-	-	-	-	17	123	140
2012	-	-	-	-	1	79	80
2013	-	-	-	-	2	73	75
2014	-	4	2	-	21	74	101
2015	35	3	1	1	11	10	61
2016	23	7	5	2	27	38	102
2017	16	5	14	1	21	8	65
2018	13	22	33	8	30	2	108
2019	16	26	34	6	31	17	130
2020	9	9	11	-	14	2	45
2021	106	-	-	-	15	-	121
2022	151	-	-	-	22	-	173
2023	302	-	22	-	71	14	409
Total	671	76	122	18	290	680	1857

Table 10. Number of sharks associated with each release code for oceanic whitetip sharks captured on free sets in the U.S. WCPO purse seine fishery.

Year	A0	A1	A2	A3	D	U	Total
2008	0	0	0	0	1	3	4
2009	1	0	0	0	2	6	9
2010	0	0	0	0	0	28	28
2011	0	0	0	0	2	15	17
2012	0	0	0	0	0	21	21
2013	0	0	1	0	0	17	18
2014	1	5	1	0	11	9	27
2015	6	12	8	3	16	10	55
2016	9	1	2	0	4	6	22
2017	3	5	0	1	5	0	14
2018	8	2	13	1	15	0	39
2019	4	4	11	3	16	1	39
2020	0	1	3	0	1	0	5
2021[a]	0	0	0	0	0	0	0
2022[a]	11	0	0	0	1	0	12
2023	54	0	4	0	25	1	84
Total	97	30	43	8	99	117	394

[a] Data from the IATTC where there are different reporting requirements

Sabarros et al. (2023) assessed post-release mortality of oceanic whitetip sharks captured in purse seine fisheries in the western Indian Ocean using electronic tags. They found that for sharks assessed to be in good condition at release mortality was 0%, followed by 80% for injured, and 100% for moribund sharks. Given that this study is recent, focused on the same type of fishery (although in a different ocean basin), and specific to oceanic whitetip sharks, we consider it the best available scientific information for assessing total mortality (at-vessel and post-release) for oceanic whitetip sharks captured in the U.S. WCPO purse seine fishery. We acknowledge that the data are based on only 16 tagged sharks and while the 100% survival for sharks released in good condition (A1) may be high, we feel it is balanced by the high mortality rates for injured (80%; A2) and moribund (100%; A3) sharks. There is likely a wide range of conditions included in the A2 category, from minor scrapes to more serious injuries.

As noted in Table 9 and Table 10, a large majority of sharks released alive have condition code A0. As these sharks were known to be released alive, we must include them in our calculations of mortality rates. In order to assign post-interaction mortality to these sharks, we partition these sharks among condition codes A1, A2 and A3 based on the historical proportion of condition codes from 2008 to 2023. Table 11 (columns for Captured FAD and Captured Free) contain the results of this analysis, distributing A0 sharks among the A1, A2 and A3 condition codes.

For the estimate of current mortality rates, we limit the data to the timeframe of 2016 to 2023 as 2016 is the first full year after the implementation of regulations prohibiting the retention of oceanic whitetip sharks by the U.S. WCPO purse seine fishery (Table 11. Previous to this date, at-vessel mortality rates included those individuals that were retained and the at-vessel mortality estimate from the 2021 biological opinion was 47% for captures from 2008 to 2018 (NMFS 2021). For the data from 2016 to 2023 we found an at-vessel mortality rate of 23% (Table 12). We apply the total mortality rate of 64.3% for FAD and free sets combined to the projected estimates of captures from Table 8 to estimated anticipated mortalities for oceanic whitetip shark captures in the U.S. WCPO purse seine fishery (Table 13).

Table 11. Numbers of oceanic whitetip sharks captured in the U.S. WCPO purse seine fishery assigned to each release condition from 2016 to 2023 and the resulting number of mortalities based on release condition mortality rates from Sabarros et al. (2023).

Release Condition	**Mortality Rate from Sabarros et al. (2023)**	**Captured FAD**	**Captured Free**	**Estimated killed FAD**	**Estimated killed Free**
A1	0.0	321	48	0	0
A2	0.8	509	85	407	68
A3	1.0	77	13	77	13
D	1.0	246	69	246	69

Table 12. At-vessel and total mortality estimates for oceanic whitetip sharks captured in the U.S. WCPO purse seine fishery from 2016 to 2023 (Table 11) based on release condition mortality rates from Sabarros et al. (2023).

Mortality Rate Scenario	**FAD Sets**	**Free Sets**	**Total**
At-Vessel Mortality Rate	0.213	0.321	0.230
At-Vessel + Post Release Mortality Rate	0.633	0.698	0.643

Table 13. Anticipated captures and mortalities for oceanic whitetip sharks captured in the U.S. WCPO purse seine fishery from 2024 to 2043.

5-yr Running Sum Years	Captures over five years	Mortalities over five years
2024-2028	2736	1759
2025-2029	2945	1894
2026-2030	3171	2039
2027-2031	3414	2195
2028-2032	3675	2363
2029-2033	3957	2544
2030-2034	4260	2739
2031-2035	4586	2949
2032-2036	4937	3174
2033-2037	5315	3418
2034-2038	5722	3679
2035-2039	6161	3962
2036-2040	6632	4264
2037-2041	7140	4591
2038-2042	7687	4943
2039-2043	8276	5321
2040-2044	8847	5689

We next examine the probable consequences of incidentally capturing and killing the numbers of oceanic whitetip sharks specified in Table 13. We assume that the current estimated population growth rate is inclusive of mortalities in the U.S. WCPO purse seine fishery, as the fishery has been operating over the time period when we believe the population trajectory began increasing. Therefore to estimate the population trends without the impact of the fishery, we added back in the number of estimated mortalities to the estimated population size each year for 20 years into the future and recalculated the population growth rates with these additions. As our population trajectories are in one-year time steps, we divide the 5-yr running sum of mortalities in Table 13 by five to get the average number of mortalities per year. As this annual mortality would be most representative of the mid-point of the 5-yr interval, we assign the value to the third year of the 5-yr interval. For example, from 2022 to 2026 we expect a total of 1,517 mortalities (Table 13). This implies an average of 303 mortalities per year (1,517/5 = 303) and we assign this level of mortality to the year 2024. As noted in Section 2, Status of Listed Resources, we assume the population abundance in 2016 was 775,214 sharks and increasing at a rate of 7.66% per year (r = 0.0738). Again using the exponential growth equation we project abundances from 2016 to 2041 (the mid-points of the five yr running sum years from 2020 to 2024 through 2039 to 2043). Table 14 summarizes the results of this analysis. Given that we assume both the population and annual captures are increasing by 7.66% per year, the percent of the population abundance captured and killed each year remains constant at 0.03% and 0.02% respectively (Table 14). Adding the annual mortalities back to the annual abundances, we calculated a new population growth rate of 7.68% per year. The difference in the new population growth rate from 7.66% is not biologically meaningful. Given the high natural variability in the factors that determine year-to-year population growth, this difference is also not detectable with our predictive capabilities.

This analysis considers the population abundance estimated only for the WCPO portion of the Pacific oceanic whitetip population. If we expanded the analysis to our estimates of the full

Pacific population, the impact to the population would be lower than assessed for the WCPO portion, assuming a similar population trajectory. We consider the implications of this effect in Section 5, Integration and Synthesis.

Table 14. Impact of U.S. WCPO purse seine captures and mortalities on WCPO oceanic whitetip shark abundance

5-yr RS Years	Mid-point Year	Abundance	Annual Captures	Annual Mortalities	Percent Captured	Percent Killed
2023-2027	2025	1,506,190	505	325	0.03	0.02
2024-2028	2026	1,621,551	543	349	0.03	0.02
2025-2029	2027	1,745,748	585	376	0.03	0.02
2026-2030	2028	1,879,457	630	405	0.03	0.02
2027-2031	2029	2,023,407	678	436	0.03	0.02
2028-2032	2030	2,178,383	730	469	0.03	0.02
2029-2033	2031	2,345,229	786	505	0.03	0.02
2030-2034	2032	2,524,854	846	544	0.03	0.02
2031-2035	2033	2,718,236	911	586	0.03	0.02
2032-2036	2034	2,926,430	980	630	0.03	0.02
2033-2037	2035	3,150,570	1055	678	0.03	0.02
2034-2038	2036	3,391,877	1136	730	0.03	0.02
2035-2039	2037	3,651,666	1223	786	0.03	0.02
2036-2040	2038	3,931,352	1317	847	0.03	0.02
2037-2041	2039	4,232,460	1418	912	0.03	0.02
2038-2042	2040	4,556,630	1527	982	0.03	0.02
2039-2043	2041	4,905,629	1643	1056	0.03	0.02
2040-2044	2042	5,281,358	1769	1137	0.03	0.02

5 CUMULATIVE EFFECTS

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. 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 U.S., which would preclude the possibility of future state, tribal, or local action that would not require some form of federal funding or authorization. NMFS conducted electronic searches of business journals, trade journals, and newspapers using Google scholar, WorldCat, and other electronic search engines. Those searches produced no evidence of future private action in the action area that would not require federal authorization or funding and is reasonably certain to occur.

While we considered various state-managed vessel-based fisheries that exist in American Samoa that fish pelagic waters (up to 25 miles offshore). We do not believe they will overlap in geographical space for fishing activities and would only overlap when vessels from this fishery transit to American Samoan ports. Craig et al. (2013) discuss three artisanal fisheries, the pelagic troll fishery, the bottom handline fishery, and a pelagic tournament fishery. Additionally, a small boat (alia) longline fleet has operated in American Samoa since the 1990s (Kleiber and Leong 2018). Nearshore (mostly recreational) fisheries such as shallow bottomfishing, reef trolling, spearfishing, whipping/casting, trapping, and netting also occur (Loomis et al., 2019). Again, we do not believe any of these fisheries would overlap where fishing activities from this fishery would occur. The same could be said for recreational boating around American Samoa as well. As a result, NMFS is not aware of any actions that are likely to occur in the action area during the foreseeable future.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline vs. cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the Environmental Baseline (Section 2.1).

6 INTEGRATION AND SYNTHESIS

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the Effects of the Action (Section 4) and the Cumulative Effects (Section 5) to the Environmental Baseline (Section 3), and in light of the Status of the Listed Resources (Section 2), formulate our opinion as to whether the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution.

6.1 Oceanic Whitetip Shark

Oceanic whitetip sharks are listed as threatened throughout their range and were classified as overfished, experiencing substantial declines in abundance, total biomass, spawning biomass, and recruitment levels in previous status assessments (Rice and Harley 2012; Futerman 2018; Trembley-Boyer et al., 2019). The potential impacts from climate change on oceanic whitetip shark habitat are highly uncertain, but given their broad distribution in various habitat types, these species may be able to 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 NMFS (2024a) believe they are likely to be minimal.

While the primary threat to the oceanic whitetip shark's survival and recovery is fishing, particularly their capture and mortality occurring in longline and purse seine fisheries, we recognize that the Hawaii DSLL fishery and other WCPO longline and purse seine fisheries in the action area and throughout the species range have been undertaking a number of measures to reduce capture and mortality from capture in fisheries. The Hawaii DSLL fishery converted to 100% monofilament leaders, and also placed greater emphasis on removing trailing gear to improve capture outcomes. Bigelow et al. (2022) provide evidence that WCPO oceanic whitetip shark population is now increasing due, in part, to these measures. More broadly, WCPFC's CMM 2022-04 prohibits the retention of oceanic whitetip sharks, and includes additional measures on minimizing bycatch (including some gear restrictions), implementing safe release practices, and prohibiting wire leaders and shark lines for longline fishing.

In Section 2, Status of the Listed Resources, we present evidence of increasing CPUEs across WCPO and East Pacific fisheries, however these are increasing at rates above the estimated R_{max} for the species and may not be sustainable. We therefore conducted our risk assessment based on the assumption of the population increasing at a rate of 7.66% per year which is based on the 2016 and 2031 start and end points of modeled projections of Bigelow et al. (2022). This rate of increase would be inclusive of historic mortalities from the U.S. WCPO purse seine fishery under its current operation since oceanic whitetip sharks were prohibited from being retained in 2012.

As discussed in Section 4, Effects of the Action, we anticipate captures of the threatened oceanic whitetip shark in the U.S. WCPO purse seine fishery to increase as the population increases into the foreseeable future. Exponential growth equations describe the growth rates of depleted but recovering populations well, however, eventually density-dependent factors will slow rates of recovery. Considering this, we make projections out to 20 years but acknowledge that these projections are based on specific assumptions: 1) the population is increasing at 7.66% per year and will continue to do so over the next 20 years; and 2) capture rates in the fishery will be consistent with this rate of increase over the next 20 years. The status of this population must be closely monitored through fishery observer data for both purse seine and longline fisheries and applied to stock assessments to ensure the rate of captures does not out-pace the rate of population recovery, acknowledging that there will be considerable interannual variability in captures and capture rates. Given these assumptions, our analysis suggests the WCPO purse seine fishery will capture a mean of 585 sharks per year from 2025 to 2029 with 376 anticipated mortalities. From 2039 to 2043 we expect an annual mean of 1,655 sharks captured per year based on the estimated 7.66% per year increase in both the population and fisher captures, with 1,064 mortalities.

Even when we treat the WCPO stock estimate (775,000 individuals in 2016) as if it was a reasonable minimum estimate for the entire Pacific population, the U.S WCPO purse seine fishery only removes 0.02% of the current population annually over the next 20 years. Without the mortalities from the U.S WCPO purse seine, the population trends would increase from the baseline of 7.66% per year to 7.68% per year. This difference in rate is not biologically meaningful. Given the high natural variability in the factors that determine year-to-year population growth, this difference is also not detectable with our predictive capabilities.

Because the population trend will continue to be positive with no discernable change from baseline, we are reasonably certain the proposed action will not cause material changes having biological consequences to the species' numbers, reproduction, or distribution. In accordance with Section 1.3.1 (Jeopardy Analyses) above, we are reasonably certain the U.S WCPO purse seine fishery will not reduce appreciably the likelihood of the survival or recovery of oceanic whitetip sharks in the wild by reducing their reproduction, numbers, or distribution.

7 CONCLUSION

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of oceanic whitetip sharks.

8 Incidental Take Statement

Section 9(a) of the ESA prohibits taking of endangered species. In the case of threatened species, section 4(d) of the ESA leaves it to the Secretary's discretion whether and to what extent to extend the statutory 9(a) take prohibitions, and directs the agency to issue regulations it considers necessary and advisable for the conservation of the species. The proposed action results in the incidental take of threatened oceanic whitetip sharks. Currently there is no take prohibition for oceanic white tip sharks, thus an ITS is not required to provide an exemption to the prohibition of take under section 9 of the ESA for this species. However, consistent with the decision in *Center for Biological Diversity v. Salazar*, 695 F.3d 893 (9th Cir. 2012), we have included an ITS to serve as a check on the no-jeopardy conclusion by providing a reinitiation trigger so the action does not jeopardize the species if the level of take analyzed in the biological opinion is exceeded. In addition, on May 14, 2024, NMFS issued a proposed rule to issue protective regulations under section 4(d) which would apply to all of the prohibitions listed under sections 9(a)(1)(A) to 9(a)(1)(G) to oceanic whitetip sharks which will require an incidental take statement once the rule is final (89 FR 41917).

The term "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). The proposed action results in the incidental take of oceanic whitetip sharks. 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 this incidental take statement (ITS).

8.1 Amount or Extent of Take

Section 7 regulations require NMFS to specify the impact of incidental taking as the amount or extent of such taking (50 C.F.R. 402.14(i)(1)(i)). The amount of take represents the number of individuals that are expected to be taken by actions.

In the 2021 biological opinion, NMFS determined that incidental take is reasonably certain to occur as described in Table 15.

The number of takes occurring annually is highly variable due to fluctuations in fishery target-species distribution, ESA-listed species distribution and abundance, fishing effort, sea surface temperatures, ocean currents, and other factors that are difficult to predict. As a result, using the estimated mean annual take levels as reinitiation triggers is not reasonable or practical. Warden et al. (2015) state "when the population is large compared to the incidental mortality, frequent (e.g., annual) monitoring is not likely to produce results that are substantially different from the previous assessment. Less frequent but more comprehensive assessments, which explicitly address uncertainty, may provide more reliable information." For these reasons, and based on our experience monitoring fisheries, we believe that the maximum 5-year running sum is the most appropriate metric for meaningful tracking of take with respect to the ITS.

Year to year variation in capture numbers is expected, and managing the incidental take by the 5-year running sum accounts for this annual variation, allowing for years with higher than average captures and years with lower than average captures. Exceeding the maximum 5-year running sum (Table 15) over any five consecutive years is a reinitiation trigger.

This does not imply we will wait five years to assess exceedance of take. Exceedance of capture numbers specified in Table 15 anytime with the 5-year timeframe will be a reinitiation trigger. As an example, the capture of more than 2,736 oceanic whitetip sharks between 2024 and 2026 would be a reinitiation trigger; we would not wait until the full 5-year time period of 2024-2028 expired before reinitiation.

We will use all 2025 captures as year one for tracking this ITS, acknowledging that any captures prior to implementation of this supplemental biological opinion are not exempted by this ITS. Therefore, to determine if reinitiation is warranted, the first 5-year term of the ITS will include captures from January 1, 2025 to December 31, 2029 (the 2025-2029 5-year Timeframe in Table 15).

Table 15. Anticipated take of oceanic whitetip sharks by the U.S. WCPO purse seine fishery. The captures are given as 5-year running sums that increase over time.

5-year Timeframe (January 1 of start year to December 31 of end year)	Captures Over 5-yr Timeframe
2025-2029	2945
2030-2034	4260
2035-2039	6161
2040-2044	8847

8.2 Reasonable and Prudent Measures

Reasonable and prudent measures refer to those actions the Director considers necessary or appropriate to minimize the impacts of the incidental take on the species (50 CFR 402.02). We determine that the following reasonable and prudent measures, as implemented by the terms and conditions that follow, are necessary and appropriate to minimize the impacts of the proposed action on threatened and endangered species and to monitor the level and nature of any incidental takes.

1. NMFS shall ensure that the U.S. WCPO purse seine fishery has a monitoring and reporting program sufficient to confirm that extent of take is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

8.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action may lapse.

1. The following terms and conditions implement Reasonable and Prudent Measure No. 1:
    a. NMFS shall work with the relevant regional observer programs and technical experts such as the SPC, to improve the collection of standardized information

regarding the incidental capture, injury, and mortality of oceanic whitetip sharks particularly with respect to species identification, fate, condition, handling, and set information for interactions with protected species.

b. NMFS shall work with the relevant regional observer programs to explore carcass/sample retention of oceanic whitetip sharks for scientific purposes to illustrate the life history characteristics of animals encountered in this fishery before returning them to the ocean. This shall include exploring methods to train observers in the collection of genetic samples in order to determine which population(s) are affected by the fishery.

c. NMFS shall, on an annual basis, acquire and analyze all available protected species data from the U.S. WCPO purse seine fishery, to monitor actual take of oceanic whitetip sharks against the take exemptions provided in this supplemental biological opinion to serve as a check on the agency's decision that the incidental take of these species is not likely to jeopardize their continued existence. Unidentified animals should be prorated appropriately to ESA-listed species. CPUE will be calculated as part of this analysis and trends will be tracked and included in the report. This report of the previous year's actual and estimated take along with CPUE trends should be provided to NMFS PRD within 6 months of NMFS receiving the data.

Conservation Recommendations

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

1. NMFS should develop and implement minimization measures to reduce the incidental capture and mortality of ESA-listed sharks in the United States WCPO purse seine fishery.
    a. NMFS should work with other WCPFC members to assess whether increases in the survival of oceanic whitetip sharks or Indo-West Pacific scalloped hammerhead sharks that interact with the United States WCPO purse seine fishery could be made through amendments to the CMM, and work with PRD to implement any appropriate revisions.
2. NMFS IFD should work with WCPFC members and other entities to improve efforts to mitigate marine pollution in the WCPO and from the United States WCPO purse seine fishery.

8.4 Reinitiation of Consultation

This concludes formal consultation for the authorization of the U.S. WCPO purse seine fishery. Under 50 CFR 402.16(a), reinitiation of consultation is required and shall be requested by the Federal agency, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

1. If the amount or extent of taking specified in the incidental take statement is exceeded;

2. If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
3. If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the supplemental biological opinion or written concurrence; or
4. If a new species is listed or critical habitat designated that may be affected by the identified action.

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