WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

DRAFT

Amendment to the Fishery Ecosystem Plan for the Pelagic Fisheries of the Western Pacific Region Including a Draft Environmental Assessment

Framework to Manage Loggerhead and Leatherback Sea Turtle Interactions in the Hawaii Shallow-set Longline Fishery

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Cover Page

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Including a Draft Environmental Assessment

Framework to Manage Loggerhead and Leatherback Sea Turtle Interactions in the Hawaii Shallow-set Longline Fishery

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Abstract

The Hawaii shallow-set longline fishery, managed under the Western Pacific Regional Fishery Management Council's Pelagic Fishery Ecosystem Plan (FEP), reduced loggerhead and leatherback turtle interactions by approximately 90% through the implementation of new technologies (large circle hooks and mackerel-type bait). Regulatory Amendment 3 to the Pelagic Fishery Management Plan (FMP) that established the requirements for these gear measures also established annual interaction limits for loggerhead and leatherback turtles ("hard caps"), which, if reached, would trigger the closure of the fishery for the remainder of the calendar year. The existing annual fleet-wide hard caps, firsts implemented in 2004, prevent loggerhead and leatherback takes above the specified limit, but do not provide early detection or response to higher interaction rates that may indicate a potential for higher impacts to sea turtle populations or a fishery closure early in the calendar year. Effective management of loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery should consider responsive measures that can help ensure year-round operations while addressing the needs for protected species conservation. The Council at its 173rd Meeting recommended amending the Pelagic FEP to establish a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery that would provide managers and fishery participants with the necessary tools to respond to and mitigate fluctuations in loggerhead and leatherback turtle interactions, so as to ensure a continued supply of fresh swordfish to U.S. markets, consistent with the conservation needs of these sea turtles. The Council at its 175th Meeting will consider taking final action on additional mitigation measures for the Western Pacific leatherback turtles under the management framework recommended at the 173rd Meeting.

This draft Environmental Assessment (EA) evaluates potential environmental impacts of the following alternatives:

Alternative 1: No Action (Fishery operates under loggerhead hard cap limit of 17 pursuant to court order)

Alternative 2: Establish a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery

Sub-Alternative 2A: Single-year hard cap limits and individual trip limits for loggerhead and leatherback turtles (*173rd Council meeting preferred alternative*)

Sub-Alternative 2B: Single-year hard cap limits, individual trip limits and individual vessel limits for loggerhead and leatherback turtles

Sub-Alternative 2C: Single-year hard cap limits, individual trip limits, individual vessel limits, and in-season temporary closure upon reaching a specified percentage of the single-year hard cap for loggerhead and leatherback turtles

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1 INTRODUCTION

1.1 Background Information

The Western Pacific Fishery Management Council (Council) and the National Marine Fisheries Service (NMFS) manage fishing for swordfish (*Xiphias gladius*) and other pelagic management unit species (PMUS) in the Exclusive Economic Zone (EEZ or federal waters, generally 3-200 nautical miles or nm from shore) around American Samoa, Guam, the Commonwealth of the Northern Mariana Islands (CNMI) and Hawaii, and on the high seas through the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region (Pelagic FEP) as authorized by the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. § 1801 *et seq.*).

Regulatory Amendment 3 to the Pelagic Fishery Management Plan (FMP; currently the Pelagic Fishery Ecosystem Plan (FEP)) established a model Hawaii shallow-set longline swordfish fishery and implemented a suite of measures in 2004 to achieve optimum yield while not jeopardizing the long term existence of sea turtles and other listed species (69 FR 17329, April 2, 2004). The measures focused on reducing the number and severity of interactions by implementing new technologies (large circle hooks and mackerel-type bait) to reduce sea turtle interaction rates and requiring Hawaii longline vessels to carry approved de-hooking devices to maximize the post-hooking survival. The amendment also established a maximum effort limit of 2,120 shallow-sets per year administered through a set certificate program[1] and annual interaction limits for loggerhead and leatherback turtles ("hard caps"), which, if reached, would trigger the closure of the fishery for the remainder of the calendar year. These measures were intended to control fishing effort and sea turtle interactions while information was being gathered on the model fishery.

The fishery has been subject to 100% observer coverage since 2004, providing NMFS and the Council with over a decade's worth of information available to assess the effectiveness of the circle hooks and mackerel-type bait intended to reduce sea turtle interactions. Evaluation of the effectiveness of these gear requirements in the shallow-set fishery for the period of May 2004 through March 2007 showed that sea turtle interaction rates were reduced by approximately 90 percent for loggerheads, 85 percent for leatherbacks, and 89 percent for combined species, compared to the period (1994-2001) when the fishery was operating without such gear (Gilman and Kobayashi 2007). A more recent analysis including observer data through 2014 show that the gear measures continue to be effective, with reductions in leatherback and loggerhead turtle interaction rates of 84% and 95%, respectively, for the post-regulation period (Swimmer et al. 2017).

Since the turtle mitigation measures were first implemented in 2004, fishing effort in the shallow-set fishery peaked in 2010 and has since declined. The number of vessels participating in the fishery declined from a high of 35 vessels in 2006 to a low of 15 vessels in 2016. Total catch and adjusted revenue have also declined, with total catch peaking in 2008 at 4.3 million pounds and adjusted revenue peaking in 2007 at $8.5 million. The shallow-set longline fishery

[1] In 2008, the Council recommended and NMFS approved removal of the annual effort set limit to optimize the harvest of swordfish without jeopardizing sea turtle populations (74 FR 65460, December 10, 2009).

targeting swordfish is highly seasonal, with effort typically increasing in October and peaking in March.

The fishery has reached the hard cap twice since its implementation in 2004: once in 2006 when the loggerhead hard cap of 17 turtles was reached (fishery closed on March 20, 2006); and once in 2011 when the leatherback hard cap of 16 turtles was reached (fishery closed on November 18, 2011). The hard cap limits are set equal to the expected amount of incidental take set forth in the incidental take statement (ITS) included in the Biological Opinion (BiOp) issued by the National Marine Fisheries Service (NMFS) for the continued operation of the shallow-set fishery, pursuant to Section 7 of the Endangered Species Act (ESA). The limits themselves do not necessarily have biological significance for the species' survival and recovery, but they help ensure that impacts do not exceed a threshold that triggers reinitiation of consultation.

When a hard cap limit is reached, the consequence to the fishery is closure for the remainder of the calendar year. Accordingly, a hard cap closure under the existing hard cap measure, especially during the peak Hawaii swordfish season, may reduce fishery yields and create a disruption in the U.S. domestic swordfish market. For example, the fishery's catch and revenue for 2006 when the fishery closed in March from reaching the loggerhead hard cap limit was 37% and 46% lower, respectively, compared to one year before and after the closure year.

Moreover, market spillover and transferred effects of the hard cap measure and associated closures may increase impacts to sea turtle populations for the U.S. swordfish market. Spillover and transferred effects may result from the market replacement of domestic swordfish with imported swordfish from countries with higher bycatch rates, as well as from production displacement of U.S. vessels with foreign vessels in the same general fishing area. Studies have demonstrated that the 2001-2004 closure of the Hawaii shallow-set longline fishery resulted in an increase of 2,882 sea turtle interactions associated with swordfish consumed in the U.S. (Rausser et al. 2009), and the subsequent reopening of the fishery contributed to 842 to 1,826 fewer sea turtle interactions over the period of 2005-2008 (Chan and Pan 2012).

The average annual number of observed interactions for the 2005-2016 period following the reopening of the fishery was 9.9 loggerhead turtles (range = 0-17) and 7.8 leatherback turtles (range = 2-16) per year. Loggerhead turtle interactions in the Hawaii shallow-set longline fishery in 2017 and 2018 were higher than levels observed since the fishery reopened in 2004 through 2016. The total number of loggerhead interactions for 2017 was 21, and 33 loggerhead interactions were observed from January to May 2018. While these numbers were lower than the hard cap limit of 34 loggerhead turtles based on the 2012 BiOp, they demonstrated that the fishery has the potential to experience higher interaction levels than the long-term average (12.4 loggerhead turtles annually from 2005-2018) in a short period. During the period of high loggerhead turtle interactions, a small number of vessels interacted with majority of the observed loggerhead turtles, while a large proportion of the shallow-set vessels targeting swordfish during the period of high interactions also had at least one observed interaction.

NMFS Pacific Islands Fisheries Science Center (PIFSC) conducted a preliminary characterization of the recent loggerhead turtle interactions in the Hawaii shallow-set longline fishery compared to the years prior (PIFSC unpublished data). The analysis indicated that the

spatial distribution of the interactions and fishing effort during the high interaction period in 2017 and 2018 were not anomalous compared to previous years, and there was no apparent change in other operational characteristics within the fishery (e.g., gear configuration, bait, timing, duration) to explain the higher loggerhead interaction rates. Additionally, the average size of individual turtles observed in 2017 and 2018 was consistent with the average size observed in previous years. PIFSC continues to explore the linkage of loggerhead turtle interactions in the Hawaii shallow-set longline fishery to hatchling production at nesting beaches in Japan as well as additional examination of the oceanographic environment and fishing behavior.

The existing annual fleet-wide hard caps are useful to prevent takes above the specified limit, but do not provide early detection or response to higher interaction rates when the number of interactions is below the hard cap limit. Effective management of protected species interactions should consider responsive measures that can help ensure year-round operations while addressing the needs for protected species conservation. The recent spike in loggerhead turtle interactions suggest the need for a more robust suite of conservation and management framework that can respond to higher interaction rates, hotspots and fluctuations in sea turtle interactions that may indicate a potential for higher impacts to sea turtle populations or a fishery closure early in the calendar year. Development of a more responsive management approach would further minimize impacts to sea turtles, while helping to ensure the year round supply of fresh swordfish to meet market demands.

1.1.1 December 2017 Ninth Circuit Court Decision on the 2012 Biological Opinion and Associated Stipulated Settlement Agreement and Court Order

On December 27, 2017, the Ninth Circuit Court of Appeals issued a 2-1 opinion finding that NMFS's 2012 BiOp's no-jeopardy determination and associated incidental take statement for the loggerhead turtle to be arbitrary and capricious.[2] The majority found that NMFS' no-jeopardy determination was inconsistent with a climate population viability assessment that projected future decline in the loggerhead population. The court upheld NMFS's no-jeopardy determination and incidental take statement for the leatherback turtle.

On May 4, 2018, the portion of the 2012 BiOp and accompanying incidental take statement relating to loggerhead turtles was vacated and remanded to NMFS under a stipulated settlement agreement and court order. NMFS agreed to close the fishery for the remainder of 2018, and when the fishery re-opens January 1, 2019, to reinstate a hard cap limit of 17 for the loggerhead unless a new BiOp and hard cap rule have been implemented by NMFS. This limit of 17 is based on the incidental take statement included in a 2004 BiOp. The court-ordered closure of the Hawaii shallow-set longline fishery became effective May 8, 2018. The fishery's loggerhead turtle interactions for 2018 were 33 at the time of the closure, and thus the fishery was closed prior to reaching the hard cap limit of 34 turtles.

This amendment to the Pelagic FEP includes measures for specifying hard cap limits for loggerhead and leatherback turtles. The hard caps were established in 2004 under Regulatory

[2] *Turtle Island Restoration Network, et al. v. U.S. Dep't of Commerce*, 878 F.3d 725 (9th Cir. 2017).

Amendment 3 of the Pelagic FMP, and are not implemented as a requirement under the ESA.[3] This amendment, developed pursuant to the MSA, therefore provides the authority for establishing a revised hard cap limit for loggerhead turtles based on the new BiOp.

1.1.2 Reinitiation of ESA Consultation for the Hawaii Shallow-set Longline Fishery

NMFS reinitiated ESA consultation on the fishery on April 20, 2018 due to the fishery's first-documented interaction with a threatened Guadalupe fur seal, issuance of a final rule listing 11 new green sea turtle distinct population segments (DPSs), the listing of two new species as threatened (oceanic whitetip shark and giant manta ray), and the fishery's exceedance of the incidental take statement for olive ridley sea turtles. In support of its request for reinitiation, NMFS prepared a biological evaluation (BE) that predicts the annual anticipated level of interactions by the fishery to be equal to or less than 37 for loggerhead turtles and equal to or less than 21 for leatherback turtles, based on the 95th percentile values of the predicted distribution.

1.1.3 Initial Council Actions

In response to the relatively stable loggerhead and leatherback turtle interactions from 2004-2016 and the lack of growth in fishing effort in the Hawaii shallow-set longline fishery, the Council, at its 171st Meeting in October 2017, reviewed whether the continuation of sea turtle hard caps is necessary to achieve the management objectives of Pelagic FEP. The Council reviewed information on the history of the hard cap measure, effectiveness of the gear requirements implemented in 2004, interaction data since the implementation of hard caps, and the performance of the fishery. The Council recommended development of a draft amendment to the Pelagic FEP considering management options for hard caps and selecting as its preliminary preferred alternative the removal of the hard cap measure. Following the 171st Meeting, Council staff initiated development of the draft amendment, including additional alternatives that would establish a framework to implement more responsive measures that would ensure year-round operations while minimizing impacts to sea turtle populations.

Following the higher loggerhead turtle interaction rates in late 2017 and early 2018, and the Ninth Circuit Court Decision in December 2017, the Council at its 172nd Meeting in March 2018 considered a revised set of options that includes the development of a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery. The Council recommended development of a framework that may include, among other measures, a) specification of hard caps; b) in-season measures to implement a temporary closure when a certain proportion of the loggerhead or leatherback limit is reached; c) real-time spatial management measures to monitor and manage interaction hotspots and fluctuations; and d) establishment of a fleet communication program to facilitate implementation of real-time spatial management measures and dissemination of interaction information to the fleet. The Council also directed staff to work with Hawaii shallow-set longline fishery participants to consider an industry-implemented cooperative framework where industry has discretion to manage fleet-wide sea turtle interactions based on hard caps identified by the Council and NMFS, and to

[3] While the ESA requires reinitiation of Section 7 consultation when an ITS is exceeded, it does not require that the fishery suspend operations upon reaching an ITS, or require hard caps or other mechanisms to close the fishery.

identify communication pathways that may be implemented to provide more timely information to the fleet on sea turtle interactions.

In response to the Council directive at its 172nd Meeting, Council staff worked with SSC members and PIRO Sustainable Fisheries Division to review examples of industry-led bycatch management programs implemented in Alaska, West Coast and Atlantic fisheries. Additionally, the Council and the Hawaii Longline Association convened an industry workshop on May 4, 2018, on the management of sea turtle interactions in the Hawaii shallow-set longline fishery to review examples from other fisheries, and discuss potential application of industry-led programs to the Hawaii shallow-set longline fishery. Workshop discussions suggested that participants of the Hawaii shallow-set longline fishery could start by entering into an information sharing agreement that would set up a data sharing and fleet communication platform. Under the agreement, the vessels could provide data related to sea turtle interactions and other relevant information to a third party and for that third party to provide data summaries back to the fleet in accordance with the terms of the agreement. The agreement could specify the types of data the participants would be willing to share with other vessels so that information that would assist vessels with sea turtle avoidance would be shared among the participants to the agreement while protecting proprietary fishing information. The agreement could be further developed in subsequent years to incrementally implement bycatch avoidance strategies (e.g., rolling hotspots) as more information is gathered through the data sharing platform. The review of examples from other fisheries and workshop discussions also identified potential regulatory structures to incentivize development and encourage participation in industry-implemented sea turtle avoidance strategies, such as through two-tiered interaction limits in which a lower limit would be established for vessels that do not participate in those initiatives.

The Council, at its 173rd Meeting in June 2018, considered measures to include in the framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery. The Council recommended an amendment to the Pelagic FEP to establish a management framework for the Hawaii shallow-set longline fishery that consists of 1) annual limits on the number North Pacific loggerhead and leatherback turtle interactions consistent with the anticipated level of annual interactions that is set forth in the current valid biological opinion; and 2) individual trip interaction limits for loggerhead and leatherback turtles. The Council also recommended specifications under the framework as follows: 1) Annual limit of 37 North Pacific loggerhead and 21 leatherback turtles; and 2) individual trip limit of 5 North Pacific loggerhead turtles.

At its 174th Meeting in October 2018, the Council received information on a new population vulnerability assessment (PVA) for loggerhead and leatherback turtles prepared for the ongoing Section 7 consultation. The PVA indicated that Western Pacific leatherback turtle population continues to show a long-term declining trend.

The Council at its 175th Meeting on December 17, 2018, will consider taking final action on additional mitigation measures for the Western Pacific leatherback turtles under the management framework recommended at the 173rd Meeting, taking into consideration the status of the Western Pacific leatherback turtle, including the results of the PVA model.

1.2 Proposed Action

The proposed action is to amend the Pelagic FEP to establish a management framework for the Hawaii shallow-set longline fishery that consists of the following measures:

1. Establish an annual limit on the number of North Pacific loggerhead and leatherback turtle interactions that the Council will recommend to NMFS consistent with the anticipated level of annual interactions that is set forth in the current valid biological opinion. Once either one of these interaction limits is reached, the fishery closes for the remainder of the calendar year.
2. Establish individual trip interaction limits for loggerhead and leatherback turtles for the Hawaii limited entry permit vessels that declare their trips as a shallow-set trip
    i. Upon determining that a vessel has reached either the loggerhead or leatherback turtle trip interaction limit based on data from NMFS observers, shallow-set vessels will be required to return to port without making additional sets.
    ii. The vessel may resume shallow-set fishing operations after returning to port and providing the required 72-hour notification under 50 CFR 665.803 prior to departure.
    iii. The Council may make recommendations to NMFS to revise the individual trip limits upon periodic review of the effectiveness of the limits.

The proposed action would also apply the framework to implement the following specifications:

a. Annual limit of 37 North Pacific loggerhead and 21 leatherback turtles; and
b. Individual trip limit of 5 North Pacific loggerhead turtles.

The Council at its 175th Meeting may recommend additional mitigation measures for the Western Pacific leatherback turtles under the proposed management framework.

1.3 Purpose and Need for Action

The purpose of this action is to develop a framework for effectively managing impacts to leatherback and loggerhead sea turtles from the Hawaii shallow-set longline fishery, consistent with the requirements of the ESA and the MSA, while maintaining fishing opportunities during peak swordfish season (October through March). The existing annual fleet-wide hard caps prevent loggerhead and leatherback takes above the specified limit, but do not provide early detection or response to higher interaction rates that may indicate a potential for higher impacts to sea turtle populations or a fishery closure early in the calendar year. Effective management of loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery should consider responsive measures that can help ensure year-round operations while addressing the needs for protected species conservation.

Specifically, the framework should include measures intended to detect and mitigate unusually high interaction rates, and to minimize further interactions while helping to ensure year-round supply of swordfish to meet domestic demand.

This action is needed to provide managers and fishery participants with the necessary tools to respond to and mitigate fluctuations in loggerhead and leatherback turtle interactions, so as to

ensure a continued supply of fresh swordfish to U.S. markets, consistent with the conservation needs of these sea turtles.

1.4 Action Area

The action area is the area of operation of the Hawaii shallow-set longline fishery, which include the US Exclusive Economic Zone (EEZ) around Hawaii and high seas to the north and northeast of the main Hawaiian Islands (MHI). Longline fishing is prohibited in the MHI longline fishing prohibited area ranging from 50-75 nm from shore, the Northwestern Hawaiian Islands (NWHI) protected species zone, and the Papahanaumokuakea Marine National Monument. From 2009-2016, the fishery operated in an area between 180°- 125° W and 17°- 45° N (Figure 1).

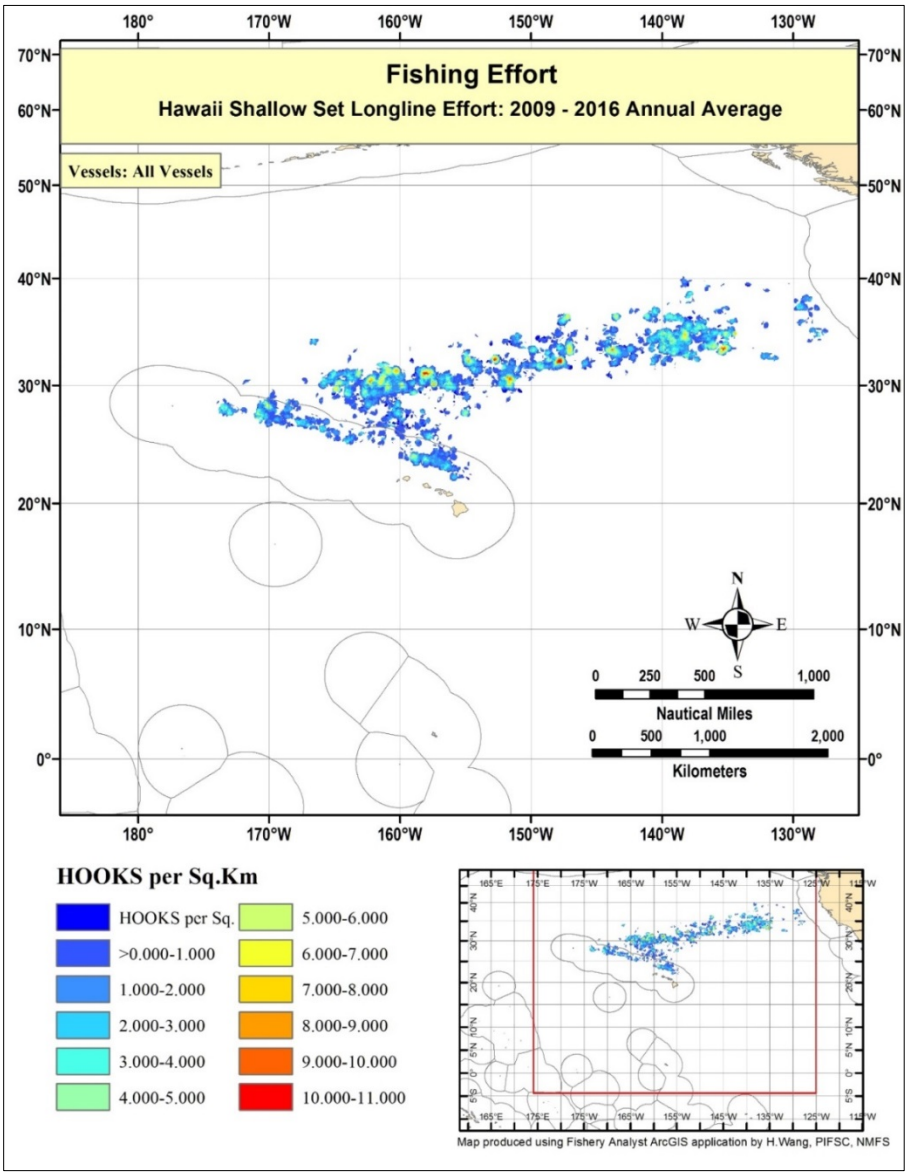

Figure 1. Location of shallow sets made by the Hawaii longline fishery from 2009– 2016. Some sets do not appear on the map due to confidentiality. (PIFSC Fisheries Research and Monitoring Division, 5/9/2017).

1.5 Decision(s) to be Made

This document will support a decision by the Regional Administrator (RA) of the NMFS Pacific Island Region, on behalf of the Secretary of Commerce, whether to approve, disapprove, or partially approve the Council's recommendation. The RA will also use the information in this EA to make a determination about whether the proposed action would constitute a major federal action that has the potential to significantly affect the quality of the environment. If NMFS determines the action would *not* significantly affect the quality of the environment, NMFS will prepare a Finding of No Significant Impact (FONSI). If NMFS determines the proposed action is a major federal action that would significantly affect the quality of the environment, NMFS would prepare an environmental impact statement (EIS) before taking action.

1.6 List of Preparers

Asuka Ishizaki, Protected Species Coordinator, WPFMC
Eric Kingma, International Fisheries, Enforcement, and NEPA Coordinator, WPFMC

1.7 Public Involvement

The Council and SSC discussed the management of sea turtle interactions in the Hawaii shallow-set longline fishery, including the development of a management framework at their meetings in October 2017, March 2018, and June 2018. The Council and the SSC considered the proposed action at the 173rd Meeting (June 11-13, 2018) and the 129th Meeting (June 6-8, 2018), respectively. The Council considered and discussed issues relevant to the development of the framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery, including sea turtle interaction data, recommendations of the Council's Statistical and Scientific Committee (SSC) made at the 129th SSC meeting, and other relevant information. All meetings of the Council and SSC were open to the public and advertised through notices in the *Federal Register*, and on the Council's website. The proposed action was additionally discussed at the following advisory group meetings: Protected Species Advisory Committee, April 19-20, 2018 (83 FR 13732); Pelagic Plan Team, May 14-16, 2018 (83 FR 17803); and Hawaii Archipelagic FEP Advisory Panel, May 24, 2018 (83 FR 20794). The public had opportunities to comment at the meetings on the proposed action.

At its 175th Meeting to be held on December 17, 2018, the Council will consider additional mitigation measures for the Western Pacific leatherback turtles under the management framework recommended at the 173rd Meeting. The Protected Species Advisory Committee will also meet on December 17, 2018, in advance of the Council meeting to review relevant information pertaining to the action. Both meetings are open to the public and publicized in the Hawaii media, Federal Register (83 FR 62309), and on the Council's website. See: www.wpcouncil.org for more information.

After Council action, NMFS will publish in the *Federal Register* the proposed FEP amendment and regulatory revisions to implement the proposed action. The public will have another opportunity to provide a comment on the action, and NMFS will consider public comments on the proposed action before making a decision on the FEP amendment and publishing the final

rule. Readers may find instructions on how to comment on the proposed rule and draft EA by searching on RIN at www.regulations.gov, or by contacting the responsible official or Council at the above addresses. NMFS must receive comments by the deadline specified in the proposed rule to be considered.

2 DESCRIPTION OF THE ALTERNATIVES CONSIDERED

2.1 Development of the Alternatives

The Council considered a range of options for developing a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery at its 172nd Meeting in March 2018 and 173rd meeting in June 2018. The Council considered a broad range of measures for the framework, including specification of hard caps (single year, multi-year, and removal of hard caps); in-season measures (individual vessel limits, individual trip limits, and in-season temporary closures); real-time spatial measures to manage interaction hotspots, and non-regulatory measures (fleet communication, sea turtle avoidance pilot program, and research to minimize trailing gear).

In discussing the action, the SSC and Council considered the following information:

- Anticipated level of interactions in the BE for SSLL consultation reinitiated on April 20, 2018;
- 9th Circuit Court decision settlement agreement;
- Potential development of industry initiative for a sea turtle avoidance program;
- Data on loggerhead and leatherback turtle interactions since 2004;
- Effort and economic performance trend of the fishery since 2004;
- Impacts of hard cap closure on the fishery's performance;
- Characteristics of the higher loggerhead interaction levels in 2017 and 2018, including:
    - Interactions concentrated in December 2017-January 2018;
    - Small number of vessels interacted with majority of the observed loggerhead turtles, while a large proportion of the shallow-set vessels targeting swordfish during the period of high interactions also had at least one observed interaction;
    - Spatial distribution of interactions in December 2017-January 2018 were not anomalous compared to previous years;
    - Proportion of loggerhead interactions occurring inside the TurtleWatch temperature band (17.5-18.5°C) and spatial effort distribution inside and outside the Turtle Watch temperature band were not anomalous compared to previous years;
    - Average size of loggerhead turtles captured in December 2017 and January 2018 were similar to the average size in December and January from previous years; and
    - PIFSC continues to explore the linkage of loggerhead turtle interactions in the Hawaii shallow-set longline fishery to hatchling production at nesting beaches in Japan as well as additional examination of the oceanographic environment and fishing behavior.

Based on the loggerhead and leatherback turtle interaction data and the economic performance of the fishery, the primary needs for managing loggerhead and leatherback turtle interactions were identified as follows:

- Mechanism for early detection and response to higher interaction rates that may indicate rapid accumulation of interactions, which would in turn reduce overall interactions in years with high interactions such as those seen in 2017-2018 for loggerhead turtles; and

- Minimize further interactions when such higher interaction rates are detected while helping to ensure year-round supply of swordfish to meet domestic demand.

In considering the options under the specification of hard caps, the Council selected the single-year hard cap limits over the multi-year hard cap limits due to potential impacts to the fishery and ability to ensure year-round supply of swordfish to meet domestic demand if the fishery reached a multi-year hard cap limit in the first year (e.g., the fishery would be closed for 18 months if a 2-year hard cap limit was reached in the first 6 months of the 2-year period).

In considering options for in-season measures, the Council selected the individual trip limit over the individual vessel limits on the basis that trip limits would provide sufficient economic incentive to minimize sea turtle interactions, individual trip and vessel limits were likely to result in similar reductions in interactions, and the additional burden of prohibiting vessels from fishing shallow-set if vessels reached the individual vessel limits would not result in substantial conservation gains. The SSC also noted that there are no clear trends that identify individual vessels with higher levels of interactions in comparison to other vessels in fleet.

The Council did not select the in-season temporary closure upon reaching a specified percentage of the single-year hard cap given that the additional biological benefits from such closures would be minimal if the fleet-wide hard cap limits or individual trip limits were included in the framework. The in-season temporary closures could additionally introduce the potential for significant administrative burden.

The Council did not select real-time spatial management measures to be included in the framework as the SSC found that information on real-time hotspots is not well known and not suitable for regulatory action. The SSC also noted that information is also lacking on fishing behavior and whether or not some vessels move to other locations as a result of sea turtle interactions.

The Council therefore recommended amending the Pelagic FEP to establish a management framework for the Hawaii shallow-set longline fishery that consists of the following measures:

1. Establish an annual limit on the number of North Pacific loggerhead and leatherback turtle interactions that the Council will recommend to NMFS consistent with the anticipated level of annual interactions that is set forth in the current valid biological opinion. Once either one of these interaction limits is reached, the fishery closes for the remainder of the calendar year.
2. Establish individual trip interaction limits for loggerhead and leatherback turtles for the Hawaii limited entry permit vessels that declare their trips as a shallow-set trip
    i. Upon determining that a vessel has reached either the loggerhead or leatherback turtle trip interaction limit based on data from NMFS observers, shallow-set vessels will be required to return to port without making additional sets.
    ii. The vessel may resume shallow-set fishing operations after returning to port and providing the required 72-hour notification under 50 CFR 665.803 prior to departure.
    iii. The Council may make recommendations to NMFS to revise the individual trip limits upon periodic review of the effectiveness of the limits.

Using the framework described above, the Council also recommended the following specifications:

a. Annual limit on the number of North Pacific loggerhead and leatherback turtle interactions
    i. The Council anticipates that NMFS will complete a new biological opinion not later than October 31, 2018. Based upon the current Biological Evaluation (BE), the Council anticipates that the new biological opinion will authorize take of no more than 37 North Pacific loggerheads and 21 leatherbacks. Accordingly, the Council recommends an annual limit of 37 North Pacific loggerheads and 21 leatherbacks, effective January 1, 2019.
    ii. The Council will review its recommendation if the new biological opinion results in a jeopardy decision or otherwise results in a different incidental take statement for North Pacific loggerheads or leatherbacks.
b. Specify the individual trip limit of 5 North Pacific loggerhead turtles. The Council does not recommend specifying leatherback turtle trip limit at this time. The Council further recommends annual monitoring of the effectiveness of the loggerhead turtle trip limits and the potential need for leatherback turtle limit specifications as part of the annual SAFE report review process.

The Council's recommendation to specify a loggerhead trip limit of 5 was based on the finding that it would provide a meaningful reduction in interactions in years with high interaction rates, such as those observed in 2017-2018. Observed sea turtle interaction data since 2004 indicate that most shallow-set longline trips with loggerhead turtle interactions have 1-2 interactions per trip, with a small proportion of trips having 4 or more interactions coinciding with years with the highest total fleet-wide interactions. Based on the PIFSC simulation applying different level of trip limits to past observed interactions, a limit of 5 loggerhead turtles per trip would have reduced loggerhead turtle interactions in 2018 by 30%, even without accounting for avoidance behavior by the vessels. The Council therefore determined that the loggerhead trip limit of 5 would provide a mechanism for early detection and response to higher interaction rates, and minimize further interactions when such higher interaction rates are detected while helping to ensure year-round supply of swordfish to meet domestic demand.

The Council at its 173rd Meeting did not recommend specification of individual trip limits for leatherbacks under the framework because observed interaction data from 2004-2018 indicated that individual trip limits do not have a potential to provide substantial reduction of leatherback turtle interactions if interaction patterns remain similar to past years.

The Council at its 175th Meeting will consider the merits of additional mitigation measures for leatherback turtles, given the long-term declining trend of the affected population.

2.2 Description of the Alternatives

This section describes the alternatives for developing a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery and the expected fishery outcomes that would occur under each alternative. Comparison of features of the Alternatives considered and possible fishery outcomes are provided in Table 14 and Table 15.

Features Common to All Alternatives

Under all alternatives considered, the Hawaii shallow-set longline fishery will continue to be managed under existing gear and handling requirements to minimize impacts to sea turtles. These include the required use of 18/0 or larger circle hooks with no more than 10° offset and mackerel-type bait, adherence to regulations for safe handling and release of sea turtles, and possession on board the vessel required turtle handling and dehooking gear. These measures have successfully reduced loggerhead and leatherback turtle interactions by approximately 90% since their implementation in 2004 (Gilman and Kobayashi 2007, Swimmer et al. 2017).

Under all alternatives considered, NMFS would continue to monitor the Hawaii shallow-set longline fishery under 100 percent observer coverage and provide near real-time data on loggerhead and leatherback turtle interactions. Current NMFS observer data collection protocols for the Hawaii longline fishery instruct observers to report sea turtle interactions using a satellite phone after each observation. These call-in reports are used to monitor the existing hard caps in near real-time.

2.3 Alternative 1: No Action (Fishery operates under loggerhead hard cap limit of 17 loggerhead and 26 leatherback interactions pursuant to court order)

Under Alternative 1, no changes would be made to the management measures and the fishery would continue to be managed under existing measures to minimize impacts to sea turtles, including gear and handling requirements, as well as the hard cap measure. The No Action Alternative would not implement any new management measures intended to respond to and mitigate fluctuations in loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery.

Under Alternative 1, the fishery would operate under hard cap limits of 17 loggerhead turtles per year and 26 leatherback turtles per year. The loggerhead and leatherback hard cap was previously 34 and 26, respectively, under the final rule implementing revised hard caps based on the 2012 BiOp (76 FR 60637, October 4, 2012). On May 4, 2018, the portion of the 2012 BiOp pertaining to loggerhead turtles was vacated and remanded to NMFS under a stipulated settlement agreement and court order. The Hawaii shallow-set longline fishery was closed effective May 8, 2018, until December 31, 2018, pursuant to the court order (83 FR 21939, May 11, 2018), and will reopen on January 1, 2019. The court order also required NMFS to promulgate a new regulation to become effective on January 1, 2019, establishing the hard cap limit for loggerhead turtles at 17 per year, consistent with the incidental take statement from the 2004 BiOp published on February 23, 2004, unless a new biological opinion is completed and a supporting hard cap rule is in place. NMFS published a final rule on October 2, 2018 revising the loggerhead hard cap limit pursuant to the court order (83 FR 49495). The court order does not

affect the leatherback turtle portions of the 2012 BiOp, and thus the existing hard cap limit of 26 leatherback turtles would remain in place.

Expected Fishery Outcomes

Under Alternative 2, the Hawaii shallow-set longline fishery would continue to be managed under existing measures to minimize impacts to sea turtles, including gear and handling requirements, as well as the hard cap measure. This alternative does not implement any measures for early detection of and response to higher interaction rates, hotspots, or fluctuations that may indicate a potential for higher impacts to sea turtle populations or a fishery closure early in the calendar year.

The court-ordered requirement to implement a loggerhead hard cap limit of 17 per year is based on the ITS in the 2004 BiOp. The ITS was based on predictive modeling of the anticipated level of interactions using 1994-1999 data (observer coverage of 3.3-5.8% annually for both shallow-set and deep-set longline fisheries) and applying the interaction reduction rates associated with circle hooks and mackerel bait from experimental results in the Atlantic (Kobayashi 2003). Since the Hawaii shallow-set longline fishery's reopening in April 2004, the fishery has accumulated 14 additional years of operational data under the circle hook and mackerel-type bait measures under 100% observer coverage. Additionally, improved information on loggerhead abundance and fishery impacts on population trends are available. Therefore, under the No Action Alternative, the fishery would operate under a conservative loggerhead hard cap limit that does not reflect the best available scientific information for the species' conservation status or needs.

Under this alternative, the fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year). Sea turtle interactions are likely to fluctuate substantially between years, and the fishery is likely to close early in the calendar year in high loggerhead interaction years due to the conservative hard cap limit. When a hard cap is reached, the fishery remains closed until December 31 of the same calendar year, which may delay the start of the fishing season that typically starts around October.

2.4 Alternative 2: Establish a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery

Under Alternative 2, the Council would amend the Pelagic FEP to establish a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery. As described in Section 2.1, the Council considered two primary management needs in developing the alternatives: mechanisms for early detection and response to higher interaction rates; and minimizing further interactions when higher interaction rates are detected while helping to ensure year-round supply of swordfish to meet domestic demand. The sub-alternatives in this framework build upon the single-year hard cap measure and consider a combination of additional measures to address these management needs. The individual measures considered under Alternative 2 are described in Section 2.4.1. The sub-alternatives for measures included in the framework are described in Section 2.4.2 and summarized in Table 15. The Council would maintain all other measures to minimize impacts to sea turtles, including the gear and handling requirements.

As previously described, the stipulated settlement agreement and court order of May 4, 2018, states that NMFS may not increase the loggerhead hard cap limit from the court-ordered reversion to a limit of 17 loggerhead turtles based on the 2004 BiOp except through a new regulation issued under applicable authority and after issuance of a new BiOp. The hard caps were established in 2004 under Regulatory Amendment 3 of the Pelagic FMP, and are not implemented as a requirement under the ESA. This amendment, developed pursuant to the MSA, therefore provides the authority for establishing a revised hard cap limit for loggerhead turtles based on the new BiOp. NMFS reinitiated consultation on the Hawaii shallow-set longline fishery on April 20, 2018.

2.4.1 Description of individual measures under Alternative 2

2.4.1.1 Single-year Hard Cap Limits

Under the framework, the Council may recommend specifications of annual fleet-wide interaction limits (hard cap limits) for loggerhead and leatherback turtles in the Hawaii shallow-set longline fishery. The Council's recommended hard cap limits would be consistent with the anticipated level of annual interactions set forth in the current BiOp. Once implemented, the limits would remain in place until such time that the Council makes a recommendation to NMFS to revise the specifications.

Loggerhead and leatherback turtle interactions are monitored in near real-time by NMFS observers. Current NMFS observer data collection protocols for the Hawaii longline fishery instruct observers to report sea turtle interactions using a satellite phone after each observation. Upon reaching either of the interaction limits, NMFS would close the Hawaii shallow-set longline fishery until the end of the calendar year in which the limit was reached.

Hard caps were first established in 2004 under Regulatory Amendment 3 of the Pelagic FMP as part of the measures intended to control fishing effort and sea turtle interactions while information was being gathered on the model swordfish longline fishery using circle hooks and mackerel-type bait. The hard cap measure is not required under the BiOp prepared pursuant to the ESA. While the ESA requires reinitiation of Section 7 consultation when an ITS is exceeded, it does not necessarily require that the fishery suspend operations upon reaching an ITS, or require hard caps or other mechanisms to close the fishery. The hard caps therefore provide additional assurance that fishery's impacts remain below a fixed level of interactions analyzed in the BiOp, and may eliminate the need for reinitiation of ESA consultation by preventing an exceedance of the ITS.

2.4.1.2 Individual Trip Limits

Under the framework, the Council may recommend specifications for individual trip limits on the number of loggerhead and leatherback turtle interactions for the Hawaii limited entry permit vessels that declare their trips as a shallow-set trip. The Council may recommend different trip limits for the two sea turtle species, and may also recommend not specifying a limit for one or both of the species. Once implemented, the limits would remain in place until such time that the Council makes a recommendation to NMFS to revise the specifications. The Council may make

recommendations to NMFS to revise the individual trip limits upon periodic review of the effectiveness of the limits.

The individual trip limit would apply to all trips declared as shallow-set gear under the Hawaii limited entry permit program and all interactions counting toward the individual trip limit would also count toward the fleet-wide hard cap limit. Upon determining that a vessel has reached either the loggerhead or leatherback turtle trip limit based on the data from NMFS observers, the vessel would be required to return to port without making additional sets. The vessel may resume shallow-set fishing operations after returning to port and providing the required 72-hour notification under 50 CFR 665.803 prior to departure.

Individual trip limits are intended to mitigate a large proportion of loggerhead and leatherback turtle interactions from occurring in a single trip. Observed sea turtle interaction data since 2004 indicate that trips with loggerhead turtle interactions typically have 1-2 interactions per trip in years with low fleet-wide loggerhead turtle interactions (Table 1). Conversely, trips with 3 or more loggerhead turtle interactions have been observed in years with high fleet-wide interactions. In 2018, when the highest number of loggerhead turtle interactions was observed, 16% of the trips contributed to 58% of the total fleet-wide interactions. Monitoring the number of loggerhead turtle interactions per trip would provide an early detection mechanism for higher fleet-wide interactions, and the individual trip limit would provide a "dampening" response by minimizing further interactions on those trips. Individual trip limits are expected to be an important complement to sea turtle hard caps to help ensure year-round fishing operations, consistent with the conservation needs of sea turtles.

Leatherback turtle interactions in the shallow-set fishery have been less variable than loggerhead turtle interactions, with most trips with leatherback turtle interactions having 1-2 interaction per trip and only one trip having 3 interactions since 2004 (Table 1). Individual trip limits for leatherback turtle interactions may serve as a preventative measure if higher interaction rates are observed in the future.

Table 1. Number of loggerhead and leatherback turtle interactions per trip, 2004-February 2018.

Loggerhead turtles			Leatherback turtles		
Number of turtles per trip	**Number of trips**	**Percent of trips with ≥1 turtle interactions**	**Number of turtles per trip**	**Number of trips**	**Percent of trips with ≥1 turtle interactions**
1	88	78.6%	1	80	88.9%
2	15	13.4%	2	9	10.0%
3	5	4.5%	3	1	1.1%
4	1	0.9%	4	0	NA
≥5	3	2.7%	≥5	0	NA

Source: PIFSC unpublished data

Individual trip limits would provide an individual vessel incentive to avoid sea turtle interactions because shallow-set vessels may fish 500-1,000 nm from port and require considerable up-front

costs for each trip, and thus a shortened trip duration may result in net loss for that trip. Given the economic disincentive of reaching the trip limit, vessel operators are more likely to employ additional avoidance strategies on subsequent trips, such as avoiding areas with higher potential for interactions using information from NMFS' TurtleWatch program.

The individual trip limit also has an inherent cooling-off period due to the distance between fishing grounds and ports in Honolulu and California where vessels fishing shallow-set gear under the Hawaii longline limited entry permit land their catch. The travel distance from port to the areas where the shallow-set vessels typically operate is at minimum 2-3 days and may take as long as 5-6 days one-way. If a vessel reaches a trip limit, the travel time back to port, the required 72-hour notice, and travel time to return to fishing grounds would result in a minimum of 7-10 day days of no fishing by the applicable vessel. This time lag between the last set on the trip in which a vessel reaches a trip limit and the first set on the subsequent trip provides an important cooling-off period that allows for the conditions contributing to the high interactions to dissipate and reduces the likelihood of additional interactions in that area in subsequent trips. The trip limit also places the accountability of interactions on individual vessels and ensures that the consequence burden remains with the vessel that reaches the individual trip limit.

In response to a recommendation from the Council's Pelagic Plan Team, PIFSC conducted a simple simulation using observer data since 2004 to evaluate the potential effects of the individual trip limits on the fleet-wide annual loggerhead and leatherback turtle interactions. A range of individual vessel limits were applied to the historical interaction data and any trip that reached the limit were truncated at that point with the remaining turtle interactions from that trip removed. For trips spanning two calendar years, if the scenario limit was reached at the end of the first year, and the trip had additional interactions in the same trip after the year changed, the trip was removed from the second year to simulate the trip being terminated after reaching the limit. The results of this simulation are shown in Table 2. It should be noted that this simulation assumes all other factors contributing to the number of loggerhead or leatherback turtle interactions per trip remain the same. In other words, the simulation does not assume any voluntary sea turtle avoidance behaviors by vessel operators that may further reduce interactions, any changes to fishing behavior in vessels not affected by the limits, or any other changes to the fleet behavior that may result in no net reduction in the fleet-wide annual number of interactions.

The simulation results show that the total number of interactions could have been reduced by at least one interaction in four out of the 14 years since 2004 for loggerhead turtles and one out of the 14 years for leatherback turtles by applying an individual trip limit of 2 (Table 2). On the higher end of the simulated limits, only 2.7% of trips since 2004 with at least one loggerhead turtle interaction had 5 or more interactions per trip (Table 2), but truncating those trips with a limit of 5 interactions per trip contributed to 14% and 30% lower interactions in 2017 and 2018, respectively (Table 2).

Table 2. Simulation results applying a range of individual trip limits to observed interaction data from 2004-2018.

Year	Loggerhead					Leatherback				
	Obs.	**lim=2**	**lim=3**	**lim=4**	**lim=5**	**Obs.**	**lim=2**	**lim=3**	**lim=4**	**lim=5**
2004	1	1	1	1	1	1	1	1	1	1
2005	12	12	12	12	12	8	8	8	8	8
2006	**17**	**14** (-18%)	**16** (-6%)	**17**	**17**	2	2	2	2	2
2007	15	15	15	15	15	5	5	5	5	5
2008	0	0	0	0	0	2	2	2	2	2
2009	3	3	3	3	3	9	9	9	9	9
2010	7	7	7	7	7	8	8	8	8	8
2011	12	12	12	12	12	**16**	**16**	**16**	**16**	**16**
2012	6	6	6	6	6	7	7	7	7	7
2013	6	6	6	6	6	11	11	11	11	11
2014	15	15	15	15	15	16	15 (-6%)	16	16	16
2015	13	13	13	13	13	5	5	5	5	5
2016	15	13 (-13%)	15	15	15	5	5	5	5	5
2017	21	14 (-33%)	16 (-24%)	17 (-19%)	18 (-14%)	4	4	4	4	4
2018	33	15 (-55%)	18 (-45%)	21 (-36%)	23 (-30%)	6	6	6	6	6

Note: Years with hard cap closures are shown in bold. First column for each species (Obs.) is the actual number of observed interactions, and subsequent columns (lim=x) apply individual trip limits ranging from 2-5 to the actual observed interactions. Colored cells denote results that reduced the total fleet-wide interactions when trips were truncated after reaching the limit and the remaining interactions from the trip removed from the total.
Source: PIFSC unpublished data.

For leatherback turtles, truncating trips after 2 or more interactions could have had an effect on only 1 year, and only when a limit of 2 per trip was applied, given that only 1 trip since 2004 had more than 3 interactions per trip since 2004. The individual trip limit for leatherback turtles would serve as a preventative measure in the event that higher interaction rates are observed and more vessels experience multiple leatherback turtles in a trip, thereby preventing the increase in interactions from levels observed since 2004.

The years with the reductions based on the simulation results are the years with the higher number of observed interactions for each species, suggesting that the individual trip limit may effectively reduce the potential of reaching the hard cap while reducing impacts to loggerhead and leatherback populations by preventing a large number of interactions from occurring in a small portion of the fleet. This would in turn help maintain opportunities to fish for swordfish throughout the year.

2.4.1.3 Individual Vessel Limits

Under the framework, the Council may recommend specifications for individual vessel limits on the number of loggerhead and leatherback turtle interactions a vessel operating under the Hawaii limited entry permit vessels may have in a calendar year while fishing on trips declared as shallow-set. The individual vessel limit would apply equally to all vessels that fish using shallow-set gear under the Hawaii limited entry permit program and all interactions by individual vessels would also count toward the fleet-wide limit. The individual limit would not be a quota or an individual allocation of turtle interactions that divides the fleet-wide hard cap among vessels participating in the shallow-set component of the Hawaii limited entry permit program.

Upon determining that a vessel has reached either the loggerhead or leatherback turtle annual vessel limit based on data from NMFS observers, the vessel will be required to return to port without making additional sets and will be prohibited from shallow-set fishing for the remainder of the calendar year. The vessel may use deep-set gear in subsequent trips after returning to port and providing the required 72-hour notification under 50 CFR 665.803 prior to departure. The vessel may resume shallow-set fishing on January 1 of the following year.

Individual vessel limits are intended to mitigate a large proportion of loggerhead and leatherback turtle interactions from occurring on a small number of vessels. Observed sea turtle interaction data since 2004 indicate that most shallow-set longline vessels with loggerhead or leatherback turtle interactions have 1-2 interactions per year in years with low fleet-wide loggerhead turtle interactions (Table 3). Vessels with 4 or more loggerhead turtle interactions annually or 3 or more leatherback turtle interactions annually have been observed in years with high fleet-wide interactions. In 2018, when the highest number of loggerhead turtle interactions was observed, 27% of vessels contributed to 64% of the interactions. Monitoring the number of interactions per vessel per year provides an early detection mechanism for higher fleet-wide interactions, and the vessel limit would provide a response to the higher interaction rates by prohibiting that vessel from participating in the fishery for the remainder of the calendar year.

Table 3. Number of loggerhead and leatherback turtle interactions per vessel per year, 2004-February 2018. Permit numbers were used as a proxy for individual vessels.

Loggerhead turtles			Leatherback turtles		
Number of turtles per vessel per year	**Number of vessels**	**Percent of vessel years with at least one interaction**	**Number of turtles per vessel per year**	**Number of vessels**	**Percent of vessel years with at least one interaction**
1	66	68.0%	1	57	75.0%
2	16	16.5%	2	14	18.4%
3	8	8.2%	3	4	5.3%
4	3	3.1%	4	1	1.3%
≥5	4	4.1%	≥5	0	0%

Source: PIFSC unpublished data

In response to a recommendation from the Council's Pelagic Plan Team, PIFSC conducted a simple simulation using observer data since 2004 to evaluate the potential effects of individual vessel limits on the fleet-wide annual loggerhead and leatherback turtle interactions. A range of individual vessel limits were applied to the historical interaction data and any vessels that reached the limit were removed from that year to calculate the total number of interactions. The results of this simulation are shown in Table 4. It should be noted that this simulation assumes all other factors contributing to the annual number of loggerhead or leatherback turtle interactions per vessel remain the same. In other words, the simulation does not assume any voluntary sea turtle avoidance behaviors by vessel operators that may further reduce interactions, any changes to fishing behavior in vessels not affected by the limits, or any other changes to the fleet behavior that may result in no net reduction in the fleet-wide annual number of interactions.

Table 4. Simulation results applying a range of individual vessel limits to observed interaction data from 2004-2018.

	Observed and simulated number of interactions with individual vessel limits									
	Loggerhead					**Leatherback**				
Year	**Obs.**	**lim=2**	**lim=3**	**lim=4**	**lim=5**	**Obs.**	**lim=2**	**lim=3**	**lim=4**	**lim=5**
2004	1	1	1	1	1	1	1	1	1	1
2005	12	12	12	12	12	8	8	8	8	8
2006	**17**	**14** (-18%)	**16** (-6%)	**17**	**17**	2	2	2	2	2
2007	15	12 (-20%)	14 (-7%)	15	15	5	5	5	5	5
2008	0	0	0	0	0	2	2	2	2	2
2009	3	3	3	3	3	9	8 (-11%)	9	9	9
2010	7	7	7	7	7	8	8	8	8	8
2011	12	11 (-8%)	12	12	12	**16**	**15** (-6%)	**16**	**16**	**16**
2012	6	6	6	6	6	7	7	7	7	7
2013	6	6	6	6	6	11	10 (-9%)	11	11	11
2014	15	15	15	15	15	16	13 (-19%)	15 (-6%)	16	16
2015	13	11 (-15%)	13	13	13	5	5	5	5	5
2016	15	10 (-33%)	12 (-20%)	14 (-7%)	15	5	5	5	5	5
2017	21	11 (-48%)	13 (-38%)	14 (-33%)	15 (-29%)	4	4	4	4	4
2018	33	14 (-58%)	19 (-42%)	23 (-30%)	26 (-21%)	6	6	6	6	6

Note: Years with hard cap closures are shown in bold. First column for each species (Obs.) is the actual number of observed interactions, and subsequent columns (lim=x) apply individual vessel limits ranging from 2-5 to the actual observed interactions. Colored cells denote results that reduced the total fleet-wide interactions when vessels were removed for the remained of the year after reaching the limit.
Source: PIFSC unpublished data.

The simulation results show that the total number of interactions could have been reduced by at least one interaction in seven out of the 14 years since 2004 for loggerhead turtles and four out of the 14 years for leatherback turtles by applying an individual vessel limit of 2 per year (Table 4). For loggerhead turtles, only 4% of vessel years with at least 1 interaction had 5 or more interactions (Table 3), but removing these vessels after the fifth interaction contributed to 29% and 21% lower interactions in 2017 and 2018, respectively (Table 4). No reductions occurred with leatherback vessel limits of 4 or 5 as the maximum number of observed interactions per vessel in any given year has been 4. A leatherback vessel limit of 3 per year reduced interactions in one year by 6%, while a limit of 2 per year reduced interactions in four years by 6-19% per year.

The years with the reductions based on the simulation results are the years with the higher number of observed interactions for each species, suggesting that the individual vessel limit may effectively reduce the potential of reaching the hard cap while reducing impacts to loggerhead and leatherback populations by preventing a large number of interactions from occurring in a small portion of the fleet. This would in turn help ensure that the remaining vessels to continue fishing for swordfish throughout the year.

2.4.1.4 In-season temporary closure upon reaching a specified percentage of the single-year hard cap

Under the framework, the Council may recommend implementation of an additional in-season closure to the loggerhead and leatherback hard cap measure, whereby a temporary fishery closure would be implemented when a certain percentage of the fleet-wide loggerhead or leatherback turtle hard cap limits are observed during the first three quarters of the calendar year (January through September). The fishery would reopen on October 1 of the same calendar year. The percentage of the hard cap limits at which the in-season closure would be triggered would be based on observed interaction data since 2004. Once implemented, the in-season temporary closure trigger would remain in place until such time that the Council makes a recommendation to NMFS to revise the trigger.

The shallow-set longline fishery targeting swordfish is highly seasonal, with effort typically increasing in October and peaking in March, after which effort gradually declines through the summer months (Figure 2). However, hard cap closures are implemented under the regulatory fishing year which is equivalent to a calendar year and thus a hard cap closure has the potential to impact fishing opportunities during the first part of the peak season that starts in October. This measure would allow the fleet to resume shallow-set longline fishing at the start of the typical fishing season when the fishery begins to increase its effort to meet the demand for Hawaii swordfish, rather than mid-season on January 1.

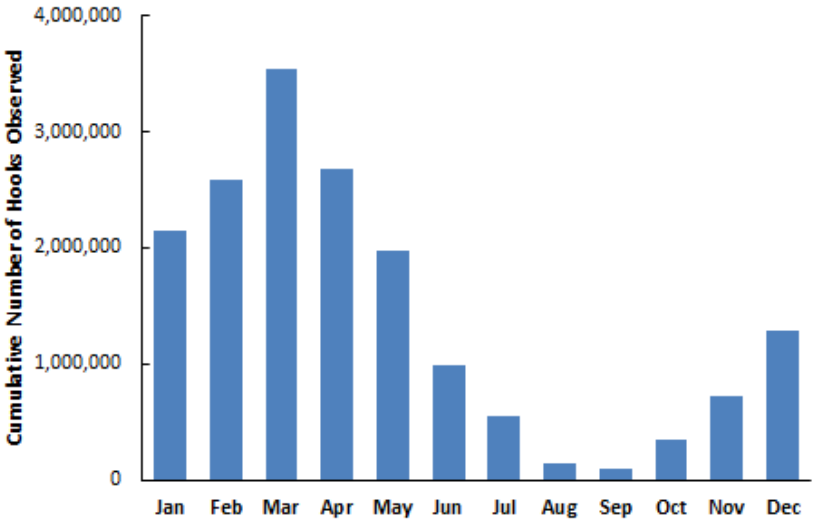

Figure 2. Cumulative observed monthly effort in hooks for the Hawaii shallow-set longline fishery (100% observer coverage), 2004-2017.
Data source: NMFS Pacific Islands Regional Office Observer Program

Table 5. Percentage of loggerhead and leatherback turtle interactions by quarter, 2005-2017.

	Q1 (Jan-March)	Q2 (April-June)	Q3 (July-Sept)	Q4 (Oct-Dec)
Loggerhead turtles	64.7%	12.2%	3.6%	19.4%
Leatherback turtles	26.8%	34.0%	10.3%	28.9%

Note: Percentages are based on the cumulative total number of observed interactions (by interaction date) by quarter from 2005-2017 for each species. Data for 2004 and 2018 were omitted due to partial year data.

The observed interaction data for 2005-2017 show that approximately 80.6% of the total loggerhead turtle interactions and 71.1% of the total leatherback turtle interactions are observed in the first three quarters (January-September; Table 5). In-season closure triggers based on these data (rounded up to the closest full number) would be defined as follows:

a) 81% of the fleet-wide loggerhead hard cap limit during the first three quarters of the calendar year, with the fishery reopening on October 1 of the same calendar year; or
b) 72% of the fleet-wide leatherback hard cap limit during the first three quarters of the calendar year, with the fishery reopening on October 1 of the same calendar year.

2.4.2 Sub-Alternatives under Alternative 2

The following sections describe the three sub-alternatives for combining the individual measures described in Section 2.4.1 under the framework. The Council's preferred alternative, sub-alternative 2A, also includes specification options for individual trip limits.

2.4.2.1 Sub-Alternative 2A: Single-year hard cap limits and individual trip limits for loggerhead and leatherback turtles (*preferred; 173rd Meeting recommendation*)

Under the preferred alternative, the framework would establish a process to specify fleet-wide single-year hard cap limits and individual trip limits for loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery. Descriptions of the single-year hard cap limits and individual trip limits are included in Section 2.4.2.

This preferred alternative would implement the Council's recommended action at its 173rd Meeting (June 2018) as follows:

1. Establish an annual limit on the number of North Pacific loggerhead and leatherback turtle interactions that the Council will recommend to NMFS consistent with the anticipated level of annual interactions that is set forth in the current valid biological opinion. Once either one of these interaction limits is reached, the fishery closes for the remainder of the calendar year.
2. Establish individual trip interaction limits for loggerhead and leatherback turtles for the Hawaii limited entry permit vessels that declare their trips as a shallow-set trip
    i. Upon determining that a vessel has reached either the loggerhead or leatherback turtle trip interaction limit based on data from NMFS observers, shallow-set vessels will be required to return to port without making additional sets.
    ii. The vessel may resume shallow-set fishing operations after returning to port and providing the required 72-hour notification under 50 CFR 665.803 prior to departure.
    iii. The Council may make recommendations to NMFS to revise the individual trip limits upon periodic review of the effectiveness of the limits.

<u>Specification of Hard Cap Limits</u>

At the 173rd Meeting, the Council recommended the following specifications for the fleet-wide annual hard cap limits on the number of North Pacific loggerhead and leatherback turtle interactions under the preferred alternative:

1. The Council anticipates that NMFS will complete a new biological opinion not later than October 31, 2018. Based upon the current Biological Evaluation (BE), the Council anticipates that the new biological opinion will authorize take of no more than 37 North Pacific loggerheads and 21 leatherbacks. Accordingly, the Council recommends an annual limit of 37 North Pacific loggerheads and 21 leatherbacks, effective January 1, 2019.
2. The Council will review its recommendation if the new biological opinion results in a jeopardy decision or otherwise results in a different incidental take statement for North Pacific loggerheads or leatherbacks.

The Council's recommended specification of the hard cap limits were based on the anticipated level of interactions in the BE initiating ESA Section 7 consultation for the shallow-set fishery. The anticipated level of interactions were based on predictions generated by PIFSC using Bayesian data analysis methods appropriate for count data (McCracken 2018). The method used for the predictions are described in Section 3.3.6.

Specification of Individual Trip Limits

At the 173rd Meeting, the Council recommended the following specifications for individual trip limits under the preferred alternative:

- Specify the individual trip limit of 5 North Pacific loggerhead turtles.
- The Council did not recommend specifying leatherback turtle trip limit at this time.
- The Council further recommended annual monitoring of the effectiveness of the loggerhead turtle trip limits and the potential need for leatherback turtle limit specifications as part of the annual SAFE report review process.

The Council's recommendation to specify a loggerhead trip limit of 5 was based on the finding that it would provide a meaningful reduction in interactions in years with high interaction rates, such as those observed in 2017-2018. Observed sea turtle interaction data since 2004 indicate that most shallow-set longline trips with loggerhead turtle interactions have 1-2 interactions per trip, with a small proportion of trips having 4 or more interactions coinciding with years with the highest total fleet-wide interactions. Based on the PIFSC simulation applying different level of trip limits to past observed interactions, a limit of 5 loggerhead turtles per trip would have reduced loggerhead turtle interactions in 2018 by 30%, even without accounting for avoidance behavior by the vessels. The Council therefore determined that the loggerhead trip limit of 5 would provide a mechanism for early detection and response to higher interaction rates, and minimize further interactions when such higher interaction rates are detected while ensuring year-round supply of swordfish to meet domestic demand.

The Council at its 173rd Meeting did not recommend specification of individual trip limits for leatherbacks under the framework because observed interaction data from 2004-2018 indicated that individual trip limits do not have a potential to provide substantial reduction of leatherback turtle interactions if interaction patterns remain similar to past years. The Council at its 175th Meeting will consider the merits of additional mitigation measures for leatherback turtles, given the long-term declining trend of the affected population.

The Council will monitor the effectiveness of the loggerhead turtle trip limits and the potential need for leatherback turtle limit specifications as part of the annual SAFE report review process. In future years, the Council may use the framework to recommend adjusting the loggerhead trip limit or specifying a leatherback trip limit based on the monitoring results.

Expected Fishery Outcomes for Sub-Alternative 2A

Under this preferred alternative, the fishery would be managed under fleet-wide single year hard caps consistent with the best available scientific information in the current BiOp, and the additional individual trip limits that would provide an early detection and response mechanism to higher interaction rates when the fleet-wide interaction levels are well below the hard cap limit. The fleet-wide single year hard cap limits provide the assurance that impacts do not exceed a threshold that triggers reinitiation of ESA consultation. The individual trip limits are expected to reduce the likelihood of reaching the loggerhead hard cap because it would prevent a large proportion of loggerhead turtles from being taken in a single trip, which are typically associated with years with high interaction rates. The individual trip limits for leatherback turtles may serve as a preventative measure if higher interaction rates are observed in the future. The individual trip limits are expected to help ensure year-round operations of the Hawaii shallow-set longline fishery.

This sub-alternative would revise the loggerhead and leatherback turtle hard cap limits to be consistent with the anticipated level of annual interactions set forth in the current BiOp. This sub-alternative would also allow the loggerhead hard cap to be revised consistent with the best available scientific information in the current BiOp, rather than being based on an outdated 2004 BiOp under the No Action Alternative.

Under this sub-alternative, the fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year). Sea turtle interactions are likely to fluctuate substantially between years, but would be expected to remain well below the hard cap in most years and not exceed the anticipated level of loggerhead and leatherback turtle interactions authorized in the BiOp. Compared to the No Action Alternative, the fishery is likely to have a lower likelihood of closing early in the calendar year from reaching the hard cap due to the combination of individual trip limits and a higher loggerhead hard cap limit.

The potential for the individual trip limits to mitigate interactions and reduce the likelihood of reaching the hard cap limit when unusually high interaction rates are encountered would vary depending on the specified limit level. For purposes of analysis, this EA evaluates a lower/middle/upper range specification for loggerhead turtles and lower/upper range specification for leatherback turtles based on observed data for 2004-2018 on the number of interactions per trip (Table 6). A scenario for no specifications is also analyzed for each species. The potential range of outcomes for the individual trip limits under Sub-Alternative 2A are described below. The Council's recommended specifications at the 173rd Meeting are indicated as the preferred scenario.

Table 6. Range of individual trip limits analyzed under Sub-Alternative 2A.

Range	Loggerhead	Leatherback
No specification	No limit	No limit (***preferred; 173rd Meeting recommendation***)
Lower	2 per trip	2 per trip
Mid	5 per trip (***preferred; 173rd Meeting recommendation***)	N/A
Upper	10 per trip	5 per trip

Loggerhead Turtles
Observer data from 2004-2018 show that the number of loggerhead turtle interactions per shallow-set trip ranges from zero to 11, with all of the trips with 5 or more interactions occurring during the 2017-2018 period when the unusually high interaction rates were observed. The upper range of the loggerhead specification is analyzed at 10 interactions per trip, and the mid-range is analyzed at 5 interactions per trip. The lower range is bounded at a limit of 2 per trip rather than 1 per trip, as observer data from 2004-2018 indicate that a requirement for vessels to return to port after encountering 1 loggerhead turtle interaction would not further minimize interactions on most trips, as 79% of shallow-set trips with observed loggerhead turtle interactions had only 1 interaction on the trip.

The four potential outcome scenarios (no specification and lower/middle/upper range specifications) and the expected outcomes for each are described below and summarized in Table 7.

Outcome 2A-LH(a): No specification

The fishery would be managed under the hard cap limit only. Individual trip limits would not be implemented until such time that the Council recommends a specification.

Outcome 2A-LH(b): Lower range specification (individual trip limit = 2)

The lower range of the specification is likely to have the greatest amount of reduction in high interaction rate years and limited to no reduction in low interaction rate years. Based on 2004-2018 simulation results, a limit of 2 loggerhead interactions per trip would have reduced interactions by 33% in 2017 and 55% in 2018. This level of reduction is expected to reduce the likelihood of reaching the loggerhead hard cap.

Based on 2004-2018 simulation results, 21% of trips with observed loggerhead interactions during that period would have been affected by a trip limit of 2 interactions, of which 63% of the trips affected would not have contributed to additional reductions in interactions by returning to port due to only having 2 interactions total on those trips.

Outcome 2A-LH(c): Middle range specification (individual trip limit = 5) (***preferred; 173rd Meeting recommendation***)

The middle range of the specification is likely to have a substantial amount of reduction in high interaction rate years, although the reduction would be lower than Outcome 2A-LH(b). As with Outcome 2A-LH(b), limited to no reduction is expected in low interaction rate years. Based on 2004-2018 simulation results, a limit of 5 loggerhead interactions per

trip would have reduced interactions by 14% in 2017 and 30% in 2018. This level of reduction is expected to reduce the likelihood of reaching the loggerhead hard cap.

Based on 2004-2018 simulation results, 3% of trips with observed loggerhead interactions during that period would have been affected by a trip limit of 5 interactions. All of the affected trips would have contributed to additional reductions in interactions by returning to port.

Outcome 2A-LH(d): Upper range specification (individual trip limit = 10)

The upper range of the specification is likely to have a limited amount of reduction in loggerhead interactions given the rare nature of such high levels of interactions in a single trip. Based on 2004-2018 simulation results, a limit of 10 loggerhead interactions per trip would have reduced interactions by 5% in 2017. Due to the limited reduction in interactions expected, specification of the individual trip limit at the upper range is likely to have minimal effects on the likelihood of reaching the loggerhead hard cap.

Table 7. Potential outcomes of individual trip limit specification scenarios for loggerhead turtles under Sub-Alternative 2A.

Potential outcome scenario	Limit	Expected reduction in turtle interactions	Likelihood of reaching hard cap limit	Other considerations
Outcome 2A-LH(a) No specification	N/A	No reduction expected when higher interaction rates are observed.	Same as management under hard cap only.	N/A
Outcome 2A-LH(b) Lower range specification	2 per trip	Likely to have the greatest amount of reduction in high interaction rate years (33% reduction in 2017 and 55% in 2018 based on simulations)	Reduced likelihood of reaching hard cap limit.	Majority of trips that reach the trip limit may not contribute to minimizing further interactions by returning to port (due to majority of trips with 2 interactions not likely to have additional interactions)
Outcome 2A-LH(c) Middle range specification (***preferred***)	5 per trip	Substantial reduction expected in high interaction rate years, but lower reduction than Outcome 3A-LH(b) (14% reduction in 2017 and 30% in 2018 based on simulations)	Reduced likelihood of reaching hard cap limit.	Affected trips are likely to contribute to additional reductions in interactions by returning to port.
Outcome 2A-LH(d) Upper range specification	10 per trip	Likely to have a limited amount of reduction in loggerhead interactions given the rare nature of such high levels of interactions in a single trip.	Minimal effects on the likelihood of reaching hard cap limit.	N/A

Leatherback Turtles
Observer data from 2004-2018 show that the number of leatherback turtle interactions per shallow-set trip range from zero to 3. Only 1 trip during the 2004-2018 period had 3 interactions per trip. The upper range of the leatherback specification is analyzed at 5 interactions per trip, and no mid-range was analyzed due to the narrow range of the observed number of interactions per trip. The lower range is bounded at a limit of 2 per trip rather than 1 per trip, as observer data from 2004-2018 indicate that a requirement for vessels to return to port after encountering 1 leatherback turtle interaction would not further minimize interactions on most trips, as nearly 89% of shallow-set trips with observed leatherback turtle interactions had only 1 interaction on the trip.

The three potential outcome scenarios (no specification and lower/upper range specifications) and the expected outcomes for each are described below and summarized in Table 8.

Outcome 2A-LB(a): No specification (***preferred; 173rd Meeting recommendation***)

The fishery would be managed under the hard cap limit only. Individual trip limits would not be implemented until such time that the Council recommends a specification.

Outcome 2A-LB(b): Lower range specification (individual trip limit = 2)

The lower range of the specification is likely to have limited amount of reduction in interactions given that most trips with leatherback interactions have 1 or 2 interactions per trip. As a result, specification of individual trip limit for leatherback turtles is not expected to substantially reduce the likelihood of reaching the leatherback hard cap if interaction levels remain at similar levels observed since 2004. Specification at the lower range may serve as a preventative measure if higher interaction rates are observed in the future.

Based on 2004-2018 simulation results, 11% of trips with observed leatherback interactions during that period would have been affected by a trip limit of 2 interactions, of which 90% of the trips affected would not have contributed to additional reductions in interactions by returning to port due to only having 2 interactions total on those trips.

Outcome 2A-LB(c): Upper range specification (individual trip limit = 5)

The upper range of the specification is not likely to reduce leatherback turtle interactions given that the maximum number of leatherback turtle interactions per trip for the 2004-2018 period has been 3 per trip. Specification at the upper range may serve as a preventative measure if significantly higher interaction rates are observed in the future.

Table 8. Potential outcomes of individual trip limit specification scenarios for leatherback turtles under Sub-Alternative 2A.

Potential outcome scenario	Limit	Expected reduction in turtle interactions	Likelihood of reaching hard cap limit	Other considerations
Outcome 2A-LB(a) No specification (***preferred***)	N/A	No reduction expected.	Same as management under hard cap only.	N/A
Outcome 2A-LB(b) Lower range specification	2 per trip	Likely to have limited amount of reduction.	Not expected to reduce likelihood of reaching hard cap limit.	Most trips that reach the trip limit may not contribute to minimizing further interactions by returning to port (due to most trips with 2 interactions not likely to have additional interactions).
Outcome 2A-LB(c) Upper range specification	5 per trip	No reduction expected.	Not expected to reduce likelihood of reaching hard cap limit.	N/A

2.4.2.2 Sub-Alternative 2B: Single-year hard cap limits, individual trip limits and individual vessel limits for loggerhead and leatherback turtles

Under Sub-Alternative 2B, the framework would establish a process to specify fleet-wide single-year hard cap limits, individual trip limits and individual vessel limits for loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery. This sub-alternative would include individual vessel limits as an additional measure to the framework considered under Sub-Alternative 2A. Descriptions of the single-year hard cap limits, individual trip limits, and individual vessel limits are included in Section 2.4.2.

Expected Fishery Outcomes for Sub-Alternative 2B

Under this sub-alternative, the fishery would be managed under fleet-wide single year hard caps consistent with the best available scientific information in the current BiOp. Of the three measures that would be included in the framework under Sub-Alternative 2B, individual trip limits are expected to provide the primary mechanism for early detection and response to higher interaction rates. The individual vessel limits would prevent vessels from reaching the individual trip limit multiple times in a year by prohibiting vessels that reach the vessel limit from shallow-setting for the remainder of the calendar year.

Similar to Sub-Alternative 2A, the fleet-wide single year hard cap limits provide the assurance that impacts do not exceed a threshold that triggers reinitiation of ESA consultation. Individual trip limits are expected to reduce the likelihood of reaching the loggerhead hard cap because it would prevent a large proportion of loggerhead turtles from being taken in a single trip, which are typically associated with years with high interaction rates. The individual trip limits for leatherback turtles may serve as a preventative measure if higher interaction rates are observed in the future. The available observer data from 2004-2018 indicate that the likelihood of a single vessel having multiple trips with high loggerhead or leatherback turtle interactions in a year is low, and the additional burden of prohibiting vessels from fishing shallow-set if vessels reached the individual vessel limits is not expected to result in substantial conservation gains.

Under this sub-alternative, the fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year). Sea turtle interactions are likely to fluctuate substantially between years, but would be expected to remain well below the hard cap in most years and not exceed the anticipated level of loggerhead and leatherback turtle interactions authorized in the BiOp.

The potential for the individual trip limits and individual vessel limits to mitigate interactions and reduce the likelihood of reaching the hard cap limit would vary depending on the specified limit level. For purposes of analysis, this EA evaluates a combination of lower/middle/upper range specification for loggerhead turtles and a combination of lower/upper range specification for leatherback turtles based on observed data for 2004-2018 on the number of interactions per trip and per vessel (Table 9). Scenarios with no specifications of individual trip limit or vessel limit are also considered for each species. The potential range of outcomes for the individual trip limits and individual vessel limits under Sub-Alternative 2B are described below.

Table 9. Range of individual trip limits analyzed under Sub-Alternative 2B.

	Loggerhead		**Leatherback**	
Range	**Trip limit**	**Vessel limit (annual)**	**Trip limit**	**Vessel limit (annual)**
No specification	No limit	No limit	No limit	No limit
Lower	2 per trip	2 per vessel	2 per trip	2 per vessel
Mid	5 per trip	5 per vessel	N/A	N/A
Upper	10 per trip	10 per vessel	5 per trip	5 per vessel

Loggerhead Turtles

The range of loggerhead individual trip limits analyzed for Sub-Alternative 2B is the same as those included in Sub-Alternative 2A. For individual vessel limits, observer data from 2004-2018 show that the number of loggerhead turtle interactions per shallow-set longline vessel per year ranges from zero to 11. The upper range of the loggerhead specification is analyzed at 10 interactions per vessel per year, the mid-range is analyzed at 5 interactions per vessel per year, and the lower range is analyzed at 2 interactions per vessel per year.

The potential outcomes of Sub-Alternative 2B for loggerhead turtles would depend on the combination of the individual trip limit and individual vessel limit specifications that would be recommended by the Council for implementation. Only a portion of all possible combinations were analyzed, as shown in Table 10. Combinations in which the trip limit and vessel limit specifications were the same, or the trip limit was greater than the vessel limit, were not analyzed as these scenarios would mean that the individual vessel limit would be reached before the trip limit and that the consequences of individual trip limits would not be triggered. Combinations in which the Council does not recommend specification of individual vessel limits would have expected outcomes similar to scenarios 2A-LH(a) through 2A-LH(d) under Sub-Alternative 2A and are not further analyzed here.

Table 10. Potential outcome scenarios for loggerhead turtle individual trip limit and vessel limit specifications under Sub-Alternative 2B. "X" denotes scenarios not analyzed.

		Individual Trip Limit Range			
		No specification	**Lower**	**Mid**	**Upper**
Individual Vessel Limit Range	**No specification**	Similar to 2A-LH(a)	Similar to 2A-LH(b)	Similar to 2A-LH(c)	Similar to 2A-LH(d)
	Lower	**2B-LH(a)**	X	X	X
	Mid	**2B-LH(b)**	**2B-LH(d)**	X	X
	Upper	**2B-LH(c)**	**2B-LH(e)**	**2B-LH(f)**	X

The six potential outcome scenarios and the expected outcomes for each are described below and summarized in Table 11.

Outcome 2B-LH(a): No specification of *trip limit* + Lower range specification of *vessel limit* (limit = 2)

When the individual trip limit is not specified, individual vessel limits provide the early detection and response to higher interaction rates. Based on 2004-2018 simulation results, a limit of 2 loggerhead interactions per vessel per year would have reduced interactions by 48% in 2017 and 58% in 2018. This level of reduction is similar to or greater than the reductions expected from outcome 2A-LH(b) and is expected to reduce the likelihood of reaching the loggerhead hard cap.

Based on 2004-2018 simulation results, 32% of cases (cumulative number of vessels operating each year) with observed loggerhead turtle interactions during that period would have been affected by a vessel limit of 2 interactions per year. Of those cases, 52% would not have contributed to additional reductions in interactions by being prohibited from shallow-setting for the remainder of the calendar year due to only having 2 interactions total for that year.

Outcome 2B-LH(b): No specification of *trip limit* + Middle range specification of *vessel limit* (limit = 5)

The middle range of the individual vessel limit specification is likely to have a substantial amount of reduction in high interaction rate years similar to Outcome 2A-LH(c), but the reduction would be lower than Outcome 2B-LH(a). Based on 2004-2018 simulation results, a limit of 5 loggerhead interactions per vessel per year would have reduced interactions by 29% in 2017 and 21% in 2018. This level of reduction is expected to reduce the likelihood of reaching the loggerhead hard cap.

Based on 2004-2018 simulation results, 4% of cases (cumulative number of vessels operating each year) with observed loggerhead turtle interactions during that period would have been affected by a vessel limit of 5 interactions per year. Of those cases, 25% would not have contributed to additional reductions in interactions by being prohibited from shallow-setting for the remainder of the calendar year due to having 5 interactions total for that year.

Outcome 2B-LH(c): No specification of *trip limit* + Upper range specification of *vessel limit* (limit = 10)

The upper range of the vessel limit specification is likely to have a limited amount of reduction in loggerhead interactions given the rare nature of such high levels of interactions by a single vessel in any given year. Based on 2004-2018 simulation results, a limit of 10 loggerhead interactions per vessel per year would have reduced interactions by 5% in 2017. Due to the limited reduction in interactions expected, specification of the individual vessel limit at the upper range is likely to have minimal effects on the likelihood of reaching the loggerhead hard cap.

Outcome 2B-LH(d): Lower range specification of *trip limit* (limit = 2) + Middle range specification of *vessel limit* (limit = 5); and
Outcome 2B-LH(e): Lower range specification of *trip limit* (limit = 2) + Upper range specification of *vessel limit* (limit = 10)

The expected outcome of specifying the individual trip limit at a lower range and the individual vessel limit at a middle or upper range would be similar to the outcome of scenario 2A-LH(b) (individual trip limit specification at lower range). The available observer data from 2004-2018 indicate that the likelihood of a single vessel having multiple trips with high loggerhead turtle interactions in a year is low, thus specifying a vessel limit in addition to the trip limit is not expected to further reduce interactions.

Outcome 2B-LH(f): Middle range specification of *trip limit* (limit = 5) + Upper range specification of *vessel limit* (limit = 10)

The expected outcome of specifying the individual trip limit at a middle range and the individual vessel limit at a upper range would be similar to the outcome of scenario 2A-LH(c) (individual trip limit specification at middle range). The available observer data from 2004-2018 indicate that the likelihood of a single vessel having multiple trips with high loggerhead turtle interactions in a year is low, thus specifying a vessel limit in addition to the trip limit is not expected to further reduce interactions.

Table 11. Potential outcomes of individual trip limit and individual vessel limit specification scenarios for loggerhead turtles under Sub-Alternative 2B.

Potential outcome scenario	Limit	Expected reduction in turtle interactions	Likelihood of reaching hard cap limit	Other considerations
Outcome 2B-LH(a) Trip = No spec Vessel = Lower	No trip spec + 2 per vessel	Likely to have a similar or greater reduction in interactions in high interaction rate years compared to scenario 2A-LH(b) (48% reduction in 2017 and 58% in 2018 based on simulations)	Reduced likelihood of reaching hard cap limit.	Approximately half of vessels that reach the vessel limit may not contribute to minimizing further interactions by being prohibited from shallow-setting for the remainder of the year (due to only having 2 total interactions per year)
Outcome 2B-LH(b) Trip = No spec Vessel = Middle	No trip spec + 5 per vessel	Likely to have similar reduction in interactions in high interaction rate years compared to scenario 2A-LH(c) (29% reduction in 2017 and 21% in 2018 based on simulations)	Reduced likelihood of reaching hard cap limit.	Most affected cases are likely to contribute to additional reductions in interactions by being prohibited from shallow-setting for the remainder of the year.
Outcome 2B-LH(c) Trip = No spec Vessel = Upper	No trip spec + 10 per vessel	Likely to have a limited amount of reduction in interactions given the rare nature of such high levels of interactions by a single vessel.	Minimal effects on the likelihood of reaching hard cap limit.	N/A
Outcome 2B-LH(d) Trip = Lower Vessel = Middle	2 per trip + 5 per vessel	Similar to scenario 2A-LH(b) due to low likelihood of a single vessel having multiple trips with high loggerhead interactions in a year.	Similar to scenario 2A-LH(b).	N/A
Outcome 2B-LH(e) Trip = Lower Vessel = Upper	2 per trip + 10 per vessel	Similar to scenario 2A-LH(b) due to low likelihood of a single vessel having multiple trips with high loggerhead interactions in a year.	Similar to scenario 2A-LH(b).	N/A

Outcome 2B-LH(f) Trip = Middle Vessel = Upper	5 per trip + 10 per trip	Similar to scenario 2A-LH(c) due to low likelihood of a single vessel having multiple trips with high loggerhead interactions in a year.	Similar to scenario 2A-LH(c).	N/A

Leatherback Turtles

The range of individual trip limits analyzed for Sub-Alternative 2B is the same as those included in Sub-Alternative 2A. For individual vessel limits, observer data from 2004-2018 show that the number of leatherback turtle interactions per shallow-set longline vessel per year ranges from zero to 4. Only 1 vessel during the 2004-2018 period had 4 interactions in a year. The lower range of the vessel limit specification for leatherback turtles is analyzed at 2 interactions per vessel per year, and the upper range is analyzed at 5 interactions per vessel per year. The mid-range for leatherback vessel limit was not analyzed due to the narrow range of the observed number of interactions per trip.

The combination of leatherback turtle individual trip limit and individual vessel limit specification analyzed in the EA are shown in Table 12.

As described for loggerhead turtle specifications above, combinations in which the trip limit and vessel limit specifications were the same, or the trip limit was greater than the vessel limit, were not analyzed. Combinations in which the Council does not recommend specification of leatherback individual vessel limits would have expected outcomes similar to scenarios 2A-LB(a) through 2A-LB(c) under Sub-Alternative 2A and are not further analyzed here.

Table 12. Potential outcome scenarios for leatherback turtle individual trip limit and vessel limit specifications under Sub-Alternative 2B. "X" denotes scenarios not analyzed.

		Individual Trip Limit Range		
		No specification	**Lower**	**Upper**
Individual Vessel Limit Range	**No specification**	Similar to 2A-LB(a)	Similar to 2A-LB(b)	Similar to 2A-LH(c)
	Lower	**2B-LB(a)**	X	X
	Upper	**2B-LB(b)**	**2B-LB(c)**	X

The three potential outcome scenarios and the expected outcomes for each are described below and summarized in Table 13.

Outcome 2B-LB(a): No specification of *trip limit* + Lower range specification of *vessel limit* (limit = 2)

The lower range of the individual vessel specification for leatherback turtles is likely to have some reduction in interactions. Based on 2004-2018 simulation results, a limit of 2 leatherback turtle interactions per vessel per year would have reduced interactions by 1 interaction each in 2009, 2011, and 2013, and 3 interactions in 2014. This level of reduction is not expected to meaningfully reduce the likelihood of reaching the leatherback hard cap limit.

Based on 2004-2018 simulation results, 25% of cases (cumulative number of vessels operating each year) with observed leatherback interactions during that period would have been affected by a vessel limit of 2 interactions per year, of which 73% of the trips affected would not have contributed to additional reductions in interactions by being prohibited from shallow-setting for the remainder of the calendar year due to having 2 interactions total for that year.

Outcome 2B-LB(b): No specification of *trip limit* + Upper range specification of *vessel limit* (limit = 5)

The upper range of the specification is not likely to reduce leatherback turtle interactions given that the maximum number of leatherback turtle interactions per vessel for the 2004-2018 period has been 4 per vessel per year. Specification at the upper range may serve as a preventative measure if significantly higher interaction rates are observed in the future.

Outcome 2B-LB(c): Lower range specification of *trip limit* (limit = 2) + Upper range specification of *vessel limit* (limit = 5)

The expected outcome of specifying the individual trip limit at a lower range and the individual vessel limit at an upper range would be similar to the outcome of scenario 2A-LB(b) (individual trip limit specification at lower range). The available observer data from 2004-2018 indicate that the likelihood of a single vessel having multiple trips with high leatherback turtle interactions in a year is low, thus specifying a vessel limit in addition to the trip limit is not expected to further reduce interactions.

Table 13. Potential outcomes of individual trip limit and individual vessel limit specification scenarios for leatherback turtles under Sub-Alternative 2B.

Potential outcome scenario	Limit	Expected reduction in turtle interactions	Likelihood of reaching hard cap limit	Other considerations
Outcome 2B-LB(a) Trip = No spec Vessel = Lower	No trip spec + 2 per vessel	Likely to have some reduction in interactions (maximum reduction of 3 interactions in one year based on simulations)	Not expected to meaningfully reduce likelihood of reaching hard cap limit.	Majority vessels that reach the vessel limit may not contribute to minimizing further interactions by being prohibited from shallow-setting for the remainder of the year (due to only having 2 total interactions per year)
Outcome 2B-LB(b) Trip = No spec Vessel = Upper	No trip spec + 5 per vessel	No reduction expected.	Not expected to reduce likelihood of reaching hard cap limit.	N/A
Outcome 2B-LB(c) Trip = Lower Vessel = Upper	2 per trip + 5 per vessel	Similar to scenario 2A-LB(b) due to low likelihood of a single vessel having multiple trips with high loggerhead interactions in a year.	Not expected to reduce likelihood of reaching hard cap limit.	N/A

2.4.2.3 Sub-Alternative 2C: Single-year hard cap limits, individual trip limits, individual vessel limits, and in-season temporary closure upon reaching a specified percentage of the single-year hard cap for loggerhead and leatherback turtles

Under Sub-Alternative 2C, the framework would establish a process to specify fleet-wide single-year hard cap limits, individual trip limits, individual vessel limits, and an in-season temporary closure upon reaching a specified percentage of the single-year hard cap for loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery. This sub-alternative would include the in-season closure as an additional measure to the framework considered under Sub-Alternative 2B. Descriptions of the single-year hard cap limits, individual trip limits, individual vessel limits, and in-season temporary closure are included in Section 2.4.2.

Expected Fishery Outcomes for Sub-Alternative 2C

Under this sub-alternative, the fishery would be managed under fleet-wide single year hard caps consistent with the best available scientific information in the current BiOp. Of the four measures that would be included in the framework under Sub-Alternative 2C, individual trip limits are expected to provide the early detection and response mechanism to higher interaction

rates. The individual vessel limits would prevent vessels from reaching the individual trip limit multiple times in a year by prohibiting vessels that reach the vessel limit from shallow-setting for the remainder of the calendar year. The in-season temporary closure would provide a mechanism to allow shallow-set vessels to resume targeting swordfish at the beginning of the fishing season in October rather than delaying the start of the season until January 1, if the individual trip limits and vessel limits do not provide the intended "dampening" effect when high interaction rates are observed during the first three quarters of the calendar year.

Similar to Sub-Alternatives 2A and 2B, the fleet-wide single year hard cap limits provide the assurance that impacts do not exceed a threshold that triggers reinitiation of ESA consultation. Individual trip limits are expected to reduce the likelihood of reaching the loggerhead hard cap because it would prevent a large proportion of loggerhead turtles from being taken in a single trip, which are typically associated with years with high interaction rates. The individual trip limits for leatherback turtles may serve as a preventative measure if higher interaction rates are observed in the future. The available observer data from 2004-2018 indicate that the likelihood of a single vessel having multiple trips with high loggerhead or leatherback turtle interactions in a year is low, and the additional burden of prohibiting vessels from fishing shallow-set if vessels reached the individual vessel limits is not expected to result in substantial conservation gains. The in-season temporary closure may reduce the likelihood of reaching the fleet-wide annual hard cap limit in years with high loggerhead or leatherback turtle interactions because the fishery would be closed until October 1 if a percentage of the loggerhead or leatherback hard cap limit is reached during the first three quarters of the calendar year. However, the likelihood that the in-season temporary closure would be triggered would be low if the individual trip limit or individual vessel limit is specified at level that would minimize interactions in high interaction rate years.

The in-season temporary closure may increase the frequency of a fleet-wide closure, as it would place a lower limit during the first nine months of the calendar year. However, impacts from such increase in closures may be offset by the ability to resume fishing in October at the start of the typical fishing season rather than to delay until January 1. Administrative burden may increase if temporary closures increase the frequency of implementing closure procedures.

Under this sub-alternative, the fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year). Sea turtle interactions are likely to fluctuate substantially between years, but would be expected to remain well below the hard cap in most years and not exceed the anticipated level of loggerhead and leatherback turtle interactions authorized in the BiOp. The potential outcomes of the individual trip limit and individual vessel limit specifications would be the same as Sub-Alternative 2B (see Section 2.4.2.2).

2.5 Alternatives Considered, but Rejected from Further Analysis

In the development of this action, the Council considered a broader range of options for measures that may be included in the management framework. Alternatives considered by the Council but not analyzed further in this document are described below.

Multi-year Hard Cap Limits

This alternative would have modified the annual limits of loggerhead and leatherback turtles to a multi-year limit (2- or 3-year), consistent with the multi-year ITSs provided in the BiOp for the Hawaii shallow-set longline fishery. However, a multi-year limit, if implemented without an additional annual control, has the potential to close the fishery for more than one year if the fishery reaches the limit in the first year of the multi-year period. The alternative was rejected from further analysis due to the potential for an extended closure, which would be inconsistent with the purpose and need of the action to help ensure a continued supply of fresh swordfish to U.S. markets. An extended closure exceeding a period of one year also lacks legitimate conservation basis under the ESA.

Set Hard Cap Limits Lower than the ITS in the BiOp

This alternative would have considered hard cap limits lower than the loggerhead and leatherback hard cap limits in the BiOp for the Hawaii shallow-set longline fishery The alternative was rejected from further analysis because it would be inconsistent with the purpose of the action to develop a framework for effectively managing impacts to leatherback and loggerhead sea turtles from the Hawaii shallow-set longline fishery, consistent with the requirements of the ESA and the MSA, while maintaining fishing opportunities during peak swordfish season. Under the National Standard 1 of the MSA, fishery management measures must prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from the fishery. OY is generally seen as the amount of harvest in a fishery which will provide the greatest benefit of the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems including harvest at sustainable levels. The level of loggerhead and leatherback turtle interactions authorized in the ITS is a number of interactions that is not expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of sea turtles. An alternative that reduces the hard caps below this level would prevent fulfilling National Standard 1 because the fishery would close before producing optimum yield.

Removal of Hard Caps

This alternative would have removed the hard cap measure consisting of specified annual limits for loggerhead and leatherback turtles and associated fishery closure procedure. The Council considered this alternative at its 171st Meeting and selected the removal of hard caps as its preliminary preferred alternative. The higher levels of loggerhead turtle interactions observed since 2017 indicated that although existing management measures including hard caps provide important safeguards to ensure that sea turtle interactions remain within levels analyzed, they do not provide for early detection of and response to higher sea turtle interaction rates to guard against early closure of the fishery should the hard cap limit be reached. The Council

subsequently recommended a broader management framework to provide managers and fishery participants with the necessary tools to respond to and mitigate fluctuations in sea turtle interactions, so as to help ensure a continued supply of fresh swordfish to U.S. markets, consistent with the conservation needs of sea turtles.

Real-time Spatial Management Measures

This alternative would have established a process and mechanism to implement real-time spatial management measures to respond to unusually high loggerhead and leatherback interaction rates under anomalous oceanographic conditions or other unforeseen circumstances. The Council considered options at its 172nd and 173rd Meetings for establishing a monitoring mechanism utilizing observer data that would identify, on a real-time or near-real-time basis, interaction hotspots where interactions have exceeded a certain threshold. The identified hotspots would be closed to shallow-set longline fishing for a pre-determined period of time not exceeding 4 weeks.

The Council did not select real-time spatial management measures to be included in the framework as the SSC found that information on real-time hotspots is not well known and that information is lacking on fishing behavior changes in response to sea turtle interactions. Although TurtleWatch provides useful information to fishermen on where interaction potential may be higher for loggerhead turtles based on near real-time sea surface temperature data, the tool does not identify real-time interaction hotspots and does not inform decision-makers of the duration or size of potential hotspot closures. Beyond TurtleWatch, data are lacking on the effective size and duration of hotspot closures, as well as the potential for dispersed effort from such closures to areas of potentially higher sea turtle concentrations. In other words, we have insufficient data to conclude that actions to disperse fishing effort from a particular location will positively impact sea turtle conservation. Therefore, effectiveness of hotspot closures for loggerhead and leatherback turtles remain speculative.

Furthermore, identifying sea turtle interaction hotspots for possible closure raises significant notice and enforcement concerns, since days if not weeks will elapse before an area closure can be put in effect. In short, we cannot know that the area of concern continues to have a high concentration of sea turtles by the time the closure is noticed and effective.

For these reasons, there is insufficient data to support real-time spatial management measures as an effective responsive tool to mitigate fluctuations in sea turtle interactions, and thus the alternative was rejected from further analysis.

Time-Area Closures

This alternative would have considered static, pre-defined time-area closures for the Hawaii longline fishery to reduce loggerhead and leatherback turtle interactions, such as a January time-area closure previously considered in Amendment 18 to the Pelagic FMP. Observer data since 2004 indicate that there is considerable interannual variability in interactions even peak interaction months for loggerhead and leatherback turtles. For example, January was previously selected for a time-area closure alternative in Amendment 18, but observer data indicate that eight of the years since 2004 had zero or one interaction in January, indicating that the a closure

in January would have provided little to no conservation benefit in those years. Pre-defined time-area closures do not meet the purpose and need for this action, which aims to develop measures intended to detect and respond to unusually high interaction rates and to minimize further interactions while helping to ensure year-round supply of swordfish to meet domestic demand. Static, pre-defined closures do not respond to current interaction data, and thus this alternative was rejected from further analysis.

Sea Turtle Interaction Avoidance Pilot Program Utilizing Fleet Communication

In addition to the regulatory framework, the Council at its 173rd Meeting recommended establishing a timeline for monitoring the development and review of a sea turtle interaction avoidance pilot program utilizing fleet communication to be implemented by the industry. This recommendation is not intended to be part of the management framework at this time, but rather establishes a timeline for the Council to consider future adjustment to the framework. The Council's recommended timeline is as follows:

1. Support the development of the pilot program by working with the Hawaii shallow-set longline fishery participants, NMFS and other partners, and providing assistance as necessary and appropriate to set up the data sharing and fleet communication platform or other program components;
2. Monitor the development and implementation of the pilot program over 3 year period through periodical meetings between Council staff and industry participants;
3. After the 3 year development and implementation period, the Council would conduct a review of the pilot program through the Pelagic Plan Team and/or the appropriate Council advisory bodies. As part of the review, the Council will determine whether the program may be further improved and incentivized by modifying the management measures for mitigating sea turtle impacts in the fishery by establishing incentives as part of the management measures for mitigating sea turtle impacts in the shallow-set longline fishery under the Pelagic FEP.

At the May 4, 2018, industry workshop convened by the Council and the Hawaii Longline Association, the following pilot program was identified as a potential initiative that may be undertaken by the Hawaii shallow-set longline fishery participants, in coordination with the Council and other partners as appropriate, to incrementally develop a sea turtle interaction avoidance program:

- Participants of the Hawaii shallow-set longline fishery could start by entering into an information sharing agreement that would set up a data sharing and fleet communication platform.
- Under the agreement, the vessels could provide data related to sea turtle interactions and other relevant information to a third party and for that third party to provide data summaries back to the fleet in accordance with the terms of the agreement.
- The agreement could specify the types of data the participants would be willing to share with other vessels so that information that would assist vessels with sea turtle avoidance would be shared among the participants to the agreement while protecting proprietary fishing information.

- The agreement could be further developed in subsequent years to incrementally implement bycatch avoidance strategies (e.g., rolling hotspots) as more information is gathered through the data sharing platform.

The development and implementation of the pilot program is dependent on the industry participation and uptake of the agreement. If the pilot program is successful in establishing an information sharing agreement and fleet communication platform, it may provide an additional tool for vessels to minimize impacts to loggerhead and leatherback turtles while maintain fishing opportunities throughout the fishing season. The program remains in its initial stages of development and the outcomes of the program is speculative at this time. For this reason, the pilot program is not analyzed further in this document.

Table 14. Comparison of Features for Individual Measures Considered under Alternative 2.

Features	Individual Measures Considered under Alternative 2: Establish a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery			
	Single-year hard cap limits	**Individual trip limits**	**Individual vessel limits**	**In-season temporary closure upon reaching a specified percentage of the single-year hard cap**
Loggerhead (LH) and leatherback (LB) triggers	Council may recommend specification of hard cap limits consistent with the anticipated level of annual interactions set forth in the current BiOp.	Council may recommend specifications for individual trip limits on the number of LH and LB interactions on trips declared as shallow-set.	Council may recommend specifications for individual vessel limits on the number of LH and LB a vessel may have in a calendar year while fishing on trips declared as shallow-set.	Council may recommend a temporary fishery closure to be implemented when a certain percentage of the fleet-wide LH or LB hard cap limits are observed during the first three quarters of the calendar year. LH: 81% of limit during Jan-Sept LB: 72% of limit during Jan-Sept
Consequences of reaching the limit or trigger	SSLL fleet-wide closure for the remainder of the calendar year.	The applicable vessel will be required to return to port without making additional sets, and may resume shallow-set fishing after providing the required 72-hour notification under 50 CFR 665.803 prior to departure. Vessels that do not reach the limit will continue to operate.	The applicable vessel will be prohibited from targeting swordfish using shallow-set gear for the remainder of the calendar year. Vessels that do not reach the limit will continue to operate.	SSLL fleet-wide closure until September 30; fishery reopens on October 1 of the same calendar year.

Likelihood of reaching the authorized level of incidental take or hard cap limit	No reduction without additional measures.	Lower than status quo (mitigate large proportion of interactions from occurring on small number of trips)	Lower than status quo (mitigate large proportion of interactions from occurring on small number of vessels)	Lower than status quo (fishery would close at a lower limit in Jan-Sept)
Mechanism for early detection and response to higher interaction rates	None. Response (fishery closure) only occurs when limit is reached.	Responds to individual vessels with higher interactions. Trips with more than 4 interactions per trip are associated with years with the highest total fleet-wide interactions.	Responds to individual vessels with higher interactions. Vessels with more than 4 interactions per year are associated with years with the highest total fleet-wide interactions.	Detects and responds to higher interactions in Jan-Sept

Table 15. Comparison of Features of the Alternatives.

Topic	**Alternative 1: No-action (Fishery operates under loggerhead hard cap limit of 17 pursuant to court order)**	**Alternative 2: Establish a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery**		
		Sub-alternative 2A: (*Preferred Alternative*)	**Sub-alternative 2B**	**Sub-alternative 2C**
Measures included in the alternative	Status quo with hard cap limit of 17 loggerhead turtles (based on settlement agreement and court order) and 26 leatherback turtles	1) Single year hard cap limits 2) Individual trip limits	1) Single year hard cap limits 2) Individual trip limits 3) Individual vessel limits	1) Single year hard cap limits 2) Individual trip limits 3) Individual vessel limits 4) In-season temporary closure upon reaching a specified percentage of the single-year hard cap
Expected fishery outcomes	Fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year).	Fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year).	Same as sub-alternative 2A.	Same as sub-alternative 2A.

Mechanism for early detection and response to higher interaction rates	None. Response (fishery closure) only occurs when limit is reached.	Individual trip limits for loggerhead turtles provide mechanism for early detection and response to high interactions. Individual trip limits for leatherback turtles may serve as a preventative measure if higher interaction rates are observed in the future.	Same as sub-alternative 2A.	Same as sub-alternative 2B.
Likelihood of fleet-wide hard cap closure	Occasional fleet-wide closure expected from reaching the hard cap limit.	Individual trip limits for loggerhead turtles are expected to reduce likelihood of reaching hard cap limits, providing a greater likelihood that the fishery maintains year-round operations.	Similar to sub-alternative 2A. The addition of the individual vessel limits may provide an additional stopgap against reaching the hard cap limit if a vessel encounters high interactions on multiple trips within a year.	Similar to sub-alternative 2B. The addition of the in-season temporary closure would provide an additional stopgap against reaching the hard cap limit if the individual trip and vessel limits do not provide sufficient response to high interaction rates.
Mechanism for addressing conservation needs of loggerhead and leatherback turtles	Hard cap limits provide assurance that the fishery's impacts remain below a fixed level of interactions analyzed in the BiOp.	Hard cap limits provide assurance that the fishery's impacts remain below a fixed level of interactions analyzed in the BiOp. Individual trip limits are expected to reduce the likelihood of reaching the hard cap limits and consequently reduce the total fleet-wide number of interactions.	Hard cap limits provide assurance that the fishery's impacts remain below a fixed level of interactions analyzed in the BiOp. Individual trip and vessel limits are expected to reduce the likelihood of reaching the hard cap limits and consequently reduce the total fleet-wide number of interactions.	Hard cap limits and provide assurance that the fishery's impacts remain below a fixed level of interactions analyzed in the BiOp. Individual trip and vessel limits, and the in-season temporary closure are expected to reduce the likelihood of reaching the hard cap limits and consequently reduce the total fleet-wide number of interactions.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section describes the affected fisheries and fishery resources, and other biological and physical resources. For additional information on the fisheries and affected resources, please refer to the Pelagic FEP (WPFMC 2009a), Amendment 18 to the Pelagic FEP (WPRFMC 2009b) and the Stock Assessment and Fishery Evaluation (SAFE) Report (WPRFMC 2017).

3.1 Affected Physical Resources

The action area includes the portion of the North Pacific Ocean encompassing an approximate area between 180°- 125° W and 17°- 45° N where the Hawaii shallow-set longline fishery operates, and includes the US EEZ around Hawaii and high seas to the north and northeast of the MHI. The Hawaii shallow-set longline fishery operates in the pelagic ecosystem with gear fishing at depths of less than 100 m. Physical features of the affected environment include open ocean waters and features of those habitats such as circulation, temperature, and salinity. The physical setting of the fisheries is described in the Pelagic FEP (WPRFMC 2009a).

3.2 Affected Biological Resources: Target and Non-Target Stocks

Species of oceanic pelagic fishes live in tropical and temperate waters throughout the Pacific Ocean. They are capable of long migrations that reflect complex relationships to oceanic environmental conditions. These relationships are different for larval, juvenile and adult stages of fish. Geographic distribution varies with seasonal changes in ocean temperature. In both the Northern and Southern Hemispheres, there is seasonal movement of tunas, billfish and other pelagic species toward the pole in the warmer seasons and a return toward the equator in the colder seasons. Adult pelagic fishes in the western Pacific range as far north as Japan and as far south as New Zealand. Albacore, striped marlin and swordfish can be found in even cooler waters at latitudes as far north as latitude 50° N and as far south as latitude 50° S.

This section identifies the pelagic management unit species (PMUS) managed under the Pelagic FEP that are harvested in longline fisheries of American Samoa, Guam, the CNMI and Hawaii. They include several species of tuna, billfish and sharks shown in Table 16. This section also briefly summarizes the overfishing and overfished status of PMUS where known. For a comprehensive discussion of the biology and life history of PMUS, see the Pelagic FEP (WPFMC 2009a).

The Pelagic FEP (WPFMC 2009a) includes criteria for overfishing and overfished status determinations. Overfishing occurs when the fishing mortality rate (F) for one or more years is greater than the maximum fishing mortality threshold (MFMT), which is the fishing mortality rate that produces MSY (F_{MSY}). Thus, if the F/F_{MSY} ratio is greater than 1.0, overfishing is occurring.

A stock is considered overfished when its biomass (B) has declined below the minimum stock size threshold (MSST), the level, which jeopardizes the capacity of the stock to produce MSY on a continuing basis (B_{MSY}). Specifically, the $B_{MSST} = (1\text{-}M)B_{MSY}$, where M is the natural mortality rate of the stock, or one half of B_{MSY}, whichever is greater. For example, if the natural mortality

rate of a stock is 0.35, $B_{MSST} = 0.65*B_{MSY}$. Thus, if the B/B_{MSY} ratio falls below 0.65, the stock is overfished. If a stock has a natural mortality rate of 0.6, MSST is set at the default of $0.5*B_{MSY}$ (because 1- 0.6 = 0.4, and 0.5 is greater than 0.4). For such a stock, the stock is overfished when the B/B_{MSY} ratio falls below 0.5.

Table 16. Stock status of PMUS under the Pelagic FEP.

Species	Stock	Overfishing?	Overfished?
Bigeye tuna (*Thunnus obesus)*	Western Central Pacific	No	No
	Eastern Pacific	Yes	No
Yellowfin tuna (*Thunnus albacares)*	Western Central Pacific	No	No
	Eastern Pacific	No	No
Skipjack tuna (*Katsuwonus pelamis*)	Western Central Pacific	No	No
Albacore (*Thunnus alalunga)*	North Pacific	No	No
	South Pacific	No	No
Pacific bluefin tuna (*Thunnus orientalis*)	Pacific	Yes	Yes
Swordfish *(Xiphias gladius)*	Western Central North Pacific	No	No
	Eastern Pacific	Yes	No
Striped marlin (*Kajikia audax*)	Western Central North Pacific	Yes	Yes
Blue marlin (*Makaira nigricans*)	Pacific	No	No
Blue shark (*Prionace glauca*)	North Pacific	No	No
Oceanic whitetip shark (*Carcharhinus longimanus*)	Western and Central Pacific	Yes	Yes
Shortfin mako shark (*Isurus oxyrinchus*)	North Pacific	Unknown	Unknown
Longfin mako shark (*Isurus paucus*)	North Pacific	Unknown	Unknown
Silky shark (*Carcharhinus falciformis*)	Western and Central Pacific	Yes	Yes
Common thresher shark (*Alopias vulpinus*)	North Pacific	Unknown	Unknown
Bigeye thresher shark (*Alopias superciliosus*)	North Pacific	Unknown	Unknown
Pelagic thresher shark (*Alopias pelagicus*)	North Pacific	Unknown	Unknown
Salmon shark *(Lamna ditropsis*)	North Pacific	Unknown	Unknown
Mahimahi (*Coryphaena spp*.)	Pacific	Unknown	Unknown
Wahoo (*Acanthocybium solandri*)	Pacific	Unknown	Unknown
Opah (*Lampris* spp.)	Pacific	Unknown	Unknown
Pomfret (family Bramidae)	Western Pacific	Unknown	Unknown
Black Marlin (*Istiopax indica*)	Pacific	Unknown	Unknown
Shortbill spearfish (*Tetrapturus anustirostris*)	Pacific	Unknown	Unknown
Sailfish (*Istiophorus platypterus*)	Pacific	Unknown	Unknown

Species	Stock	Overfishing?	Overfished?
Kawakawa (*Euthynnus affinis*)	Pacific	Unknown	Unknown
Oilfish (family Gympylidae)	Pacific	Unknown	Unknown
Squid	Pacific	Unknown	Unknown

Source: WPRFMC (In prep).

For further detailed information on target and non-target stocks including life history and distribution, refer also to the 2009 Amendment 18 to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region including a Final Supplemental Environmental Impact Statement prepared by the Council and NMFS (WPRFMC 2009b).

3.2.1 North Pacific Swordfish

Swordfish (*Xiphias gladius*) are the primary target species of the Hawaii-based shallow-set fishery, typically comprising 90 percent of the landed catch. Broadbill swordfish are worldwide in distribution in all tropical, subtropical and temperate seas, ranging from around 50° N to 50° S (Nakamura 1985; Bartoo and Coan 1989). The adults can tolerate a wide range of water temperature, from 5°-27° C, but are normally found in areas with SSTs above 13° C (Nakamura 1985). Larvae and juveniles occur in warmer tropical and subtropical regions where spawning also occurs. Swordfish occur throughout the entire region of the Council's jurisdiction and in the EEZs of neighboring countries and adjacent high seas.

In 2014, the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) completed a stock assessment for North Pacific swordfish using data through 2012 (ISC 2014c). Based on the best scientific information available, the swordfish population in the North Pacific is comprised of two stocks, separated by a roughly diagonal boundary extending from Baja California, Mexico, to the Equator. These are the Western Central North Pacific Ocean (WCNPO) stock, distributed in the western and central Pacific Ocean, and the EPO stock, distributed in the eastern Pacific Ocean (Figure 3). The Hawaii shallow-set longline fishery predominately catches swordfish from the WCNPO stock.

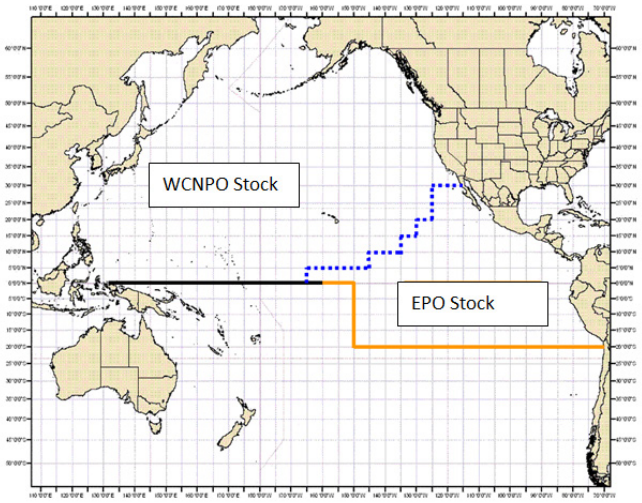

Figure 3: Stock boundaries of North Pacific Swordfish
Source: NMFS PIFSC

WCNPO stock

The results of the 2014 assessment support the conclusion that the WCNPO stock is not subject to overfishing because $F_{2012}/F_{MSY} = 0.58$, and is not overfished because $B_{2012}/B_{MSY} = 1.20$. The 2014 stock assessment estimated MSY for the WCNPO stock at 14,920 mt. In 2016, total landings of WCNPO swordfish by all U.S. longline fisheries was 1,617 mt, or approximately 4 percent of the estimated MSY. Approximately 99% of US longline swordfish landings in the Pacific were made by the Hawaii longline fishery (NMFS 2018).

EPO stock

The results of the 2014 assessment support a conclusion that the EPO stock is subject to overfishing because $F_{2012}/F_{MSY} = 1.11$, but is not overfished because $B_{2012}/B_{MSY} = 1.87$. The 2014 stock assessment estimated MSY for the EPO stock at 5,490 mt. Based on federal logbook records, catch of swordfish by the U.S. longline vessels operating within the boundary of the EPO stock is less than 5 mt annually, or less than 1 percent of the estimated MSY (PIFSC unpublished data). Thus, overfishing of the EPO stock is due to excessive international fishing pressure and the IATTC and WCPFC have inadequate measures in place to address the issue. Nonetheless, NMFS continues to work with the Pacific and Western Pacific Councils and the State Department to ensure that effective management measures be adopted by the WCPFC and IATTC to end overfishing.

3.2.2 Bigeye Tuna

Bigeye tuna is considered a Pacific-wide stock, but is assessed separately in the WCPO and EPO. Bigeye tuna in the EPO was assessed in 2017 and was found to not be experiencing overfishing or in an overfished condition (Aires-de-Silva et al. 2017).

The most recent stock assessment for WCPO bigeye tuna was completed in July 2017 and covers bigeye tuna from Indonesia in the far western Pacific, to the 150° W in the central Pacific Ocean (McKechnie, et al., 2017). The 2017 assessment updates the previous stock assessment prepared by the SPC in 2014 by incorporating additional bigeye catch data from 2013-2015, and investigating alternative regional bigeye tuna stock structure in combination with new bigeye tuna growth curve, which suggests bigeye tuna is more productive than previously assumed.

Based on the uncertainty grid adopted by the WCPFC SC13, the WCPO bigeye tuna spawning biomass is likely above the biomass LRP and recent F is likely below FMSY, and therefore noting the level of uncertainties in the current assessment it appears that the stock is not experiencing overfishing (77% probability) and it appears that the stock is not in an overfished condition (84% probability). The central tendency of relative recent spawning biomass under the selected new and old growth curve model weightings was median (SBrecent/SBF=0) = 0.32 with a range of 0.08 to 0.44. There was a roughly 16% probability (23 out of 144 model weight units) that the recent spawning biomass had breached the adopted LRP.

The central tendency of relative recent fishing mortality under the selected new and old growth curve model weightings was median(Frecent/FMSY) = 0.83 with a range of 0.54 to 1.76 (Table

4). There was a roughly 23% probability (33 out of 144 model weight units) that the recent fishing mortality was above FMSY.

3.2.3 Yellowfin Tuna

The most recent stock assessment for yellow tuna in the WCPO was conducted by Tremblay-Boyer et al. (2017). Yellowfin is not believed to be subject to overfishing or overfished. Similar to what was done for bigeye, the SC endorsed a weighted assessment model uncertainty grid to characterize stock status. SC13 noted that the central tendency of relative recent spawning biomass was median (SBrecent/SBF=0) = 0.33 with a probable range of 0.20 to 0.41 (80% probable range), and that there was a roughly 8% probability (4 out of 48 models) that the recent spawning biomass had breached the WCPFC LRP. The central tendency of relative recent fishing mortality was median (Frecent/FMSY) = 0.74 with an 80% probability interval of 0.62 to 0.97, and there was a roughly 4% probability (2 out of 48 models) that the recent fishing mortality was above F_{MSY}. In 2016, total yellowfin tuna landings by the longline fisheries in Hawaii, American Samoa, Guam and the CNMI was 1,522 mt (Table 17) or less than 1 percent of the estimated MSY. Of the 1,522 mt, the longline fleet based in Hawaii accounted for 1,098 mt with the remainder landed by the American Samoa longline fishery.

3.2.4 Albacore Tuna

The ISC in 2017 completed most recent stock assessment of North Pacific albacore, which uses data through 2015 (ISC 2017). The assessment indicates that: a) the stock is likely not overfished relative to the limit reference point adopted by the WCPFC (20%SSBcurrent, F=0), and b) no F-based reference points have been adopted to evaluate overfishing, but stock status was evaluated against seven potential reference points and current fishing intensity (F2012-2014) is below six of the seven reference points except for F50%. In 2016, total albacore tuna landings in the North Pacific by the longline fisheries in Hawaii, American Samoa, Guam and the CNMI was 244 mt (Table 17), or less than 1 percent of the estimated MSY. Nearly all of the landings were made by the Hawaii longline fishery.

3.2.5 Blue Marlin

The 2016 stock assessment by the ISC Billfish Working Group (ISC 2016), which uses data through 2014 indicates Pacific blue marlin is not experiencing overfishing (F_{2014}/F_{MSY} = 0.88). Applying the 2014 spawning biomass (SB) estimates of 24,809 mt, and the SB at MSY of 19,858 mt, the ratio of SB/SB_{MSY} is 1.25 indicating the stock is not overfished. In 2016, total blue marline tuna landings by all longline fisheries in Hawaii, American Samoa, Guam and the CNMI was 517 mt (Table 17), or approximately 3 percent of the estimated MSY. Of the 517 mt, the Hawaii longline fishery accounted for 429 mt with the remainder caught by American Samoa longline fishery.

3.2.6 Striped Marlin

The results of a 2015 stock assessment (ISC 2015) indicates the western and Central North Pacific stock of striped marlin continues to be subject to overfishing (F/F_{MSY} is =1.49) and overfished (SB/SB_{MSY} = 0.39). The 2015 stock assessment estimated MSY at 5,657 mt. CMM

2010-01 for North Pacific striped marlin adopted by the WCPFC requires members and cooperating non-members to limit striped marlin landings by all gears from their highest catches from 2000-2003, and then further reduce catches by 10 percent in 2011, 15 percent in 2012, and 20 percent in 2013. The SIDS and PTs are exempt from catch limits under the measure. The highest striped marlin catch by U.S. fisheries between 2000 and 2003 is 571 mt. Thus, a 20 percent reduction from 571 mt is 457 mt. The Hawaii longline fishery accounts for more than 90 percent of the total U.S. of this stock, with the remainder made by Hawaii small-scale troll fisheries. Since 2012, total landings of WCNPO striped marlin by all U.S. fisheries combined has never exceeded 457 mt (NMFS PIFSC 2016 U.S. Part 1 annual report to the WCPFC).

In 2016, total WCNPO striped marlin landings by all U.S. fisheries was 341 mt, with the Hawaii longline fishery accounting for 329 mt (Table 17) and the Hawaii troll fisheries accounting for 12 mt. Thus, overfishing of the stock is due to excessive international fishing pressure and the IATTC and WCPFC have inadequate measures in place to address the issue. Nonetheless, NMFS continues to work with the Pacific and Western Pacific Councils and the State Department to ensure that effective management measures be adopted by the WCPFC and IATTC to end overfishing.

3.2.7 North Pacific Blue Shark

The results of the 2017 assessment (ISC 2017b) indicate the North Pacific blue shark is not subject to overfishing ($F_{2012\text{-}2014}/F_{MSY} = 0.37$), and is not overfished ($SB_{2012\text{-}2014}/SB_{MSY} = 1.71$). The 2017 stock assessment estimated SB_{MSY} at 179,539 mt. In 2016, total blue shark landings by all U.S. longline fisheries was 0 mt (Table 17). Nearly all blue sharks caught in US longline fisheries are returned to the sea alive, with some discarded dead as well.

3.2.8 Oceanic Whitetip Shark

A 2012 stock assessment for oceanic whitetip shark indicates that it is likely overfished and experiencing overfishing (Rice and Harley 2012a). Recent analysis of four different datasets for the WCPO oceanic whitetip sharks show clear, steep and declining trends in abundance indices for this species. Analysis of two of these datasets for median lengths confirmed that oceanic whitetip sizes decreased significantly until samples became too scarce for meaningful analysis. Given the strong evidence for the depleted state of the oceanic whitetip population in the WCPO, stock assessment studies may clarify but will not alter the case for further conservation and management action. The assessment by Rice and Harley (2012a) estimate current biomass of oceanic whitetip sharks in the WCPO to be 7,295 mt and current catches at 2,001 mt, which is lower than the MSY of 2,700 mt. The biomass equivalence to individuals is estimated to be approximately 200,000 individuals (FAO 2012). The greatest impact on the stock is attributed to bycatch from the WCPO longline fishery, with lesser impacts from the target longline activities and purse seining in the WCPO. Given the bycatch nature of fishery impacts, mitigation measures provide the best opportunity to improve the status of the oceanic whitetip population.

Despite the data limitations, model runs indicate that the WCPO oceanic whitetip shark stock is currently overfished and overfishing is occurring relative to commonly used MSY-based reference points and depletion-based reference points. Under CMM 2011-04, the WCPFC has agreed to a non-retention measure to reduce fishing mortality and to rebuild spawning biomass of

oceanic white tip shark. In 2016, total oceanic white tip shark landings by all U.S. longline fisheries was 0 mt.

On January 30, 2018, NMFS issued a final rule (83 FR 4153) to list the oceanic white-tip shark as threatened under the ESA.

3.2.9 Shortfin Mako Shark

Recent abundance indices and median size analyses for shortfin mako in the WCPO have shown no clear trends; therefore, there is no apparent evidence of the impact of fishing on this species in the WCPO. Most previously published stock status studies are also inconclusive. Ongoing issues of concern for the WCPO are: 1) a previously published study suggesting stock reduction in the northwest Pacific using virtual population analysis; 2) the high vulnerability of shortfin mako to longline fishing; and 3) the potential for collateral targeting in directed fishing for blue sharks in the North Pacific. In 2016, total mako shark landings by all U.S. longline fisheries was 46 mt (Table 17).

3.2.10 Silky Shark

Silky sharks have a restricted habitat range compared to the other WCPFC key species but within this range, they dominate both longline and purse seine catches. The assessment by Rice and Harley (2012b) conclude that current catches are higher than the MSY (5,950 mt versus 1,885 mt), further catch at current levels of fishing mortality would continue to deplete the stock below MSY. The greatest impact on the stock is attributed to bycatch from the longline fishery, but there are also significant impacts from the associated purse seine fishery, which catches predominantly juvenile individuals, the fishing mortality from the associated purse seine fishery is above F_{MSY}. Given the bycatch nature of fishery impacts, mitigation measures provides the best opportunity to improve the status of the silky shark population. The stock assessment was presented to the 8th WCPFC Science Committee. Due to concerns over the data conflict and potential biases in the silky shark assessment, it was not possible to provide management advice based on the assessment. However, noting that some basic fishery indicators (e.g., mean lengths and some CPUE series) are showing declines in recent years, the Science Committee recommended no increase in fishing mortality on silky sharks. In 2016, total silky shark landings by all U.S. longline fisheries was 46 mt (Table 17).

Table 17. Longline landings (mt) by species and species group for U.S. longline vessels operating in the WCPFC statistical area, 2015-2017.

	U.S. in North Pacific Ocean			CNMI in North Pacific Ocean			Guam in North Pacific Ocean			American Samoa in North Pacific Ocean			American Samoa in South Pacific Ocean			Total		
	2017	**2016**	**2015**	**2017**	**2016**	**2015**	**2017**	**2016**	**2015**	**2017**	**2016**	**2015**	**2017**	**2016**	**2015**	**2017**	**2016**	**2015**
Vessels	136	133	135	119	117	117		118	112	118	23	22	15	20	21	150	151	156
Species																		
Albacore, North Pacific	74	209	197							16	34	19				90	243	217
Albacore, South Pacific			0										1,381	1,517	1,855	1,381	1,517	1,855
Bigeye tuna	2,968	3,761	3,427	997	884	999		939	856	1,330	586	441	64	72	116	5,358	5,284	5,840
Pacific bluefin tuna	0	0	0							0			1	0	6	2	1	6
Skipjack tuna	157	183	176							35	26	11	63	94	67	254	306	254
Yellowfin tuna	1,761	1,098	681							293	175	105	533	386	255	2,587	1,654	1,041
Other tuna		0	0								0						0	0
TOTAL TUNA	4,960	**5,252**	**4,482**	997	**884**	**999**		**939**	**856**	1,674	821	577	2,042	2,069	2,299	9,673	9,003	9,214
Black marlin	0	1	0							0		0	0			1	1	0
Blue marlin	485	429	445							84	57	55	38	30	25	606	506	525
Sailfish	9	15	11							2	2	2	1	2	2	12	19	15
Spearfish	206	251	188							26	28	15	2	2	1	234	281	204
Striped marlin, North Pacific	286	281	378							48	48	36				334	327	414
Striped marlin, South Pacific			0										2	2	3	2	2	3
Other marlins	1	1	1							0		0				1	1	1
Swordfish, North Pacific	924	595	665							49	43	24				973	639	690
Swordfish, South Pacific			0										6	6	8	6	6	8
TOTAL BILLFISH	1,910	**1,573**	**1,688**							209	179	133	48	41	40	2,168	1,782	1,861
Blue shark											0			1	1		1	1
Mako shark	30	37	35							5	9	4	0	0		35	46	39
Thresher	2	3	5							0	0	1	1	0		3	4	6
Other sharks	0	0											0	0		0	0	
Oceanic whitetip shark														0				
Silky shark	0															0		
Hammerhead shark		0															0	
Tiger shark																		
Porbeagle																		
TOTAL SHARKS	32	**40**	**40**							6	10	5	1	1	1	39	51	45
Mahimahi	147	202	199							22	28	21	14	4	6	183	234	226
Moonfish	258	304	279							61	74	55	1	2	2	321	380	336
Oilfish	93	160	165							21	29	20	0	2	0	115	191	185
Pomfret	261	339	380							38	46	39	0	0	0	299	386	419
Wahoo	218	309	256							35	47	27	48	47	58	301	403	340
Other fish	2	7	7							0	1	1	0	1	1	3	9	9
TOTAL OTHER	980	**1,322**	**1,285**							178	224	164	64	55	66	1,222	1,602	1,515
GEAR TOTAL	**7,883**	**8,187**	**7,495**	**884**	**999**	**1,000**	**939**	**856**		**2,067**	**1,234**	**878**	**2,155**	**2,167**	**2,405**	**13,101**	**12,439**	**12,634**

Source: NOAA NMFS (2018).

3.2.11 Hawaii Shallow-set Longline Fishery Catch Statistics

Table 8 shows the released catch, retained catch, and total catch of PMUS caught in Hawaii shallow-set longline fishery. Additional information on the fishery is summarized in the Socioeconomic Setting section of this document (see Section 75. The latest fishery statistics can be found in the FEP Annual SAFE reports at: http://www.wpcouncil.org/fishery-plans-policies-reports/fishery-reports-2/.

Table 18. Released catch, retained catch, and total catch of PMUS (number of fish) caught in the Hawaii shallow-set longline fishery, 2016.

	Shallow-set longline fishery			
	Released catch	Percent released	Retained catch	Total Catch
Tuna				
Albacore	3	5.1	56	59
Bigeye tuna	72	7.7	869	941
Bluefin tuna	0	0.0	0	0
Skipjack tuna	2	10.0	18	20
Yellowfin tuna	16	5.3	285	301
Other tuna	0	0.0	0	0
Total tunas	**93**	**7.0%**	**1,228**	**1,321**
Billfish				
Blue marlin	4	4.2	91	95
Spearfish	28	17.5	132	160
Striped marlin	32	9.7	297	329
Other marlin	0	0.0	7	7
Swordfish	719	7.4	9,011	9,730
Total billfish	**783**	**7.6%**	**9,538**	**10,321**
Other PMUS				
Mahimahi	28	2.5	1,106	1,134
Moonfish	46	17.0	225	271
Oilfish	275	47.8	300	575
Pomfret	3	16.7	15	18
Wahoo	1	2.6	38	39
Total other PMUS	**353**	**17.3%**	**1,684**	**2,037**
Non-PMUS fish	**1**	**100.0**	**0**	**1**
Total non-shark	**1,230**	**9.0%**	**12,450**	**13,680**
PMUS Sharks				
Blue shark	10,874	100.0	0	10,874
Mako shark	783	87.5	112	895
Thresher shark	87	98.9	1	88
Oceanic Whitetip shark	22	100.0	0	22
Silky shark	0	0.0	0	0
Total PMUS sharks	**11,766**	**99.0%**	**113**	**11,879**
Non-PMUS sharks	**57**	**100.0**	**0**	**57**
Grand Total	**13,053**	**51.0%**	**12,563**	**25,616**

Source: WPRFMC 2017.

3.3 Affected Biological Resources: Protected Resources

The Hawaii shallow-set longline vessels have the potential to interact with a range of protected species (such as marine mammals, sea turtles, and seabirds). Table 19 lists the species listed as endangered or threatened under the ESA that have the potential to interact with the shallow-set fishery managed under the Pelagic FEP. This section also provides the number of interactions observed and estimated between protected species and the Hawaii shallow-set longline fishery with regard to recent fishing effort.

Species Protected under the Endangered Species Act (ESA)

The ESA provides for the conservation of species that are endangered or threatened, and the conservation of the ecosystems on which they depend. Section 7(a)(2) of the ESA requires each federal agency to ensure 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 designated critical habitat of such species. To "jeopardize" means to reduce appreciably the likelihood of survival and recovery of a species in the wild by reducing its numbers, reproduction, or distribution. When a federal agency's action "may affect" an ESA-listed species, that agency is required to consult formally with NMFS (for marine species, some anadromous species, and their designated critical habitats) or the U.S. Fish and Wildlife Service (USFWS) for terrestrial and freshwater species or their designated critical habitat. The product of formal consultation is the agency's biological opinion (BiOp). Federal agencies are exempt from this formal consultation requirement if they have concluded that an action "may affect, but is not likely to adversely affect" ESA-listed species or their designated critical habitat, and NMFS or USFWS concur with that conclusion (see ESA section 7 Formal Consultation; 50 CFR 402.14(b)).

The ESA also prohibits the taking[4] of listed species except under limited circumstances. Western Pacific fisheries authorized under the Pelagic FEP operate in accordance with terms and conditions set by ESA consultations, including applicable incidental take statements. The consultations consider the potential interactions of fisheries with listed species, the impacts of interactions on the survival and recovery of listed species, and the protection of designated critical habitat.

As provided in 50 CFR 402.16, NMFS is required to reinitiate formal consultation if:

1. the amount or extent of the incidental take is exceeded;
2. new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in an opinion;
3. the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the opinion; or
4. a new species is listed or critical habitat designated that may be affected by the action.

[4] The definition of "take" includes to harass, harm, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. 50 CFR 402.02.

Table 19. ESA-listed species with the potential to interact with the Hawaii shallow-set longline vessels permitted under the Pelagic FEP.

Species	ESA status
Sea Turtles	
Central North Pacific green turtle distinct population segment (DPS) (*Chelonia mydas*)	Threatened
East Pacific green turtle DPS (*Chelonia mydas*)	Threatened
Hawksbill turtle (*Eretmochelys imbricata*)	Endangered
Leatherback turtle (*Dermochelys coriacea*)	Endangered
North Pacific loggerhead turtle DPS (*Caretta caretta*)	Endangered
Olive ridley turtle *(Lepidochelys olivacea*)	Threatened, except for Mexico's nesting population which is Endangered
Marine Mammals	
Blue whale (*Balaenoptera musculus*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Hawaiian monk seal (*Neomonachus schauinslandi*)	Endangered
Main Hawaiian Islands insular false killer whale DPS (*Pseudorca crassidens*)	Endangered
North Pacific right whale (*Eubalaena japonica*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Guadalupe fur seal (*Arctocephalus townsendi*)	Endangered
Seabirds	
Hawaiian dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*)	Endangered
Newell's shearwater (*Puffinus auricularis newelli*)	Threatened
Short-tailed albatross (*Phoebastria albatrus*)	Endangered
Sharks and Rays	
Scalloped hammerhead shark, Eastern Pacific DPS	Endangered
Oceanic whitetip shark (*Carcharhinus longimanus*)	Threatened
Giant manta ray (*Manta birostris*)	Threatened

Source: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm, accessed May 15, 2017.

The following identifies the valid BiOps under which western Pacific longline fisheries currently operate. This section summarizes much of the information contained in these documents for the purpose of describing baseline conditions. For further information, refer to the following documents on NMFS' website below, or by contacting NMFS using the contact information at the beginning of the document. http://www.fpir.noaa.gov/DIR/dir_public_documents.html

NMFS. 2012, as amended. Continued operation of the Hawaii-based Shallow-set Longline Swordfish Fishery - under Amendment 18 to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region.

USFWS. 2012, Biological Opinion of the U.S. Fish and Wildlife Service for the Operation of Hawaii-based Pelagic Longline Fisheries, Shallow-Set and Deep-Set, Hawaii.

Consultation for the Hawaii shallow-set longline fishery was reinitiated on April 20, 2018, due to reaching several reinitiation triggers. The fishery had interactions with the ESA-listed Guadalupe fur seals, which was previously unknown to interact with the fishery, and the revision of the green turtle listing under distinct population segments (DPSs; 81 FR 20058) also triggered the requirement for reconsultation. Additionally, NMFS listed the oceanic whitetip shark (83 FR 4153) and giant manta rays (83 FR 2916) as threatened species under the ESA in January 2018, and the fishery exceeded the olive ridley sea turtle ITS in early 2018. On May 4, 2018, the portion of the 2012 BiOp pertaining to loggerhead turtles was vacated and remanded to NMFS under a stipulated settlement agreement and court order. A summary of the anticipated level of interactions and the analysis of the Hawaii shallow-set fishery's effects on ESA-listed species in the Biological Evaluation (BE) reinitiating consultation is included in Section 3.3.6.

Species Protected under the Marine Mammal Protection Act (MMPA)

The MMPA prohibits, with certain exceptions, the take of marine mammals in the U.S. EEZ and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. The MMPA authorizes the Secretary to protect and conserve all cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals and sea lions, except walruses). The MMPA requires NMFS to prepare and periodically review marine mammal stock assessments. *See* 16 U.S.C. § 1361, *et seq*.

Pursuant to the MMPA, NMFS has promulgated specific regulations that govern the incidental take of marine mammals during fishing operations (50 CFR 229). Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries that classifies U.S. commercial fisheries into three categories, based on relative frequency of incidental mortality and serious injury to marine mammals in each fishery:

- Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing. Annual mortality and serious injury of a stock in a given fishery is by itself responsible for the annual removal of greater than or equal to 50 percent or more of any stock's potential biological removal (PBR) level (i.e., frequent incidental mortality and serious injuries of marine mammals).

- Category II designates fisheries with occasional serious injuries and mortalities incidental to commercial fishing. Annual mortality and serious injury of a stock in a given fishery is, collectively with other fisheries, responsible for the annual removal of greater than 10 percent of any stock's PBR level, and is by itself responsible for the annual removal of between 1 and less than 50 percent, exclusive, of any stock's PBR level (i.e., occasional incidental mortality and serious injuries of marine mammals).

- Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities. A Category III fishery is, collectively with other fisheries, responsible for the annual removal of 10 percent or less of any stock's PBR level; or collectively with other fisheries, more than 10 percent of any stock's PBR level, but is by itself responsible for the annual removal of 1 percent or less of PBR level (i.e., a remote likelihood or no known incidental mortality and serious injuries of marine mammals).

According to the 2018 List of Fisheries (83 FR 5349, February 7, 2018), the Hawaii shallow-set longline fishery is a Category II fishery due to its interactions with Blainville's beaked whales, bottlenose dolphins, false killer whales, Central North Pacific humpback whales, risso's dolphins, rough-toothed dolphins, striped dolphins, and short-finned pilot whales. Among other requirements, owners of vessels or gear engaging in a Category I or II fishery are required under 50 CFR 229.4 to obtain a marine mammal authorization to lawfully take incidentally, non-ESA listed marine mammals by registering with NMFS' marine mammal authorization program. The CNMI and Guam longline fisheries are inactive and not designated under the List of Fisheries at this time.

Section 101 (a)(5)(E) of the MMPA requires the Secretary of Commerce to allow the incidental, but not intentional, taking of individuals from marine mammal stocks that are designated as depleted because of a listing as threatened or endangered under the ESA in the course of commercial fishing operations if it is determined that three criteria are met:

1. Incidental mortality and serious injury will have a negligible impact on the affected species or stock;
2. A recovery plan has been developed or is being developed; and
3. Where required under section 118 of the MMPA, a monitoring program has been established, vessels engaged in such fisheries are registered in accordance with section 118 of the MMPA, and a take reduction plan (TRP) has been developed or is being developed for such species or stock.

3.3.1 Sea Turtles

The Hawaii shallow-set longline fishery interacts with several species of sea turtles. The fishery is also managed through several measures to mitigate the potential for turtle interactions and injury if interactions occur. These measures include training and handling requirements for reducing the severity of interactions, and requirements for the fishery to use large circle hooks and mackerel-type fish bait. Additionally, federal regulations require a fishery closure once the fishery reaches the loggerhead or leatherback hard cap limits. On March 31, 2012, NMFS issued a no-jeopardy biological opinion (2012 BiOp; NMFS 2012) for the shallow-set longline fishery, and authorized incidental take of loggerhead, leatherback, olive ridley and green sea turtles (NMFS 2014) shown in Table 20. Based on this information, NMFS in its 2012 BiOp concluded that the Hawaii shallow-set longline fishery as managed under the Pelagic FEP is not likely to jeopardize the continued existence or recovery of any sea turtle species. The 1-year ITSs for loggerhead and leatherback turtles are equal to the hard cap limits implemented after the 2012 BiOp.

Table 20. The numbers of sea turtles estimated to be captured and/or killed in the Hawaii shallow-set fishery over two consecutive calendar years in NMFS 2012 biological opinion.

Sea turtle species	1-year		2-year	
	Interactions	Mortalities	Interactions	Mortalities
N. Pacific loggerhead [a]	34	7	68	14
Leatherback	26	6	52	12
Olive ridley	2	1	4	2
Green	3	1	6	2

[a] The portion of the 2012 BiOp pertaining to loggerhead turtles was vacated and remanded to NMFS under a stipulated settlement agreement and court order on May 4, 2018.
Source: NMFS 2012b.

On December 27, 2017, a Ninth Circuit panel issued a split 2-1 opinion finding that NMFS's 2012 BiOp's no-jeopardy determination and associated incidental take statement for the loggerhead turtle to be arbitrary and capricious. *Turtle Island Restoration Network, et al. v. U.S. Dep't of Commerce, et al.*, 878 F.3d 725, 740 (9th Cir. 2017). On May 4, 2018, the portion of the 2012 BiOp pertaining to loggerhead turtles was vacated and remanded to NMFS under a stipulated settlement agreement and court order. The Hawaii shallow-set longline fishery was closed effective May 8, 2018, until December 31, 2018, pursuant to the court order. The fishery's loggerhead turtle interactions for 2018 were 33 at the time of the closure, and thus the fishery was closed prior to reaching the hard cap limit of 34 turtles. The fishery will reopen on January 1, 2019.

The fishery exceeded the olive ridley ITS in early 2018. Additionally, described above, the loggerhead portion of the 2012 BiOp was vacated on May 8, 2018. ESA Section 7 consultation for the Hawaii shallow-set longline fishery was reinitiated on April 20, 2018. A summary of the anticipated level of interactions and the analysis of the Hawaii shallow-set fishery's effects on ESA-listed species in the Biological Evaluation (BE) reinitiating consultation is included in Section 3.3.6.

The NMFS Observer Program monitors incidental interactions on all (100 percent) shallow-set fishing trips. Table 21 summarizes the annual number of observed sea turtle interactions in the Hawaii shallow-set longline fishery from 2004 to May 2018.

Table 21. Annual number of observed sets (based on begin set date) and observed interactions (based on interaction date) of loggerhead, leatherback, green and olive ridley turtles in the Hawaii shallow-set longline fishery, 2004-2018.

Year	Annual number of observed sets	Observed Interactions (100% Coverage)			
		Loggerhead	Leatherback	Green	Olive ridley
2004	135	1	1	0	0
2005	1645	12	8	0	0
2006	850	17[a]	2	0	0
2007	1570	15	5	0	1
2008	1605	0	2	1	2
2009	1761	3	9	1	0
2010	1875	7	8	0	0
2011	1463	12	16[b]	4	0
2012	1369	5	7	0	0
2013	961	5	11	0	0
2014	1337	15	16	1	1
2015	1156	13	5	0	1
2016	727	15	5	0	0
2017	973	21	4	2	4
2018[c]	TBA	33	6	1	1
Average (2005-2018)[d]	1,330	12.4	7.5	0.7	0.7

[a] Fishery closed on March 20, 2006, as a result of reaching the loggerhead hard cap of 17
[b] Fishery closed on November 18, 2011 as a result of reaching the leatherback hard cap of 16
[c] Fishery closed on May 8, 2018, pursuant to the stipulated settlement agreement and court order.
[d] 2004 data omitted from calculation of the long-term average due the fishery reopening after the peak fishing season.

Loggerhead and Leatherback Interactions in the Hawaii Shallow-set Longline Fishery from 2004-2018

The average annual number of observed interactions for the 2005-2018 period following the reopening of the fishery was 12.4 loggerhead turtles and 7.5 leatherback turtles per year (Table 21). Nearly all loggerhead and leatherback turtles observed interacting with the fishery are released alive and in accordance with proper handling protocol to maximize post-hooking survival. The fishery has reached the hard cap twice since its implementation in 2004 (Table 21): once in 2006 when the loggerhead hard cap of 17 turtles was reached (fishery closed on March 20, 2006); and once in 2011 when the leatherback hard cap of 16 turtles was reached (fishery closed on November 18, 2011). In majority of the years, the annual observed interactions remained below 50 percent of the hard cap for each species (Figure 4).

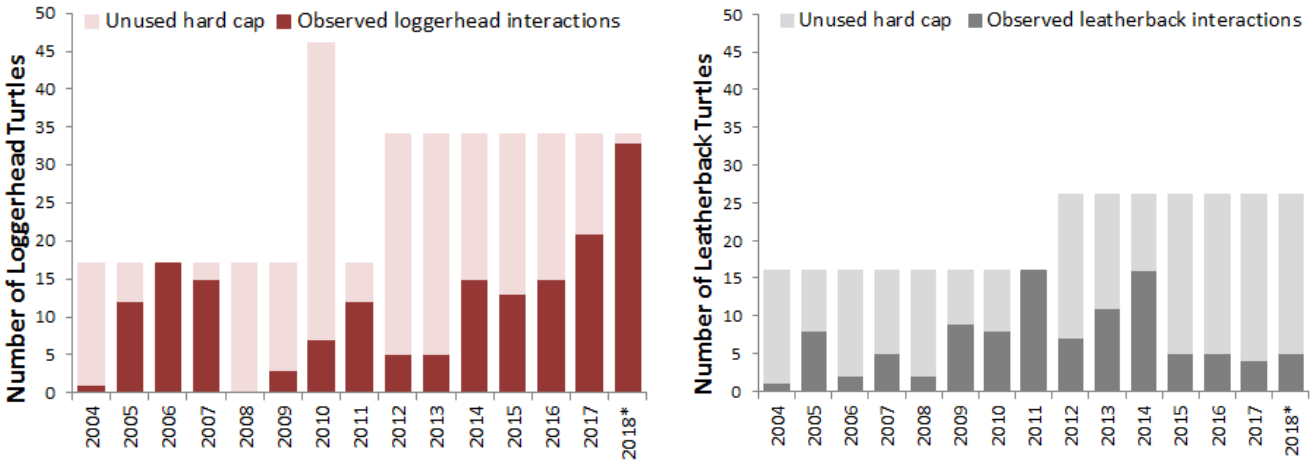

Figure 4. Annual number of observed loggerhead (left) and leatherback (right) and "unused" annual hard cap for each species. Dark colors in each figure indicate the observed interactions and light colors indicate the unused portion of the hard cap. Data for 2018 includes all interactions through the fishery closure on May 4, 2018.

Loggerhead turtle interactions in the Hawaii shallow-set longline fishery in 2017 and 2018 were higher than levels observed since the fishery reopened in 2004. The total number of loggerhead interactions for 2017 was 21, and 33 interactions were observed from January through May 2018. While these numbers were lower than the hard cap limit of 34 loggerhead turtles based on the 2012 BiOp, they demonstrated that the fishery has the potential to experience higher interaction levels than the long-term average (12.4 loggerhead turtles annually from 2005-2018) in a short period.

Juvenile loggerhead turtles are known to associate with fronts, eddies and geostrophic currents in the North Pacific Transition Zone (Polovina et al. 2004, Howell et al. 2008). Previous research has shown that over 50 percent of loggerhead turtle interactions in the Hawaii shallow-set longline fishery occur in a temperature band between 63.5°F and 65.5°F (Howell et al. 2008), which is an area tacked under NMFS' experimental product called TurtleWatch to help avoid interactions with loggerhead turtles.[5]

Most of the recent loggerhead turtle interactions were observed in December 2017 and January 2018, during which time a small number of vessels interacted with majority of the observed loggerhead turtles, while a large proportion of the shallow-set vessels targeting swordfish during the period of high interactions also had at least one observed interaction.

NMFS Pacific Islands Fisheries Science Center (PIFSC) conducted a preliminary characterization of the recent loggerhead turtle interactions in the Hawaii shallow-set longline fishery compared to the years prior (PIFSC unpublished data). The analysis indicated that the spatial distribution of the interactions in December 2017 and January 2018 when the interactions

[5] https://www.pifsc.noaa.gov/eod/turtlewatch.php

were highest were not anomalous for that time of the year. Approximately 50% of the loggerhead interactions occurred within the temperature band between 63.5-65.5°F, consistent with TurtleWatch. Fishing effort distribution inside and outside of the TurtleWatch temperature bands was also not anomalous in December 2017 and January 2018 compared to previous years. There was also no apparent change in other operational characteristics within the fishery (e.g., gear configuration, bait, timing, duration) to explain the higher loggerhead interaction rates. Additionally, the average size of individual turtles observed in December 2017 and January 2018 (approximately 51 cm straight carapace length (SCL)) was consistent with the average size observed in those months in previous years.

Loggerhead turtle reproductive output at their source nesting beaches in Japan has been high since 2008. Loggerhead turtle nest counts in Japan increased steadily from 2,064 nests in 1997 to 5,167 nests in 2005, then increased substantially to over 10,000 nests in 2008, after which high nesting years continued through 2014 with a record of 15,396 nests in 2013 (NMFS 2017). The higher level of nesting since 2008 likely resulted in a substantially higher hatchling production compared to the decade prior. Most of the loggerhead turtles observed interacting in the Hawaii shallow-set longline fishery in December 2017 and January 2018 were in the range of 40-60 cm SCL, which is estimated to be approximately 3-10 years in age based on skeletochronology (Tomaszewicz et al. 2015) and consistent with the period of high nesting in Japan. PIFSC continues to explore the linkage of loggerhead turtle interactions in the Hawaii shallow-set longline fishery to hatchling production as well as additional examination of the oceanographic environment and fishing behavior.

Population Assessments for the North Pacific Loggerhead and Western Pacific Leatherback Turtles

PIFSC conducted population assessments of the North Pacific loggerhead and Western Pacific leatherback turtles to support the ESA Section 7 consultation for the Hawaii shallow-set longline fishery (PIFSC presentation to the 130th SSC Meeting). The assessment utilized a Bayesian state-space population viability analysis (PVA) using nest counts as index of abundance to estimate population growth rate and to generate population projections (Figure 5). More complex demographic models were determined to be not suitable due to the lack of population-specific demographic data.

Nest count data from three nesting beaches representing approximately 52% of loggerhead turtle nesting in Japan were used for the North Pacific loggerhead turtle PVA. Modeling results estimated that the current mean total reproductive female abundance for the portion of the population included in the assessment is 3,632 (95% CI range = 2,976 – 4,468), and the mean long-term population growth rate (r) was estimated at 2.4% (95% CI range = -10.8% – 15.6%). Projections show a low probability (less than 25% probability on average) that the North Pacific loggerhead turtle population would fall below 12.5% to 50% abundance thresholds within 100 years.

Nest count data from two nesting beaches representing approximately 85% of nesting for the Western Pacific leatherback population were used for the PVA. Due to missing count data, an auto-regressive time series model was used to fill in the missing data in the nest count time series

prior to proceeding with the PVA model. Modeling results estimated that the current mean total reproductive female abundance for the portion of the population included in the assessment is 1,180 (95% CI range = 949 – 1,479), and the mean long-term population growth rate (r) was estimated at -5.3% (95% CI range = -16.4% – 5.9%). Projections show a high probability (greater than 91% probability on average) that the Western Pacific leatherback turtle population would fall below 12.5% to 50% abundance thresholds within 100 years. While the long-term population trend is negative and the projections generated using an exponential growth equation show that the population is likely to continue a declining trend, the underlying leatherback population data show an increase in the last few years of the dataset, suggesting some rebound capacity.

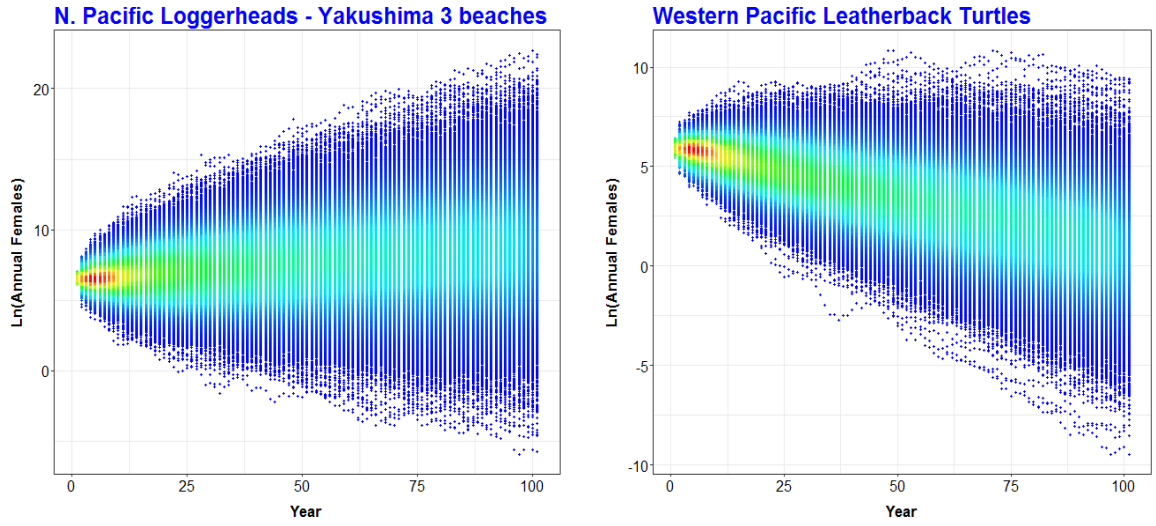

Figure 5. Population projection results for North Pacific loggerhead turtles (left) and Western Pacific leatherback turtles (right). Model projections are of annual females in natural log space. Figures show 10,000 model projection runs for 100 years into the future from the final data year.

3.3.2 Marine Mammals

ESA-listed Marine Mammals

ESA-listed marine mammal species that are that have been observed or may occur in the area where Pelagic FEP fisheries operate include the following species:

- Blue whale (*Balaenoptera musculus*)
- Fin whale (*Balaenoptera physalus*)
- Hawaiian monk seal (*Monachus schauinslandi*)
- Humpback whale (*Megaptera novaeangliae*)
    - Mexico DPS (threatened)
    - Central America DPS (endangered)
    - Western North Pacific DPS (endangered)

- Main Hawaiian Islands insular false killer whale (*Pseudorca crassidens*)
- North Pacific right whale (*Eubalaena japonica*)
- Sei whale (*Balaenoptera borealis*)
- Sperm whale (*Physeter macrocephalus*)
- Guadalupe fur seal (*Arctocephalus townsendi*)

Detailed information on these species' geographic range, abundance, bycatch estimates, and status can be found in the most recent stock assessment reports (SARs), available online at: http://www.nmfs.noaa.gov/pr/sars/. Additional, recent information may be found in NMFS 2012b and NMFS 2014.

Although blue whales, north Pacific right whales, and sei whales are found within the action area and could potentially interact with the Pelagic FEP fisheries, there have been no reported or observed incidental hookings or entanglements of these species in these fisheries. There are records of fishery interactions with humpback whales and one fin whale in the Hawaii shallow-set longline fishery. In addition, NMFS has assigned prorated interactions to the population of MHI insular false killer whales based on interactions with pelagic false killer whales, and on interactions with false killer whales from unknown populations and unidentified blackfish. Interactions with listed marine mammals are described below.

On February 27, 2015, gear from a Hawaii shallow-set longline vessel entangled a fin whale slightly more than 200 miles from the coast of California. The crew released the animal with no gear attached. NMFS determined that the Hawaii shallow-set longline fishery is not likely to adversely affect fin whales and documented its determination in a memorandum of concurrence dated September 16, 2015.

On September 8, 2016 (81 FR 62259), NMFS published a final rule in the Federal Register to reclassify the humpback whale into 14 distinct population segments under the Endangered Species Act (ESA), of which four DPSs were listed as threatened or endangered. The remaining ten DPSs were not listed under the ESA, including the Hawaii DPS.

Non ESA-listed Marine Mammals

Based on research, observer, and logbook data, marine mammals, not listed under the ESA that may occur in the region and that may be affected by the fisheries managed under the Pelagic FEP include the following species:

- Blainville's beaked whale (*Mesoplodon densirostris*)
- Bryde's whale (*Balaenoptera edeni*)
- Bottlenose dolphin (*Tursiops truncatus*)
- Common dolphin (*Delphinus delphis*)
- Cuvier's beaked whale (*Ziphius cavirostris*)
- Dwarf sperm whale (*Kogia sima*)
- False killer whale (*Pseudorca crassidens*) other than the MHI Insular DPS
- Fraser's dolphin (*Lagenodelphis hosei*)
- Killer whale (*Orcinus orca*)

- Longman's beaked whale (*Indopacetus pacificus*)
- Melon-headed whale (*Peponocephala electra*)
- Minke whale (*Balaenoptera acutorostrata*)
- Northern elephant seal (*Mirounga angustirostris*)
- Northern fur seal (*Callorhinus ursinus*)
- Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)
- Pantropical spotted dolphin (*Stenella attenuata*)
- Pilot whale, short-finned (*Globicephala macrorhynchus*)
- Pygmy killer whale (*Feresa attenuata*)
- Pygmy sperm whale (*Kogia breviceps*)
- Risso's dolphin (*Grampus griseus*)
- Rough-toothed dolphin (*Steno bredanensis*)
- Spinner dolphin (*Stenella longirostris*)
- Striped dolphin (*Stenella coeruleoalba*)

Detailed information on these species' geographic range, abundance, bycatch estimates, and status can be found in the most recent stock assessment reports (SARs), available online at: http://www.nmfs.noaa.gov/pr/sars/. Interactions with marine mammals are described in the next section.

Marine Mammal Interactions in the Hawaii Shallow-set Longline Fishery

Table 22 provides total marine mammal interactions observed in the shallow-set fishery from 2008 through 2016. All trips are observed in the shallow-set fishery; therefore, expansion of the data is not necessary.

On October 10, 2014, NMFS authorized a permit under the MMPA section 101(a)(5)(E), addressing the shallow-set and deep-set fisheries' interactions with ESA-listed species or depleted stocks of marine mammals (NMFS 2014). The permit authorizes the incidental, but not intentional, taking of ESA-listed humpback whales (CNP stock), sperm whales (Hawaii stock), and MHI insular false killer whales. In issuing this permit, NMFS determined that incidental taking by the Hawaii shallow-set fishery will have a negligible impact on the affected stocks of marine mammals. The Hawaii DPS of humpback whales, which mostly overlaps with the CNP stock under the MMPA, was delisted from the ESA in 2016.

There has not been an interaction with a Hawaii sperm whale in the shallow-set longline fishery since the deep-set and shallow-set longline fisheries were split in 2004 for management purposes (NMFS 2014). Prior to the separation of the fisheries, there was an interaction in 1999 with a vessel that was targeting swordfish, and one in 2002 with an experimental fishery that was testing sea turtle mitigation gear similar to what is used in the shallow-set longline fishery now. The interaction occurred on a control set and the sperm whale was entangled in the mainline; the mainline was cut and the animal escaped with no line attached (Boggs 2002).

There have been no interactions between the MHI IFKW stock and the shallow-set longline fishery.

The Hawaii shallow-set longline fishery had observed interactions with ESA-listed Guadalupe fur seals in 2016 and 2017. This species was previously not known to interact with the shallow-set fishery and was not included in the 2012 BiOp. Consultation for this species was included in the ongoing consultation reinitiated on April 20, 2018. The Guadalupe fur seal interactions occurred outside of the U.S. EEZ off the coast of California.

Table 22. Observed annual marine mammal interactions (including mortalities, serious injuries, and non-serious injuries) with the Hawaii shallow-set longline fishery from 2008-2016.

Species	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blackfish*	1	0	0	1	0	0	0	0	0	0
Short-beaked Common dolphin	0	0	0	1	0	0	1	0	0	0
Risso's dolphin	4	3	7	4	0	3	6	3	2	2
Blainville's beaked whale	0	0	0	1	0	0	0	0	0	0
Humpback whale	1	0	0	1	0	0	0	1	0	0
False killer whale	1	1	0	1	1	0	1	0	0	0
Striped dolphin	1	0	2	0	1	0	2	0	1	3
Bottlenose dolphin	0	0	2	2	1	2	4	2	1	0
Rough-toothed dolphin	0	0	0	0	0	1	0	0	0	0
Fin whale	0	0	0	0	0	0	0	1	0	0
Unidentified cetacean	0	1	1	0	1	0	0	1	0	0
Pygmy or dwarf sperm whale	1	0	0	0	0	0	0	0	0	0
Beaked whale, Mesoplodont	0	0	0	1	0	0	0	0	0	0
Ginkgo-toothed beaked whale	0	0	0	0	0	0	0	1	0	0
Unidentified beaked whale	0	0	0	1	0	2	0	1	0	0
Northern elephant seal	0	0	0	0	0	1	1	0	0	0
Guadalupe fur seal	0	0	0	0	0	0	0	0	1	3
Unidentified pinniped	0	0	0	0	0	0	0	3	0	0
Unidentified sea lion	0	0	0	0	0	0	1	2	0	0

Note: "Blackfish" include unidentified whales considered to be either false killer whales or short-finned pilot whales.
Source: 2015 Pelagic FEP SAFE Report (WPFMC 2017);, 2016 Pelagic FEP SAFE Report ; NMFS PIRO 2017 Annual Report.

3.3.3 Seabirds

ESA-listed Seabirds

The endangered short-tailed albatross, threatened Newell's shearwater, and endangered Hawaiian dark-rumped petrel have ranges that overlap the fishing grounds of the Hawaii longline fisheries (see sources cited in WPFMC 2011). A comprehensive description of the species' distribution, population status, threats, and recovery strategy can be found in the species' recovery plans.[6]

In 2012, an ESA section 7 consultation with the U.S. Fish and Wildlife Service covering the potential impacts of the Hawaii deep-set and shallow-set fishery on listed seabirds concluded that the Newell's shearwater and the Hawaiian petrel are not affected by these fisheries. In addition, USFWS concluded in the USFWS 2012 BiOp that the continued operation of the Hawaii deep- and shallow-set longline fisheries will adversely affect the short-tailed albatross but will not jeopardize its survival and recovery in the wild. No critical habitat has been designated for this species; therefore, none will be affected. The BiOp covering the short-tailed albatross anticipates that one (1) short-tailed albatross in the shallow-set fishery may be taken every five years in the form of injury or death as a result of interactions with fishing activity operating under existing regulations (USFWS 2012). This is an authorized observed level of take and if this level is exceeded, NMFS will be required to reinitiate consultation with the USFWS. Since NMFS initiated the mandatory Hawaii longline observer program in 1994, there have been no observed interactions between ESA-listed seabird species and Hawaii shallow-set longline fishery.

Non ESA-listed Seabirds

Seabird regulations for the Hawaii longline fisheries were published in the *Federal Register* on December 19, 2005 (70 FR 75075). The regulations require that longline fishermen employ a suite of mitigation measures that are specific to side-setting or stern-setting, and may include blue-dyed bait, weighted branch lines, strategic offal discards, setting from the side of the vessel, using a "bird curtain", or a hydraulic line-setting machine, among others. These measures help deter birds from becoming hooked or entangled while attempting to feed on bait or catch. For a complete description of the requirements, see 50 CFR 665.815. These requirements would remain in effect under all Alternatives.

In addition to the ESA-listed seabirds described above, the Hawaii shallow-set longline fisheries occasionally interact with other seabirds such as albatrosses, northern fulmar, and sooty shearwaters, and gulls.

Albatrosses, which forage by diving, are some of the most vulnerable species to bycatch in fisheries (Brothers et al. 1999). These species are long-lived, have delayed sexual maturity, small clutches and long generation times, resulting in populations that are highly sensitive to changes in adult mortality. Nineteen of the world's 21 albatross species are now globally threatened with

[6] Available online at: http://ecos.fws.gov/tess_public/TESSWebpageRecovery?sort=1.

extinction according to the IUCN (IUCN 2004, BirdLife 2004), and incidental catch in fisheries, especially longline fisheries, is considered one of the principal threats to many of these species (Veran et al. 2007).

On October 7, 2011, in response to a petition to list the black-footed albatross under the ESA, the USFWS found that the Hawaiian Islands breeding population and the Japanese Islands breeding population of the black-footed albatross are separate DPS, as defined by the DPS policy (76 FR 62503). However, the USFWS also found that neither DPS of the black-footed albatross currently warrants listing under the ESA. The USFWS observed that black-footed albatross bycatch should continue to be minimized by the implementation of effective bycatch minimization measures, and concluded that Hawaii-based longline fishing is not a significant threat to the black-footed albatross.

Seabird Interactions in the Hawaii Shallow-set Longline Fishery

Table 23 contains the numbers of albatross that have interacted with the Hawaii shallow-set longline fisheries from 2005 through 2017 based on observed interactions by the NMFS Observer Program. From 2004, observer coverage rates were 100 percent in the shallow-set fishery.

Seabird mitigation measures implemented in the Hawaii longline fishery since 2001 resulted in a reduction of over 90% in total seabird interactions by 2006 in the deep-set and shallow-set fisheries combined (Van Fossen 2007). The major reduction in the number of interactions was due in most part to requirement that the shallow-set longline fishery begin setting one hour after local sunset and to complete setting one hour before local sunrise. Seabirds likely drown if the interaction occurs during gear deployment (setting), but during gear retrieval (hauling), seabirds may be released alive when fishermen promptly apply seabird handling and release techniques.

In addition, from 2004 through 2017, based on observed sets, the shallow-set fishery interacted with one northern fulmar, four sooty shearwaters, and one unidentified gull (http://www.fpir.noaa.gov/SFD/SFD_seabirds.html).

Table 23. Number of albatross interactions observed in the Hawaii shallow-set longline fishery, 2005- 2016.

Year	Laysan	Black-footed
2005	62	7
2006	8	3
2007	39	8
2008	33	6
2009	81	29
2010	40	39
2011	49	19
2012	61	37
2013	46	28
2014	36	29

Year	Laysan	Black-footed
2015	45	41
2016	26	40
2017	6	51

Source: 2015 Pelagic FEP SAFE Report (WPFMC 2017), 2016 Pelagic FEP SAFE Report; NMFS PIRO 2017 Annual Report.
Note: 1 interaction with an unidentified gull was reported in 2017.

3.3.4 Sharks and Rays

ESA Listed Sharks and Rays

On July 3, 2014, NMFS issued a final rule to list under the ESA, the Indo-West Pacific scalloped hammerhead shark distinct population segment (DPS), and the Eastern Pacific scalloped hammerhead shark DPS as threatened and endangered, respectively (79 FR 38213). The Indo-West Pacific DPS includes areas around most of the U.S. Pacific territories and possessions. The Eastern Pacific DPS generally includes the eastern Pacific, east of 140° W. NMFS has not designated critical habitat for these DPSs. Detailed information on the scalloped hammerhead sharks including the range, abundance, status, and threats to the species can be found in the 2014 BiOp for the deep-set longline fishery (NMFS 2014), the 2014 Status Review Report and the 2014 Final Rule (79 FR 38213).

On January 30, 2018, NMFS issued a final rule to list the oceanic whitetip shark as a threatened species under the ESA (83 FR 4153). The oceanic whitetip shark is distributed worldwide in epipelagic tropical and subtropical waters between 30° North latitude and 35° South latitude. The species is a highly migratory species that is usually found offshore and in deep waters. NMFS has not proposed critical habitat or protective regulations under ESA section 4(d) at this time. Detailed information on the oceanic whitetip sharks including the range, abundance, status and threats to the species can be found in the 2016 Status Review Report (Young et al. 2016) and the 2016 Proposed Rule (81 FR 96304).

Additionally, on January 22, 2018, NMFS issued a final rule to list the giant manta ray as a threatened species under the ESA (83 FR 2916). The giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water. The species is considered to be a migratory species, with estimated distances travelled of up to 1,500 km. NMFS has not proposed critical habitat or protective regulations under ESA section 4(d) at this time. Detailed information on the giant manta ray including the range, abundance, status and threats to the species can be found in the 2017 Status Review Report (Miller & Kilmovich 2016) and the 2016 Proposed Rule (82 FR 3694).

NMFS is currently undergoing ESA Section 7 consultation on the newly listed oceanic whitetip shark and giant manta rays.

Scalloped Hammerhead Shark Interactions in the Hawaii Shallow-set Longline Fisheries

The Hawaii shallow-set longline fishery generally occurs within the range of the Central Pacific DPS of scalloped hammerhead shark; this DPS was not listed under the ESA. The shallow-set fishery does not occur within the range of the Indo-West Pacific DPS; however a portion of the shallow-set fishery does fall within the range of the Eastern Pacific DPS. There have been no recorded or observed takes of hammerhead sharks in the shallow-set longline fishery in the area of the Eastern Pacific DPS (NMFS Observer Program, unpublished data). On the March 2, 2015 Letter of Concurrence, NMFS concurred with the determination that the continued authorization of the Hawaii shallow-set longline fishery under the Pelagic FEP is not likely to adversely affect the Eastern Pacific scalloped hammerhead shark DPS due to the low risk of interaction between the DPS and the fishery.

Oceanic Whitetip Shark Interactions in the in the Hawaii Shallow-set Longline Fishery

Oceanic whitetip sharks are caught incidentally in the Hawaii longline fisheries. However, in accordance with WCPFC CMM 2011-01, Hawaii longline vessels are required to release all oceanic white tip sharks incidentally caught in the WCPO. Additionally, because this species has no market value, and federal regulations have prohibited shark finning since 2002, they are also released if caught in the EPO.

Based on observer data for 2011-2013, the Hawaii shallow-set longline fishery caught an average catch of 42 oceanic whitetip sharks annually, which is equivalent to 3.33 mt (Table 24). This level of catch amounts to 0.05% of the current biomass and 0.17% of current total catch in the WCPO.

Table 24. Average annual catch of oceanic whitetip shark in the Hawaii shallow-set longline fishery (2011-2013) compared to total catch and biomass estimates.

	Average annual catch, 2011-2013[a]			% of WCPO	% WCPO
Fishery	Numbers	Pounds	Metric Tons	Total Catch	Est. Biomass
HI SSLL	42	7,336	3.33	0.17%	0.05%

[a] US National Bycatch Report First Edition Update 2

[b] $C_{current}$(Reference) = 2,001 metric tons (Rice and Harley 2012)

[c] $B_{current}$(Reference) = 7,295 metric tons (Rice and Harley 2012)

A preliminary analysis of annual standardized CPUE for oceanic whitetip shark for 1995-2014 conducted as part of the 2016 Status Review Report (Young et al. 2016) indicated that the population in the area of the Hawaii longline fishery operation may have stabilized in recent years. Observer data from 2015 and 2016 indicate that the nominal CPUE was approximately same or slightly higher than 2014 (NMFS PIROP Observer data, unpublished), but these data are not standardized and should be interpreted with caution.

Of the oceanic whitetip sharks incidentally caught in the Hawaii shallow-set longline fishery, an average of 87.1% of the catches are released alive (Table 25). NMFS PIFSC is currently conducting a study to assess the post-release survivorship of sharks released alive in the Hawaii and American Samoa longline fisheries.

Table 25. Proportions of oceanic whitetip sharks released alive in the Hawaii shallow-set longline fishery, 2007-2017.

Year	% released alive
2007	92.9%
2008	83.0%
2009	74.5%
2010	81.1%
2011	88.5%
2012	91.7%
2013	92.6%
2014	85.7%
2015	90.9%
2016	90.6%
2017	96.6%
10-year Average	**87.1%**

Source: NMFS Pacific Islands Regional Observer Program, unpublished data.

The impact of the Hawaii shallow-set longline fishery on the oceanic whitetip shark population is likely to be minimal, considering the small contribution to the total WCPO catch (<1%) and in relation to the current biomass (<0.1%) as well as the high proportion of the sharks released alive. As described in the final rule listing (CITE), the oceanic whitetip shark is not subject to the take prohibitions in section 9 of the ESA because NMFS has determined that protective regulations under section 4(d) are not deemed necessary and appropriate for the conservation of that species.

Giant Manta Ray Interactions in the in the Hawaii Shallow-set Longline Fishery

Giant manta rays are caught incidentally in the Hawaii shallow-set longline fishery. The average annual incidental catch of giant manta rays for 2011-2013 was estimated at 88 lbs in the Hawaii shallow-set longline fishery (NMFS 2016). Most of the giant manta rays incidentally caught in the fishery are released alive (Table 26).

There is no historical or current global abundance estimates for giant manta rays. Most estimates of subpopulations are based on anecdotal observations, and range from around 100-1,500 individuals (Miller and Klimovich 2016). The 2016 NMFS Status Review Report for the giant manta ray concluded that the incidental catch of this species in U.S. longline fisheries are likely to have minimal impacts on the population (Miller and Klimovich 2016).

Table 26: Observed interactions and proportions of giant manta rays released alive in the Hawaii shallow-set longline fishery, 2007-2017.

	SSLL	
Year	Observed interactions	% released alive
2007	5	60%
2008	0	—
2009	0	—
2010	6	100%
2011	3	33%
2012	0	—
2013	0	—
2014	1	100%
2015	0	—
2016	0	—
2017	2	100%

Source: NMFS Pacific Islands Regional Observer Program, unpublished data.

3.3.5 Critical Habitat

Leatherback Sea turtle Critical Habitat

On January 26, 2012, NMFS designated critical habitat for leatherback sea turtles off the west coast of the U.S., including areas off WA, OR, and CA (77 FR 4170). Because Hawaii longline vessels in the shallow-set fishery may occasionally transit through the U.S. EEZ to and from west coast ports, NMFS evaluated the fishery for potential effects to leatherback sea turtle critical habitat in both the 2012 BiOp for the shallow-set fishery (NMFS 2012). Because longline fishing is prohibited by federal law within the EEZ off the west coast, NMFS determined that the shallow-set longline fisheries may affect, but are not likely to adversely modify designated critical habitat for leatherback sea turtles.

Monk Seal Critical Habitat

On August 21, 2015, NMFS published a final rule (80 FR 50926) designating critical habitat for the Hawaiian monk seal (*Neomonachus schauinslandi*) in the main Hawaiian Islands (MHI) and expanding monk seal critical habitat in the Northwestern Hawaiian Islands (NWHI). NMFS identified features that are essential for the conservation of monk seals, including areas preferred for pupping and nursing, areas that support adequate prey quality and quantity for foraging, and areas for hauling out, resting, or molting. Accordingly, NMFS identified critical habitat in certain areas in the MHI, and around designated islands in the NWHI, to include, generally, from the beach to the 200-m depth contour and the seafloor and the waters and habitat within 10 m of the seafloor. Please consult the final rule for specific critical habitat boundaries.

In response to the critical habitat designation, NMFS reinitiated ESA section 7 consultation to evaluate the potential impacts of Hawaii shallow-set longline fishery on monk seal critical

habitat. Because monk seals do not prey on species targeted by the Hawaii's shallow-set longline fishery and due to the fact that longline vessels are prohibited from fishing within 50 to 75 nm around all Hawaiian Islands, NMFS determined that the Hawaii shallow-set longline fisheries may affect, but are not likely to adversely modify monk seal critical habitat. NMFS documented its determinations in a memorandum of concurrence dated September 16, 2015.

3.3.6 Summary of Analysis in the 2018 Biological Evaluation

Consultation for the Hawaii shallow-set longline fishery was reinitiated on April 20, 2018, due to reaching several reinitiation triggers, including interactions with Guadalupe fur seals previously unknown to interact with the fishery, DPS listing of green turtles, and new species listings (oceanic whitetip and giant manta ray), and exceedance of the olive ridley sea turtle ITS. A summary of analysis in the Biological Evaluation (BE) reinitiating consultation for the shallow-set longline fishery (NMFS and WPRFMC 2018) is provided in this section.

In the BE reinitiating consultation for the shallow-set longline fishery, NMFS concluded that the fishery is not likely to adversely affect the following species or critical habitat:

- Green sea turtle - East Indian-West Pacific DPS, Central West Pacific DPS, Southwest Pacific DPS, or Central South Pacific DPS;
- Hawksbill sea turtle;
- False killer whale - MHI Insular DPS;
- Humpback whale - Mexico DPS;
- Fin whale;
- Blue whale;
- North Pacific right whale;
- Sei whale;
- Sperm whale;
- Scalloped hammerhead shark - eastern Pacific DPS;
- Hawaiian monk seal critical habitat; or
- MHI insular false killer whale DPS critical habitat.

NMFS requested reinitiation of formal consultation on the following species, for which the analysis in the BE is summarized in this section:

- Loggerhead sea turtle - North Pacific DPS;
- Leatherback sea turtle (western Pacific population);
- Olive ridley sea turtle (eastern and western Pacific population);
- Green sea turtle - Central North Pacific DPS and East Pacific DPS;
- Guadalupe fur seal;
- Oceanic whitetip shark; and
- Giant manta ray.

In the Biological Evaluation (BE) requesting reinitiation of consultation, NMFS estimated the anticipated level of interactions for the applicable ESA-listed species based on predictions generated by PIFSC using Bayesian data analysis methods appropriate for count data (McCracken 2018). The predictions for the leatherback, green and olive ridley sea turtles are

based on observed interactions in the fishery from January 1, 2005 through December 31, 2017. For North Pacific loggerhead sea turtles, the predictions are based on observed interactions from January 1, 2005 through January 31, 2018, to account for loggerhead interactions observed in the first month of 2018. For the Guadalupe fur seal, the predications were based on data from 2013 through 2017. For the oceanic whitetip shark and the giant manta ray, the predictions were based on data through November 18, 2017, as not all relevant catch records were available through the end of 2017. The time period included in the predictions represents the period in which the fishery has been operating under 100% observer coverage and with the circle hook and mackerel-type bait requirements to reduce sea turtle interactions.

The predictions assume that the characteristics of the fishery do not change in the future compared to the observed period (i.e., 2004 and onward). The model assumes that the annual number of interactions is independent between years, given that insufficient information exists at this time to make informed predictions of future patterns in interactions. While potential patterns in interactions (e.g., higher interactions tend to be observed in consecutive years) are seen for some species in the observed data since 2004, the data have not been assessed to evaluate the significance or to explore the underlying factors.

For the purposes of the BE, the analysis also assumed that the fishery operated throughout the year for every year included in the analysis and did not truncate the predicted takes (i.e. the analysis did not include hard caps for either loggerheads or leatherbacks). As the data include two years where the fishery was closed prior to the end of the year due to reaching a hard cap (2006 and 2011) and one incomplete year for the elasmobranch species (2017), PIFSC split the data into three periods based on the date of capture: January 1 through March 20, March 21 through November 18, and November 19 through December 31. Depending on the temporal pattern of bycatch for the species of interest, some years may have been dropped and some periods merged.

For each species included in the analysis, PIFSC generated predicted interaction estimates associated with the 80th percentile, and 95th percentile values for the predicted distribution for 1-year and multi-year (i.e., 2 and 3 year) periods. The percentile values reflect the probability that the observed interactions for the predicted period (e.g., 1, 2 or 3 years) would be equal to or less than the value. PIFSC also provided predicted interaction estimates using the mean.

The multi-year estimates generated by the model-based prediction takes into account the inter-annual variability in the number of observed interactions over time. Statistically, the probability that observed interactions would be at the upper end of the 1-year predicted range over several consecutive years is low. The multi-year predictions reflect a distribution of predicted values that incorporate the inter-annual variability in the observed data and smooth out the uncertainty associated with the predictions over a longer period. As a result, the 95th percentile values of the predicted 2-year and 3-year total interactions are lower than the 1-year predictions at the same percentile level multiplied by two or three years.

For the purposes of the BE analysis, NMFS used the 95th percentile values for the 1-year predictions as the anticipated level of interactions because the 95th percentile approach provides

the upper bound of future potential interactions for any given year based on Bayesian modeling of past interactions (Table 27).

Table 27. Predicted estimates of anticipated levels of ESA-listed species interactions in the Hawaii shallow-set longline fishery in any given year, based on the 95th percentile values of the predicted distribution (McCracken 2018; NMFS 2018).

Species	1-year total
Loggerhead turtle (North Pacific DPS)	37
Leatherback turtle	21
Olive ridley turtle (Eastern Pacific Population)	4
Olive ridley turtle (Western Pacific Population)	2
Green turtle (Eastern Pacific DPS)	3
Green turtle (Central North Pacific DPS)	3
Guadalupe fur seal (including prorated unidentified pinniped and unidentified sea lions)	14
Oceanic whitetip shark	227
Giant manta ray (including prorated manta/mobula)[a]	10

[a] "Manta/Mobula" is used when a fisheries observer is unable to distinguish whether the ray is a Manta (giant or reef) or a Mobula, or if the observer is able to confirm it is a Reef Manta (*Manta alfredi*).

The population-level effects of the anticipated level of sea turtle interactions in the Hawaii longline fishery is quantified in the BE as the number of adult females removed from the populations. Adult females are the only component of sea turtle populations for which data are available, from counts of adult females on nesting beaches. This "adult nester equivalent" (ANE) is a useful metric because it can be compared to the total number of nesting females in a population, typically the only available index of abundance. To calculate ANE for a population, three adjustment factors are required: adult equivalence of juveniles, ratio of females in the population, and probability that a turtle would die if it interacts with the fishery (only a portion of interactions lead to death). PIFSC calculated ANE estimates using the methods described in Jones and Martin (2016), and compared the ANE estimate to corresponding nesting abundance estimates to determine possible effects to the species. The resulting ANEs and proportion of nesting population are summarized in Table 28.

Table 28. Population level effect metrics for ESA-listed sea turtle populations over a 1-year period (NMFS 2018).

Species	Total Anticipated Annual Interactions	ANE	Estimated Total Nesters	Proportion of Nesting Population
Loggerhead turtle (North Pacific DPS)	37	0.676	8,632	0.000049
Leatherback turtle	21	1.502	2,750	0.00052
Olive ridley turtle (Eastern Pacific Population)	4	0.118	20,062	< 0.000001
Olive ridley turtle (Western Pacific Population)	2	0.06	3,846	< 0.000001

Green turtle (Eastern Pacific DPS)	3	0.006	>1 million (annual)	< 0.000001
Green turtle (Central North Pacific DPS)	3	0.006	205,000	0.000002

The abundance of Guadalupe fur seals is estimated at approximately 20,000 animals, and NMFS estimates the PBR to be 542 animals per year (Carretta et al. 2016). The fishery's anticipated level of mortality amounts to 2.39% of the current PBR Guadalupe fur seals per year, and therefore will have insubstantial impacts.

The stock assessment for the oceanic whitetip shark (rice and Harley 2012) estimated current biomass of oceanic whitetip sharks in the WCPO to be 7,295 t and current catch at 2,001 t annually. The 2016 biological review for the oceanic whitetip shark (Young et al. 2016) estimates 7,295 t of shark biomass would be equivalent to roughly 200,000 individuals. In the BE, NMFS estimates that the anticipated level of interactions in any given year of equal to or less than 227 oceanic whitetip sharks to represent 29 mortalities or 0.0145% (29/200,000*100) of the estimated number of individuals in the WCPO. Population estimates of oceanic whitetip sharks in the EPO are unavailable, and thus this population-level impact is a conservative estimate.

NMFS estimates in the BE that the anticipated level of interactions for giant manta rays in any given year of equal to or less than 10 would lead to 3 giant manta ray mortalities. There is no historical or current global abundance estimates or stock assessments for giant manta rays. Most estimates of subpopulations are based on anecdotal observations, and range from around 100-1,500 (Miller and Klimovich 2016). Little information is available on the abundance of giant manta rays in the high seas area in the central north Pacific where the Hawaii shallow-set longline fishery operates. Nevertheless, the 2016 NMFS Status Review Report for the giant manta ray concluded that the incidental catch of this species in U.S. longline fisheries are likely to have minimal effects on the population (Miller and Klimovich 2016).

3.4 Socio-economic Setting

The socioeconomic setting for the Hawaii shallow-set longline fishery is described below. A detailed history and description of the fishery can be found in the Amendment 17 to the Pelagic FMP (WPRFMC 2009b) and the latest fishery statistics can be found in the FEP Annual SAFE reports at: http://www.wpcouncil.org/fishery-plans-policies-reports/fishery-reports-2/.

The discovery of a large swordfish resource around the Hawaiian archipelago in the 1980s prompted a revitalization of the Hawaii longline fishery. Catches grew from negligible amounts in the mid-1980s to 5.3 million pounds in 1990. Much of this fishery growth was from the entry of new longline vessels from other parts of the U.S., as well as the development of a new local longline fleet in Hawaii. By 1993, catches of swordfish peaked at about 13.0 million pounds (WPRFMC 2013), representing 30% of all the North Pacific swordfish production (19,672 mt or 43.6 million pounds)[7] at the time. Subsequent catches declined after 1993 to around 6.4 million pounds until 2000, after which the fishery was closed due to the outcome of litigation.

[7] http://isc.fra.go.jp/fisheries_statistics/index.html

Since reopening of the shallow-set longline fishery in 2004, fishing effort peaked in 2010 at 114 trips and 1.8 million hooks set, and has since been on a declining trend. The number of vessels participating in the shallow-set fishery has declined over time from a high of 35 vessels in 2006 to a low of 15 vessels in 2016, whereas the numbers of trips and hooks have been more variable (Table 29, Figure 6). Total catch for the shallow-set longline fishery has been on a declining trend since reaching a peak at 4.0 million pounds in 2009, and adjusted revenue has also declined since reaching a peak at $9.5 million in 2011 (Figure 7). Catch-per-unit-effort (CPUE) of swordfish declined from 19.1 fish per 1,000 hooks in 2006 to 9.3 in 2010, but has since remained relatively stable ranging from 9.8 to 12.4 fish per 1,000 hooks (Figure 8).

Available data show that the removal of the effort limits in 2009 and implementation of the higher sea turtle hard caps in 2012 did not result in increased shallow-set fishing effort approaching historical levels (1994-1999). This is likely attributed to the diminishing net returns for shallow-set vessels over the past decade, driven by a weakened swordfish market, CPUE declines in swordfish catch, fuel prices, and uncertainties associated with the sea turtle hard cap closure (WPRFMC 2017). In addition, many vessels have switched to year-round deep-set longlining targeting bigeye, which generally results in higher profits as compared to shallow-set fishing for swordfish.

Despite the poor economic performance of this fishery in recent years, fishing effort in future years may reasonably range within levels seen since 2004, as high global swordfish demand in combination with fresh sustainable swordfish from Hawaii fisheries could rapidly change levels due to market demand. Additionally, the largest component of the Hawaii longline fleet is comprised of Vietnamese-American ownership, which have a long-term history of targeting swordfish, and changes in bigeye limits for the deep-set longline fishery could encourage more vessels to resume targeting swordfish as an alternative in the event of a bigeye closure.

Table 29. Hawaii shallow-set longline fishery effort based on logbook data, 2004-2017.

Year	Active Vessels	Number of Trips	Number of Sets	Number of Hooks
2004	7	11	135	113,318
2005	33	109	1,645	1,385,457
2006	35	57	850	705,466
2007	28	88	1,570	1,371,949
2008	27	93	1,597	1,496,298
2009	28	112	1,762	1,721,346
2010	28	108	1,833	1,803,432
2011	20	82	1,468	1,489,243
2012	18	81	1,355	1,453,234
2013	15	58	962	1,060,341
2014	20	81	1,338	1,483,809
2015	22	65	1,110	1,235,703
2016	13	40	670	719,385
2017	18	61	949	1,027,013

Source: NMFS PIFSC logbook data, https://www.pifsc.noaa.gov/fmb/reports.php

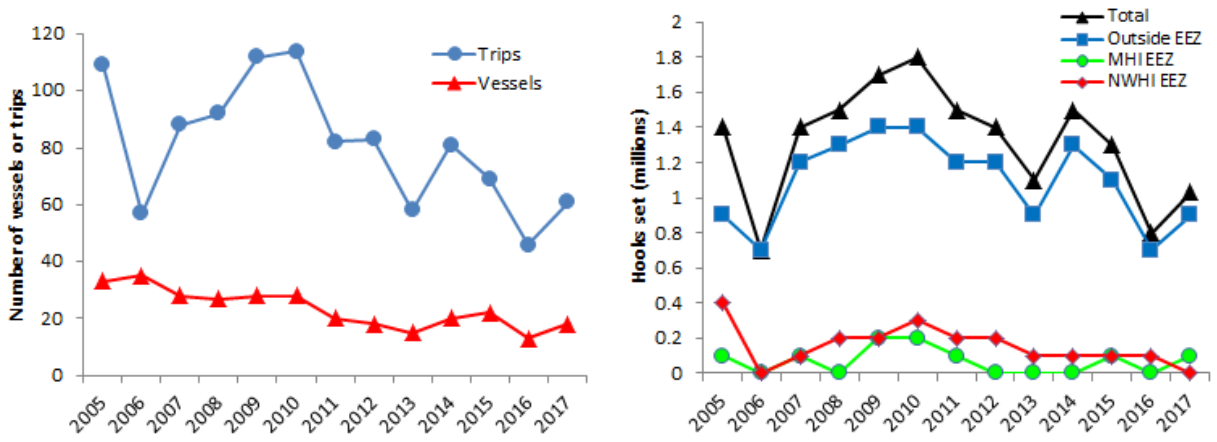

Figure 6. Number of Hawaii shallow-set longline vessels, trips, and hooks set, 2005-2017. Source: WPRFMC 2016, WPRFMC 2017, WPRFMC 2018.

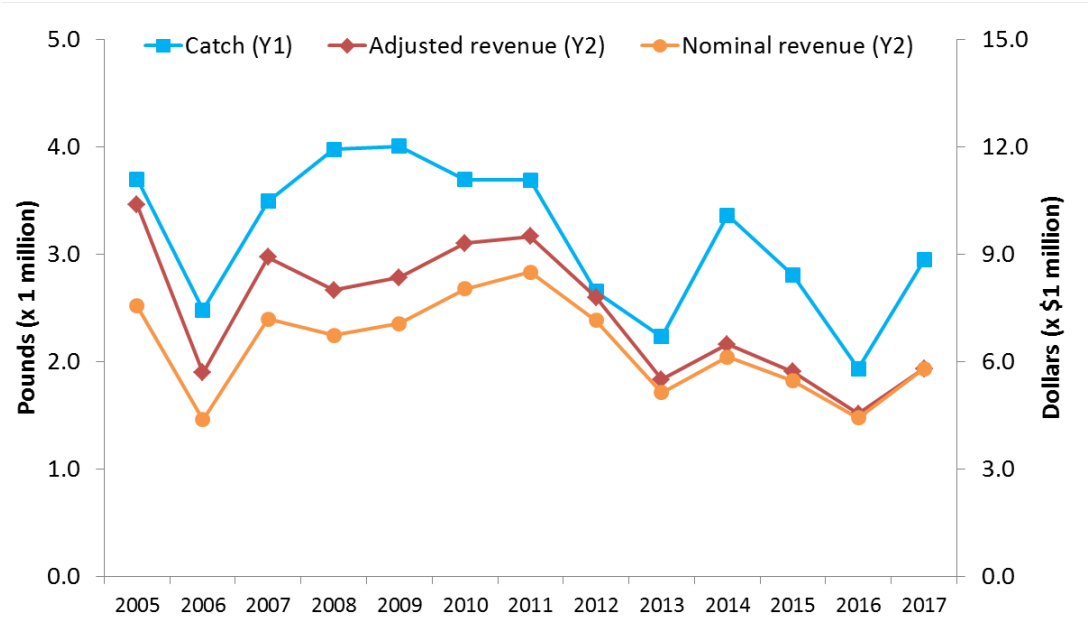

Figure 7. Catch and revenue for the Hawaii shallow-set longline fishery, 2005-2017. Catch data are based on estimated logbook landings from all Hawaii longline limited entry permit holders using shallow-set gear. Revenue data are based on pounds sold in Hawaii and West Coast ports.
Source: PIFSC Unpublished Data.

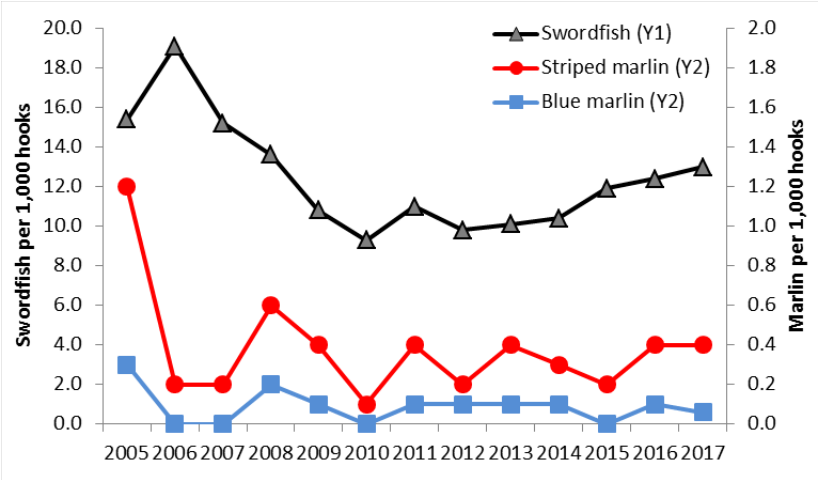

Figure 8. Billfish CPUE for the Hawaii shallow-set longline fishery, 2005-2017.
Source: WPRFMC 2016, WPRFMC 2017, WPRFMC 2018.

The shallow-set longline fishery is highly seasonal due to peak market demand for Hawaii swordfish, with effort typically increasing in October and peaking in March, after which effort gradually declines through the summer months (Figure 9). The swordfish fishing season for the Hawaii shallow-set longline fishery corresponds to seasonally low levels of swordfish imports, indicating that the peak demand for Hawaii swordfish occurs in the winter months when swordfish imports are lowest (Figure 10). The swordfish catch in the Hawaii longline fishery accounts for nearly half of the US commercial landings (Figure 11). In the five-year period of 2012-2016, the average swordfish catch in the Hawaii longline fishery was approximately 3.1 million pounds, of which 2.3 million pounds were from the shallow-set fishery, and amounting to 44% and 33%, respectively, of the total US domestic commercial landing of swordfish during that same period (WPRFMC 2017, NMFS Commercial Fisheries Statistics).

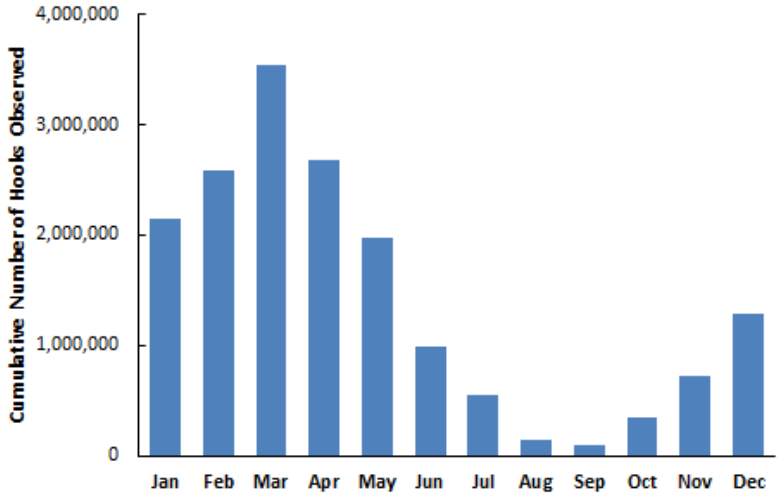

Figure 9. Cumulative observed monthly effort in hooks for the Hawaii shallow-set longline fishery (100% observer coverage), 2004-2017.
Data source: NMFS Pacific Islands Regional Office Observer Program

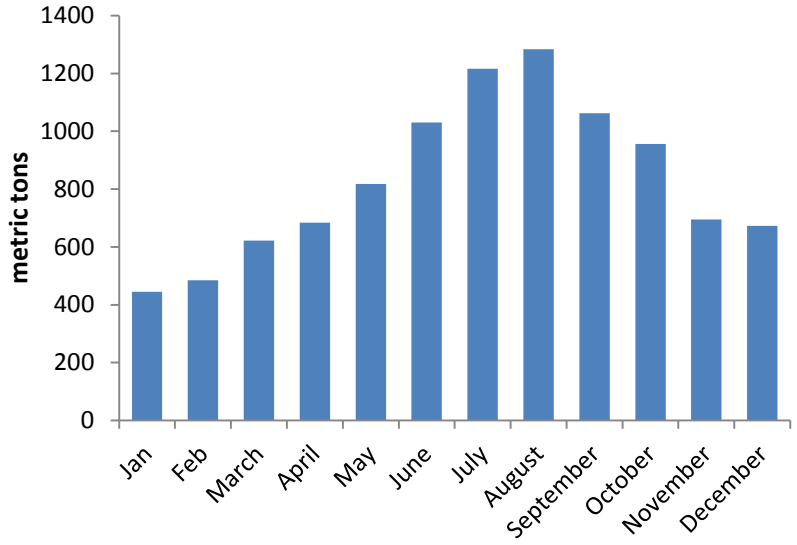

Figure 10: Average Monthly Swordfish Imports into the United States, 2013-2017
Source: Figure made from data available at: https://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/raw-data/imports-exports-annual#1

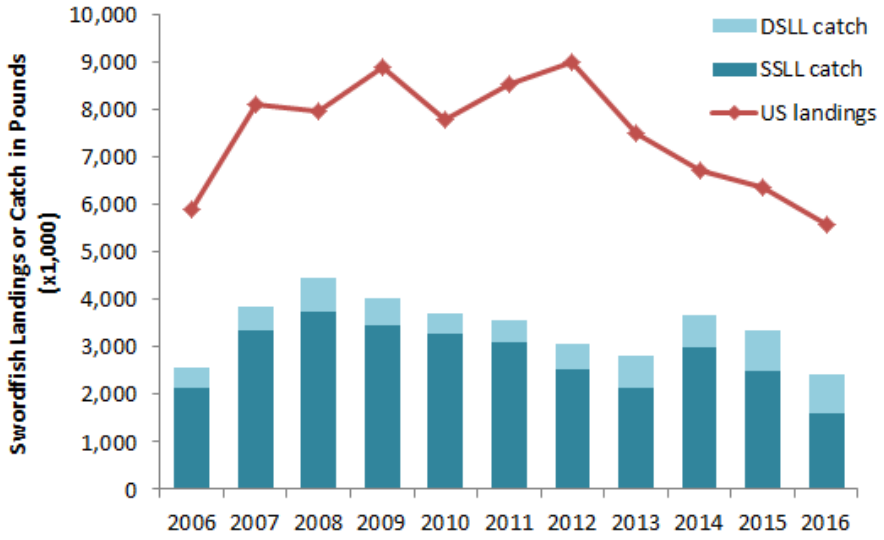

Figure 11. Hawaii shallow-set and deep-set longline fishery swordfish catch and total US domestic swordfish landings, 2006-2016.
Source: WPRFMC (2017) and NMFS Commercial Fisheries Statistics (https://www.st.nmfs.noaa.gov/st1/commercial/index.html)

The shallow-set fishery has had two hard cap closures since 2004, once in March 2006 from reaching the loggerhead limit of 17 turtles, and another in November 2011 from reaching the leatherback limit of 16. The closure in March during the peak fishing season for the shallow-set fishery resulted in a substantial reduction in effort, catch and revenue in 2006 compared to 1 year before and after (Table 30). Number of trips in 2006 was 42% lower than the average of the

years before and after, and hooks set were 50% lower. Catch in 2006 was 37% lower than the average of the years before and after, and nominal revenue was 46% lower in the closure year. The impact of the leatherback hard cap closure in 2011 is less evident due to the November closure when compared with the average of 1 year before and after (Table 30), which may be confounded by the overall declining trend in effort and catch since 2010.

Table 30. Difference in fishery performance between hard cap closure years (2006, 2011) and the average of 1 year before and after each closure.

2006 Loggerhead Hard Cap Closure				
Performance measure	**Closure year (2006)**	**Average of 1 year before and after**	**Difference**	**%**
Trips	57	98.5	-41.5	-42%
Hooks (million)	0.7	1.4	-0.7	-50%
Catch (1,000 lbs)	2,328	3,692	-1,364	-37%
Nominal Revenue ($1,000)	$3,985	$7,353	-$3,368	-46%
2011 Leatherback Hard Cap Closure				
Performance measure	**Closure year (2011)**	**Average of 1 year before and after**	**Difference**	**%**
Trips	82	98.5	-16.5	-17%
Hooks (million)	1.5	1.6	-0.1	-6%
Catch (1,000 lbs)	3,500	3,214	+286	+9%
Nominal Revenue ($1,000)	$6,086	$6,232	-$146	-2%

Data source: WPRFMC 2016

3.5 Management Setting

The swordfish fishery conducted by the Hawaii shallow-set longline fishery is managed under the Pelagic FEP. The shallow-set and deep-set longline fisheries are managed under a single limited access fishery with a maximum of 164 vessel permits. The shallow-set fishery is monitored under 100% federal observer coverage. The Hawaii permitted vessels are required to provide 72-hour advance notification prior to leaving port on a fishing trip to declare trip type (shallow-setting or deep-setting) and to receive observer placement. Vessels may not switch gear type during a trip. Regulations for the Hawaii longline fishery are enforced by NOAA OLE and US Coast Guard.

Swordfish is a highly migratory stock that is subject to management by WCPFC and IATTC. Current WCPFC measures for shallow-set longline fishing for swordfish include the use of large circle hooks or whole finish bait (CMM 2008-03).

Detailed descriptions of the management setting for the Hawaii shallow-set longline fishery can be found in the Pelagic FEP (WPFMC 2009a) and Amendment 18 to the Pelagic FEP (WPRFMC 2009b).

4 ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES

This section describes the potential effects of each alternative on the components of the affected environment or other socioeconomic elements identified in Section 3 above.

This chapter describes the potential environmental consequences that could result from the Alternatives considered. The analysis relies on the information described in Chapter 3 as the baseline to evaluate the impacts of the management alternatives considered herein. The environmental resources that are potentially affected include the following: target and non-target species (including bycatch), protected resources, socioeconomic setting and management setting. Climate change impacts are discussed in the cumulative effects section.

4.1 Potential Effects of Alternatives on Physical Resources

None of the alternatives are anticipated to result in changes to the Hawaii shallow-set longline fishery in a manner that would affect the physical environment including open ocean waters and features of those habitats such as circulation, temperature, and salinity. As such, these topics will not be discussed further.

4.2 Potential Effects on Target and Non-target Stocks

4.2.1 Potential Effects of Alternative 1: No Action (Fishery operates under loggerhead hard cap limit of 17 pursuant to court order)

Under Alternative 1, the fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year), and is not expected to result in changes in effects to target and non-target stocks described in Section 3.2.

4.2.2 Potential Effects of Alternative 2

Under all sub-alternatives for Alternative 2, the fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year).

Implementation of the individual trip limits under all sub-alternatives and individual vessel limits under Sub-Alternatives 2B and 2C is expected to reduce the likelihood of reaching the hard cap limit and increase the likelihood for maintaining fishing operations throughout the calendar year when higher interaction rates are observed. Consequently, target and non-target catch by the Hawaii shallow-set longline fishery may be higher than the No-action Alternative in such years. However, increases in target and non-target catch as a result of the extended fishing year are likely to be within the range observed since 2004 and are not expected to result in adverse effects to target and non-target stocks.

Implementation of the in-season temporary closure under Sub-Alternatives 2C is expected to have a limited effect on the fleet-wide fishing effort if the individual trip limits and individual vessel limits provide the intended “dampening” effect when high interaction rates are observed during the first three quarters of the calendar year. If the individual trip limit or vessel limit does

not provide the intended dampening effect, if trip or vessel limits are not specified, or if trip or vessel limits are specified at the upper range of the specifications, the in-season temporary closure may close the fishery until October 1 if loggerhead or leatherback turtle interactions reach the specified percentage of the fleet-wide hard cap limit. In such scenarios, the fishery may temporarily close earlier than the No-action Alternative, but the lost effort may be offset by the effort after October 1, resulting in an overall similar effort level compared to the No-action Alternative. As such, the in-season temporary closure is not likely to result in adverse effects to target and non-target stocks.

4.3 Potential Effects on Protected Resources

4.3.1 Potential Effects of Alternative 1: No Action (Fishery operates under loggerhead hard cap limit of 17 pursuant to court order)

Under Alternative 1, the fishery would continue to operate without any measures to provide early detection of and response to higher interaction rates that may indicate a potential for higher impacts to sea turtle populations. The existing hard cap measure provides assurance that the fishery's impacts to loggerhead and leatherback turtles remain below a fixed level of interactions analyzed in the BiOp.

Under this Alternative, the fishery would operate under a loggerhead turtle hard cap limit of 17, pursuant to the final rule implementing the court order (83 FR 49495, October 2, 2018). The limit of 17 loggerhead turtles is based on the ITS in the 2004 BiOp. The ITS was based on predictive modeling of the anticipated level of interactions using 1994-1999 data (observer coverage of 3.3-5.8% annually for both shallow-set and deep-set longline fisheries) and applying the interaction reduction rates associated with circle hooks and mackerel bait from experimental results in the Atlantic (Kobayashi 2003). Since the Hawaii shallow-set longline fishery's reopening in April 2004, the fishery has accumulated 14 additional years of operational data under the circle hook and mackerel-type bait measures under 100% observer coverage. Additionally, more recent data on loggerhead abundance and fishery impacts on population trends are available. Therefore, under the No Action Altenrtaive, the fishery would operate under a conservative loggerhead hard cap limit that does not reflect the best available scientific information for the species' conservation status or needs.

A loggerhead limit of 17 represents approximately half of the anticipated level of interactions estimated in the BE for the ESA Section 7 consultation reinitiated on April 20, 2018. Based on the ANE analysis conducted for an anticipated level of 37 loggerhead interactions, 17 interactions would be equivalent to 0.31 adult female mortalities per year.

Effects to all other protected species are expected to be similar to the baseline conditions described in Section 3.3.

4.3.2 Potential Effects of Alternative 2

Under all sub-alternatives for Alternative 2, implementation of the fleet-wide single-year hard caps provides assurance that the fishery's impacts to loggerhead and leatherback turtles remain below a fixed level of interactions analyzed in the BiOp.

The Council at its 173rd Meeting recommended hard cap limits based on the anticipated level of interactions in the BE for the ESA Section 7 consultation reinitiated on April 20, 2018. The anticipated level of interactions in the BE is equal to or less than 37 loggerhead turtles and equal to or less than 21 leatherback turtles in any given year. This level of loggerhead turtle interactions is equivalent to 0.68 adult female mortalities per year, or less than 0.005 percent of the nesting population. Similarly the anticipated level of leatherback turtle interactions is equivalent to 1.5 adult female mortalities per year, or approximately 0.05 percent of the nesting population. These level of interactions are likely to have insubstantial impacts to the loggerhead and leatherback turtle populations (Todd Jones, pers. comm., January 15, 2018).

Implementation of the individual trip limits, individual vessel limits, and in-season temporary closure under Sub-Alternatives 2A, 2B, and 2C are expected to further reduce loggerhead and leatherback turtle interactions in years with high interaction rates. Additional discussion on the effects of the sub-alternatives on loggerhead and leatherback turtles is included in the following sections.

Under all sub-alternatives, the fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004. As such, impacts to other protected species are expected to be similar to the No-Action Alternative and within the baseline level of interactions described in Section 3.3.

4.3.2.1 Potential Effects of Sub-Alternative 2A on Loggerhead and Leatherback Turtles

Implementation of the individual trip limits is expected to reduce the likelihood of reaching the loggerhead hard cap because it would prevent a large proportion of loggerhead turtles from being taken in a single trip, which are typically associated with years with high interaction rates. The individual trip limits for leatherback turtles may serve as a preventative measure if higher interaction rates are observed in the future. The individual trip limit may also provide incentives for individual vessels to move away from areas with sea turtle interactions, and are expected to reduce loggerhead and leatherback turtle interactions during years with higher interaction rates.

The potential for the individual trip limits to mitigate interactions and reduce the likelihood of reaching the hard cap limit when unusually high interaction rates are encountered are qualitatively discussed in Section 2.4.2.1 and summarized below in Table 31.

Table 31. Potential reductions in loggerhead and leatherback interactions and likelihood of reaching hard cap limits under Sub-Alternative 2A.

Potential outcome scenario	Limit	Expected reduction in turtle interactions	Potential reduction based on PIFSC simulation	Likelihood of reaching hard cap limit
Loggerhead Turtle Outcomes				
Outcome 2A-LH(a) No specification	N/A	No reduction expected when higher interaction rates are observed.	N/A	Same as management under hard cap only.

Outcome 2A-LH(b) Lower range specification	2 per trip	Likely to have the greatest amount of reduction in high interaction rate years.	33% reduction in 2017 and 55% in 2018	Reduced likelihood of reaching hard cap limit.
Outcome 2A-LH(c) Middle range specification (***preferred***)	5 per trip	Substantial reduction expected in high interaction rate years, but lower reduction than Outcome 2A-LH(b)	14% reduction in 2017 and 30% in 2018	Reduced likelihood of reaching hard cap limit.
Outcome 2A-LH(d) Upper range specification	10 per trip	Likely to have a limited amount of reduction in loggerhead interactions given the rare nature of such high levels of interactions in a single trip.	N/A	Minimal effects on the likelihood of reaching hard cap limit.
Leatherback Turtle Outcomes				
Outcome 2A-LB(a) No specification (***preferred***)	N/A	No reduction expected.	No reduction.	Same as management under hard cap only.
Outcome 2A-LB(b) Lower range specification	2 per trip	Likely to have limited amount of reduction.	6% reduction in 2014.	Not expected to reduce likelihood of reaching hard cap limit.
Outcome 2A-LB(c) Upper range specification	5 per trip	No reduction expected.	No reduction.	Not expected to reduce likelihood of reaching hard cap limit.

4.3.2.2 Potential Effects of Sub-Alternative 2B on Loggerhead and Leatherback Turtles

Individual trip limits under Sub-Alternative 2B is expected to have the same effects on loggerhead and leatherback turtles as described under Sub-Alternative 2A. The addition of the individual vessel limits under Sub-Alternative 2B is expected to prevent vessels from reaching the individual trip limit multiple times in a year by prohibiting vessels that reach the vessel limit from shallow-setting for the remainder of the calendar year. The available observer data from 2004-2018 indicate that the likelihood of a single vessel having multiple trips with high loggerhead or leatherback turtle interactions in a year is low, and the additional burden of prohibiting vessels from fishing shallow-set if vessels reached the individual vessel limits is not expected to result in substantial conservation gains.

The potential for the individual trip limits and individual vessel limits to mitigate interactions and reduce the likelihood of reaching the hard cap limit when unusually high interaction rates are encountered are qualitatively discussed in Section 2.4.2.2 and summarized below in Table 32.

Table 32. Potential reductions in loggerhead and leatherback interactions and likelihood of reaching hard cap limits under Sub-Alternative 2B.

Potential outcome scenario	Limit	Expected reduction in turtle interactions	Potential reduction based on PIFSC simulation	Likelihood of reaching hard cap limit
Loggerhead Turtle Outcomes				
Outcome 2B-LH(a) Trip = No spec Vessel = Lower	No trip spec + 2 per vessel	Likely to have a similar or greater reduction in interactions in high interaction rate years compared to scenario 2A-LH(b)	48% reduction in 2017 and 58% in 2018	Reduced likelihood of reaching hard cap limit.
Outcome 2B-LH(b) Trip = No spec Vessel = Middle	No trip spec + 5 per vessel	Likely to have similar reduction in interactions in high interaction rate years compared to scenario 2A-LH(c)	29% reduction in 2017 and 21% in 2018	Reduced likelihood of reaching hard cap limit.
Outcome 2B-LH(c) Trip = No spec Vessel = Upper	No trip spec + 10 per vessel	Likely to have a limited amount of reduction in interactions given the rare nature of such high levels of interactions by a single vessel.	N/A	Minimal effects on the likelihood of reaching hard cap limit.
Outcome 2B-LH(d) Trip = Lower Vessel = Middle	2 per trip + 5 per vessel	Similar to scenario 2A-LH(b) due to low likelihood of a single vessel having multiple trips with high loggerhead interactions in a year.	33% reduction in 2017 and 55% in 2018	Similar to scenario 3A-LH(b).
Outcome 2B-LH(e) Trip = Lower Vessel = Upper	2 per trip + 10 per vessel	Similar to scenario 2A-LH(b) due to low likelihood of a single vessel having multiple trips with high loggerhead interactions in a year.	33% reduction in 2017 and 55% in 2018	Similar to scenario 3A-LH(b).
Outcome 2B-LH(f) Trip = Middle Vessel = Upper	5 per trip + 10 per trip	Similar to scenario 2A-LH(c) due to low likelihood of a single vessel having multiple trips with high loggerhead interactions in a year.	14% reduction in 2017 and 30% in 2018	Similar to scenario 3A-LH(c).

Leatherback Turtle Outcomes				
Outcome 2B-LB(a) Trip = No spec Vessel = Lower	No trip spec + 2 per vessel	Likely to have some reduction in interactions	maximum reduction of 3 interactions in one year	Not expected to meaningfully reduce likelihood of reaching hard cap limit.
Outcome 2B-LB(b) Trip = No spec Vessel = Upper	No trip spec + 5 per vessel	No reduction expected.	No reduction.	Not expected to reduce likelihood of reaching hard cap limit.
Outcome 2B-LB(c) Trip = Lower Vessel = Upper	2 per trip + 5 per vessel	Similar to scenario 2A-LB(b) due to low likelihood of a single vessel having multiple trips with high loggerhead interactions in a year.	6% reduction in 2014.	Not expected to reduce likelihood of reaching hard cap limit.

4.3.2.3 Potential Effects of Sub-Alternative 2C on Loggerhead and Leatherback Turtles

Individual trip limits and individual vessel limits under Sub-Alternative 2C is expected to have the same effects on loggerhead and leatherback turtles as described under Sub-Alternative 2B. The addition of the in-season temporary closure under Sub-Alternative 2C would provide a mechanism to allow shallow-set vessels to resume targeting swordfish at the beginning of the fishing season in October rather than delaying the start of the season until January 1, if the individual trip limits and vessel limits do not provide the intended "dampening" effect when high interaction rates are observed during the first three quarters of the calendar year.

The in-season temporary closure may reduce the likelihood of reaching the fleet-wide annual hard cap limit in years with high loggerhead or leatherback turtle interactions because the fishery would be closed until October 1 if a percentage of the loggerhead or leatherback hard cap limit is reached during the first three quarters of the calendar year. However, the likelihood that the in-season temporary closure would be triggered would be low if the individual trip limit or individual vessel limit is specified at level that would minimize interactions in high interaction rate years.

The in-season temporary closure may also increase the frequency of a fleet-wide fishery closure, as it would place a lower limit during the first nine months of the calendar year. If the in-season temporary closure is triggered, the total number of loggerhead and leatherback turtle interactions may be up to 19% lower than the hard cap for loggerheads and 28% lower than the hard cap for leatherback turtles if no additional interactions are observed from October to December.

4.4 Potential Effects on Socioeconomic Setting

4.4.1 Potential Effects of Alternative 1: No Action (Fishery operates under loggerhead hard cap limit of 17 pursuant to court order)

Under Alternative 1, the fishery is expected to operate within the effort range observed since the reopening of the fishery in 2004 (approximately 650-1,850 sets per year). This alternative would not provide for additional measures to reduce the potential for reaching the hard cap limit. Loggerhead and leatherback turtle interactions are likely to fluctuate substantially between years, and may close the fishery early in the calendar year in high interaction years. When a hard cap is reached, the fishery remains closed until January 1 of the subsequent calendar year and delays the start of the fishing season that typically starts around October. The fishery is likely to reach the loggerhead hard cap limit more frequently than the leatherback limit, given that the court-ordered limit of 17 loggerhead turtles is based on outdated projections from the 2004 BiOp.

4.4.2 Potential Effects of Alternative 2

Under all sub-alternatives for Alternative 2, the fishery is anticipated to have a lower likelihood of reaching the hard cap limit than the No-action Alternative because the loggerhead hard cap limit will be based all available operational data since 2004, and the individual trip limits and individual vessels limit are expected to prevent a large proportion of the loggerhead or leatherback limit to be taken in a single trip or by a single vessel. This would in turn allow the remaining vessels to continue fishing for swordfish throughout the peak season and continue to fish throughout the year, resulting in a minor to moderate positive benefits for most vessels and minimizing the fleet-wide impacts to catch and revenue from fleet-wide hard cap closures.

Under all sub-alternatives, the vessels that reach the individual trip limit will be required to return to port without making additional sets, but may resume shallow-set fishing operations after returning to port and providing the required 72-hour notification prior to departure. Based on available observer data from 2004-2018, the probability of a single vessel experiencing high number of observed interactions in consecutive trips is low.

Under Sub-Alternatives 2B and 2C, the vessels that reach the individual vessel limits will not be able to fish for swordfish for the remainder of the calendar year. These vessels may resume fishing after returning to port and reconfiguring their vessels to target bigeye tuna using deep-set gear.

Sub-Alternative 2C may increase the frequency of a fleet-wide fishery closure, as it would place a lower limit during the first nine months of the calendar year. However, impacts to catch and revenue from such increase in closures may be offset by the ability to resume fishing in October at the start of the typical fishing season rather than to delay until January 1.

4.5 Potential Effects on Management Setting

None of the alternatives are anticipated to adversely impact the marine habitat, particularly critical habitat, EFH, HAPC, marine protected areas (MPAs), marine sanctuaries, or marine monuments. The Hawaii shallow-set longline fishery is not known to have large adverse impacts

to habitats, thus none of the Alternatives are likely to lead to substantial physical, chemical, or biological alterations to the habitat. Fishing activity would not occur in identified critical habitat, so no critical habitat would be impacted by the alternatives considered. Longline fishing does not occur in MPAs, marine sanctuaries or marine monuments, so no marine protected areas would be impacted.

Effects of the alternatives on administration are discussed in the following sections.

4.5.1 Potential Effects of Alternative 1: No Action (Fishery operates under loggerhead hard cap limit of 17 pursuant to court order)

Alternative 1 would not modify the administrative procedures for the Hawaii shallow-set longline fishery. The fishery will continue to operate under a hard cap, which requires NMFS to publish a Federal Register notice upon the fishery reaching the annual loggerhead or leatherback limit to close the fishery for the remainder of the calendar year.

4.5.2 Potential Effects of Alternative 2

Administrative burden of implementing the single-year hard cap limit under all sub-alternatives for Alternative 2 would be similar to the No-action Alternative.

Implementation of the individual trip limits under all sub-alternatives and the individual vessel limits under Sub-Alternatives 2B and 2C would result in additional administrative burden to track the number of interactions by individual vessels or trips. These changes are likely to be minor, as the existing monitoring data provided by the observer program can be tracked at the individual trip or vessel level without substantial changes to the monitoring protocol. If these sub-alternatives reduce the likelihood of reaching the hard cap limit, there would be reduced administrative burden for implementing hard cap closures.

Implementation of the in-season temporary closure under Sub-Alternative 2C would require similar administrative procedure to the No-action Alternative. Administrative burden of implementing the in-season closure may be higher than the No-action Alternative if the measure increases the frequency of a fishery closure due to having a lower threshold for the first three quarters of the calendar year. If the fishery closes due to high interaction rates in the first three quarters of the year and interaction rates remain high after the fishery reopens on October 1, the fishery may experience two fleet-wide closures in a calendar year.

4.6 Potential Cumulative Effects of the Alternatives

Cumulative effects refer to the combined effects on the human environment that result from the incremental impact of the proposed action, and its alternatives, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-federal) or person undertakes such other actions. Further, cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. The cumulative effects analysis examines whether the direct and indirect effects of the alternatives considered on a given resource interacts with the direct and indirect effects of other past, present and

reasonably foreseeable actions on that same resource to determine the overall, or cumulative effects on that resource.

The following cumulative effects analysis is organized by the following issues: target and non-target species, protected species, and fishery participants and communities. Because pelagic longline fishing activities authorized occur far offshore and in deep oceanic waters away from land, populated areas, and marine protected areas such as marine national monuments, none of the Alternatives considered would have an effect on air/water quality, coral reefs, benthic marine habitats. As such, these resources will not be considered in this cumulative effects analysis.

4.6.1 Cumulative Effects Related to Effects on Target and Non-Target Stocks

Past, Present and Reasonably Foreseeable Management Actions

There are currently a number of proposed pelagic fishery management actions which the Council has either recommended or is considering. These include proposed changes to the American Samoa longline limited entry permit program; proposed changes to the retention of swordfish in the American Samoa longline fleet; exemptions for longline vessels from the American Samoa Large Vessel Prohibited Area; and development of a framework for implementing domestic catch and effort limits for fish stocks which are managed internationally, and domestic limits for the catch of striped marlin. In general, the Alternatives considered would not have interactive effects with the proposed actions listed as they vary in management scope and impact, and the public will have an opportunity to review and comment on the actions at a later date.

Both the WCPFC and IATTC adopt management measures that are applicable to fisheries that catch swordfish. To meet the conservation management objectives of these RFMOs, international cooperation is required. The United States will continue to participate in these RFMOs and implement conservation and managements that apply to US fisheries.

Five major exogenous factors were identified as having the potential to contribute to cumulative effects on pelagic target and non-target stocks, which are described in further detail in the Amendment 18 to the Pelagic FEP (WPRFMC 2009b):

- Fluctuations in the pelagic ocean environment focusing on regime shifts
- Ocean noise
- Marine debris
- Ocean productivity related to global climate change

Potential Cumulative Effects on Target and Non-Target Species

Given that North Pacific swordfish stocks are currently healthy, it is not anticipated that exogenous factors coupled with the impacts of the Alternatives considered would have significant cumulative impacts to target and non-target species. The Alternatives considered under this action are not expected to increase fishing effort beyond the range observed since 2004. Impacts to other target species that have been showing signs of overfishing such as bigeye tuna, albacore, yellowfin, and striped marlin are very small are not anticipated to exceed thresholds that would lead to overfished conditions. Stocks of other target and non-target species

are not subject to overfishing and the cumulative impacts including the impacts of the Alternatives considered are not believed to result in overfishing of these fish stocks.

4.6.2 Cumulative Effects Related to Protected Resources

Past, Present and Reasonably Foreseeable Management Actions

Through data collected from observer programs and other sources, the Council and NMFS will continue to monitor interactions between managed fisheries and marine mammals. NMFS scientists in association with other researchers will continue to collect biological samples to refine stock definitions as well as conduct surveys to monitor populations. The Council and NMFS will continue to conduct workshops with participation from fishermen to develop mitigation methods as appropriate, and NMFS will continue to conduct mandatory annual protected species workshops for all longline permit holders that teach how to identify marine mammals and how to reduce and mitigate interactions. Due to the recent listing of oceanic white tip shark and giant manta ray, NMFS has reinitiated ESA consultation on pelagic longline fisheries managed under the Pelagic FEP.

Spillover and transferred effects may result from the market replacement of domestic swordfish with imported swordfish from countries with higher bycatch rates, as well as from production displacement of U.S. vessels with foreign vessels in the same general fishing area. Studies have demonstrated that the 2001-2004 closure of the Hawaii shallow-set longline fishery resulted in an increase of 2,882 sea turtle interactions associated with swordfish consumed in the U.S. (Rausser et al. 2009), and the subsequent reopening of the fishery contributed to 842 to 1,826 fewer sea turtle interactions over the period of 2005-2008 (Chan and Pan 2012). Temporary closure of the Hawaii shallow-set longline fishery, especially during the peak season, that results in displacement of U.S. swordfish production with foreign production is therefore likely to result in increased impacts to sea turtle populations for the U.S. swordfish market.

Other past and present management actions, as well as exogenous factors affecting protected resources, are described in further detail in the Amendment 18 to the Pelagic FEP (WPRFMC 2009b). These include interactions in US and foreign fisheries, sea turtle conservation projects, human use and consumption of sea turtles, marine debris, fluctuations in the ocean environment, and climate change.

Potential Cumulative Effects on Protected Resources

The Council and NMFS have taken significant steps to reduce sea turtle and seabird interactions in longline fisheries, and ongoing work is being conducted to further reduce interactions. Longline fisheries managed under the Pelagic FEP are held as the benchmark (WCPFC Science Committee 2009 Report) for successful sea turtle, and seabird interaction reductions, and the successes of the Council and NMFS' work are being transferred to other fleets in the region.

Alternatives under consideration that have the potential to reduce the frequency of reaching the loggerhead or leatherback hard cap limits is likely to minimize the potential for transferred and spillover effects, thereby minimizing the overall impacts to sea turtle populations from swordfish consumption in the U.S.

Under all alternatives, U.S. longline vessels will continue to be subject to strict measures to avoid and reduce protected species interactions and to reduce the severity of interactions when they do occur. Therefore, impacts to protected species will be similar. The levels of interactions that are authorized in each fishery do consider the estimated impacts on the same species by all fisheries where the domestic fishery operates, as well as cumulative effects. Cumulative impacts of the U.S. fleets have been considered and authorized in the BiOps, and determinations of impacts to MMPA-protected species to a lesser extent, that apply to the domestic longline and other pelagic fisheries in the western Pacific region.

4.6.3 Cumulative Effects Related to Effects on the Socio-economic Setting

In accordance with the Magnuson-Stevens Act, the Council and NMFS will continue to assess the impact of management actions on fishery participants and fishing communities, and where possible, minimize negative effects while developing appropriate measures for the conservation and management of fishery resources.

There are a number of wide-ranging factors (that change over time) that have the potential to affect fishing participants as well as fishing communities. Current factors may include, but are not limited to, high fuel costs, high costs of other equipment and supplies, increased seafood imports, and restricted access to traditional fishing grounds. High fuel and materials/supply costs affect fishing participants by increasing the costs to go fishing.

The amount of imported seafood is also increasing, where the U.S. now imports nearly 85 percent of consumed seafood.[8] Increased seafood imports are significant as the level of imports relates to market competition, where a glut of foreign fish products can flood the market and lower ex-vessel prices for U.S. fishermen. Once U.S. fish products lose market channels to imported seafood products, it may also be hard for U.S. fishermen to regain those channels.

In addition, a reliance on foreign imports in Hawaii is believed to impact local food security. At a broader level, a recent study by the Great Britain's Royal Institute of International Affairs (Ambler-Edwards et al. 2009) has identified seven fundamental issues, which affect food production and food security. These are as follows:

[8] http://www.fishwatch.gov/farmed_seafood/index.htm

1. Rapidly rising world population (population growth rates in the western Pacific region range from 1-7%)
2. Nutrition transition, i.e., a shift from traditional staples to processed foods high in sugars, oils, and fats
3. The rising costs of energy (oil, gas, electricity)
4. Limited availability of agricultural land (especially critical on small islands)
5. Increasing demands for water for agricultural and food production
6. Climate change
7. Labor and urban drift

With regard to the Hawaii fishing communities, which face the issues such as rising operational costs and increasing seafood imports, alternatives that result in more frequent fleet-wide hard cap closures may lead to more foreign imports of swordfish and other pelagic species to fill any market gaps in the Hawaii and U.S. seafood market that depend on fish products provided by the Hawaii shallow-set longline fishery throughout the year. The Hawaii longline fishery contributes to nearly half of the U.S. commercial swordfish landing.

4.6.4 Climate Change

A climate change impact analysis is a difficult undertaking given its global nature and interrelationships among sources, causes, mechanisms of actions and impacts. We focus our analysis on whether climate change is expected to impact resources that are the focus of this analysis including target stocks, non-target stocks, and on protected species.

The impacts of climate change on these resources may be positive if climate change impacts benefit a species' prey base or otherwise enhance the species' ability to survive and reproduce, or impacts may be negative if the impacts reduce a species' ability to survive and reproduce. Impacts may also be neutral.

Climate change would have similar impacts to the resources regardless of which Alternative is selected. In the coming years, the Council and NMFS will continue to monitor domestic catches of all pelagic MUS, and continue to consider information from scientifically-derived stock status reports as future catch and allocation limits are made, and as changes to fishery management are contemplated and implemented. Ongoing and future monitoring and research will allow fishery managers and scientists to consider impacts of climate change, fishing, and other environmental factors that are directly or indirectly affecting the resources.

The alternatives under consideration are not expected to substantially affect the level of fishing effort beyond the range observed since 2004. Neither NMFS, nor the Council controls where fishing vessels fish beyond existing restricted fishing areas, how long a fishing trip lasts, or other decisions that are made by individual fishermen. Some changes in fishing behavior may occur as a result of sub-alternatives considering individual trip or vessel limits or real-time spatial management measures if vessels engage in sea turtle avoidance methods that involve moving away from hotspots. However, any changes are likely to be minor as the overall effort level is not expected to be affected as a result of the alternatives under consideration. For these reasons, none of the alternatives are expected to result in a large change to greenhouse gas emissions.

Table 33. Summary of Effects of the Alternatives.

Topic	Alternative 1: No-action (Fishery operates under loggerhead hard cap limit of 17 pursuant to court order)	Alternative 2: Establish a framework for managing loggerhead and leatherback turtle interactions in the Hawaii shallow-set longline fishery		
		Sub-alternative 2A: 1) Single year hard cap limits 2) Individual trip limits **(*Preferred Alternative*)**	**Sub-alternative 2B** 1) Single year hard cap limits 2) Individual trip limits 3) Individual vessel limits	**Sub-alternative 2C** 1) Single year hard cap limits 2) Individual trip limits 3) Individual vessel limits 4) In-season temporary closure upon reaching a specified percentage of the single-year hard cap
Biological resource: target and non-target stocks	Baseline conditions as described in Section 3.	No additional or new impacts expected to target and non-target stocks.	No additional or new impacts expected to target and non-target stocks.	No additional or new impacts expected to target and non-target stocks.
Biological resource: protected resources	Loggerhead limit: 17 Leatherback limit: 26 Baseline conditions as described in Section 3.	Fleet-wide loggerhead and leatherback turtle interactions will remain below levels analyzed in the current BiOp. Likely to have lower loggerhead and leatherback interactions in years with higher interaction rates. Impacts to all other protected species likely to be similar to No Action.	Fleet-wide loggerhead and leatherback turtle interactions will remain below levels analyzed in the current BiOp. Likely to have lower loggerhead and leatherback interactions in years with higher interaction rates. Impacts to all other protected species likely to be similar to No Action.	Fleet-wide loggerhead and leatherback turtle interactions will remain below levels analyzed in the current BiOp. Likely to have lower loggerhead and leatherback interactions in years with higher interaction rates. Impacts to all other protected species likely to be similar to No Action.
Socio-economic setting	Fishery likely to occasionally close from reaching the loggerhead or leatherback hard cap limit. Frequency of reaching loggerhead limit likely to	Fleet-wide impacts to catch and revenue from reaching the hard cap limit will be lower, as the individual trip limit is expected to lower the likelihood of reaching the	Similar to Sub-Alternative 2A. In addition to Sub-Alternative 2A, vessels that reach the limit will be prohibited from	Similar to Sub-Alternative 2B. In-season temporary closure may increase the frequency of a fleet-wide fishery closure

	be higher than reaching leatherback limit. Catch and revenue likely to be lower in years with hard cap closure, and if closure occurs earlier in the calendar year.	fleet-wide hard cap. Vessel that reach the trip limit will be required to return to port without making additional sets, and may resume shallow-set fishing after providing the required 72-hour notification under 50 CFR 665.803 prior to departure. Vessels that do not reach the limit will continue to operate.	targeting swordfish using shallow-set gear for the remainder of the calendar year. Vessels that do not reach the limit will continue to operate.	due to having a lower limit for the first nine months, but impacts may be offset by the ability to resume fishing in October of the same calendar year.
Management setting	Baseline conditions as described in Section 3.	Minor changes to monitoring interactions will be required to track number of interactions per trip. Administrative burden may be reduced if frequency of hard cap closure is reduced.	Minor changes to monitoring interactions will be required to track number of interactions per trip and annual number of interactions per vessel. Administrative burden may be reduced if frequency of hard cap closure is reduced.	Minor changes to monitoring interactions will be required to track number of interactions per trip and annual number of interactions per vessel. Administrative burden may be reduced if frequency of hard cap closure is reduced. Administrative burden may increase if temporary closures increase the frequency of implementing closure procedures.

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