# Regulatory Amendment

# Revised Swordfish Trip Limits in the Hawaii Deep-set Longline Fishery to Reduce Regulatory Discards

## including an Environmental Assessment and Regulatory Impact Review

**May 14, 2012**

**Prepared by:**

Western Pacific Regional Fishery Management Council
1164 Bishop Street, Suite 1400
Honolulu, HI 96813

and

Pacific Islands Regional Office
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814

# List of Acronyms/Abbreviations

| | |
|---|---|
| BiOp | Biological Opinion |
| CMM | Conservation and Management Measure |
| CPUE | Catch per Unit of Effort |
| Council | Western Pacific Regional Fishery Management Council |
| EA | Environmental assessment |
| EEZ | Exclusive Economic Zone |
| EFH | Essential Fish Habitat |
| EPO | Eastern Pacific Ocean |
| ESA | Endangered Species Act |
| FEP | Fishery Ecosystem Plan |
| FMP | Fishery Management Plan |
| FR | Federal Register |
| HAPC | Habitat Areas of Particular Concern |
| ITS | Incidental take statement |
| lb | Pound(s) |
| MMPA | Marine Mammal Protection Act |
| MSY | Maximum Sustainable Yield |
| mt | Metric tons(s) |
| MUS | Management Unit Species |
| nm | nautical mile(s) |
| NMFS | National Marine Fisheries Service |
| NEPA | National Environmental Policy Act |
| NOAA | National Oceanic and Atmospheric Administration |
| Pelagic FEP | Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region |
| PIFSC | Pacific Islands Fisheries Science Center |
| PIRO | Pacific Islands Regional Office |
| PMUS | Pelagic Management Unit Species |
| RFMO | Regional fishery management organization |
| SSC | Scientific and Statistical Committee |
| SPC | Secretariat of the Pacific Community |
| STAL | Short-tailed albatross |
| USCG | U.S. Coast Guard |
| USFWS | U.S. Fish and Wildlife Service |
| VMS | Vessel monitoring system |
| WCPFC | Western and Central Pacific Fisheries Commission |
| WCPO | Western and Central Pacific Ocean |
| WPRFMC | Western Pacific Regional Fishery Management Council |

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## including an Environmental Assessment and Regulatory Impact Review

**May 14, 2012**

**Responsible Agency**
Pacific Islands Regional Office
National Marine Fisheries Service, NOAA
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814-4700
Contact: Michael Tosatto
Regional Administrator
Telephone (808) 944-2200
Fax: (808) 973-2941

**Responsible Council**
Western Pacific Regional Fishery Management Council
1164 Bishop St., Suite 1400
Honolulu, HI 96813
Contact: Kitty M. Simonds
Executive Director
Telephone (808) 522-8220
Fax: (808) 522-8226

## Abstract:

The Hawaii-based deep-set longline fishery (deep-set fishery) targets bigeye tuna and occasionally catches swordfish. In 2004, the Western Pacific Fishery Management Council (Council) and National Marine Fisheries Service (NMFS) established a limit of 10 swordfish per vessel per trip (swordfish trip limit) for the deep-set fishery to discourage deep-set fishermen from setting their gear shallow to target swordfish on the same trip (WPFMC 2004). The measures were intended to reduce longline fishery interactions with sea turtles, especially in shallow water.

The average deep-set vessel catches five and retains three (3) swordfish per trip. Occasionally, however, a vessel may catch up to 25 swordfish during a trip. Fishermen claim that the 10-fish limit occasionally forces them to throw away swordfish caught in excess of the limit ("regulatory discards"). The Council believes the current trip limit for the deep-set fishery results in an

inefficient use of fishery resources and may lead to wasteful regulatory discards, which are contrary to several National Standards in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

In response to these concerns, the Council recommends that NMFS revise regulations for the deep-set fishery to increase the number of swordfish that may be possessed and landed by Hawaii longline limited access permit holders when fishing north of the Equator on a deep-set trip if they meet certain operational conditions. Based on the Council's recommendations, NMFS proposed to revise the swordfish limits, as follows:

a) With a NMFS observer on board, there would be no limit. Observers would monitor fishing activities, and would document and mitigate interactions with protected species.
b) Without an observer, the limit would be 25 swordfish when using only circle hooks. The circle hooks would reduce the number and severity of interactions with sea turtles.
c) With no observer and using anything other than circle hooks, the current limit of 10 swordfish would remain unchanged.

All other measures applicable to the deep-set fishery would remain unchanged, including an average of 20 percent observer coverage of deep-set trips to monitor fishing activities and document interactions with protected species. The intent of the proposed action is to optimize fishery resources by reducing regulatory discards of swordfish and increase efficiency of the fishery, while maintaining safeguards for sea turtles and other protected species.

This document describes and analyzes the potential environmental, social, and economic impacts of the proposed changes to regulations governing the deep-set fishery, as managed under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region (Pelagic FEP). None of the alternatives are expected to result in a change to the manner in which the fishery is conducted (i.e., area fished, number of vessels engaging in deep-set fishing, the number of trips taken per year, number of hooks set per vessel during a trip, depth of hooks, or deployment techniques in setting longline gear). Large changes are not expected to the physical marine environment or impacts to target and non-target fish species. Alternatives 2a and 2b may encourage fishermen to fish using only circle hooks and, therefore, are expected to benefit sea turtles, marine mammals, seabirds.

NMFS is seeking public comment on a proposed rule (RIN 0648-BB48) that would revise the swordfish trip limits. Instructions on how to comment on the proposed rule can be found by searching on NOAA-NMFS-2012-0097 at www.regulations.gov, or by contacting the responsible official at the above address.

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# 1.0 Introduction

*History of the deep-set fishery swordfish trip limit*

There are two longline fisheries that operate around Hawaii; a deep-set fishery that targets tuna and a shallow-set fishery that targets swordfish. In the 1990's longline vessel operators fishing around Hawaii would set their gear deep (up to 350 meters) to target tuna, and then set some gear shallow (less than 100 meters) to target swordfish on the same trip. In response to a U.S. Federal Court Order in 2001, NMFS temporarily prohibited targeting swordfish with longline gear north of the Equator to protect and conserve sea turtles (66 FR 20134, April 19, 2001). The measures effectively closed the shallow-set fishery until permanent management measures could be developed for the shallow-set fishery. NMFS then issued an emergency interim rule with additional measures to protect sea turtles such as sea turtle handling and resuscitation measures and a requirement for vessel operators to attend NMFS protected species workshops (66 FR 31561, June 12, 2001). The measures were developed to reduce the number of incidentally-caught sea turtles to levels that were in accordance with NMFS 2001 Biological Opinion (BiOp) for the Hawaii deep-set and shallow-set longline fisheries (NMFS 2001).

Soon after NMFS implemented these measures, several deep-set longline vessels that were fishing north of 30 º N. and targeting tuna began returning to port with moderate to large numbers of swordfish, prompting concerns regarding sea turtle take in the deep-set fishery. The increase in swordfish catches on deep-set trips indicated that vessels are incidentally catching swordfish or may be setting gear shallow to target swordfish. Therefore, in 2002 NMFS issued an emergency interim rule to prohibit Hawaii longline vessels that fish north of 26 degrees north latitude from possessing or landing more than 10 swordfish per trip (67 FR 16323, April 5, 2002).

The limit of 10 swordfish per trip was based on vessel logbook data from deep-set tuna trips that incidentally caught swordfish while fishing. Based on available data at the time, 95 percent of all deep-set trips returned with 10 or fewer swordfish, so the Council and NMFS used this number as a reasonable maximum for the retention of incidentally-caught swordfish in the deep-set fishery (67 FR 40232, June 12, 2002). The measures were intended to prevent additional interactions with loggerhead sea turtles, geographically separate Hawaii longline vessels from areas expected to have higher densities of loggerhead turtles, and to remove economic incentives for deep-set fishermen to make shallow longline sets for swordfish.

In 2004, NMFS reopened the shallow-set fishery under a suite of management measures designed to reduce sea turtle impacts (69 FR 17329, April 2, 2004; WPFMC 2004). These measures insured that the shallow-set fishery was consistent with the requirements of NMFS' 2004 BiOp (NMFS 2004). The regulations include definitions and operational requirements to distinguish deep-set and shallow-set fishing activities, a limit of 10 swordfish per trip for the deep-set tuna fishery regardless of the area fished, and a requirement that Hawaii longline permit holders notify NMFS of the trip type (deep-set or shallow-set) before the vessel leaves port, among other measures. The 2004 BiOp required NMFS to maintain a minimum observer coverage rate of 20 percent for deep-set fishery to document interactions with sea turtles.

The swordfish trip limit deters vessels that engage in deep-setting from shallow-setting to target and land unlimited quantities of swordfish and potentially interacting with sea turtles. The notification requirement assists NMFS in deployment of observers to document sea turtle interactions and collect fishery data. The deep-set fishery operates under a sea turtle incidental take statement (ITS) and deep-set fishermen are required to use several mitigation techniques to reduce or mitigate interactions with seabirds, marine mammals, and sea turtles. Since implementation of the seaturtle mitigation measures, the deep-set fishery has not exceeded the ITS.

*Summary of Action*

The Council recommends modifying the current trip limit to provide additional opportunity to Hawaii longline limited access permit holders on a deep-set trip to possess and land fish that are already being caught in the course of deep-set fishing. Therefore the Council recommends an increase in the number of swordfish that may be possessed or landed by Hawaii longline limited access permit holders when fishing north of the Equator on a deep-set trip if they meet certain operational conditions, as follows:

a) With a NMFS observer on board, there would be no limit. Observers would monitor fishing activities, and would document and mitigate interactions with protected species.
b) Without an observer, the limit would be 25 swordfish when using only circle hooks. The circle hooks would reduce the number and severity of interactions with sea turtles.
c) With no observer and using anything other than circle hooks, the current limit of 10 swordfish would remain unchanged.

The proposed measures were deliberated at the Council's and its Scientific and Statistical Committee's (SSC) public meetings. The purpose of the proposed changes are to optimize fishery resources by reducing regulatory discards of swordfish and increase efficiency of the fishery, while maintaining safeguards for sea turtles and other protected species. The proposed changes are voluntary whereby fishermen would be provided the opportunity to retain all swordfish if an observer is aboard the vessel regardless of the type of hook used, or to invest and use only circle hooks to retain 25 swordfish if an observer is not aboard the vessel. All other measures applicable to the deep-set fishery would remain unchanged, including the trip limit of 10 swordfish regardless of hook type or if an observer is on the vessel. The proposed regulations would only apply to longline fishing north of the Equator, because specific rules on the retention of swordfish and gear configurations apply to longline fishing south of the Equator (see 50 CFR 665.813(k)). The trip limit south of the equator is 10 swordfish per trip.

The National Marine Fisheries Service (NMFS) and the Council prepared this environmental assessment (EA) to evaluate the potential impact of four alternatives on the environment, including a No-Action alternative. In general, we anticipate this action to have a very limited environmental impact. None of the alternatives are expected to result in a change to the manner in which the fishery is conducted (i.e., area fished, number of vessels engaging in deep-set fishing, the number of trips taken per year, number of hooks set per vessel during a trip, depth of hooks, or deployment techniques in setting longline gear). Large changes to the physical marine environment or impacts to target and non-target fish species are not expected.

The proposed measures under Alternative 2a and 2b may encourage fishermen to fish using only circle hooks and therefore expected to benefit sea turtles, marine mammals, seabirds, and the fishing community. The action alternatives would likely not result in additional impacts to North Pacific swordfish, and each alternative may reduce high grading (discard small fish for large fish) under the current 10-swordfish trip limit. North Pacific swordfish stocks are currently healthy, i.e.; stocks are not overfished and overfishing is not occurring; therefore, the potential increase in landings of swordfish that are incidentally caught would likely not affect its stock status.

## *1.1 Purpose and need for action*

After reviewing trends in the deep-set fishery over the past eight years, and considering feedback from fishery participants, the Council concludes that the current management measure that limits a deep-set longline trip to 10 swordfish results in an inefficient use of fishery resources. The purpose of the proposed changes is to optimize Hawaii longline deep-set tuna fishery resources by reducing regulatory discards of swordfish, while maintaining safeguards for sea turtles and other protected species.

The current swordfish limit, which was established using a less expansive dataset than exists today, requires fishermen to discard incidentally caught swordfish that may be marketable contributes to regulatory discard[1] and is a waste of the resource. The original intent of a trip limit to prevent targeting of swordfish on trips declared as deep-set tuna trips to protect sea turtles has not changed. However, a recent analysis of deep-set incidental catch indicates that the number of swordfish caught in the deep-set fishery per trip is more than the previous analysis indicated. Therefore, the Council proposes to modify the longline regulations to allow retention of an additional number of swordfish that are already incidentally caught on tuna fishing trips. Additional retention of swordfish would permit fishermen to better optimize the responsible use of the nation's fishery resources and optimize economic benefits for participants in the fishery.

## *1.2 How to comment on the proposed regulatory changes*

NMFS will publish a proposed rule in the *Federal Register* to request public comments. Instructions on how to comment on the proposed rule can be found by searching on RIN 0648-BB48 at www.regulations.gov, or by contacting the responsible official or Council listed above. After considering comments, NMFS will publish a final rule in the *Federal Register*.

[1] The MSA defines "regulatory discards" as fish harvested in a fishery which fishermen are required by regulation to discard whenever caught. The MSA defines the term "bycatch" as fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards.

# 2.0 Alternatives Considered in Detail

## *2.1 Development of alternatives*

At its 146th meeting held on October 20, 2009 in Honolulu, the Council discussed a measure that would address the industry's concerns about increasing the swordfish trip limits in the deep-set fishery and considered technical input from its SSC. The Council generated the following recommendation:

> "Regarding the deep-set longline swordfish trip catch limit, the Council recommended staff review the impact of the catch limit on swordfish incidental catch and draft an options paper with alternatives that may include among other options, modifying the swordfish catch limit, removing the limit altogether, as well as the no action alternative."

The Council's Pelagic Plan Team (PPT) met on March 4, 2010 to discuss the rationale for the current swordfish trip limit in the Hawaii deep-set longline fishery and the Council's recommendation from the 146th Council meeting. The PPT also heard from fishermen that during the springtime (April, May, and mid-June), deep-set fishing operations incidentally catch more than 10 swordfish on a trip that are marketable and they would like to retain them for sale. The PPT also was informed by fishery scientists that differences between logbook and observer data indicate a potential under-reporting of swordfish catch and discard by fishermen in the deep-set fishery logbooks. For an extended discussion of patterns in fishery catch reporting in the Hawaii-based pelagic longline fishery see sections 3.0 and 4.0.

NMFS has collected logbook and observer data from the deep-set fishery since 1994. The Council used logbook data to develop the current 10-fish trip limit where only 5 percent of the trips exceeded 10 fish. Recent observer data from 2004 to 2010 show that 9.4 percent of longline trips caught more than 10 swordfish per trip, whereas the logbook data show only 1.2 percent of deep-set trips caught more than 10 fish per trip. A few trips caught more than 25 fish. The PPT concluded that the observer data is the best available fishery information and recommended a limit of 25 swordfish per trip since this was the tail end of the frequency distribution of the number of swordfish caught incidentally by Hawaii deep-set longline fishermen[2]. A limit of 25 swordfish would be an acceptable upper limit since only a few of the observed trips caught more than 25 swordfish. The PPT concluded that a limit that is larger than 25 fish might create an incentive for a vessel to engage in shallow-set fishing while on a declared deep-set trip.

The PPT also considered the use of circle hooks in the deep-set fishery and their potential to reduce the number and severity of sea turtle interactions. Over the past decade, the use of circle hooks by longliners has been shown to greatly reduce the frequency of hooking sea turtles, with larger hooks being more effective than smaller hooks, although smaller circle hooks still reduce hooking (Read 2007). The required use of large circle hooks and mackerel-type bait in the Hawaii shallow-set fishery has greatly reduced the number and severity of sea turtle interactions

[2] See Section 4.1 for a discussion of the frequency of swordfish catch by the Hawaii deep-set tuna fishery in recent years.

(WPFMC 2009f). Therefore, the PPT recommended, as a conservation incentive, a new trip limit of 25 swordfish per trip for vessels fishing with circle hooks. The PPT also recommended maintaining the original limit of 10 swordfish per trip for vessels fishing with tuna hooks as an incentive for these vessels to switch to circle hooks.

The Pelagic Plan Team made the following recommendation to the Council for their 147th meeting:

> "The Pelagic Plan Team notes that the imposition of a swordfish trip limit for the Hawaii deep set longline fishery was due to the potential for vessels to switch from deep set to shallow set fishing and have increased interactions with turtles. Based on the logbook and observer data, the Pelagic Plan Team recommends that consideration be given to and further analysis be conducted for increasing deep set longline trip limits to 25 swordfish for vessels fishing with circle hooks and retaining the 10 swordfish per trip for vessels using tuna hooks or J-hooks."

Council staff prepared an options paper for the 147th Council Meeting, held in March 2010, to consider swordfish discards in greater detail, and included potential fishery outcomes and environmental considerations (WPFMC 2010).

The Council discussed the options paper and considered the use of the NMFS Observer Program to enhance one of the options. Observers are deployed on the Hawaii longline vessels for documenting protected species interactions and to collect other fishery data. The Council thought that limiting swordfish retention on deep-setting vessels with observers was unnecessary because any interaction with turtles would be documented, and assumed that deep-setting vessels with observers would not set shallow to target swordfish. Therefore, the Council generated the following preferred recommendation regarding swordfish trip limits for the deep-set fishery:

> "The Council recommended establishing a 25 swordfish trip limit for deep-set tuna targeting longline vessels using circle hooks, and 10 swordfish per trip for vessels using tuna-hooks, if vessels are not carrying observers. If an observer is being carried by a deep-set tuna vessel then there is no limit to the amount of swordfish that can be retained by a longline vessel."

## *2.2 Description of alternatives*

Regardless of which action alternative is selected, none of the measures are expected to result in a demonstrable change to deep-set fishery operations including effort, area fished, number of vessels engaging in deep-set fishing, the number of trips taken per year, number of hooks set per vessel during a trip, depth of hooks, or longline gear deployment techniques. As a result, none of the action alternatives are expected to result in an increase in incidental swordfish catch or protected species interactions during deep-set fishing trips compared with current levels. It is likely that under all alternatives fewer swordfish would be landed than caught because typically, not all swordfish are marketable. Impacts of the alternatives are analyzed in Section 5.0.

For all alternatives, observers will continue to be assigned by NOAA on a random basis for at least 20% of all trips. Observers monitor the fishery and collect information on catch, effort,

bycatch, and information about protected species. Captains and crew will continue to be responsible for using approved methods to reduce interactions with protected species and to undertake proper handling of animals that are accidentally hooked.

**Alternative 1. No action:** Under the No action alternative, the current limit of 10 swordfish per vessel, per trip for the deep-set fishery targeting tuna would remain in place.

Under this alternative, there would be no change to the swordfish limit. After a vessel operator decides to retain 10 swordfish during a trip all remaining swordfish caught would need to be discarded; this is considered regulatory discard because operators are currently prohibited from retaining or landing more than 10 swordfish per deep-set trip. After 10 swordfish were caught during a trip, the remainder could be discarded as bycatch or fishermen could high-grade the catch (discard small fish for large fish) to land 10 swordfish.

**Alternative 2. Modify the swordfish trip limit:**

**Alternative 2a.** Alternative 2a would modify the trip limit to 25 swordfish per vessel, per trip for the deep-set fishery when using circle hooks, but retain the 10 swordfish per vessel, per trip when using other hooks.

Under this alternative, some deep-set fishing operations are expected to voluntarily use only circle hooks, because those that do, could retain up to 25 swordfish per trip. Under this alternative, for those operations that are not currently using circle hooks, there would be an initial cost to reconfigure their gear from tuna hooks to circle hooks and ongoing cost to replace hooks. Some vessels are expected to switch and take advantage of the potential extra revenue.

There may be a reduction in regulatory discard for those operations that use circle hooks since more swordfish could be retained than the current limit of 10 swordfish. There could be some high grading of swordfish, but this activity would likely be reduced compared with the no-action alternative since more swordfish could be retained. So when a larger fish is caught, a smaller one would not necessarily have to be discarded. Current data show that all larger fish incidentally caught are already retained and landed so any excess beyond the current limit that could be retained and marketed under this alternative would likely be smaller fish.

**Alternative 2b (preferred)**. Alternative 2b would modify the trip limit to 25 swordfish per vessel, per trip for the deep-set fishery when using circle hooks but retain the 10 swordfish per vessel, per trip when using other hooks. In addition, vessels carrying an observer, regardless of the type of hook being used, would be able to retain and land all swordfish. This is the Council's preferred alternative.

Under this alternative, up to 25 swordfish could be retained per trip if using circle hooks or an unlimited number retained if an observer is aboard regardless of the type of hook. For vessels with an observer, the unlimited scenario would not frequently exceed 25 swordfish since records show that most trips do not exceed 25 fish. Based on NMFS observer data, it's likely that the maximum amount would be 47 fish per trip. However, only one trip was observed to take this many fish so this is a rare occurrence.

There would be a reduction in regulatory discard for any vessels using circle hooks since more swordfish could be retained than the current limit of 10 swordfish. There could be some high grading of swordfish, but this activity would likely be reduced compared to the no-action alternative. Under this alternative, for those operations that are not currently using circle hooks, there would be an initial cost to reconfigure their gear from tuna hooks to circle hooks and ongoing cost to replace hooks. Some vessels are expected to switch and take advantage of the potential extra revenue. Regulatory discard could end under this alternative, but small or otherwise unmarketable swordfish may still be discarded.

**Alternative 3. Remove the swordfish trip limit,** Alternative 3 would remove the swordfish trip limit for the deep-set fishery. Under this alternative, there would be no trip limit for swordfish in the deep-set fishery and the fishery would be allowed to retain and land all swordfish that were incidentally caught. Although most trips do not exceed 25 fish, NMFS observer data shows an upper bound of 47 fish per trip. Based on this information it's likely that swordfish catch per trip would rarely exceed 25 fish. Regulatory discard would end under this alternative, but small or otherwise unmarketable swordfish may still be discarded. Since more swordfish could be retained and landed than under the current limit of 10 swordfish, high grading would be much less likely to occur than under the current regulations.

# 3.0 Description of Hawaii Longline Fisheries

Longline fishing employs a mainline that is deployed as the fishing vessel moves across the water. The mainline is suspended horizontally below the surface between evenly spaced floats that are clipped along the mainline. Branch lines that terminate with baited fishhooks are clipped to and suspended below the mainline when the gear is at depth. Longline deployment is typically referred to as "setting," and the gear, once it is deployed, is typically referred to as a "set." Longline sets are normally left drifting to "soak" for several hours before they are retrieved back aboard along with any catch. Mainlines typically consist of a single strand of monofilament line with a test strength of 450 to 680 kg (1000 to 1500 lb). Mainlines are stored on large horizontal reels, and may exceed 74 km (40 nm) in length. Float lines most frequently consist of braided, multi-strand lines with a quick release clip on one end and a large float on the other. Float lines are typically 10 to 30 meters (m) long depending on the fishery. Branch lines typically consist of 15 to 30 m of 227 kg (500 lb) test monofilament line with a quick release clip on one end and a fishhook on the other. Depending on the fishery and applicable regulations, branch lines may, or may not, have some form of weight attached above the hook

Boggs and Ito (1993) provide a detailed history of the Hawaii longline fishery from its inception in 1917 as a coastal sampan-based fishery, to the early 1990s, when the fishery was in the process of revitalization that had begun in the late 1980s. This revitalization was based on the development of new markets on the U.S. mainland and Japan for fresh tuna and swordfish. During the revitalization period there was a doubling of longline permits from 37 to 75 from 1987 to 1989. Permit numbers doubled again from 75 in 1989 to 156 at the end of 1991.

The Hawaii-based longline fishery is a limited entry fishery with an upper limit of 164 longline

permits. The fishery has two components, a larger deep-set fishery (roughly 130 vessels) that targets bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacores*) around the Hawaiian Islands and a smaller shallow-set fishery (roughly 30 vessels) that targets swordfish (*Xiphias gladius*) to the north of the Hawaiian Islands. The shallow-set and deep-set fisheries are described in more detail in Sections 3.1 and 3.2, respectively. In addition to other regulations, permit holders or designated agents for a vessel registered for use under Hawaii longline limited access permits must provide notification of the trip type (either deep-setting or shallow-setting).

Federal fishery managers officially defined deep- and shallow-set gear to separate the two fisheries in December 2004 (69 FR 17329, April 2, 2004). Specifically, a deep-set must have: all float lines on the vessel at least 20 m in length, a minimum of 15 branch lines between any two floats, no light sticks may be used, and a maximum of 10 swordfish may be retained or landed by the vessel. If any one of these criteria is not met, the vessel is considered to be shallow-setting. There are additional differences. The deep-set fishery generally targets bigeye tuna, and the shallow-set fishery targets swordfish. In addition to tunas and swordfish, a variety of other pelagic fish species are caught in both fisheries. Some of these species are kept, while others are discarded and considered bycatch. The general characteristics of the two gear types are provided in Table 1 and Fig. 1, illustrating the differences and similarities between them.

**Table 1. Characteristics of the Hawaii shallow- and deep-set longline fisheries.**

| Characteristics | Shallow-set | Deep-set |
|---|---|---|
| **Ave. number of swordfish caught per trip in 2011*** | 179 | 2 |
| **Set depth** | Approx. 25-75 m | Approx. 40-350 m |
| **Hook type** | **18/0 circle hooks (0-10° offset) | 3.6-3.8 tuna hooks or 14/0-16/0 circle hooks |
| **Approx. no. hooks per set** | 850 | 2,000 to 3,000 |
| **Bait** | **Mackerel-type bait only – no squid | Saury, sardines |
| **Number of branch lines between any two floats** | 4 to 5 | ** At least 15 (except basket gear: at least 10 branch lines between floats) |
| **Floatline length** | Range 5 to 13 m | **Float lines at least 20 m |
| **Light sticks used?** | Yes | **No |
| **Retention limits** | None | **No more than 10 swordfish possessed or landed at any time during a given trip |
| **Set deployment/retrieval** | Night/Day (some regulatory requirements based setting method) | Morning/Day |

Note: * Data from 2011 logbooks
**Required by regulation

Deep-set gear is intended to reach depths of 200 to 500 meters where bigeye tuna concentrations are highest (Evans et. al 2005). The deep-set configuration is achieved by use of a line shooter. The line shooter deploys the line faster than the vessel is moving forward, thus forming deep sags in the line. In contrast, shallow-set gear is usually deployed by simply allowing the mainline to spool off of the mainline reel as the vessel is underway; no line shooter is used. Also, in the shallow-set fishery, fishermen deploy fewer hooks between floats resulting in a short inter-float mainline length that is less inclined to sag. This results in the line being set relatively shallow in the water column where swordfish tend to congregate at night.

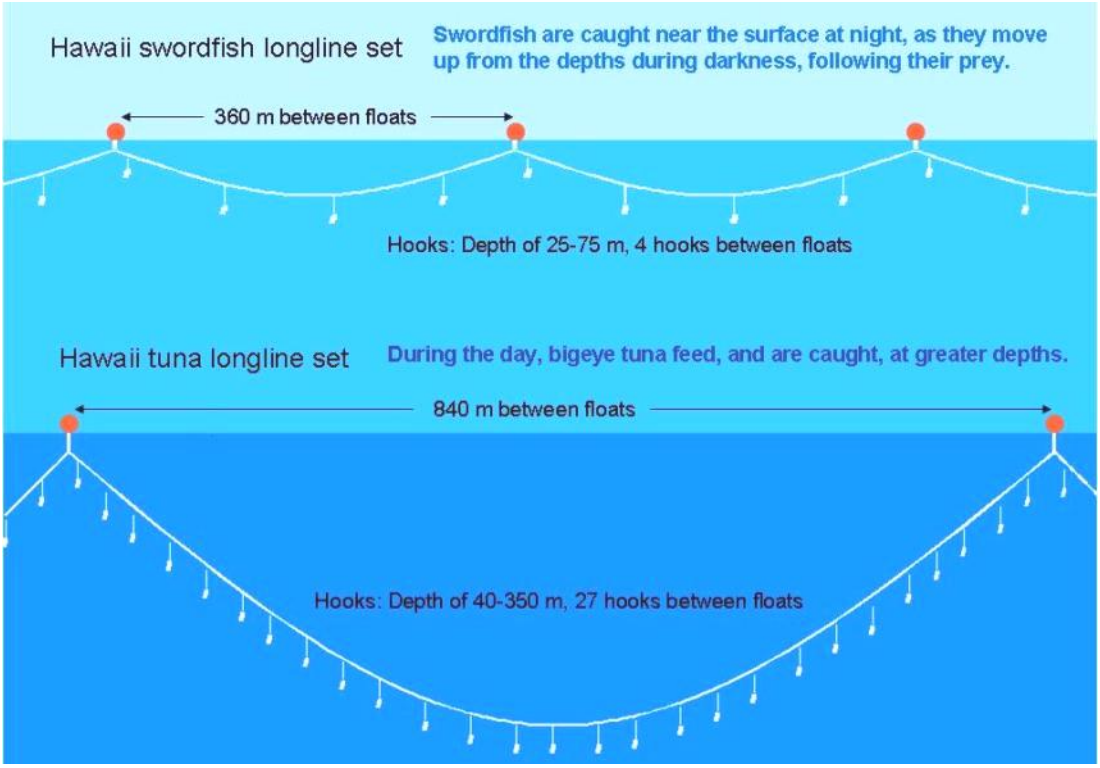


**Figure 1. Generalized depiction of shallow-set (swordfish) and deep-set (tuna) gear types.**
Source: PIFSC

Circle hooks are required in the shallow-set fishery and are used in the deep-set fishery by some operations. They are generally circular or oval in shape and have a point curving inward perpendicular to the shank. The point is less exposed in comparison to the J-hook (straight shank) and Japan tuna style hook (tuna hook) where the axis of the point runs parallel to the shank (Fig. 2). Circle hooks are designed to reduce turtle mortality by decreasing the incidence of hook ingestion or reduce capture rates (Gilman et. al 2006). If sea turtles or other large animals are hooked, circle hooks are more likely to catch on the jaw rather than be ingested; this helps to avoid internal soft-tissue injuries. If an animal hooked in this manner falls off or is brought on board to have the hook removed and released, the resulting injuries are likely to be less severe than J-hook or tuna hook injuries. The use of circle hooks and mackerel-type bait by the Hawaii-based shallow-set fishery has contributed to reducing the sea turtle interaction rate 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).

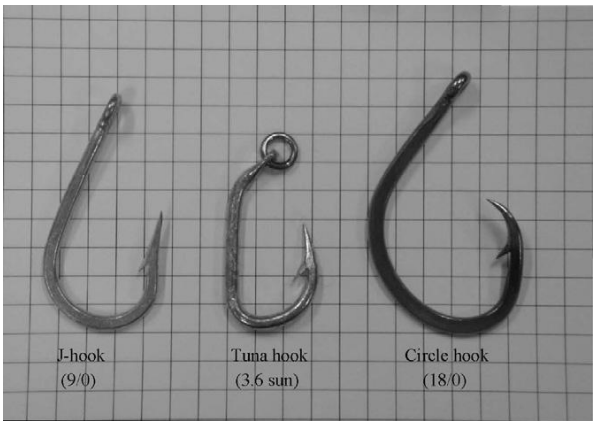


**Figure 2. Lateral view of 9/0 J-hook, 3.6 sun Japanese tuna and 18/0 circle hooks used in the field trials.**
Source: Curran and Bigelow 2010

## *3.1 Shallow-set fishery*

This document briefly describes shallow-set fishing because swordfish are caught incidentally to deep-set tuna fishing, and because swordfish are targeted by shallow-set longliners. The Council completed a final supplemental environmental impact statement (FSEIS) in association with Amendment 18 to the Western Pacific Pelagic Fishery Management Plan which pertained to the shallow-set fishery that targets swordfish in the North Pacific (WPFMC 2009f). Information about the affected environment as it pertains to swordfish fishing is found in Amendment 18 and FSEIS document, section 3.5.1. Additional information on the fishery can be found in the Fishery Ecosystem Plan for Pelagics Fisheries of the Western Pacific (WPFMC 2009e)

Based on logbook data from 2011, approximately 20 vessels out of 164 permitted to fish for pelagic species in the U.S. EEZ and the high seas around Hawaii, used shallow-setting to target swordfish primarily to the north of Hawaii (Figure 3). In 2011, shallow-set vessels made 82 trips, 1,468 sets, and deployed 1,489,243 hooks. Permit holders or designated agents (usually vessel operators) must declare to NMFS, prior to leaving port, the type of fishing activity that will be conducted (deep- or shallow-set) and may not switch after the trip is underway. This notification requirement ensures that the NMFS Observer Program may observe 100 percent of all shallow-set trips to document protected species interactions and collect other information. The fishery is also required to use 18/0 circle hooks with fish bait (as opposed to squid bait) in order to reduce the potential for and severity of sea turtle interactions. The fishery operates under the Pelagic FEP and an incidental take statement that includes provisions for the handling and release of sea turtles, and includes limits on the number of annual loggerhead and leatherback sea turtle interactions consistent with biological opinions issued in accordance with the Endangered Species Act and implemented into regulations by NMFS. If the fishery reaches either interaction limit, the shallow-set fishery closes north of the Equator until the end of the calendar year. The intent of these regulations is to continue to protect and conserve listed sea turtles. For current

regulations, please see 50 CFR Part 665 and the Hawaii Longline Regulation Summary at www.fpir.noaa.gov/SFD/SFD_regs_2.html.

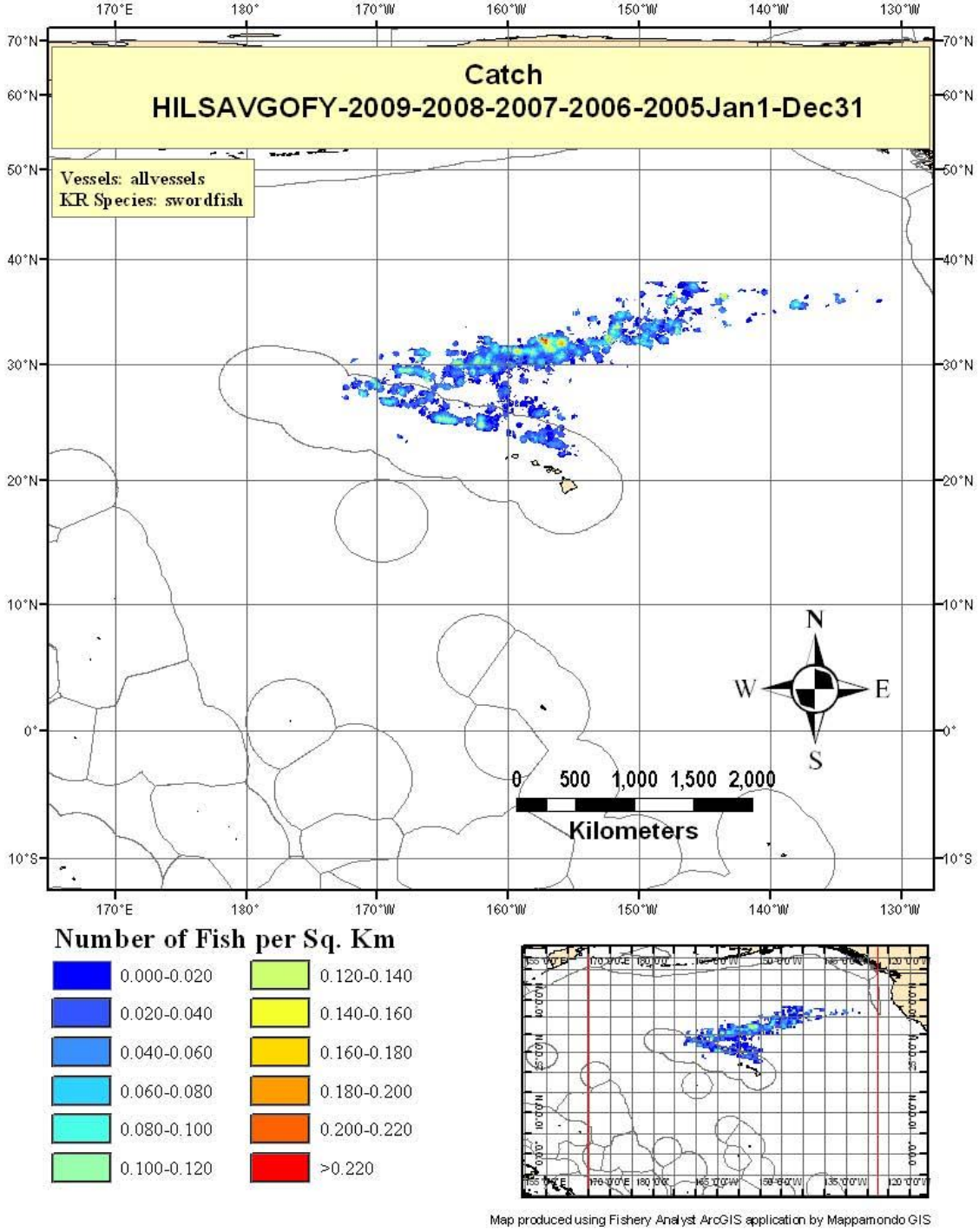


**Figure 3: Average spatial distribution of reported logbook swordfish catch in the WCPO by the Hawaii shallow-set longline fishery, in numbers of fish (includes retained and released catch), from 2005-2009.**
Source: NMFS PIFSC

Table 2 presents major species caught by the shallow-set fishery each year in 2011 as reported in federal logbooks.

**Table 2. Pelagic fish caught by the 2011 Hawaii shallow-set longline fishery.**

| Pelagic Management Unit Species (PMUS) | Number of Fish | | | CPUE (N/1000 hooks) |
|---|---|---|---|---|
| | Caught | Kept | Discarded | |
| Blue marlin | 116 | 110 | 6 | 0.08 |
| Striped marlin | 572 | 513 | 59 | 0.38 |
| Shortbill spearfish | 192 | 163 | 29 | 0.13 |
| Swordfish | 16,405 | 14,663 | 1,742 | 11.02 |
| Other billfishes* | 8 | 5 | 3 | 0.01 |
| Blue shark | 7,857 | 19 | 7,838 | 5.28 |
| Mako sharks* | 984 | 65 | 919 | 0.66 |
| Thresher sharks* | 112 | 4 | 108 | 0.08 |
| Oceanic whitetip shark | 78 | 3 | 75 | 0.05 |
| Silky shark | 1 | 0 | 1 | 0.00 |
| Other sharks* | 62 | 0 | 62 | 0.04 |
| Albacore | 2,982 | 2,480 | 502 | 2.00 |
| Bigeye tuna | 1,050 | 953 | 97 | 0.71 |
| Yellowfin tuna | 317 | 299 | 18 | 0.21 |
| Bluefin tuna | 0 | 0 | 0 | 0.00 |
| Skipjack tuna | 47 | 43 | 4 | 0.03 |
| Other tunas* | 12 | 2 | 10 | 0.01 |
| Mahimahi | 6,413 | 5,681 | 732 | 4.31 |
| Moonfish | 207 | 110 | 97 | 0.14 |
| Wahoo | 35 | 29 | 6 | 0.02 |
| Oilfish | 2,498 | 1,999 | 499 | 1.68 |
| Pomfret | 103 | 80 | 23 | 0.07 |
| Non PMUS* | **115** | **19** | **96** | **0.08** |
| Total | **40,166** | **27,240** | **12,926** | **26.97** |

Source: PIFSC 2011 Annual Logbook Report
Note: Data are reported in numbers of fish. * denotes grouping of multiple species.

## *3.2 Deep-set fishery*

Based on logbook data from 2011, approximately 129 Hawaii-based deep-set vessels fished for bigeye and yellowfin tuna, and made 1,306 trips, 17,155 sets and deployed 40,719,827 hooks. The deep-set fishery typically operates around the main Hawaiian Islands throughout the year between the Equator and 35° N. lat and 140° and 180° W. long (Figure 4). Some fishing occurs in the Pacific Remote Island Areas of Kingman Reef and Palmyra Atoll around 5° N. lat. Landings of bigeye tuna are subject to an annual catch limit of 3,763 mt in years 2009 through

2012. Except under certain circumstances, when the limit is reached, retaining bigeye tuna in the Western and Central Pacific Fisheries Commission (WCPFC) Convention Area by U.S. longline vessels is prohibited until January 1 of the next calendar year. All vessels may continue to fish in the Eastern Pacific Ocean east of 150° W. lat during the prohibition under certain restrictions and a catch limit of 500 mt for vessels longer than 24 m. In 2010, fishing for bigeye tuna in the WCPFC Convention Area was prohibited from November 22, 2010 to Dec 31st, 2010 because the catch limit was reached.

The regulations that govern deep-set longline fishery operations can be found at 50 CFR Part 300 and 665. Like the shallow-set fishery, permit holders or designated agents must notify NMFS of the type of fishing activity that will be conducted (deep- or shallow-set) prior to leaving port and may not switch after the trip is underway. NMFS deploys observers on a minimum of 20 percent of all deep-set fishing trips to document protected species interactions and collect other fishery information. A comprehensive description of the fishery can be found in the Fishery Ecosystem Plan for Pelagics Fisheries of the Western Pacific (WPFMC 2009e) and the Hawaii Longline Regulation Summary at www.fpir.noaa.gov/SFD/SFD_regs_2.html. Information on NMFS' observer program can be found at: http://www.fpir.noaa.gov/OBS/obs_index.html.

Though the fleet targets bigeye and yellowfin tunas, the fishery is diverse in terms of the type and number of species caught and landed. Logbook data for pelagic species caught in the 2011 deep-set fishery are shown in Table 3. Almost all deep-set trips that leave Hawaii fish north of the Equator and return to Hawaii.

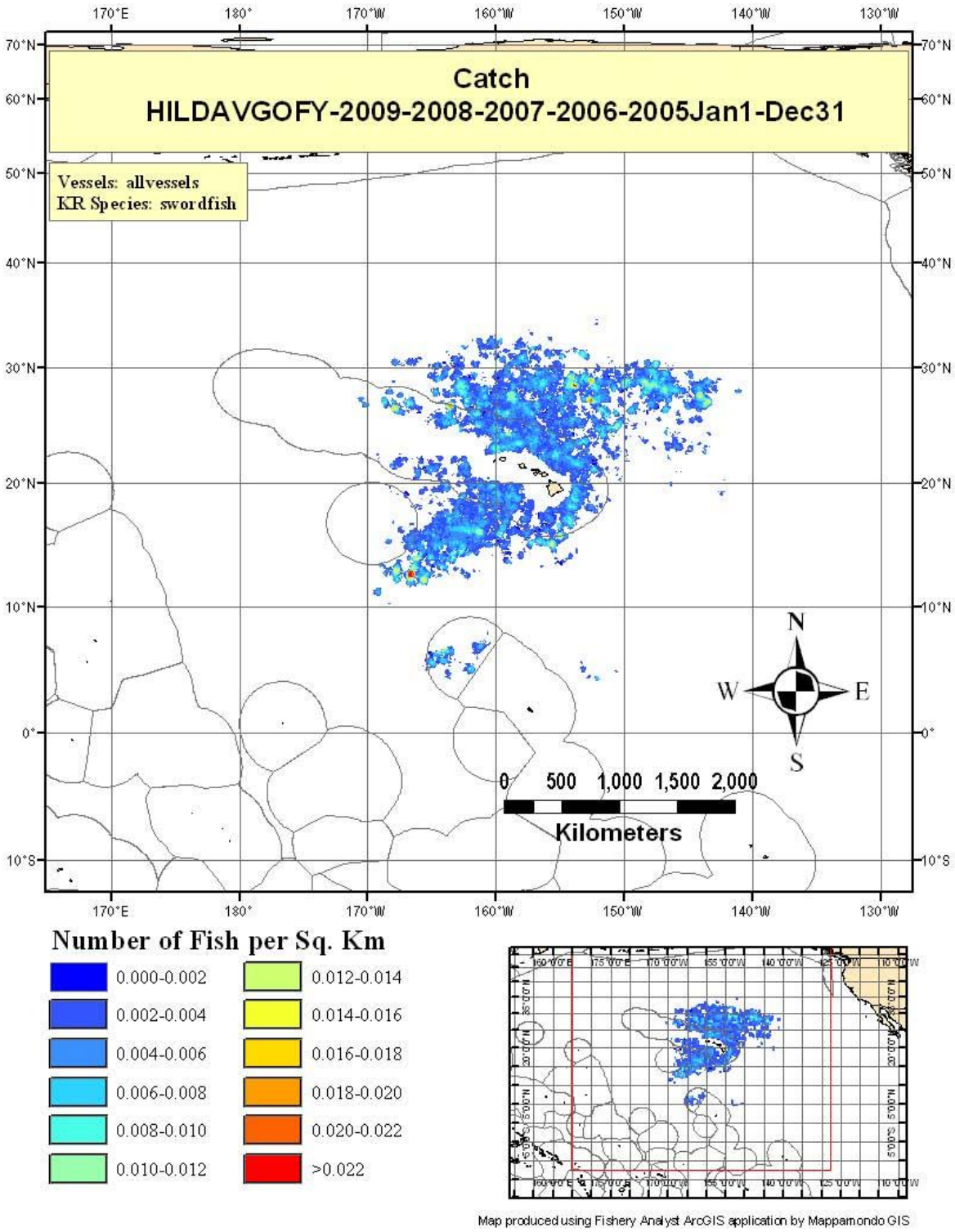


**Figure 4. Average spatial distribution of reported logbook swordfish catch in the WCPO by the Hawaii deep-set longline fleet, in numbers of fish (includes retained and released catch), between 2005-2009.**
Source: NMFS PIFSC

**Table 3. Pelagic fishes caught in the 2011 Hawaii deep-set longline fishery.**

| Pelagic Management Unit Species (PMUS) | Number of Fish | | | CPUE Number Caught per 1000 hook s |
|---|---|---|---|---|
| | Caught | Kept | Discarded | |
| Blue marlin | 4,424 | 4,382 | 42 | 0.11 |
| Striped marlin | 16,181 | 15,982 | 199 | 0.40 |
| Shortbill spearfish | 15,531 | 15,354 | 177 | 0.38 |
| Swordfish | 2,906 | 2,502 | 404 | 0.07 |
| Other billfishes | 541 | 534 | 7 | 0.01 |
| Blue shark | 47,956 | 339 | 47,617 | 1.18 |
| Mako sharks | 2,242 | 711 | 1,531 | 0.06 |
| Thresher sharks | 4,535 | 252 | 4,283 | 0.11 |
| Oceanic whitetip shark | 791 | 27 | 764 | 0.02 |
| Silky shark | 232 | 3 | 229 | 0.01 |
| Other sharks | 388 | 18 | 370 | 0.01 |
| Albacore | 31,445 | 31,171 | 274 | 0.77 |
| Bigeye tuna | 155,121 | 152,457 | 2,664 | 3.81 |
| Yellowfin tuna | 31,312 | 30,579 | 733 | 0.77 |
| Bluefin tuna | 2 | 2 | 0 | 0.00 |
| Skipjack tuna | 25,744 | 24,953 | 791 | 0.63 |
| Other tunas | 18 | 18 | 0 | 0.00 |
| Mahimahi | 74,792 | 73,724 | 1,068 | 1.84 |
| Moonfish | 17,697 | 17,633 | 64 | 0.43 |
| Wahoo | 10,446 | 10,403 | 43 | 0.26 |
| Oilfish | 36,182 | 35,839 | 343 | 0.89 |
| Pomfret | 33,340 | 32,810 | 530 | 0.82 |
| Non PMUS | **4,261** | **2,531** | **1,730** | **0.10** |
| Total | **516,087** | **452,224** | **63,863** | **12.67** |

Source: PIFSC 2011 Annual Logbook Report
Note: Data are reported in numbers of fish.

Based on observer data the most predominant hook types used in the deep-set longline fishery are tuna hooks (3.6 mm and 3.8 mm) and "small" circle hooks (15/0 and 16/0, and less commonly, 14/0) (FKWTRT 2010). Since 2004, the deep-set fishery has shifted away from using mostly tuna hooks to either all circle hooks or a mix of hooks (Table 4). Forty-three percent of the deep-set fleet use only circle hooks while 25 percent use only tuna hooks.

**Table 4. Annual composition of hooks used in the Hawaii deep-set fishery based on NMFS observer data.**

| Year | Use of only Japanese 3.6 or 3.8 sun tuna hooks | Use of 14/0, 15/0, or 16/0 circle hook | Mix of circle and tuna hooks | Use of 18/0 circle or J-hooks |
|---|---|---|---|---|
| 2004 | 87% | 5% | 2% | 6% |
| 2005 | 86% | 9% | 2% | 3% |
| 2006 | 68% | 11% | 21% | 0% |
| 2007 | 50% | 18% | 32% | 0% |
| 2008 | 38% | 28% | 33% | 1% |
| 2009 | 34% | 41% | 24% | 1% |
| 2010 | 25% | 43% | 27% | 5% |

Note: See Figure 2 for picture
Source: NMFS unpublished data

# 4.0 U.S. Swordfish Landings and Discards

Swordfish inhabit a wide region of the Pacific between the latitudes of 50° N and 50° S (Ward and Elscot 2000). In the North Pacific, the annual total catch has fluctuated around 15,000 mt since 2001. The majority of catch has been taken by longline fishing vessels from Japan, Chinese-Taipei, and the U.S., which accounted for 95 percent of the total harvest in the North Pacific in 2005, with the remaining catch taken by Korea and Mexico (Brodziak and Ishimura 2010).

Swordfish caught in the Hawaii longline fisheries are managed on an international level by the WCPFC and domestically by the Pacific Fishery Management Council and Western Pacific Fishery Management Council. The 2009 stock assessment for North Pacific swordfish concluded that the short-term projections of fishery yield under status quo fishing effort suggest that the swordfish population and fisheries would likely be stable in the near term (Brodziak and Ishimura 2010). The stock is neither experiencing overfishing nor approaching an overfished condition. Swordfish biology is described in section 5.2.2.

## *4.1 U.S. Swordfish landings*

U.S. commercial fisheries targeting North Pacific swordfish include Hawaii limited entry shallow-set vessels based out of California and Hawaii, and the commercial harpoon and drift gill net fisheries that operate in the U.S. EEZ along the West Coast. The Hawaii-based deep-set longline fishery and commercial troll and handline fisheries incidentally catch North Pacific swordfish in relatively small amounts while targeting tuna. In addition, there is one commercial deep-setting longline vessel from California targeting tuna outside the U.S. EEZ off the West Coast that catches swordfish incidentally; this vessel operates under the Pacific Council's Highly Migratory Species Fishery Management Plan. A small number of swordfish are also caught by

Hawaii recreational fisheries and West Coast anglers in the waters off California. Some catch of South Pacific swordfish is retained in the U.S. longline fishery in American Samoa but the fish are not targeted. These and other high seas international swordfish fisheries in the Pacific are described in more detail in the Pelagic Fisheries Ecosystem Plan (WPFMC 2009e).

Data for all U.S. longline fisheries operating in the Western and Central Pacific Ocean (WCPO) show the bulk of the swordfish were harvested from north Pacific waters and a small amount from south Pacific waters (Table 5.).

**Table 5. U.S. landings of Pacific swordfish, 2003 - 2010**

| Year | North Pacific (mt) | South Pacific (mt) | Total (mt) |
|---|---|---|---|
| **2003** | 1,957 | 7 | 1,964 |
| **2004** | 1,072 | 4 | 1,076 |
| **2005** | 1,451 | 3 | 1,454 |
| **2006** | 1,131 | 38 | 1,169 |
| **2007** | 2,268 | 13 | 2,281 |
| **2008** | 2,485 | 7 | 2,492 |
| **2009** | 2,207 | 12 | 2,219 |
| **2010** | 1,600 | 11 | 1,611 |

Source: WPRFMC 2011 and unpublished data

U.S. swordfish landings in the North Pacific are primarily from the Hawaii longline fishery; however, some small amounts are harvested by the main Hawaiian Islands (MHI) commercial troll and handline fisheries, and recreational vessels. Hawaii pelagic handline and troll fisheries primarily target bigeye and yellowfin tuna, with the hand line fishery averaging about 21,000 lb of swordfish and the troll fishery about 1,000 lb of swordfish annually (WPRFMC 2011). There are anecdotal accounts of charter (recreational) swordfish fishing off of Kona, Hawaii. Although information is lacking on all recreational swordfish fisheries in Hawaii, landings are likely very small and less than the Hawaii pelagic handline and troll fisheries landings. For more information about Hawaii's recreational pelagic fisheries, refer to WPRFMC (2011).

## *4.2 Swordfish landings from the Hawaii-based pelagic fisheries*

Landings from all Hawaii-based pelagic fisheries show a peak in swordfish landings in 1993 and subsequently decreasing thereafter (Fig. 5). The trend in swordfish landings reflected both an increase in the number of vessels in the longline fishery and widespread targeting of swordfish by the fishery. Poor swordfish catch rates in 1994 led to many vessels switching from solely targeting swordfish and engaging in a mix of swordfish and tuna targeting (WPRFMC 2004b). Landings remained relatively steady up to the year 2000, but dropped dramatically with the prohibition of targeting swordfish by the longline fishery in 2001. Although the commercial longline fishery for swordfish was reopened under a new set of regulations in April 2004, landings have remained substantially lower than historic levels.

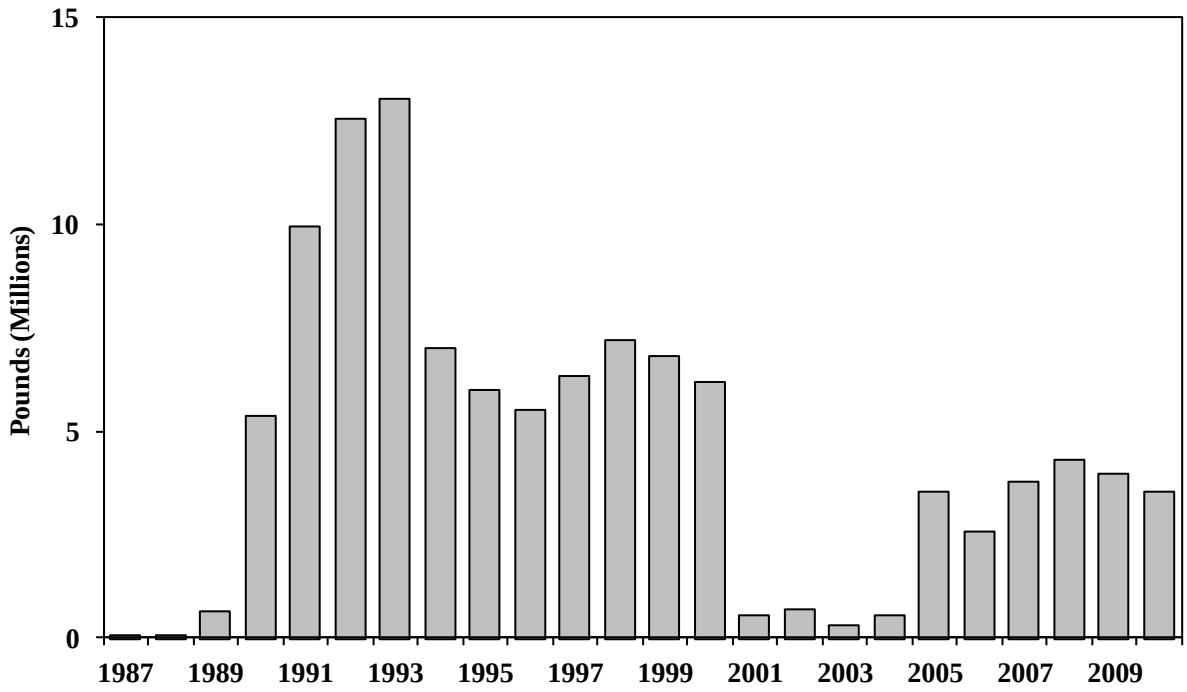


**Figure 5. Swordfish Landings from the Hawaii-based pelagic fisheries 1987 – 2010.**
(Includes commercial handline, troll, shallow-set and deep-set fisheries)
Source: WPFMC 2011 and draft WPFMC 2010 Hawaii Pelagics Annual Report module

Typically, the second quarter of the year is the period when swordfish catch increases in both longline fisheries. Figure 6 shows that the deep-set fishery catch rate almost tripled from the annual average during the second quarter of the year.

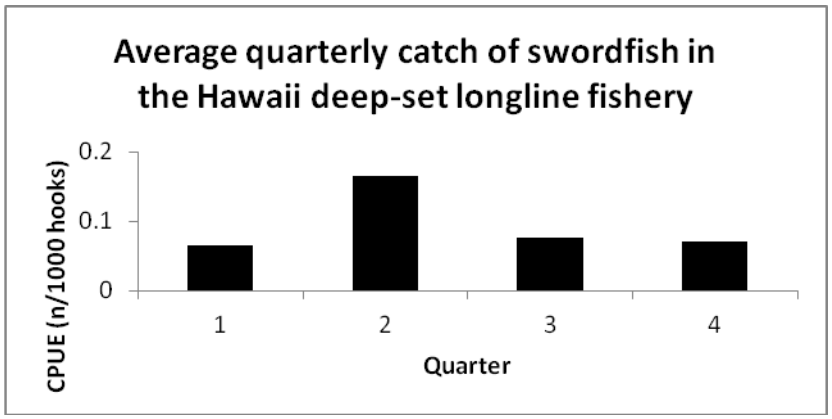


**Figure 6. Average swordfish quarterly catch rate (n/1,000 hooks), 2006-2010 in the Hawaii deep-set longline fishery.**
Source NMFS PIFSC, http://www.pifsc.noaa.gov/fmsd/reports.php
Note: Quarter 1 is January – March; Quarter 2 is April – June; Quarter 3 is July – September; Quarter 4 is October – December.

Annual CPUE for swordfish has remained stable in the deep-set fishery at an average of 0.09 fish per 1,000 hooks since 2006, while the CPUE in the shallow-set fishery for the same period has fluctuated with an average 13.7 fish per 1,000 hooks.

For comparison, the landings of swordfish by the deep and shallow segments of the Hawaii longline fishery between 2004 and 2010 are shown in Table 6. In 2010, approximately 3.2 million pounds of swordfish were landed by the shallow-set fishery and 429,000 pounds were landed in the deep-set fishery (Table 6). The low catch from the shallow-set segment of the fishery in 2004 was due to the fishery reopening in April after a three year closure stemming from litigation over sea turtle bycatch. The shallow-set fishery reopened with new gear modifications that greatly reduced turtle interactions by the shallow-set fleet (WCPFC 2004a).

**Table 6. Swordfish landings by the deep-set and shallow-set longline fisheries in Hawaii, 2004-2010.**

| Year | Deep set (lbs) | Shallow set (lbs) |
|---|---|---|
| 2004 | 354,384 | 278,973 |
| 2005 | 387,514 | 3,144,194 |
| 2006 | 398,549 | 2,144,187 |
| 2007 | 475,641 | 3,356,726 |
| 2008 | 688,654 | 3,749,131 |
| 2009 | 552,813 | 3,448,599 |
| 2010 | 429,719 | 3,235,765 |
| Average | 469,611 | 2,817,168 |

Source: NMFS PIFSC unpublished data

## *4.3 Swordfish landings, discards, and value in the deep-set fishery*

The deep-set fishery can catch and market a diversity of fish, mainly bigeye tuna, mahi mahi, pomfret, oilfish, albacore tuna and yellowfin tuna (Table 3). Data on the number of swordfish caught, retained and discarded in the deep-set fishery are shown in Tables 7 and 8. Table 7 summarizes logbook data and Table 8 summarizes data from the NMFS Observer Program.

The data from these two tables cannot be directly compared since Table 8 is based on 20 percent observer coverage and not expanded for the entire fishery.

**Table 7. Deep-set tuna fishery swordfish catch between 2004 and 2010 from logbook records.**

| Year | Vessel making deep-sets (N) | Deep-set fishing effort (hooks x 1,000) | Deep-set fishing effort (Trips) | Total sword-fish retained (N) | Total sword-fish release (N) | Total sword-fish caught (N) | Rate of discard | Rate of retention |
|---|---|---|---|---|---|---|---|---|
| 2004 | 125 | 31,906 | 1,382 | 2,905 | 848 | 3,753 | 23 % | 77% |
| 2005 | 124 | 33,661 | 1,443 | 2,622 | 471 | 3,093 | 15% | 85% |

| Year | Vessel making deep-sets (N) | Deep-set fishing effort (hooks x 1,000) | Deep-set fishing effort (Trips) | Total sword-fish retained (N) | Total sword-fish release (N) | Total sword-fish caught (N) | Rate of discard | Rate of retention |
|---|---|---|---|---|---|---|---|---|
| 2006 | 127 | 34,597 | 1,388 | 2,818 | 330 | 3,148 | 10% | 90% |
| 2007 | 129 | 38,839 | 1,427 | 2,989 | 441 | 3,430 | 13% | 87% |
| 2008 | 127 | 40,078 | 1,380 | 3,295 | 353 | 3,648 | 10% | 90% |
| 2009 | 127 | 37,630 | 1,241 | 3,071 | 260 | 3,331 | 8% | 92% |
| 2010 | 122 | 37,197 | 1,205 | 2,774 | 221 | 2,995 | 7% | 93% |
| **Mean** | **126** | **35,845** | **1,352** | **2,925** | **418** | **3,343** | **12%** | **88%** |

Source: NMFS PIFSC (http://www.pifsc.noaa.gov/fmb/reports.php)
Note: The 10-swordfish per trip limit went into effect in 2004.

Based on logbook data, approximately 23 swordfish per vessel are retained over the course of an entire year (i.e., 2,925 / 126 = 23). This equates to an approximate average of 2 fish per trip that are retained by deep-set vessels. However, many vessels catch more swordfish in the second quarter of the year (April - June). The rate of retention (total retained divided by total caught) for swordfish in the deep-set fishery has increased since 2004 (Table 7). An average of 12 percent of the swordfish were discarded in the deep-set fishery between 2004 and 2010. In 2010, only 7 percent were discarded. It's possible that fishermen are encountering more marketable fish or are attempting to utilize as many swordfish as possible, including smaller swordfish, for economic gain. However, all swordfish may not be marketable due to small size or condition (e.g., shark damage) and may be discarded.

Table 8, summarizes the data collected by NMFS observers deployed on deep-set longliners. The coverage rate for the deep-set fishery must be an annual minimum of 20 percent as required by a 2001 Court Order and specified in the NMFS 2005 BiOp (NMFS 2005a).

**Table 8. Observed swordfish catch from the deep-set tuna fishery, 2004-2010.**

| Year | Percent of trips observed | Observed Hooks Set | Observed Swordfish Retained | Observed Swordfish Discarded | Observed Swordfish Total | Observed Trips | Discards as percent of total catch |
|---|---|---|---|---|---|---|---|
| 2004 | 24.42 | 7,868,613 | 876 | 825 | 1,701 | 337 | 48 |
| 2005 | 25.57 | 9,328,681 | 834 | 638 | 1,472 | 369 | 43 |
| 2006 | 20.39 | 7,434,798 | 772 | 401 | 1,173 | 283 | 34 |
| 2007 | 20.10 | 7,728,502 | 719 | 696 | 1,415 | 276 | 49 |
| 2008 | 21.23 | 8,747,946 | 1,028 | 408 | 1,436 | 293 | 28 |
| 2009 | 24.43 | 7,864,878 | 765 | 311 | 1,076 | 256 | 29 |
| 2010 | 21.10 | 8,160,786 | 724 | 724 | 1,448 | 261 | 50 |
| **Ave.** | 22.46 | **8,162,029** | **817** | **572** | **1,389** | **296** | **40** |

Source: NMFS unpublished data. Note: Data are not expanded over the entire fishery and represent only the fishing trips that were observed.

According to observer data, an average of approximately five swordfish is caught and three are retained per trip (Table 8). Roughly 40 percent of all swordfish caught were discarded. If we expand the average observed swordfish retained and discarded, using the average observer coverage rate of 22.46 percent, the fishery retains 3,637 swordfish and discards 2,547 per year. All swordfish retained by the fishery are assumed to be landed and sold. The average annual catch in the fishery is estimated by the sum of these two figures and is 6,184. These expanded estimates of discarded and retained fish are greater than those reported in logbooks.

Figure 7. gives a visual representation of the differences in the percent of all swordfish caught that were discarded as documented in logbooks and observer reports. A greater proportion of swordfish are reported as discards on observed trips.

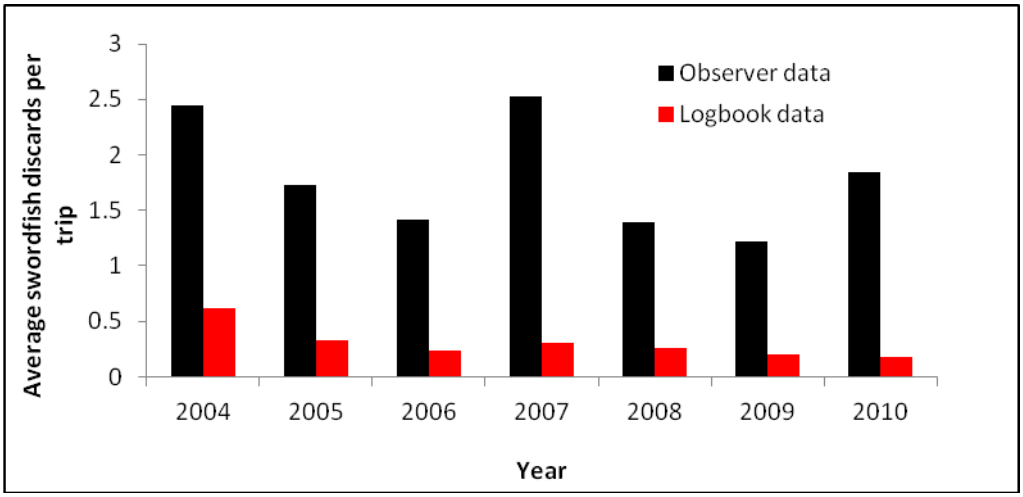


**Figure 7. Percent of swordfish discarded per trip by the deep-set tuna longline fishery as estimated from logbook data and from observer data.**
Source: NMFS unpublished observer data and PIFSC logbook data, 2004 – 2010.

A frequency distribution of the numbers of swordfish caught per trip by Hawaii deep-set longline vessels from the logbook data is shown in Figure 8. According to logbook data, about 3 percent of all deep-set trips caught the current limit of 10 swordfish and an additional 3 percent of all deep-set vessels caught more than 10 swordfish. No swordfish were caught on 43 percent of the reported trips. However the observer data in Table 7 suggest that greater numbers of swordfish are being discarded than are being reported in logbooks. A frequency distribution of the numbers of swordfish caught per trip from the observer data (Figure 9.) shows that 9.2 percent of the observed fishing trips caught more than 10 swordfish per trip.

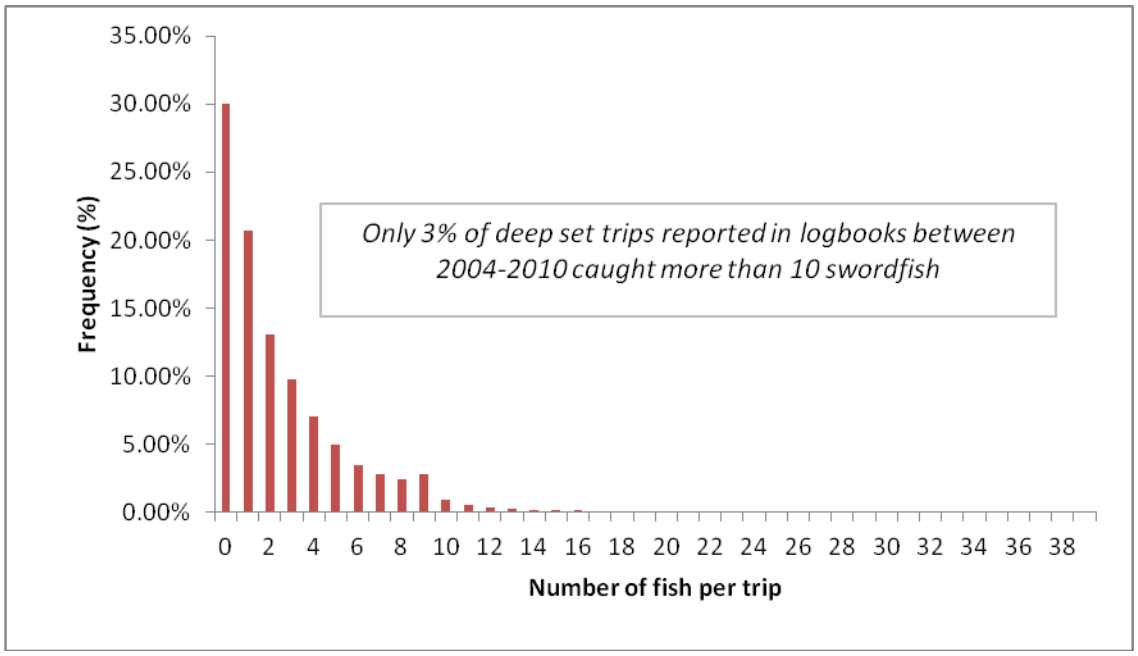


**Figure 8. Average percentage frequency (2004-2010) of the numbers of swordfish caught per trip by Hawaii deep-set bigeye targeting longline vessels from log book records**
Source: NMFS PIFSC unpub.

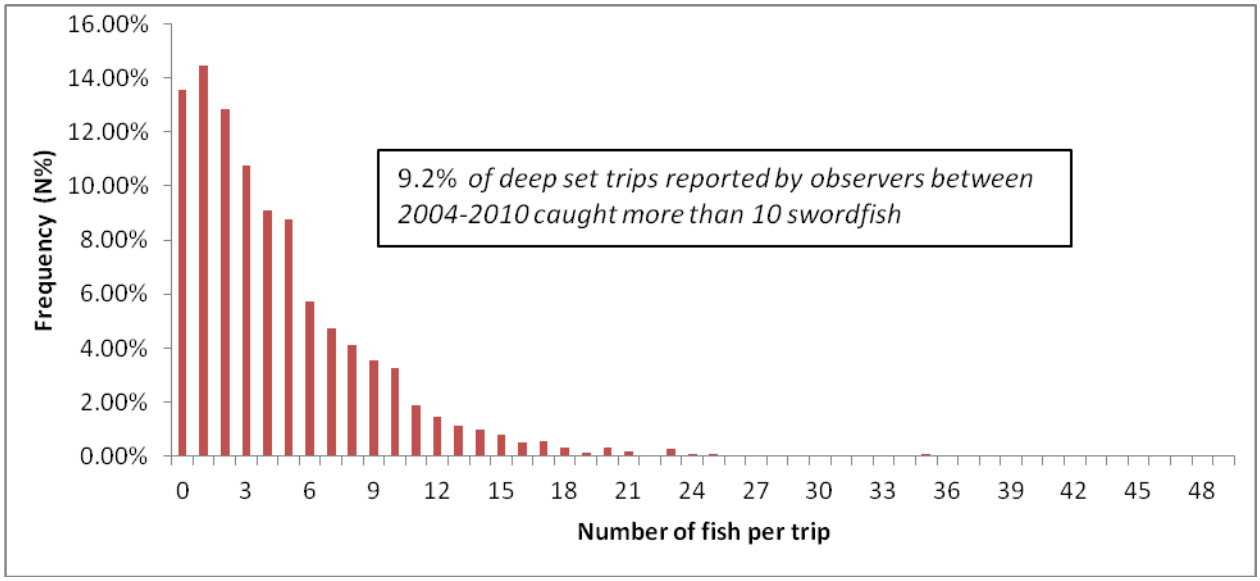


**Figure 9. Average percentage frequency (2004-2010) of the numbers of swordfish caught per trip by Hawaii deep-set bigeye targeting longline vessels from observer records**
Source: NMFS PIFSC

Underreporting of discards in logbooks was detected in a study of fish catch reporting patterns in the Hawaii-based pelagic longline fishery (Walsh and Pooley 2002). This study compared logbook information to observer information and detected differences in reporting between observers and logbooks. Most commonly, this consists of under- or non-reporting of one or more species. For example, Walsh et al. (2002) reported that logbooks listed zeroes for blue shark

(*Prionace glauca)* catches on 10.4 percent of the observed sets from 1994–1997, whereas the observers reported no catches of sharks on only 5.0 percent of these sets. The underreporting may be attributed to a lack of attention to logging discards.

*Swordfish Value and Potential Revenue*

Estimating the potential revenues to be gained from being able to retain more incidentally caught swordfish in the deep-set fishery is problematic because of under-reporting of swordfish discards in the logbooks and the limited observer coverage (20 to 26 percent, Table 8). However, the observer data was considered by the Council to be the more accurate record of discards and, therefore, was used to extrapolate an estimate of the volume of regulatory discards and the likely value of the discards using the following methodology.

The sizes of discarded fish are recorded by the observers; however, on average, the observers only measure every third fish of any particular species brought on board. A crude estimate of the total weight of discarded swordfish was developed by taking the estimated discard weight of fish as measured by the observer and multiplying this number by three, because only one of every three swordfish (approximately) were measured. This gives a total estimate of the discard weight of swordfish.

A size-frequency distribution for the discarded swordfish was then converted into a weight-frequency distribution using a length-weight equation from Uchiyama et al. (1999).
To estimate the total amount of discarded swordfish, the total discard fish weight was multiplied by the inverse of the percent observer coverage and multiplied by three to account for fish that were discarded without measurement. So, for example, the average observer coverage is at 22 percent, so the total estimated weight would be multiplied by 78 percent (the inverse of the percent coverage) then multiplied by three. This amount would be added to the weight calculated for the 22 percent level of observer coverage to provide the total estimated weight of swordfish caught in the fishery.

The results of this computation are summarized in Table 9.

**Table 9. Estimation of the annual total weight of discarded swordfish by the Hawaii deep-set longline fishery, 2004-2010.**

| Year | Number of discarded fish measured | Estimated weight of discarded fish (lb) | Average weight of discarded fish (lb) | Percent observer coverage | Estimated total discard weight raised from observer coverage(lb) | Estimated total discard weight raised for 1 in 3 fish measured (lb) |
|---|---|---|---|---|---|---|
| 2004 | 309 | 3,989 | 12.91 | 24.6 | 16,197.13 | 48,591.39 |
| 2005 | 479 | 7,200 | 15.03 | 26.1 | 27,574.74 | 82,724.21 |
| 2006 | 129 | 2,222 | 17.22 | 21.2 | 10,486.70 | 31,460.11 |
| 2007 | 206 | 3,189 | 15.48 | 20.1 | 15,881.87 | 47,645.62 |
| 2008 | 79 | 2,332 | 29.51 | 21.7 | 10,749.78 | 32,249.33 |
| 2009 | 67 | 1,420 | 21.19 | 20.6 | 6,885.74 | 20,657.21 |
| 2010 | 144 | 2,019 | 14.02 | 21.1 | 9,570.43 | 28,711.28 |
| Ave | 202 | 3,196 | 18 | 22 | 13,907 | 41,720 |

In summary, between 20,000 and 83,000 lb of swordfish are discarded by the deep-set fishery annually, or an annual average of about 41,720 lb of swordfish. The discards are mostly small fish (known colloquially by fishermen as 'rats'), with average weights ranging from 15 to 30 lb. Small swordfish (less than 50 lb) sell at auction for about half the price per pound of larger fish. Thus, taking half of the 2010 average price for swordfish of $2.32/lb, gives a value range for the discards of $23,200 to $96,280 or an annual average of $48,395, if all of the swordfish currently discarded were landed. Based on the average number of vessels that participate in the fishery (126) and the average value of the estimated discard ($48,395), the estimated additional annual revenue would be approximately $384 per vessel. This figure assumes that no discarding would occur, although fishermen may still discard small swordfish in favor of more valuable tuna and larger swordfish.

# 5.0 Description of Affected Environment and Potential Environmental Impacts

The affected environment includes areas where deep-set longline vessels fish for tuna and, while doing so, catch swordfish incidentally, and includes the area where vessels travel and offload their catch. Because the fishery incidentally catches swordfish, which are the subject of the proposed management measure, the environmental impact analysis considers the impacts of the alternatives on the target and non target species, protected species, and the Hawaii fishing community, including deep-set and shallow-set fishing vessels.

The alternatives from Section 2.0 are repeated here for quick reference.

**Alternative 1. No action:** Under this alternative, which represents the environmental baseline, the Council would take no action and the current limit of 10 swordfish per trip for the deep-set tuna targeting fishery would remain in place. Approximately 43 percent of the fishing operations would continue to use circle hooks and other operations would continue to use tuna hooks, or a mix of hook types.

**Alternative 2. Modify the swordfish trip limit:**

**Alternative 2a** would modify the trip limit to 25 swordfish per trip for the Hawaii deep-set tuna targeting fishery for vessels using circle hooks, but would retain the 10 swordfish per trip limit for vessels using tuna other hooks. The environmental impact analysis assumes that up to 57 percent of the fleet switches to circle hooks (43 percent already are using circle hooks).

**Alternative 2b (preferred)** would modify the trip limit to 25 swordfish per trip for the Hawaii deep-set tuna targeting fishery for vessels using circle hooks, but would retain the 10 swordfish per trip limit for vessels using tuna hooks. Vessels carrying an observer, regardless of the type of hook being used, would be able to retain and land all swordfish. The environmental impacts analysis assumes that up to 57 percent of the fleet switches to circle hooks.

**Alternative 3. Remove the swordfish trip limit:** this alternative would remove the swordfish trip limit for the deep-set fishery. The environmental impact analysis assumes that 43 percent of

the fishing operations would continue to use circle hooks and the rest would continue to use tuna hooks or some combination of hooks.

## *5.1 Impacts on Target Stocks*

The deep-set fishery targets bigeye and yellowfin tuna. None of the alternatives would change the manner in which the fishery is conducted that would affect the catch or stock status of these species, so their biology and life history will not be covered in detail. More detailed descriptions of the biology of bigeye and yellowfin tunas may be found in the Pelagic FEP document (WPFMC 2009e). Catch statistics are summarized in Section 3.0 and 4.0.

None of the alternatives including the preferred alternative would have an impact on bigeye tuna, the main target of the deep-set fishery. The fishery currently uses both circle and tuna hooks. Curran and Bigelow (2010) compared tuna catches using three types of hooks: 1) 9/0 J-hook, 2) Japanese tuna hook 3.6 sun, and 3) large 18/0 circle hook. The analysis found no significant difference in the catch, catch rate (catchability), or in mean length of bigeye tuna among hook types; therefore, bigeye tuna catch rates are not expected to change from the current rates under Alternatives 2a or 2b if fishermen were to change to circle hooks.

Bigeye tuna in the WCPO is currently experiencing overfishing but is not overfished (Harley et al. 2010). Yellowfin tuna in the WCPO is not experiencing overfishing and is not overfished (Langley et al. 2011). The fishery currently does not have a major impact on the target stock of bigeye or yellowfin tuna; however, the fishery will continue to be subject to the WCPFC catch limits that were created to reduce impacts to bigeye and yellowfin tuna stocks in the WCPO. Bigeye tuna will continue to be harvested by the Hawaii deep-set longline fleet in accordance with international conservation and management measures for bigeye and any associated catch limits which help to ensure that the U.S. tuna fisheries are sustainable.

Fishermen are not likely to increase fishing effort for bigeye tuna to retain more swordfish under any alternative; therefore, it is unlikely that an increase in the trip limit for swordfish would negatively impact bigeye or yellowfin tuna stocks.

## *5.2 Impacts on Non-target Stocks*

### 5.2.1 Swordfish

The deep-set fishery incidentally catches swordfish while targeting bigeye and yellowfin tuna during daylight hours and current regulations allow the retention of up to 10 swordfish per trip. Swordfish are considered a non-target species or bycatch (if discarded) in the deep-set fishery and are not actively targeted by tuna fishermen. Although none of the alternatives would change the manner in which the fishery is conducted in a way that would affect the catch or stock status of the species, its biology and life history is described here since swordfish are the subject of this action.

According to NMFS observer data from 2004-2010, an average of 3 swordfish per trip are landed by deep-set longline vessels and most of the trips catch fewer than ten swordfish (Table 8).

However, 9.2 percent of the observed deep-set trips catch more than 10 swordfish and these trips incidentally catch from 11 up to 47 swordfish per trip. Only 0.3 percent of trips catch more than 25 swordfish demonstrating that this is an uncommon occurrence.

### 5.2.2 Swordfish Biology, Fishery Susceptibility, and Stock Status

Broadbill swordfish are worldwide in distribution in all tropical, subtropical, and temperate seas (Nakamura 1985; Bartoo and Coan 1989). Swordfish occur throughout the entire region of the Council's jurisdiction and in the EEZs of North America, other countries, and high seas zones. Little is known about migration in Pacific swordfish although limited tagging data support a general west to east movement from Hawaii toward North America. There is some evidence that there may be several semi-independent stocks in the Pacific: a northern stock, a southwest stock and two or three eastern stocks (Alvarado et al. 1996).

Numerous studies on the taxonomy, biology, diet, stock structure and exploitation of swordfish have been conducted. Information on billfishes, including swordfish, is summarized in Nakamura et al. (1968) and Nakamura (1985). Palko et al. (1981) and Joseph et al. (1994) provide detailed synopses of the biology of swordfish. DeMartini et al. (1999; 2006) have studied the reproductive biology, and age and growth of North Pacific swordfish caught by the Hawaii longline fisheries. With its wide-ranging distribution, and patterns of feeding both at the surface and in deeper waters, North Pacific swordfish are susceptible to being caught in the Hawaii deep-set longline fishery.

Larvae and juveniles occur in warmer tropical and subtropical regions where spawning also occurs. Adult swordfish can tolerate a wide range of water temperature, from 5°-27° C (41°F – 80.6 F°), but are normally found in areas with sea surface temperatures (SSTs) above 13° C (55.4 °F) (Nakamura 1985). Adult swordfish are the most widely distributed of all billfish species, ranging from approximately 50°N latitude to 50° S latitude in the Pacific, as indicated by catch records of commercial longline vessels. Adult swordfish are able to occupy a very broad range of water temperatures, from 5°-27° C (41° F–80.6° F) with a preferred temperature range of 18° C–22° C (64.4° F–71.6° F) (Nakamura 1985). Hawaii's average water temperature is 23.3° C (74° F), with cooler waters to the north; therefore swordfish are usually present throughout the year around Hawaii. Individual swordfish can exceed 500 kg (1,102.3 lb) in weight, with females growing larger than males. The larger fish occupy cooler waters, with few fish less than 90 kg (198.4 lb) and few males found in waters cooler than 18° C (64.4° F) (Palko et al. 1981).

Swordfish are voracious feeders at all life stages. Adult swordfish are opportunistic feeders, preying heavily on squid, various fish species, and crustaceans. Deep-set fishermen typically use saury or sardine as bait, which swordfish will eat. Oceanographic features, such as frontal boundaries that tend to concentrate forage species (especially cephalopods), apparently have a significant influence on adult swordfish distributions in the North Pacific. Swordfish are relatively abundant near boundary zones where sharp gradients of temperature and salinity exist (Palko et al. 1981). Sakagawa (1989) notes that swordfish are found in areas of high productivity where forage species are abundant near current boundaries and frontal zones. Dewees (1992) stated that swordfish tend to concentrate along productive thermal boundaries between cold up-

welling water and warmer water masses where they feed on fish and squid. This up-welling typically occurs to the north of the Hawaiian Islands between February and June. Since swordfish, bigeye and yellowfin tuna congregate in these areas of high productivity; deep-set fishermen fishing for tuna in these frontal zones, will incidentally catch swordfish while targeting tuna.

Sex ratio appears to vary with fish size and spatial distribution. Most large-sized fish are females and females appear to be more common in cooler waters. Beckett (1974) noted that few males were found in waters cooler than 18° C (64.4 °F), but make up the majority of warm water landings. This is apparently true for the deep-set fishery, which reports landings that are dominated by smaller male fish (DeMartini et al. 1999; 2006).

Juvenile swordfish gradually transition from the larval state to adult, and while scientists have not conclusively determined the length or age at which the fish reaches the juvenile stage of development, early development is rapid and a juvenile fish longer than approximately 55 cm resembles a miniature adult swordfish. In the Pacific, fish of this size (51-61 cm) have been estimated to be approximately one-year old (Yabe et al. 1959, Dewees 1992).

There are few specific references on the distribution of juvenile swordfish in the Pacific. Swordfish recruit to longline gear as juveniles (sub-adult) at sizes of approximately 50 to 80 cm (eye to fork length), which has been confirmed through reviews of catch data.

Research on the reproductive biology and size at maturity of swordfish is reviewed by DeMartini (1999) and described sexual maturity, sex ratio and size composition of central North Pacific swordfish. The average length at maturity for males was found to be from 102 cm to 144 cm (40 inches to 57 inches). Yabe et al. (1959) estimated that swordfish reach maturity between 5 and 6 years of age at a size of 150-170 cm (59-67 in) (eye to fork length). Sosa-Nishizaki (1990) estimated that female swordfish in the Pacific mature at 140-180 cm (55-71 in) based development indices for gonadal. Length at first maturity has been observed in females as small as 101-110 cm (40-43 in) (Nakano and Bayliff 1992). Spawning occurs in the upper mixed layer of the water column from the surface to 75 m (Nakamura 1985).

Holts et al. (1994) used acoustic telemetry to monitor an adult swordfish and notes that the fish spent about 75 percent of its time in or just below the upper mixed layer at depths of 10 to 50 m in water temperatures about 14° C and made excursions to approximately 300 m where the water was close to 8° C. Deep-set fishing activity in Hawaii ranges from 30 to 350 m, therefore swordfish are susceptible to being incidentally caught while fishermen target tuna.

The horizontal and vertical movements of several swordfish tracked by acoustic telemetry in the Atlantic and Pacific were documented by Carey and Robison (1981). Studies have noted a general pattern of remaining at depth, sometimes near the bottom, during the day and rising to near the surface during the night to follow prey in a vertical migration. Feeding occurs at dawn and dusk. More recently a tagging project was undertaken in New Zealand waters utilizing pop-off satellite archival tags (PATS) to track movements of swordfish during a time when they would be expected to visit sub-tropical spawning grounds and return to temperate waters (Holdsworth et al. 2007). They found all swordfish to make occasional excursions to the surface

during the day; a behavior more prevalent in larger fish, which may be the “basking” behavior described in Dewar and Polovina (2005) and discussed in Carey and Robison (1981). Deep-set fishing typically occurs during the day therefore swordfish that are basking near the surface are less susceptible to deep-set longline gear which is fishing for tuna at depth.

### 5.2.3 Status of Swordfish

International management of North Pacific swordfish is under the purview of the WCPFC and the Inter-American Tropical Tuna Commission. A 2009 stock assessment for North Pacific swordfish was undertaken by Brodziak and Ishimura (2010). The assessment was conducted using a Bayesian Surplus Production model assuming two hypotheses for stock structure. The first hypothesis used a single stock in the North Pacific Ocean above the Equator. The second hypothesis, considered the more plausible, used a two-stock scenario with stocks in the western and central Pacific and eastern Pacific separated by an irregular boundary extending from Mexico to the southwest and including sections of the eastern South Pacific extending to 20°S latitude (ISC 2009). The stock assessment for North Pacific swordfish indicated, and NMFS recognized, that the status of the stock is currently healthy neither experiencing overfishing nor approaching an overfished condition. Brodziak and Ishimura (2010) suggest that, under the status quo fishing effort, the swordfish population and fisheries would likely be stable in the near term. Therefore, retention of swordfish that are incidentally caught during deep-set longline tuna fishing does not appear to be adversely affecting its status.

### 5.2.4 Impacts on Swordfish

Under the no-action alternative, the deep-set fishery would continue to catch swordfish incidental to targeting bigeye tuna (Table 3) and would continue to retain up to 10 swordfish per trip. High-grading (discarding smaller fish for larger, more valuable fish), regulatory discards (discard after swordfish limit was reached), and discard of unmarketable or undesirable bycatch would continue at a level similar to past years (Tables 8 and 9).

The number of swordfish that are currently released alive is approximately 19 percent of the total number of swordfish observed caught (
Table **10**). The post-release mortality rate of discards (death after release) is not known and it is difficult to speculate on the stock recruitment effects of discards. However, from the NMFS observer data, which is summarized in
Table **10**, it is clear that more than half of the swordfish are alive upon retrieval. Mortality rates of discarded fish are unknown.

**Table 10. Observed disposition of swordfish caught in the Hawaii deep-set longline fishery, 1994-2010.**

| Disposition: | Discarded Alive: | Discarded Dead: | Kept: | Unknown: | Total caught*: |
|---|---|---|---|---|---|
| **Alive on retrieval** | 1,786 | 118 | 2,898 | 8 | 4,810 |
| **Dead on retrieval** | Not applicable | 2,103 | 2,594 | 5 | 4,702 |
| **Total** | 1,786 | 2,221 | 5,492 | 13 | 9,512 |

*Note: This table presents the total results of observed trips from 1994 to 2010. Since observations cover approximately 7-20 percent of trips, these total numbers are not indicative of total values.
(NMFS PIFSC unpublished data)

Under the no-action alternative, swordfish in excess of the 10-fish limit must be discarded. As seen in
Table **10**, over the past 17 years approximately 58 percent of the observed fish caught were retained, and 42 percent were discarded. Of the fish that were caught alive and then released, approximately 2.5 percent were discarded dead and 37 percent were discarded alive.

Under Alternatives 2a, 2b, and 3, the number of swordfish that could be retained may increase. The fishery outcome (actual retention) would depend on the circumstance of the individual fishermen. Both Alternatives 2a and 2b would continue some limits on retention and may result in some additional amount of swordfish retained, but may depend on how many fishing operations switch to circle hooks. The cost to fishermen to switch to circle hooks may range from about $876 to $1,315 or greater depending on what size circle hooks are purchased. This cost may not be recovered in the short term since approximately $384 per vessel per year may be gained under any alternative (see Section 5.5 and Appendix A for complete analysis). These costs may be a disincentive to switch to circle hooks.

The trip limit would be removed under Alternative 3. For Alternative 3, if we assume catch rates do not change and all fish are retained, the expected extrapolated annual landings of swordfish by the deep-set fishery would be about 6,184 fish per year. This is approximately 49 swordfish per vessel per year (6,184 swordfish divided by 126 vessels) and represents a potential increase in landings of approximately 3,637 swordfish per year.

Curran and Bigelow (2010) found significant differences in the catch and catch rate of swordfish between tuna and circle hooks, meaning that a switch to large circle hooks (18/0) may reduce the catchability of swordfish by 48.1 percent. However, 18/0 circle hooks are not usually used in the deep-set fishery.

For Alternative 2a and 2b the number of swordfish retained and landed would depend on how many vessels changed to circle hooks and the size of hook. Although difficult to speculate, we estimate the maximum potential environmental impact by using the scenario in which all vessels switch to circle hooks under Alternatives 2a and 2b, and retain all swordfish (i.e., 6,184 swordfish). However there may be some reduction in the catchability when using large circle

hooks; therefore, the maximum catch under both alternatives may be some number less than 6,184.

The fishery is subject to randomized observer deployment on 20 percent of all trips. A random sample of the observed trips and the associated catch and discard is expanded to estimate catch and discard for the unobserved trips. We assume that the observed trips are representative of all unobserved trips. Implementing Alternative 2b could introduce bias when estimating catch and discard across the fleet, particularly for swordfish discard size frequencies. The bias is that the fishery could operate under two scenarios of regulations; that is, if an observer is aboard the vessel, an unlimited amount of swordfish could be retained and if there is no observer the limit is 10 or 25 (dependent on the type of hook deployed by the vessel). Since the discard of swordfish may be less under the scenario of unlimited swordfish retention, discard sizes may be different compared to those vessels that are required to discard swordfish after 10 or 25 are caught. The introduction of bias may not be quantified but could be considered in the bycatch and discard estimates by the PIFSC in coordination with the NMFS observer program. If Alternative 2b were implemented, observed trips may not have the same level of discard that occurs in unobserved trips. These differences could be accounted for, which would introduce some complications in terms of how fisheries data is used.

If bigeye catch rates are profitable during a given trip, it is unlikely that vessel operators would lengthen their time at sea to catch more swordfish and jeopardize the quality of tuna caught or attempt to change to shallow-set gear, fish at night, or modify gear in a manner to retain 25 or more swordfish. In addition, the economic gain of retaining additional incidentally caught swordfish while on a deep-set trip is much smaller than catching and maintaining the quality of more valuable tuna catch.

None of the alternatives are expected to have a large or adverse affect on swordfish stocks because: 1) fishery effort would likely continue at the current level for bigeye tuna so incidental catch rates will likely not change; 2) value of bigeye tuna is greater than swordfish so targeting is unlikely to occur; 3) only 9.2 percent of the fishing trips would likely catch more than ten swordfish, and very few would catch more than 25 swordfish per trip; 4) the current harvest of swordfish in the WCPO is well below the maximum sustainable yield of the North Pacific stock and the deep-set fishery total estimated catch would be minor in comparison to what is available for harvest (http://swr.nmfs.noaa.gov/sfws/JonBrodziak-NP_Swordfish_Stock_Status.pdf). Logbooks, observations, and commercial sales data will allow fishery scientists and managers to continue to monitor the fishery and bycatch. Discard estimation programs would continue to be reviewed, and adjusted to accommodate changes in regulations.

### 5.2.5 Impacts on other non-target stocks

Curran and Bigelow's study (2010) around Hawaii, concluded that the use of large circle hooks (18/0) could reduce the catch of incidental species such as billfish, pelagic sharks, opah, and dolphinfish in the deep-set fishery compared to catches using tuna, J, or smaller circle hooks. They contend that, in contrast to tuna hooks, large circle hooks have conservation potential for use in the world's pelagic tuna longline fleets for some non-target highly migratory species, with catch rate reductions of 29.2–48.3 percent for billfish species and 17.1–27.5 percent for sharks.

Kersetter and Graves (2006), conducted research in the Atlantic Ocean, that found few significant differences in the non-target species catch rates when comparing the use of size 16/0, 0°-offset circle hooks to size 9/0, 10°-offset J-style hooks. Based on this information, and if additional fishermen convert to using size 16/0 circle hooks in the deep-set fishery, the level of bycatch and retained non-target pelagic species is not expected to change substantially, or there could be a slight decrease under Alternatives 2a and 2b as more fishermen change to circle hooks. The anticipated small amount of change in the catch rate of non-target species is not likely to have a large negative effect on the status of these stocks.

## *5.3 Impacts on Protected Species*

### 5.3.1 Marine Mammals

The Marine Mammal Protection Act (MMPA) establishes a comprehensive federal program for the protection and management of marine mammals occurring within U.S. jurisdiction. With respect to commercial fishing, section 118(b) of the MMPA establishes a goal of reducing incidental mortality and serious injury of marine mammals to insignificant levels approaching zero. Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries (LOF) that classifies U.S. commercial fisheries into one of three categories. These categories are based on the level of serious injury and mortality of marine mammals that occurs incidental to each fishery. Specifically, the MMPA mandates that each fishery be classified according to whether it has frequent, occasional, remote, or no likelihood of incidental mortality or serious injury of marine mammals. This section lists marine mammals that have been observed, or may occur, in the action area. This section also includes current interaction information, and potential impacts to marine mammals associated with the proposed alternatives.

Pursuant to the MMPA, NMFS has promulgated specific regulations that govern the incidental take of marine mammals during fishing operations (50 CFR 229). The regulations designate three categories of fisheries, based on relative frequency of incidental serious injuries and mortalities of marine mammals in each fishery:

- Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing;
- Category II designates fisheries with occasional serious injuries and mortalities; and
- Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities.

The deep-set fishery is a Category I fishery (76 FR 73912, November 29, 2011), so fishermen must be registered with NMFS under the Marine Mammal Authorization Program and report marine mammal interactions to NMFS, and vessels are subject to federal observers. Currently at least 20 percent of all deep-set fishing trips are observed by NMFS (NMFS 2005a). The fishery must also comply with any applicable Take Reduction Plans as noted in section 5.8.

**Affected Species and Fishery Interactions**

Marine mammals found in the action area and current interaction information is described in this section.

| | |
|---|---|
| Blainville's Beaked Whale | (*Mesoplodon densirostris)* |
| Blue whale | (*Balaenoptera musculus*) |
| Bottlenose Dolphin | (*Tursiops truncatus)* |
| Bryde's Whale | (*Balaenoptera edeni)* |
| Common Dolphin | (*Delphinus delphis)* |
| Cuvier's Beaked Whale | (*Ziphius cavirostri*s) |
| Dwarf Sperm Whale | (*Kogia simus)* |
| False Killer Whale | (*Pseudorca crassiden*s) |
| Fin whale | (*B. physalus*) |
| Fraser's Dolphin | (*Lagenodelphis hosei)* |
| Humpback whale | (*Megaptera novaeangliae*) |
| Hawaiian monk seal | (*Monachus schauinslandi*) |
| Killer Whale | (*Orcinus orca)* |
| Longman's Beaked Whale | (*Indopacetus pacificus*) |
| Melon-headed Whale | (*Peponocephala electra)* |
| Minke Whale | (*Balaenoptera acutorostrata)* |
| North Pacific Right Whale | (*Eubalaena japonica*) |
| Northern Elephant Seal | (*Mirounga angustirostris)* |
| Pantropical Spotted Dolphin | (*Stenella attenuate)* |
| Pygmy Killer Whale | (*Feresa attenuate)* |
| Pygmy Sperm Whale | (*Kogia breviceps)* |
| Risso's Dolphin | (*Grampus griseus)* |
| Rough-toothed Dolphin | (*Steno bredanensis)* |
| Sei whale | (*Balaenoptera borealis*) |
| Short-finned Pilot Whale | (*Globicephala macrorhynchu*s) |
| Sperm whale | (*Physeter macrocephalus*) |
| 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/.

The deep-set fishery operates in accordance with provisions of the Pelagic FEP and NMFS' 2005 BiOp which requires a minimum of 20 percent observer coverage for the fishery to monitor protected species interactions, including marine mammals. Based on observer data from 2006 to 2011, the fishery interacted with several species of marine mammals (Table 11). Most of the animals were released injured. Many of these injuries were later determined to be "serious injuries," or injuries likely leading to death. False killer whales have interacted with deep-set longline gear more than other species.

**Table 11. Observed marine mammal interactions in the Hawaii deep-set fishery, 2006-2011.**

| Species | Number caught | Number released injured | Number released dead |
|---|---|---|---|
| Bottlenose dolphin | 3 | 3 | 0 |
| False killer whale | 28 | 27 | 1 |
| Risso's dolphin | 5 | 4 | 1 |
| Short-finned pilot whale | 6 | 6 | 0 |
| Striped dolphin | 2 | 0 | 2 |
| Spotted dolphin | 1 | 0 | 1 |
| Unidentified cetacean | 6 | 5 | 0 |
| Unidentified dolphin | 3 | 3 | 0 |
| Unidentified whale | 10 | 10 | 0 |
| Sperm whale | 1 | 1 | 0 |

Source: NMFS Observer Program Annual Status Reports
http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html

On June 1, 2010, NMFS amended the ITS in the 2005 Opinion to authorize incidental take of Central North Pacific humpback whales in the Hawaii-based deep-set longline fishery. The authorized incidental take over a 3-year period is four interactions and zero mortalities. From 2001 to date, three humpback whales were observed entangled in deep-set longline gear with the last one occurring in 2004. The fishery has not exceeded the authorized incidental take for this species.

An analysis of NMFS observer data from 1994 to 2009 revealed that the use of small circle hooks (14/0, 15/0, and 16/0) could result in an estimated 6% reduction in interactions and greater likelihood of releasing false killer whales with non-serious injuries (i.e., injuries that result in death)(Forney et al. 2011). Although the majority (73%) of deep-set trips observed between 1994 and 2009 used primarily tuna hooks, some comparison of the potential effect of hook type was possible. In the deep-set fishery, the hook type was known for 40 caught false killer whales or blackfish: 36 animals (90%) were caught on tuna hooks and four were caught on small circle hooks. The binomial probability of having at least 36/40 animals caught on tuna hooks, given the observed proportion of trips using mostly tuna hooks is only 0.5%, suggesting that tuna hooks are more likely to capture false killer whales or blackfish than other hook types (mostly small circle hooks).

Under all alternatives, including the no-action alternative, fishermen are required to reduce the severity of interactions with marine mammals. Among the existing provisions are a requirement for vessels to carry gear to help recover animals and remove hooks, and a requirement for captains to attend protected species workshops annually to help train captains on ways to reduce interactions and the severity of injuries when interactions occur.

**Impacts of Alternatives**

Under the No-Action Alternative and Alternative 3, fishery operations and gear are not expected to change in any way that would affect the number or rate of marine mammal interactions in the deep-set fishery. Alternatives 2a and 2b may result in a shift from the use of tuna hooks to circle

hooks in the deep-set fishery. The fishery currently uses smaller circle hooks, therefore; any increase in the use of circle hooks may benefit marine mammal populations since the use of circle hooks may reduce marine mammal interaction rates and/or injury severity (Forney et al. 2011). Recent efforts to analyze and reduce false killer whale interactions have been conducted through the False Killer Whale TRT (FKWTRT). Model simulations conducted in support of the FKWTRT's deliberations predicted that exclusive use of circle hooks in the deep-set fishery could result in a 6 percent decrease in false killer whales killed or seriously injured (FWKTRT 2010).

It's likely that that none of the alternatives would affect marine mammals in any manner not previously considered or authorized by the commercial fishing incidental take authorization under section 118 of the MMPA.

### 5.3.2 ESA-Listed Species

The Endangered Species Act (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 critical habitat of such species. When a federal agency's action "may affect" an ESA-listed species, that agency is required to consult formally with NMFS (for marine species or their designated critical habitat) or the U.S. Fish and Wildlife Service (USFWS; for terrestrial and freshwater species or their designated critical habitat). Federal agencies are exempt from this formal consultation requirement if they have concluded that an action "may affect, but is not likely to adversely affect" ESA-listed species or their designated critical habitat, and NMFS or USFWS concur with that conclusion (see ESA Section 7 Implementing Regulations; 50 CFR 402).

The ESA also prohibits the taking of endangered species except under limited circumstances. Western Pacific regional fisheries are operated in accordance with ESA consultations that consider the potential interactions of fisheries with listed species, as well as the impacts of interactions on the survival and recovery of listed species and protection of critical habitat.

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

(1) the amount or extent of 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.

If the amount or extent of incidental take identified in the ITS that is enclosed in a BiOp is exceeded, NMFS SFD should immediately request initiation of formal consultation.

The proposed changes to the fishing regulations under any of the alternatives are not expected to result in a change to fishery operations that would likely require reinitiating section 7 consultation for ESA listed species. Critical habitat has not been designated in the proposed action area, so no critical habitat would be affected by the proposed action.

**Consultation History**

The deep-set fishery is known to interact with sea turtles and humpback and other whales and has the potential to interact with listed seabirds. No interactions have been observed or reported between the fishery and Hawaiian monk seals. The deep-set fishery is conducted in accordance with the provisions of two BiOps: a NMFS 2005 BiOp on impacts of the deep-set longline fishery on ESA listed marine mammals and sea turtles; and USFWS 2012 BiOp for the effects of the deep-set fishery on the short-tailed albatross.

It is likely that the proposed changes are not expected to result in a change to fishery operations that would trigger any of the reinitiation criteria.

**Affected Species**

Species listed as endangered or threatened under the ESA that have been observed or may occur in the area where the deep-set fishery operates in accordance with the Pelagic FEP are as follows:

**ESA Species listed as endangered**

| | |
|---|---|
| Hawaiian dark-rumped petrel | (*Pterodroma phaeopygia sandwichensis*) |
| Short-tailed albatross | (*Phoebastria albatrus*) |
| Olive ridley turtle | (*Lepidochelys olivacea*) – Mexico nesting population |
| Leatherback turtle | (*Dermochelys coriacea*) |
| Loggerhead turtle | (*Caretta caretta*) – North Pacific Ocean Distinct Population Segment only |
| Hawksbill turtle | (*Eretmochelys imbricata*) |
| Green turtle | (*Chelonia mydas*) – Florida and Pacific coast of Mexico breeding populations only |
| Blue whale | (*Balaenoptera musculus*) |
| Fin whale | (*Balaenoptera physalus*) |
| Humpback whale | (*Megaptera novaeangliae*) |
| North Pacific right whale | (*Eubalaena japonica*) |
| Sei whale | (*Balaenoptera borealis*) |
| Sperm whale | (*Physeter macrocephalus*) |
| Hawaiian monk seal | (*Monachus schauinslandi*) |

**ESA Species listed as threatened**

| | |
|---|---|
| Green turtles | (*Chelonia mydas*) – All other stocks |
| Loggerhead turtle | (*Caretta caretta*) – All other stocks |
| Olive ridley turtle | (*Lepidochelys olivacea*) – All other stocks |
| Newell's shearwater | (*Puffinus auricularis newelli*) |

**Species proposed for listing**

False killer whale (*Pseudorca crassidens*) – Hawaiian Insular stock only

### 5.3.2.1 ESA-listed Marine Mammals

Species Information and Fishery Interactions

Information on ESA-listed marine mammals can be found in the most recent stock assessment reports (SARs; available online at: http://www.nmfs.noaa.gov/pr/sars/species.htm) and recovery plans (available online at: http://www.nmfs.noaa.gov/pr/recovery/plans.htm#mammals). Information on fishery interactions can be found in section 5.3.1.

Impacts of Alternatives

Under the No-Action Alternative, marine mammal interactions rates in the deep-set fishery would be similar to those in the recent past because the operation of the fishery is not expected to change (i.e., area fished, number of vessels engaging in deep-set fishing, the number of trips taken per year, number of hooks set per vessel during a trip, depth of hooks, or deployment techniques in setting longline gear). The NMFS 2005 BiOp concluded that no fisheries managed by the Council are likely to jeopardize the continued existence and recovery of any ESA-listed marine mammal species or result in the destruction or adverse modification of designated critical habitat in the Western Pacific Region.

Alternatives 2a and 2b would require the use of circle hooks to retain more swordfish than the current limit (except for cases in which an observer was stationed aboard a vessel, in which case, under Alternative 2b, circle hooks would not be required in order to retain additional swordfish). The fishery currently uses circle hooks and these alternatives may increase their use. As noted above, an increase in the use of circle hooks may benefit marine mammals, since the use of circle hooks may reduce marine mammal interaction rates and/or injury severity. Recent efforts to analyze and reduce false killer whale interactions have been conducted through the FKWTRT. Model simulations conducted in support of the FKWTRT's deliberations predicted that exclusive use of circle hooks in the deep-set fishery could result in a 6 percent decrease in false killer whales killed or seriously injured (FWKTRT 2010).

Alternative 3 could create an incentive for vessels to target swordfish by setting gear shallow during a declared deep-set trip. However, the likelihood of this occurrence is not quantifiable. The PIFSC estimates total protected species interactions, including marine mammals, by expanding observed tips to estimate interactions that may have occurred on unobserved trips. However, observed trips used to model total interactions may not represent unobserved trips if gear is set deep and shallow on the same trip and interaction rates are increased.

Assuming fishers do not set gear shallow, Alternative 3 would not result in a change to interactions because they would simply retain as many incidentally caught swordfish as are caught and would not be required to discard swordfish. Illegal targeting of swordfish could be inferred if vessels landed a large number of large-sized swordfish. If Alternative 3 were selected, and if illegal fishing were suspected to be occurring, the Council and NMFS could change the management of the fishery. For this reason, Alternative 3 is not expected to result in a change to impacts on listed marine mammals.

Interactions with large whales, which primarily involve entanglement rather than hooking, are currently rare and their interaction rate would likely be unaffected by any gear changes associated with these alternatives because the use of circle hooks and the retention of incidentally caught swordfish are not direct causes for large whale interactions.

### 5.3.2.2 ESA-Listed Sea Turtles

Species Information and Fishery Interactions

All Pacific sea turtles are designated under the Endangered Species Act (ESA) as either threatened or endangered except for the flatback turtle (*Natator depressus*), which is native to Australia and does not occur in the project area and will not be covered in this document. Information, including the range, abundance, status, and threats of the listed sea turtles, can be found in the recovery plans for each species, which are available at the following NMFS websites:

Green turtle: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_pacific.pdf
Green turtle: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_eastpacific.pdf
Hawksbill: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_hawksbill_pacific.pdf
Olive ridley: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_oliveridley.pdf
Leatherback: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_leatherback_pacific.pdf
Loggerhead: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_loggerhead_pacific.pdf
(Websites accessed April 2012)

Sea turtles are incidentally taken in the deep-set fishery. All sea turtles, being air-breathers, are typically found closer to the surface, e.g., in the upper 100m of the ocean's surface; however, some turtles such as olive ridley turtles and loggerheads turtles are more susceptible to deep-set longlining because of their deep foraging behavior of up to 150 meters (Polovina et al. 2003, NMFS 2008b, NMFS 2009). A BiOp was issued in 2005 by NMFS for the deep-set longline fishery that authorized incidental take for green, leatherback, loggerhead, and olive ridley sea turtles. Interactions are monitored by NMFS observer program. Take estimates are then derived by expanding the observed totals to a fleet-wide total. The estimates are then compared to the incidental take limit (Table 12 through 14). The incidental take limit has not been exceeded in the deep-set fishery since approval of the 2005 BiOp (Table 14). Table 12 specifies two thresholds for incidental take in the fishery. NMFS must reinitiate formal consultation under section 7 of the ESA if, in a single fishing year for the Hawaii-based pelagic deep-set longline fishery, the amount of either incidental capture or mortality of sea turtles incidental to the fishery is equal to or greater than 50 percent of the total take level specified/anticipated for multiple years for any species (NMFS 2005a).

**Table 12. The number of turtles authorized to be taken (captured and/or killed) in the deep-set fishery over a period of 3 consecutive years.**

| Species | **Authorized Incidental Take** | |
|---|---|---|
| | **Number authorized to be captured** | **Number authorized to be killed** |
| Green sea turtles | 21 | 18 |
| Leatherback sea turtles | 39 | 18 |
| Loggerhead sea turtles | 18 | 9 |
| Olive Ridley sea turtles | 123 | 117 |

Source: NMFS 2005 Biological Opinion for the Deep-set component of the Hawaii longline fishery

**Table 13. Observed interactions and condition of sea turtles caught in the observed Hawaii deep-set fishery 2008-2011.**

| Sea turtles species | Observed Number of Interactions | | |
|---|---|---|---|
| | **2009** | **2010** | **2011** |
| Green | 0 | 1 injured | 1 dead |
| Leatherback | 1 injured | 1 injured | 3 injured |
| Loggerhead | 0 | 1 injured | 0 |
| Olive Ridley | 4 dead | 3 injured / 1 dead* | 1 injured/6 dead |

Note: These observations represent approximately 20 percent of the total number of trips.
* This olive ridley interaction occurred inside the EEZ around American Samoa. It is included in this report because the vessel departed Honolulu under the Hawaii Longline Permit. The vessel also has an American Samoa Longline Permit.
Source: NMFS observer program annual status reports http://www.fpir.noaa.gov/OBS/obs_hi_ll_ds_rprts.html

**Table 14. Estimated number of sea turtle interactions for the Hawaii deep-set fishery, 2009-2011, based on observed interactions and expanded for unobserved sets.**

| Sea turtles species | Sum of Estimated Incidental Take 2008-2011 | | Authorized Incidental Take* (3 yr) |
|---|---|---|---|
| | Caught | Killed | |
| Green | 6 | 3.8 | 21(c); 18(k) |
| Leatherback | 24 | 9.6 | 39(c); 18(k) |
| Loggerhead | 6 | 3.8 | 18(c); 9(k) |
| Olive Ridley | 64 | 60.5 | 123(c); 117(k) |
| Hawksbill | 0 | 0 | 0(c); 0(k) |

*(C)=authorized caught; (K)=authorized killed under 2005 Biological Opinion covering the deep-set longline fishery. Note: The estimated incidental take includes an expansion of the observed sets and applied over the entire fishery for each year.
Source: PIFSC, M. McCracken, PIFSC Internal Reports, 2009-2011

Between 2004 and 2007, the Inter-American Tropical Tuna Commission (IATTC) coordinated and implemented a circle hook exchange program to experimentally test and introduce circle hooks and safe handling measures to reduce sea turtle bycatch in mahi-mahi and tuna/billfish artisanal longline fisheries in Ecuador, Peru, Panama, Costa Rica, Guatemala and El Salvador. Almost all (99 percent) of fishery/turtle interactions identified by the IATTC program were with green or olive ridley sea turtles. By the end of 2006, over 1.5 million J-hooks from approximately 100 boats had been exchanged for turtle-friendly circle hooks. Overall, circle hooks have reduced interaction rates by 40 to 80 percent in most artisanal fisheries that switched gear types, with deep hookings reduced by 20 to 50 percent, depending on the fishery (Bolten and Bjorndal 2005, Gillman et. al 2007, Largacha et al. 2005, and Watson et al. 2005). The reason the interaction rates and deep hooking rates were reduced is because sea turtles are not as likely to be hooked or become deeply hooked from ingesting a circle hook, as they are when J-style hooks are used.

The current post-release mortality rates of sea turtles from the deep-set fishery vary depending on the type of interaction and how much gear is removed from the turtle upon release (NMFS 2005a). Hard-shelled and leatherback turtles have been shown to have disparate rates of post-hooking mortality, with leatherbacks being an estimated 10 percent more susceptible to post-hooking mortality than hard-shelled turtles. The type of hook is not included in estimating post-hooking mortality; however, the use of circle hooks could reduce the frequency of interactions and deeply ingested hooks, thereby reducing the annual sea turtle mortality estimates in the fishery, assuming fishermen also follow safe sea turtle handling techniques.

The most predominant hook types used in the deep-set longline fishery are tuna hooks (3.6 mm and 3.8 mm) and "small" circle hooks (15/0 and 16/0, and less commonly, 14/0) (FKWTRT 2010). The required use of small (16/0 or smaller), circle hooks under the draft FKWTRP would be expected to provide a conservation benefit to sea turtles. This effect has not been tested experimentally in the Hawaii-based deep-set longline fishery, and the number of observed sea turtles caught in the fishery is too small to conduct meaningful statistics for comparison of hook types. However, research in other fisheries has generally shown that circle hooks are better for sea turtles than tuna or J-hooks. The size and shape of circle hooks make it more difficult for turtles to swallow them, and thus, replacing tuna and J-hooks with circle hooks would be expected to reduce deep ingestion of hooks by sea turtle species that tend to bite baited hooks (e.g., hard shell sea turtles) (Boggs and Swimmer 2007). Additionally, in fisheries with bycatch of smaller turtles (such as olive ridley turtles, the species most frequently caught in the deep-set longline fishery), using smaller size (e.g., 16/0) circle hooks can reduce capture rates of sea turtles when the circle hooks replace other hook styles with smaller widths (Boggs and Swimmer 2007). Leatherback sea turtles are most often foul hooked, primarily in the flipper, shoulder, or armpit. Circle hooks, designed with the hook point turned in toward the shank, protect the hook point from foul hooking compared to J or tuna hooks, and researchers believe the small gap between hook point and shank in 16/0 circle hooks may be more efficient in reducing leatherback foul hooking than large (18/0 and 20/0) circle hooks (Watson et al. 2004).

The requirement to use large circle hooks (18/0) with mackerel type bait in the shallow-set fishery was implemented because research in Western Atlantic pelagic longline fishery by Watson et. al had proven its effectiveness in reducing sea turtle interactions. The results of 2003 research confirmed 2002 research results that found 18/0 circle hooks with both mackerel and squid bait significantly reduce both loggerhead and leatherback sea turtle interactions when compared with industry standard J-hooks and squid bait. Also, circle hooks significantly reduced the rate of hook ingestion by the loggerheads, reducing the post-hooking mortality associated with the interactions.

Although sea turtle interactions have been significantly reduced in the shallow-set fishery through the use of large circle hooks and mackerel bait, turtle interaction rates in the deep-set fishery are significantly lower in the deep-set fishery without their mandatory use. Interaction rates in the 2011 deep-set fishery 0.001 turtles per 1000 hooks compared to 0.022 turtles per 1000 hooks in the shallow-set fishery.

Since the deep-set fishery already has low interaction rates and nearly half the fleet already use circle hooks (15/0 and 16/0 and less commonly, 14/0), a requirement to use large circle hooks

(18/0) may not appreciably reduce interaction rates in a manner that is statistically different from other hook sizes. The fishery has operated well below the ITS for all sea turtles since 2004 and as mentioned previously, the number of observed sea turtles caught in the deep-set fishery is too small to conduct a meaningful statistical comparison of hook sizes. Since research has shown that a variety of circle hook sizes can reduce interaction rates with sea turtles, large circle hooks and bait requirements would are not required in the deep-set fishery.

Impacts of Alternatives

Under the No-Action Alternative, the 10 swordfish limit would remain and the deep-set fishery would continue to have rare interactions with sea turtles. Existing sea turtle handling, mitigation gear, and reporting requirements would remain and fishermen would likely continue to use a mix of circle and J-hooks. Impacts to sea turtles would continue to vary from year to year as shown in Table 14 and the fishery would likely not exceed the ITS under the No-action alternative.

Under Alternatives 2a and 2b, up to 25 swordfish could be retained if only circle hooks are used. Although the economic incentive to switch to circle hooks is not large, these alternatives may nonetheless encourage a greater adoption of circle hooks in the deep-set fishery. The size and shape of circle hooks make it more difficult for turtles to swallow them by commonly hooking animals in the mouth or jaw, and thus, replacing tuna and J-hooks with circle hooks is expected to reduce deep ingestion of hooks by sea turtle species that tend to bite baited hooks (e.g., hard shell sea turtles) (Boggs and Swimmer 2007). In fisheries with bycatch of smaller turtles (such as olive ridley turtles, the species most frequently caught in the deep-set longline fishery), using smaller (e.g., 16/0) circle hooks can reduce capture rates of sea turtles when the circle hooks replace other hook styles with smaller widths (Boggs and Swimmer 2007). Leatherback sea turtles are most often foul-hooked (i.e., primarily externally hooked in the flipper or shoulder area) in the shallow-set fishery. Circle hooks, designed with the hook point turned perpendicular toward the shank, protect the hook point from foul-hooking compared to J or tuna hooks. Researchers believe the small gap between hook point and shank in 16/0 circle hooks may be more efficient in reducing leatherback foul hooking than large (18/0 and 20/0) circle hooks (Watson et al. 2004).

Therefore, if a vessel switched from tuna hooks to circle hooks, Alternatives 2a and 2b may reduce the numbers of turtles caught in the deep-set fishery, potentially decrease the severity of injuries, and may improve the post-release mortality rate. Although unlimited amounts of incidentally caught swordfish could be retained under Alternative 2b regardless of hook type used if an observer is on board the vessel, the option to retain more than 25 swordfish would likely not change sea turtle interaction rates because the swordfish that would be retained are already being caught incidental to tuna fishing. Both alternatives are expected to result in conservation benefits to sea turtles if a greater proportion of the deep-set fishery uses circle hooks. If deep-set fishermen do not switch to circle hooks, sea turtle interaction rates are likely to remain similar to the recent past.

It is unlikely that removing the trip limit, as provided for under Alternative 3, would create incentives to target swordfish and lead to an increase in (undocumented) turtle interactions since it is prohibited to switch to a shallow-set gear configuration during a declared deep-set trip. If the limit for swordfish was to be removed from the fishery, the measure has the unintended

consequence of possibly encouraging shallow-set fishing. If shallow-set fishing were to occur during a declared deep-set trip, there could be more unobserved and unreported interactions with sea turtles. This activity is not suspected to currently occur; however, NOAA Office of Law Enforcement would continue to monitor fishing activity at sea and dockside for compliance with gear and fishing requirements.

Deep-set vessels likely do not have an economic incentive to target swordfish since they are seeking the more valuable bigeye and yellowfin tuna when they embark on deep-set trips. It is likely that a fishing operation would not continue to fish longer to increase catch of swordfish and jeopardize the quality of its tuna catch under this alternative. Fish landings and interactions in logbooks would be documented and reviewed by fishery managers however it would be difficult to prove targeting of swordfish during a deep-set trip. Assuming fishers do not set gear shallow, this alternative would not result in a change to interactions because they would simply retain as many incidentally caught swordfish as are caught and would not be required to discard swordfish. Illegal targeting of swordfish could be inferred if vessels landed a large number of large-sized swordfish. If Alternative 3 were selected, and if illegal fishing were suspected to be occurring, the Council and NMFS could change the management of the fishery.

### 5.3.2.3 ESA-Listed Seabirds

Species Information and Fishery Interactions

The short-tailed albatross, Newell's shearwater, and Hawaiian dark-rumped petrel are listed as either endangered or threatened under the ESA and have ranges that overlap the fishing grounds of the Hawaii deep-set longline fishery (see Section 3.2). A comprehensive description of the species' distribution, population status, threats, and recovery strategy can be found in the species' recovery plans (available online at: http://ecos.fws.gov/tess_public/TESSWebpageRecovery?sort=1). Since the NMFS observer program was initiated in 1994, there have been no observed interactions between these three listed seabird species and the Hawaii deep-set longline fleet.

A 2012 section 7 consultation determined that the Newell's shearwater and the Hawaiian petrel are not affected by the deep-set fishery. A 2012 BiOp covering the short-tailed albatross anticipates that two (2) short-tailed albatross may be taken every five years in the form of injury or death as a result interactions with fishing activity in the deep-set fishery operating under existing regulations (USFWS 2012). This is an authorized level of take and if this level is exceeded, NMFS will be required to reinitiate consultation with the USFWS.

Seabird regulations were published in the Federal Register on December 19, 2005 (70 FR 75075). Fishery operations that are deep-set fishing north of 23º N latitude, are required to comply with seabird mitigation regulations that are intended to reduce interactions between seabirds and Hawaii-based longline fishing vessels (50 CFR parts 600 and 665). The regulations require that captains of deep-setting vessels 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, or a line shooter. Side-setting requires that gear be set from a station on the vessel's side at least one meter from the stern of the vessel while using a line shooter, bird curtain and weighted branch lines. These measures help deter birds from stealing bait. For a complete

description of the requirements please visit: www.fpir.noaa.gov/SFD/SFD_regs_2.html (2010 Seabird Compliance Guide). These requirements would remain in effect under all alternatives. Seabirds likely drown if the interaction occurs during gear deployment (setting), but during gear retrieval (hauling) seabirds may be only injured and released alive when fishermen promptly apply best practice seabird handling and release techniques. Based on observer data nearly all seabirds hooked or entangled in the deep-set fishery are dead. In 2011, only two birds were released alive and 46 were observed dead (http://www.fpir.noaa.gov/OBS/obs_hi_ll_ds_rprts.html). Most interactions occur during deployment of gear.

Impacts of Alternatives

Under the No-Action Alternative and Alternative 3, no changes to ESA-listed seabird interaction rates would be expected because no changes to the manner in which the fishery is conducted are expected. It is possible that an increase in the use of circle hooks in the deep-set fishery under Alternatives 2a and 2b may benefit seabirds by reducing the likelihood that they will be hooked. A recent study in the Atlantic pelagic longline fisheries investigated the effects of hook type on seabird interactions using data from the NMFS Southeast Fisheries Science Center Pelagic Observer Program from 1992 to 2009. Results consistently showed that J-hooks produced higher seabird interaction rates and had a higher chance of accidentally hooking or entangling seabirds than circle hooks, although the effects of hook type on seabird bycatch were not significant. The study confirmed that hook type was less important than other predictors such as latitude, longitude, month and year for estimating the probability of hooking or entangling seabirds. This study suggested that switching from tuna hooks to circle hooks might reduce seabird interactions in longline fisheries although the reduction might not be significant (Li et al. 2011). However, a direct comparison may not be appropriate since the Atlantic longline fishery interacts with gulls, shearwaters, petrels, brown pelicans and northern gamets whereas the deep-set fishery typically interacts with Laysan and black-footed albatross. Based on the lack of fishery interactions with ESA-listed seabirds and the conduct of the fishery is not expected to change, it's likely that the proposed changes to the fishing regulations would not trigger any of the section 7 reinitiation criteria.

## *5.4 Impacts on Other Seabirds*

Since 2004, the deep-set fishery has interacted with Laysan and black-footed albatrosses, the Red-footed and brown booby, and sooty shearwater. Table 15 provides the number of observed interactions (hooking and entanglement).

**Table 15. Observed seabird interactions in the deep-set fishery, 2004-2011.**

| Common name | Scientific name | Total observed interactions |
|---|---|---|
| Black-footed albatross | *Phoebastria nigripes* | 97 |
| Laysan albatross | *Phoebastria immutabilis* | 119 |
| Red-footed booby | *Sula sula* | 1 |
| Brown booby | *Sula leucogaster* | 1 |
| Sooty shearwater | *Puffinus griseus* | 23 |

Source: NMFS PIRO Observer Program (http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html)

Impacts of Alternatives
There is no relationship between seabird and swordfish incidental catch so an increase in the retention of swordfish under all action alternatives would likely not result in a change to current interaction rates. Based on the analysis for the Atlantic longline fisheries, switching from tuna hooks to circle hooks might reduce seabird interactions in longline fisheries although the reduction might not be significant therefore; any increase in the use of circle hooks, as may occur under Alternatives 2a and 2b may have conservation benefits compared with the No-action Alternative.

## *5.5 Impacts on Fishery Participants and Communities*

### 5.5.1 Hawaii Fishing Community

The Magnuson-Stevens Act defines a fishing community as "...a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community" (16 U.S.C. § 1802(16)). NMFS further specifies in the National Standard guidelines that a fishing community is "...a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries dependent services and industries (for example, boatyards, ice suppliers, tackle shops)" (50 CFR 600.345).

In 1998, the Council identified the islands of American Samoa, the Northern Mariana Islands, and Guam as fishing communities for the purposes of assessing the effects of fishery conservation and management measures on fishing communities, providing for the sustained participation of such communities, minimizing adverse economic impacts on such communities, and for other purposes under the MSA (64 FR 19067, April 19, 1999). In 2002, the Council identified each of the Islands of Kauai, Niihau, Oahu, Maui, Molokai, Lanai and Hawaii as a fishing community (68 FR 46112, August 5, 2003).

The city of Honolulu on the Island of Oahu is the base of the longline and other industrial-scale fleets and the center of the state's fish marketing/distribution network. However, the total number of pelagic fisheries-related jobs in the Honolulu metropolitan area compared to the overall number of jobs in the area is very small. In 2010, total population on the island of Oahu in 2010 was 953,207; approximately 70 percent of the total state population of 1.36 million people (DBEDT 2010). Thus, although Oahu has a larger number of participants that engage in deep-set longline fishing relative to the other islands in Hawaii, the island's level of dependence on it is lower due to the size and scope of Oahu's population and economy.

### 5.5.2 Economic Value of Hawaii longline fisheries

Hawaii's economy is dominated by tourism and defense, with tourism by far the leading industry in terms of employment and expenditures. Defense expenditures in 2009 is an estimated $8.3 billion (http://hawaii.gov/dbedt/info/economic/databook/db2010/db2010.pdf), while spending by visitors who travelled to Hawaii by air or cruise ship is estimated to be $11.1 billion

(http://hawaii.gov/dbedt/info/visitor-stats/visitor-research/2010-annual-visitor.pdf). The two represent the largest shares of direct income from "export" industries (http://hawaii.gov/dbedt/info/economic/databook/). Hawaii's Gross Domestic Products for 2010 and 2011 were $66.7 billion and $68.9 billion respectively.

The Hawaii pelagic fishery is the largest and most valuable commercial fishery sector in the State. It includes longline, troll, handline, and pole-and-line fishing. Honolulu has remained in the top 10 U.S. ports in economic value, reflecting the strong market demand and importance of fresh seafood. Target pelagic species include tunas and billfishes, but a variety of other species are important including mahimahi (dolphinfish), ono (wahoo), opah (moonfish), and monchong (pomfret), among others.

The Pacific Islands Fisheries Science Center's (PIFSC) website reports that Hawaii's commercial fisheries in 2010 landed about 27.9 million pounds of fish worth approximately $83.5 million. Of this, about 23.7 million pounds were pelagic fish with an ex-vessel value (price fishermen receive for fish) of a little more than $70 million for the Hawaii longline fleet (Table 16).

**Table 16. Hawaii commercial pelagic landings, revenue, and average price by fishery, 2009-2010.**

| | 2009 | | | 2010 | | |
|---|---|---|---|---|---|---|
| **Fishery** | **Pounds Landed (1000 lbs)** | **Ex-vessel Revenue ($1000)** | **Average Price ($/lb)** | **Pounds Landed (1000 lbs)** | **Ex-vessel Revenue ($1000)** | **Average Price ($/lb)** |
| Longline | 22,360 | $59,689 | $2.73 | 23,736 | $70,093 | $3.05 |
| MHI trolling | 2,964 | $5,130 | $2.45 | 2,813 | $5,562 | $2.60 |
| MHI Handline | 1,064 | $1,783 | $2.06 | 898 | $1,878 | $2.39 |
| Offshore Handline | 290 | $398 | $2.14 | 578 | $1,187 | $2.09 |
| Aku boat | 511 | $693 | $1.36 | --- | --- | --- |
| Other Gear | 162 | $241 | $2.15 | 304 | $621 | $2.21 |
| **Total** | **27,352** | **$67,935** | **$2.65** | **28,329** | **$79,343** | **$2.97** |

Source WPRFMC 2011 and unpublished

In 2010, the longline fisheries generated 88 percent of the State's commercial fishing revenues; therefore, they are the most economically important fisheries in Hawaii. In 2009, the landed value of the total Hawaii longline catch was worth $57.9 million, with over $6 million (10.5 percent) from the shallow-set fishery and almost $51.9 million (89.5 percent) from the deep-set tuna fishery (WPFMC 2011 and PIFSC unpublished). Of that amount, about $5.8 million (96 percent) of the shallow-set fishery landed value came from swordfish, while swordfish landings in the deep-set fishery were worth over $1 million (2 percent) of the total deep-set fishery revenues.(http://www.nmfs.hawaii.edu/wpacfin/hi/Data/Pelagic/hpel4.htm; accessed 3/20/2012).

The United Fishing Agency auction in Honolulu sells almost all of the Hawaii-based longline catch. It is believed that very little of the longline catch is directly marketed to retailers or exported by the fishermen (WPFMC 2009e). Rising fuel costs have seriously impacted the

longline industry, comprising approximately 40 percent of trip expenditure costs; up from 10 percent about four years ago (Arita et al. 2011).

The most recent estimate of the ex-vessel value of fish sold by the Hawaii-based longline fisheries are less than 1 percent of Gross State Product. On the other hand, the seafood industry is an important component of local and tourist consumption, and recreational and subsistence fishing activities are conducted by a substantial proportion of the local population

Impacts of the Alternatives

None of the proposed changes are expected to result in adverse effects to fishery participants or communities. Under the No-action Alternative, fishermen would continue to comply with the regulations limiting swordfish retention to 10 per trip. Compared to the No-action Alternative, Alternatives 2a, 2b (preferred) and 3 could have an economic benefit for the Hawaii deep-set longline fishery by enabling deep-set fishermen to retain and land more swordfish.

The level of potential increase in landed swordfish under each alternative is difficult to calculate, but is qualitatively expected to follow the level of restriction on swordfish retention. Compared to the No-action Alternative, the greatest potential for increased landings is under Alternative 3 (no swordfish limit), then Alternative 2b, and the least for Alternative 2a. If observed swordfish catch levels do not change from previous years and all discards are marketable, then landings would likely increase under all action alternatives. However, it is likely that not all discards would be marketable due to small size or other reasons; therefore, landings of swordfish would be less than the total estimated discards in recent years (Table 8).

Decisions made by fishermen about how many swordfish to retain are likely to be trip-specific, and may be based on factors such as available hold space (which may be related to the CPUE of tuna on that trip), catch rates for tuna on the trip, and potential price per pound at auction for each species. Thus, all alternatives would all be expected to increase the economic welfare of Hawaii longline fishery participants. Alternative 2a and 2b would result in some economic gain to the fishery as those vessels that already have circle hooks could retain and sell up to 25 swordfish per trip without the need to initially invest in circle hooks.

Based on the data in Table 9, between 20,000 and 83,000 lb of swordfish are discarded by the deep-set longline fishery annually, or an average of about 41,720 lb of swordfish. The discards are mostly small fish (known colloquially by fishermen as ‘rats’), with average weights ranging from 15 to 30 lbs. These small fish can be marketable or may be consumed by crew at sea. Small swordfish (less than 50 lb) sell at auction for about half the price per pound than fish larger than 50 pounds. Thus, taking half the 2010 average price for swordfish of $2.32/lb, gives a value range for the discards of $23,200 to $96,280 or an average of $48,395, if all of the swordfish currently discarded were landed and sold. Based on the average number of vessels that participate in the fishery (126) and the average value of the estimated discard ($48,395), the estimated additional annual revenue would be approximately $384 per vessel. This value assumes that no discarding would occur and is likely to be the maximum value gained from swordfish per vessel per year.

Under Alternative 3, all incidentally caught swordfish may be retained; therefore, the estimated maximum value of the discards may range from $23,200 to $96,280 or an average of $48,395, if all of the swordfish currently discarded were landed and sold. In terms additional annual revenue, each vessel may realize and average of approximately $384 per year (based on an annual average of $48,395 total additional revenue and 126 vessels in the deep-set fishery).

Under Alternative 2b, vessels that have an observer would be able to retain all swordfish and maximize their economic gain if they retain all swordfish. Vessels without an observer using circle hooks could retain up to 25 swordfish per trip, but would need to discard fish after the limit is reached. Therefore, the estimated annual value gained for the entire fleet may be less than $48,395. Economic gain under Alternative 2a would be lower than Alternative 2b and 3 since only those vessels with circle hooks would be able to retain 25 swordfish per trip.

There would be an upfront cost to those fishermen who wish to switch to circle hooks in order to retain more than 10 swordfish, but they would begin to realize economic benefits after recovering the cost of hooks through the increase in swordfish revenues. Under Alternatives 2a and 2b, the opportunity to retain additional swordfish may be an incentive for fishermen to change from tuna hooks to circle hooks. Under Alternatives 2a and 2b, the opportunity to retain additional swordfish may be an incentive for fishermen to change from tuna hooks to circle hooks. A typical deep tuna set employs about 2,192 hooks, based on tabular summaries for the deep-set at http://www.pifsc.noaa.gov/fmsd/reports.php. Hook costs may vary quite widely depending on the manufacturer and supplier. For example, using catalog prices for sizes 13/0-16/0 Mustad circle hooks[3], the cost of converting over to circle hooks would range from about $876 to $1,315; depending on what size circle hooks were used. This range of values is based on the cost per individual hook ($0.40 for 13/0, $0.45 for 14/0, $0.55 for 15/0, $0.60 for 16/0) and does not consider discounts for bulk buying which may be in the vicinity of 13 to 17 percent.

It is expected, though, that for some percentage of Hawaii longline fishing operations, increasing the number of swordfish that can be retained would not be a sufficient incentive to adopt circle hooks, as they may prefer to keep using current gear. There may be a learning curve associated with the use of circle hooks and so some fishermen may prefer to use gear that is familiar to them. In addition, tuna hooks may be seen as superior in terms of their effectiveness and they have been reported by some to be easier to bait. In other words, the decision to switch to circle hooks may not be based on one factor or incentive alone. The typical deep-set longline vessel could expect to recover the initial cost of switching from tuna to circle hooks in about three years if initial cost ranged from $876 to $1,315. Initial hook cost may exceed this range, dependant on manufacturer and hook type that is chosen. There would also be hook replacement costs to consider. Based on this analysis, there appears to be little economic incentive for fishermen who are using tuna hooks to voluntarily switch to circle hooks in order to qualify to retain additional swordfish. Nevertheless, the Alternative 2a and 2b would give those fishermen using circle hooks and/or carrying an observer the opportunity to retain more swordfish than at present.

This action will likely have a negligible impact on the overall supply of swordfish, both locally and nationally, and will not directly influence the price that consumers pay for swordfish. As noted earlier, the deep-set longline fishery lands far fewer swordfish than the shallow-set

[3] Pacific Ocean and Marine, Honolulu, Hawaii (http://www.pop-hawaii.com)

longline fishery that targets swordfish. Furthermore, in recent years, an average of just over 41,720 lb or 18.9 mt of swordfish was discarded. Even if the deep-set fishery had been able to keep the discards, this value is very small relative to the 1,600 mt of North Pacific swordfish landed by U.S. fishermen in 2010. The majority of discarded swordfish that could be retained under any of the action alternatives are likely to be of lower value than swordfish retained by both the shallow-set and deep-set fishery.

In 2011, Amendment 5 to the Pelagic FEP defined deep-set fishing activity south of the Equator and implemented a trip limit of 10 swordfish per trip. If the propose action is implemented, the regulations would only apply to longline fishing north of the Equator, because specific rules on the retention of swordfish and gear configurations apply to longline fishing south of the Equator (see 50 CFR 665.813(k)). Therefore vessels would need to follow the trip limits based on the area fished.

### 5.5.3 Environmental Justice

"On February 11, 1994, President Clinton issued Executive Order 12898 (E.O. 12898), "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." E.O. 12898 provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." E.O. 12898 also provides for agencies to collect, maintain, and analyze information on patterns of subsistence consumption of fish, vegetation, or wildlife." No environmental justice issues were revealed by this environmental analysis. The proposed changes are voluntary whereby fishermen would be provided the opportunity to retain all swordfish if an observer is aboard the vessel regardless of the type of hook used, or to invest and use only circle hooks to retain 25 swordfish if an observer is not aboard the vessel. All other measures applicable to the deep-set fishery would remain unchanged, including the trip limit of 10 swordfish regardless of hook type or if an observer is on the vessel. The requirements apply only to Hawaii longline permit holders. The proposed changes would not change the manner in which the fishery is conducted, and would not have large environmental effects that could result in a disproportionate and adverse effect on minority populations or low-income populations. There is no subsistence fishery that would be affected by the proposed action.

### 5.5.4 Executive Orders 12866

To meet the requirements of E.O. 12866 of September 30, 1993, "Regulatory Planning and Review," NMFS prepares a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. This includes an analysis of the economic effects of the preferred and alternative actions, in contrast to taking "no action". The review provides an overview of the problem, policy objectives, and anticipated impacts of the action, and ensures that management alternatives are systematically and comprehensively evaluated so that the public welfare can be enhanced in the most efficient and cost-effective way.

In accordance with E.O. 12866, the following is set forth: (1) this action is not likely to have an annual effect on the economy of more $100 million or to adversely affect in a material way the

economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) this action is not likely to create any serious inconsistencies or otherwise interfere with any action taken or planned by another agency; (3) this action is not likely to materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights or obligations of recipients thereof; and (4) this action is not likely to raise novel or policy issues arising out of legal mandates, or the principles set forth in the Executive Order. Based on the information contained in this environmental assessment, the initial findings of this action are determined to not be significant under E.O. 12866. The preferred alternative is preliminarily determined to not be significant.

### 5.5.5 Regulatory Flexibility Act

The Regulatory Flexibility Act, 5 U.S.C. 601 *et seq*. (RFA), requires government agencies to assess the expected economic impact of the various regulatory alternatives on small entities, including small businesses, small organizations, and small governmental jurisdictions; and to determine ways to minimize adverse impacts. The assessment is done via the preparation of an Initial Regulatory Flexibility Analyses (IRFA) and Final Regulatory Flexibility Analysis (FRFA) for each proposed and final rule, respectively. Under the RFA, an agency does not need to conduct an IRFA or FRFA if a certification can be made that the proposed rule, if adopted, will not have a significant adverse economic impact on a substantial number of small entities.

All vessels having the potential to participate in this fishery are considered to be small entities under the current Small Business Administration definition of small fish-harvesting businesses, that is, their gross receipts do not exceed $4.0 million. NFMS has determined that the draft proposed rules would not have a significant adverse economic impact on a substantial number of small entities. This action has been certified as not expected to have significant impacts to small entities. As a result, an initial regulatory flexibility analysis is not required and none has been prepared.

### 5.5.6 Administrative Procedures Act

All federal rulemaking is governed under the provisions of the Administrative Procedures Act (APA) (5 U.S.C. Subchapter II) which establishes a “notice and comment” procedure to enable public participation in the rulemaking process. Under the APA, NOAA Fisheries is required to publish notification of proposed rules in the Federal Register and to solicit, consider and respond to public comment on those rules before they are finalized. The APA also establishes a 30-day wait period from the time a final rule is published until it becomes effective, with rare exceptions.

This environmental assessment complies with the provisions of the APA through the use of public meetings, requests for comments, and consideration of comments. The proposed rule associated with this action will have a request for public comments and be posted in the Federal Register and will be available at http://www.regulations.gov under RIN 0648-BB48. The environmental assessment will be made available with the proposed rule. If the action is approved by the Secretary of the Department of Commerce, a final rule will be announced in the Federal Register which will likely have a 30-day delay before the final rule becomes effective.

### 5.5.7 Coastal Zone Management Act

The principal objective of the Coastal Zone Management Act (CZMA) is to encourage and assist states in developing coastal management programs, to coordinate state activities, and to safeguard regional and national interests in the coastal zone. Section307(c) of the CZMA requires that any Federal activity affecting the land or water uses or natural resources of a state's coastal zone be consistent with that state's approved coastal management program, to the maximum extent practicable.

The proposal to allow deep-set tuna fishers to retain additional numbers of incidentally caught swordfish is a relatively minor action that is not expected to result in a change to the way the fishery is conducted including the number of vessels, areas fished, duration of trips, or number of hooks set. Alternatives 2a and 2b are expected to result in some conservation benefits to sea turtles, and possibly marine mammals and birds, if fishermen replace J-hooks with circle hooks. There would be no change to the State's coastal zone.

NMFS preliminarily determined that the proposed action would not affect the land or water uses or natural resources of the coastal zone and is consistent with Hawaii's coastal zone management program. A copy of this document will be submitted to the Hawaii Coastal Zone Management Office for review and concurrence with a determination that the preferred alternative is consistent to the maximum extent practicable with Hawaii's coastal zone management programs and that the proposed rules would not affect the land, water uses, or natural resources of the coastal zone.

### 5.5.8 Paperwork Reduction Act

The purpose of the PRA is to reduce information collection burdens on the public; increase program efficiency and effectiveness; and improve the integrity, quality, and utility of information to all users within and outside the agency, including capabilities for ensuring dissemination of public information, public access to government information, and protections for privacy and security. The Act is intended to ensure that the information collected under the proposed action is needed and is collected in an efficient manner (44 U.S.C. 3501(1)). This action does not propose new or revise the collection of information requirements, therefore; no additional burdens would be placed on the public. Fishery participants will still be required to report species caught, discarded, and sold, while deep-set fishing including logbooks, sales reports, and protected species interactions.

## *5.6 Impacts on Administration and Enforcement*

Under the No-action Alternative, the swordfish limit would continue to be monitored through at-sea and dockside verifications by NOAA's Office of Law Enforcement (OLE), and fishery logbook monitoring. Bycatch and landings will also continue to be reported by fishermen, and logbook and observer data will continue to be monitored by the Council, the State, and NMFS.

If any of the action alternatives is approved, there would be an initial requirement for OLE, vessel owners, and operators to be informed of any regulatory changes. Alternatives 2a and 2b (preferred) would have a minor impact to the current administrative burden for enforcement officials who monitor fishery landings to ensure compliance with the trip limit. There is already a

need to enforce compliance with the trip limit, but the additional administrative burden would be to conduct intermittent checks to compare swordfish landings with gear to make sure that circle hooks are in use and/or an observer was on board, as appropriate. NMFS would incur minor and temporary increases in the administrative burden to inform fishermen of any changes to fishery regulations. This would probably be in the form of developing an updated compliance guide pamphlet to be provided to fishermen.

None of the alternatives would require additional costs to the NMFS Observer Program. Notification by fishermen to arrange for possible observer placement on deep-set vessels would still be required before trip departure. The potential to land more swordfish on an observed deep-set trip, regardless of hook type, may create an incentive for fishermen to request an observer deployment. NMFS would not accommodate specific requests to carry an observer. NMFS would continue to place observers on vessels at random to maintain the integrity of the randomized observation and fishery sampling protocols, and allow NMFS and the Council to continue to conduct comparable catch and discards estimation modeling.

Alternative 2b (which allows unlimited retention of incidentally caught swordfish if an observer is aboard the vessel) could introduce biases in the bycatch expansion estimates for catch and discards across the fleet, particularly for swordfish discard size frequencies; this will need to be considered in future expansions of observer data. All of the alternatives would increase the administrative burden on the PIFSC as fishery scientists would need to adjust bycatch and discard estimates for the fishery in accordance with the change in the discard that is expected under each alternative. Alternative 2b would have two different types of discard situation. Changes that would need to be made would be changes to database programming and staff time. The cost estimate for this is unknown but is expected to be relatively small.

Alternatives 2a and 2b could reduce the burden of regulatory discard. Alternative 3 would remove the burden on fishermen to comply with retention limits. NMFS OLE and the Coast Guard are concerned that Alternative 3 could present monetary incentives that encourage switching to shallow-set fishing by some fishers in contravention of the regulations[4]. Although this activity could occur under Alternative 2a and 2b, the economic benefits gained by targeting swordfish would be minimal under those alternatives since the potential for a large number of swordfish to be retained and landed would be low. Moreover, at-sea inspections by the U.S. Coast Guard can involve checking the gear specifications to ensure they conform to the required minimum floatline length (20m) and the minimum number of hooks between floats (15 hooks per basket).

## *5.7 Impacts on Marine Habitat*

None of the alternatives considered would impact the marine habitat, particularly critical habitat, essential fish habitat (EFH), habitat areas of particular concern (HAPCs), marine protected areas (MPAs), marine sanctuaries, or marine monuments. Fishing activity would not occur in identified critical habitat, so no critical habitat would be impacted by the proposed regulatory

[4] In a Joint Enforcement Meeting held at the Western Pacific Regional Fishery Management Council office, February 17, 2010, concerns were expressed that removing the swordfish limit could, unintentionally, provide an economic incentive to re-rig gear at sea for shallow-set fishing, but see above.

changes. Longline fishing does not occur in MPAs, marine sanctuaries or marine monuments so no marine protected areas would be impacted.

All longliners occasionally lose hooks and other gear while fishing. Fishermen do try to recover all gear, and are normally successful – as the floats used in the fishery are marked to be visible from distance, even at night. Based on unpublished data from NMFS PIFSC, from 14,215 and 49,370 hooks were lost annually between 2001 and 2009 within the action area, or an average of about 7.3 hooks per set. Lost hooks are unlikely to have a major impact to the physical marine environment. First, hooks are not expected to continue ghost fishing indefinitely since baits would decompose. Second, hooks are expected to decompose over time. Most J and circle hooks are composed of steel and, depending on quality, the hooks will corrode. Hooks on the deep sea bed in water just above freezing, will corrode more slowly, and stainless steel hooks will corrode at a slower rate than non-stainless steel hooks.

The proposed change in the regulations to allow the retention of additional swordfish that are caught incidental to tuna fishing is not expected to change the conduct of the fishery, so there is not likely to be any change to the amount of accidental gear loss that the fishery experiences. The change from J-hooks to circle hooks is also not expected to increase the likelihood that gear would be lost. The change would also not affect the ability of fishermen to retrieve gear that has separated.

### 5.7.1 Impacts on Essential Fish Habitat

This action is not expected to have adverse impacts on essential fish habitat (EFH) or habitat areas of particular concern (HAPC) for species managed under the Pacific Pelagics Fishery Ecosystem Plan (Table 17). The same level of protection to EFH and HAPC provided under the current Pelagic FEP would be maintained. Pelagic fishing usually occurs in deep water environments (greater than 1,000 m) and do not typically make contact with coral or rock substrate, therefore; EFH and HAPCs identified in Table 17 would not be altered or substantially impacted. The proposed regulatory changes are not expected to lead to substantial changes in fishing activity, thus are not likely to lead to substantial physical, chemical, or biological alterations to the pelagic EFH or HAPC.

**Table 17. EFH and HAPC for species managed under the Pelagics, American Samoa, Hawaii, Marianas or Pacific Remote Islands Area Fishery Ecosystem Plans.**

| SPECIES GROUP | EFH (juveniles and adults) | EFH (eggs and larvae) | HAPC |
|---|---|---|---|
| Pelagics | Water column down to 1,000 m | Water column down to 200 m | Water column down to 1,000 m that lies above seamounts and banks with summits shallower than 2,000 m within the EEZ. |

| SPECIES GROUP | EFH (juveniles and adults) | EFH (eggs and larvae) | HAPC |
|---|---|---|---|
| Bottomfish | Water column and bottom habitat out to a depth of 400 m | Water column down to 400 m | All escarpments and slopes between 40-280 m, and three known areas of juvenile opakapaka habitat |
| Seamount Groundfish | Water column and bottom from 80 to 600 m, bounded by 29 deg N-35 deg N and 171 deg E -179 deg W (adults only) | Epipelagic zone (0-200 nm) bounded by 29 deg 35 deg N and 171 deg E -179 deg W (includes juveniles) | Not identified |
| Precious Corals | Keahole, Makapuu, Kaena, Wespac, Brooks, and 180 Fathom gold/red coral beds, and Milolii, S. Kauai and Auau Channel black coral beds | Not applicable | Makapuu, Wespac, and Brooks Bank beds, and the Auau Channel |
| Crustaceans | **Lobsters:** Bottom habitat from shoreline to a depth of 100 m<br><br>**Deepwater shrimp:** The outer reef slopes at depths between 300-700 m surrounding every island and submerged bank in the Western Pacific Region | Water column down to 150 m<br><br>Water column and associated outer reef slopes between 550 and 700 m surrounding every island and submerged banks in the Western Pacific Region | All banks within the Northwestern Hawaiian Islands with summits less than 30 m<br><br>No HAPC designated for deepwater shrimp. |
| Coral Reef Ecosystems | Water column and benthic substrate to a depth of 100 m | Water column and benthic substrate to a depth of 100 m | All Marine Protected Areas identified in the FEP, all PRIAs, many specific areas of coral reef habitat (see FEP) |

Note: All areas are bounded by the shoreline, and the seaward boundary of the EEZ, unless otherwise indicated.
Source: WPFMC 2009a, WPFMC 2009b, WPFMC 2009c, WPFMC 2009d, and WPFMC 2009e

## *5.8 Cumulative Impacts*

Apart from the Hawaii-based shallow-set fishery, there are no other major U.S. swordfish fisheries in the western Pacific Ocean. The American Samoa longline fishery catches a small volume of swordfish amounting to about 13.7 mt annually between 2001 and 2008 (from data in WCPFC 2010), which is marketed locally in American Samoa. As noted in Section 4.0, there are modest landings of swordfish from the California large mesh drift gillnet fishery, and the occasional recreational catch of swordfish along the U.S. West Coast.

There is also a single longline vessel fishing for tuna on the high seas beyond the U.S. EEZ along the West Coast of the Unites States. This vessel operates under the Pacific Fishery Management Council's (PFMC) Fishery Management Plan for the U.S. West Coast Fisheries for Highly Migratory Species. The vessel is authorized to fish with deep-set gear. NMFS recently revised

regulations that govern the fishery operating in the Eastern Tropical Pacific to maintain a trip limit of 10 swordfish if the vessel fishes with tuna hooks, 25 swordfish per trip with circle hooks, and no limit if the vessel carries an observer (77 FR 15973, March 19, 2012). Please visit http://www.pcouncil.org/hms/hmsfmp.html for more information. Since this vessel's incidental catch is low the impact of its activity would not result in a large adverse cumulative effect.

The Consolidated and Further Continuing Appropriations Act, 2012 was approved on November 18, 2011. Section 113 of the Act authorized the U.S. Participating Territories of the Commission to assign their catch limits through arrangements with U.S. longline vessels through 2012. In November 2011, an agreement was developed between the Hawaii Longline Association and the Government of American Samoa. This action provided opportunity to Hawaii-based deep-set longline vessels to continue fishing for bigeye tuna in the WCPFC Convention area throughout 2011. It's likely that similar arrangements would be made in 2012 and in the future if Section 113 of the Act is extended beyond 2012. However, incidental catch rates of swordfish would likely not change as a result of these arrangements and not result in a large adverse cumulative effect.

Large changes in swordfish price per pound are not expected. It is unlikely that the market for swordfish would see a substantial increase in swordfish landings as a result of the proposed regulatory changes because the additional number of marketable swordfish is not expected to be large.

None of the alternatives would change the manner in which the fishery is conducted that would affect the catch or stock status of target stocks (bigeye and yellowfin tuna). There would be no difference in catch rate if fishermen were to change to circle hooks. For these reasons, none of the alternatives would result in a large adverse cumulative effect when other impacts to tuna stocks are considered.

Impacts to non-target, incidentally-caught swordfish are not expected to be large and adverse because the fishery effort is not expected to change and incidental catch rates will remain the same; targeting of swordfish is not likely; only 9.2 percent of fishing trips catch more than 25 swordfish per trip; and finally, the current harvest of swordfish is well below maximum sustainable yield of the North Pacific stock and the total estimated catch would be minor in comparison with the amount of fish that could be harvested sustainably. The effects of allowing additional swordfish to be retained by the fishery were considered against the total catch of swordfish in the Pacific and no cumulative effects on swordfish stocks were found.

None of the alternatives is expected to change impacts of the fishery on other non-target species because the use of circle hooks is not expected to change the catch rate of non-target species. For this reason, no cumulative impact to other non-target species was found. Similarly, because the effort is not expected to change, no impacts to protected resources, when considered cumulatively, are anticipated. Protected species interactions in this fishery are minimal and would continue to be. As discussed in Section 5.3, an increase in the use of circle hooks in the fishery has the potential to reduce the severity of interactions with protected species. However, any change in the use of circle hooks would be gradual and the potential cumulative benefits would be minor.

Potential future actions that may affect the deep-set fishery include the following:

1. False Killer Whale Take Reduction Plan: In 2010, NMFS convened a False Killer Whale Take Reduction Team (TRT), pursuant to the Marine Mammal Protection Act, to develop recommendations to reduce the number and severity of false killer whale interactions in the Hawaii-based commercial longline fisheries (NMFS 2011). As part of the consensus recommendations, the TRT recommended that NMFS require the use of circle hooks (16/0 or smaller) in the deep-set longline fishery and, if a specified number of interactions occur, an area south of the main Hawaiian Islands would be closed for the remainder of the year. NMFS published a proposed rule with these and other measures as part of the False Killer Whale Take Reduction Plan (FKWTRP; 76 FR 42082, July 18, 2011).

   This EA considers the potential impact on the environment of the proposed increase in the allowable swordfish retention limit that would occur, whether or not a100 percent circle hook requirement were to be implemented in the future through the FKWTRP. The proposed circle hook requirements would not result in a large adverse cumulative effect.

2. Proposed responsible territorial charter fishing: The Council is considering a proposal to establish annual longline bigeye catch limits of 2,000 mt for the U.S. Pacific Island Territories of American Samoa, Guam, and Commonwealth of the Northern Mariana Islands (the Territories and Commonwealth) and provide limited authority to the Territories and Commonwealth to assign up to 750 mt per year of their annual longline bigeye catch limits through domestic charter arrangements or similar mechanisms that would only be available to U.S. vessels that are Federally permitted under the Pelagic FEP. That measure would undergo project-specific review and would consider the current fishery conditions. A decision on the swordfish limits would not interact with or preclude decisions that would be made regarding responsible territorial charter fishing.

3. Potential changes to the bigeye tuna catch limits: The Western and Central Pacific Fisheries Commission will discuss the continuation of Conservation Management Measures that established bigeye tuna limits for longline fisheries operating in the Convention Area of the Western and Central Pacific Ocean. The WCPFC approved a catch limit of 3,763 mt for 2012 during their March, 2012 meeting. NMFS will implement this limit in the near future. The new limit would not affect the usefulness of the proposed measures to change the swordfish limit and the proposed swordfish limits would not affect implementation of a bigeye tuna catch limit. Therefore, no additional consideration of the bigeye tuna limit is analyzed in this document.

### 5.8.1 Climate Change Impacts

Impacts of climate change on swordfish have not been specifically investigated. However, none of the proposed alternatives would change the conduct of the deep-set fishery because they would only result in the retention of additional swordfish that were already caught and, in some cases, result in additional vessels fishing using circle hooks. The location of fishing, duration of

trips, and number of sets made are not likely to change. Therefore, there would not be any increases in emissions.

There are no specific studies about the potential impacts on swordfishes, tuna, other fishes, or protected species, of potential changes in ocean circulation patterns, nutrient changes, or changes in ocean chemistry (e.g., increasing acidity). In general, it has been shown that large scale climate cycles can impact winds, currents, ocean mixing, temperature regimes, nutrient recharge, and affect the productivity of all trophic levels in the North Pacific Ocean (Polovina et al. 1994). Ocean changes can also affect the distribution and abundance of species.

Changes in oceanographic conditions may alter rates of direct and incidental harvests or interactions with marine resources in commercial fisheries. Ocean climate fluctuations that change the habitat quality or the prey availability of ocean resources have the potential to affect a species short- or long-term distribution and abundance. The magnitude of potential effects is uncertain, but these impacts would be expressed as variability in stock size, recruitment, growth rates, or other factors for marine species in stock assessment reviews.

Bigeye and yellowfin tuna, and swordfish as well as non-target fishes and protected species that interact with the fishery may be affected by any large-scale climate fluctuations and would continue to be affected in the same way regardless of which alternatives are selected for implementation. Climate change may affect marine mammals in a similar way – affecting their distribution, prey abundance, and other features. As with fishes, impacts of climate change are not expected to interact with the proposed increased swordfish retention limit to cause large changes to the manner in which the fishery interacts with marine mammals.

Climate change is likely beginning to affect sea turtles found in the action area through the impacts of rising sand temperatures, rising sea level, increased typhoon frequency, and changes in ocean temperature and chemistry (NMFS 2012). Current analyses of the impacts of climate change on sea turtle populations can be found in NMFS 2012 BiOp for the continued operation of the Hawaii-based Shallow-set Longline Swordfish Fishery.

Work continues in developing climate change forecasts. Polovina et al. (2011) developed a climate model that projects expansion of the subtropical biome. The model estimates a 30 percent expansion by 2100, coupled with a 34 and 28 percent decrease in the temperate and equatorial upwelling biomes by 2100, respectively. Over the next century, the model estimated that total biome primary production and fish catch will increase by 26 percent in the subtropical biome, decrease by 38 percent in the temperate biome, and decrease by 15 percent in the equatorial upwelling biome. While the primary production per unit area will decline slightly in the subtropical and temperate biomes, it will increase by 17 percent in the equatorial upwelling biome. Two areas where the subtropical biome boundary will exhibit the greatest movement is in the northeast Pacific, where it will move northward by as much as 1,000 km/100 yrs; and at the equator in the central Pacific, where it will move eastward by 2,000 km/100 yrs. Lastly, by the end of the century, there are projected to be more than 25 million square kilometers of water with a mean SST of 31 deg C in the subtropical and equatorial upwelling biomes, representing a new expansion of warmer habitat.

Overall, the total North Pacific fish catches are projected to decline about 7 percent over the century, compared to about a 4 percent decline in primary production. The 7 percent decline incorporates both the decline in primary production and the replacement of 8.3 million $km^2$ of temperate habitat with subtropical habitat that is estimated, based on empirical fish catches, to produce only 62 percent of the temperate fish catch. So, from the perspective of the total North Pacific, fish catches are projected to decline only modestly over the century. Although in the face of rising demand for fish, this could mean additional fishing pressure. If the status of North Pacific swordfish or tuna were to change, international management measures would likely be implemented. The U.S. is a member of the WCPFC; therefore, any swordfish or tuna conservation measures implemented by this RFMO would likely be implemented as domestic measures, potentially changing current domestic limits for swordfish. Such limits would help to ensure that domestic swordfish and tuna fisheries remain sustainable.

In comparison to the fish catches, from a biome perspective things look very different. The temperate biome supports many species that are important to fisheries including salmon, pomfret, albacore, bluefin tuna, swordfish, and squids. The reduction by more than one third in the carrying capacity of this biome and its fish catches will raise severe challenges for resource managers who will need to substantially cut fishing effort and quotas to respond to this slow long-term declining trend. Some species may be able to move northward into the Bering Sea or arctic waters, but that would involve changes in migration patterns and adaptation to new ecosystems. Many species including salmon, squids, albacore, bluefin tuna, swordfish, and tropical sea birds that use the temperate biome as foraging habitat will find this foraging habitat reduced by one third. Further, these same aquatic and seabird species have spawning habitat well to the south of Hawaii, in low latitudes, and breeding is linked to equatorial or other regional oceanographic processes. These animals and their offspring may be affected by the distance between their spawning or breeding habitats and their foraging habitats. Some species could incur greater bioenergetic costs associated with their migrations if the adults forage in temperate waters that move even farther north.

The proposed measures would not result in substantial changes in greenhouse gas emissions since deep-set fishing activity (number of vessels, area, days, sets, or hooks fished) are not expected to change under any of the alternatives.

Climate change impacts would not affect the efficacy of the proposed regulatory amendment in reducing regulatory discard (waste), encouraging the use of circle hooks, or in promoting enhanced conservation of protected species, especially sea turtles. Impacts to swordfish that occur because of changing environmental conditions would environmental changes due to climate change adjust the environmental impact findings of the measures largely because the measure allows retention of swordfish already hooked in the conduct of deep-set tuna fishing, and swordfish stock assessments would continue to take into account bycatch and non-target catch of swordfish in the deep-set fishery. If swordfish stocks were to decline, the Council could adjust fishery management measures as necessary to ensure long-term sustainability of the deep-set fishery.

# 6.0 Consistency with other statutes

## *6.1 National Environmental Policy Act*

The proposed regulatory changes for the management of the Hawaii deep-set longline fishery under the Council's Pelagic FEP includes an environmental assessment that has been written and organized in a way that meets the requirements of the National Environmental Policy Act (NEPA). This document will be used by NMFS to determine whether or not the proposed changes to the regulations concerning swordfish retention limits in the Hawaii-based deep set tuna fishery would result in a significant environmental impact that would require the preparation of an environmental impact statement.

In general, the analysis showed the proposed action would likely not result in a change of fishing practices. This resulted in the conclusion that none of the proposed alternatives would have large adverse effects on target, non-target species, endangered species, marine mammals, or seabirds. Fishermen would be allowed to retain swordfish that are already caught incidental to deep-set fishing and provisions remain that would prevent fishermen from targeting swordfish. All of the alternatives that allow an increase in the retention limit would result in a small amount of new fishery-related mortality due to some fish being retained that otherwise would have been discarded alive. The number of fish in this category is very small; however, compared to the opportunity for fishermen to retain fish that were brought aboard already dead. The additional mortality is a discountable amount that would not affect stock status of North Pacific swordfish. The overall amount of additional swordfish landed is not expected to result in large changes to markets that might adversely affect market prices for swordfish, including prices in the shallow-set fishery. The proposed action would provide incentives for tuna fishermen to switch to circle hooks.

The proposed action would not adversely affect any places or objects listed in the National Register of Historic Places because no such places or objects are known to exist in the action area. In addition, the proposed action would not result in the loss or destruction of significant scientific, cultural, or historical resources.

### 6.1.1 Purpose and Need for Action

The purpose and need for this action are described in Section 1.1

### 6.1.2 Alternatives Considered

The alternatives considered for this action are described in Section 2.0

### 6.1.3 Affected Environment

The affected environment for this action, including a description of the Hawaii longline fisheries, is described in Sections 3.0 and 4.0 and 5.0.

### 6.1.4 Impacts of the Alternatives

The expected impacts of the alternatives on the environment are described in Section 5.0.

### 6.1.5 Public Coordination

The proposed measure was deliberated at several of the Council's and the SSC's public meetings. These meetings are described in Section 2.1. The proposed regulations will be announced in the Federal Register and online at www.regulations.gov for public comment. The EA will also be available to the public in association with announcement of the proposed regulations. Comments on the proposed regulations will be considered before final agency action. A copy of the document can be obtained by contacting the responsible official or online at: http://www.regulations.gov under Regulatory Identification Number (RIN) 0648-BB48.

### 6.1.6 Coordination with other agencies

The proposed action described in this EA was developed in coordination with various federal and local government agencies that are represented on the Western Pacific Fishery Management Council. Specifically, agencies that participated in the deliberations and development of the proposed management measures include:

- American Samoa Department of Marine and Wildlife Resources
- Guam Department of Agriculture, Division of Aquatic and Wildlife Resources
- Hawaii Department of Land and Natural Resources, Division of Aquatic Resources
- Hawaii Coastal Zone Management Program
- National Oceanic and Atmospheric Administration
- Northern Mariana Islands Department of Land and Natural Resources, Division of Fish and Wildlife
- U.S. Coast Guard
- U.S. Fish and Wildlife Service
- U.S. Department of State

## *6.2 MSA National Standards*

The MSA provides ten National Standards for management of U.S. fisheries. Fishery management plans and fishery management regulatory changes must comply with these Standards. The following is an analysis of the proposed regulatory changes under the preferred alternative and their compliance with these Standards.

*National Standard 1 states that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.*

The preferred alternative is consistent with NS1 since the most recent stock assessments for swordfish indicate that the North Pacific swordfish stock is not experiencing overfishing, overfished, or approaching an overfished condition. The current annual catch by U.S. fisheries for North Pacific swordfish are well below their optimum yield. In other words the current levels of fishing effort directed at swordfish in the North Pacific was likely sufficient to conserve the swordfish stocks (or stock) while providing for a sustainable fishery. North Pacific swordfish is caught incidentally by the Hawaii deep-set tuna longline fishery, and the additional retention of

swordfish under the preferred alternative would not contribute substantially to the level of fishing mortality for North Pacific swordfish because the fish are already caught. The amendment seeks to increase the allowable retention to obtain the optimum yield of the swordfish stock.

*National Standard 2 states that conservation and management measures shall be based upon the best scientific information available.*

The preferred alternative is consistent with NS2 since it is based on the best scientific information available. The main source of fishery management information is the Hawaii longline logbooks, supplemented by NMFS observer data, which together provide an estimate of the numbers of swordfish caught, retained, and discarded in the fishery. Additional swordfish targeting fishery information was utilized to characterize the use of the resource and the effects of the proposed regulations. Additional information was obtained from scientific literature regarding stocks status, and protected species. The existing biological evaluations of the fisheries provide additional information about interactions between the fishery and protected species. The most recent economic and social information was also utilized to assess the effects of the proposed regulations.

*National Standard 3 states that, to the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.*

The North Pacific swordfish stock is a highly migratory species, exists throughout the North Pacific Ocean, and is managed as a unit throughout its range. The preferred alternative is consistent with NS3 since management of the North Pacific swordfish stock is conducted through the international tuna Regional Fishery Management Organizations (RFMOs), namely the Western and Central Pacific Fishery Commission in the Western and Central Pacific Ocean and the Inter-American Tropical Tuna Commission in the Eastern Pacific Ocean. The United States is a member of both tuna RFMOs and abides by any international conservation and management measures stemming from these organizations. Any measures developed by the Council would adhere to established measures and consider stock assessments provided by the RFMOs.

*National Standard 4 states that conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.*

The preferred alternative is consistent with NS4 as the management measure does not discriminate between residents of different States. The alternatives would apply to Hawaii longline permit holders which reside in different States, Territories, and the Commonwealth of the Northern Mariana Islands.

*National Standard 5 states that conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.*

The preferred alternative is consistent with NS5 as it considers the most efficient way to manage the Hawaii deep-set tuna longline fishery and the manner in which resources are harvested. Economics is not the sole purpose of the proposed measures, rather; the intent is to utilize fishery and fish stock resources in an efficient manner by reducing regulatory discards and harvest the optimum yield with minimal costs. The preferred alternative would allow fishermen to retain non-target fish and increase economic gain without substantially changing fishing practices. The preferred alternative also provides some additional conservation benefits to sea turtles.

*National Standard 6 states that conservation and management action shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources and catches.*

The preferred alternative is consistent with NS6. The proposed measures support a flexible management regime by providing fishermen choices to either 1) retain 10 swordfish without an investment in new gear (status quo); 2) invest in some new gear to retain 25 swordfish while mitigating impacts to sea turtles or; 3) retain all marketable swordfish if a NMFS observer is aboard the vessel to observe sea turtle impacts. The preferred Alternative (2b) accounts for variations and contingencies in stock availability, marketability, and the desire for future investments in an existing fishery. The proposed changes are voluntary whereby fishermen would be provided the opportunity to retain all swordfish if an observer is aboard the vessel regardless of the type of hook used, or to invest and use only circle hooks to retain 25 swordfish if an observer is not aboard the vessel. All other measures applicable to the deep-set fishery would remain unchanged, including the trip limit of 10 swordfish regardless of hook type or if an observer is on the vessel. These opportunities would allow fishermen to take advantage of the seasonal availability (more abundant in the winter and early spring) and available markets throughout the year.

*National Standard 7 states that conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.*

The preferred alternative is consistent with NS7 as it considers the minimization of costs and duplicative measures. It would not increase the cost of administration or enforcement in the long-term and fishermen are not required to invest in new gear to comply with the proposed measures. The preferred alternative would not have a major influence on fishermen's behavior, other than providing an incentive to switch from using conventional tuna hooks to using circle hooks and thus benefit from being able retain more than 10 swordfish per trip. The preferred alternative does not require changes in fishing effort nor compels fishermen to switch to circle hooks. It allows fishermen to retain all swordfish regardless of hook type if they are carrying a NMFS observer. Observer coverage for the deep-set fishery would not change as a result of the proposed measures and the program would continue to record interactions with all protected species.

*National Standard 8 states that conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities*.

The preferred alternative is consistent with National Standard 8 as it considers the benefits to the deep-set tuna longline operators and minimizes adverse economic effects. Sustained participation would be supported by the action as the amendment would retain the current swordfish limit (10), but would allow operators to retain in excess of 10 swordfish per trip if operating with circle hooks or carrying an observer. The amendment would minimize economic impacts by allowing vessels to refrain from investing in circle hooks yet retain all swordfish if an observer is aboard the vessel. Vessel operators would have the option to invest in circle hooks to retain up to 25 swordfish per trip.

*National Standard 9 states that conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.*

The preferred alternative is consistent with NS9 as it would reduce the number of regulatory discards on observed trips and may reduce the number and severity of incidental hookings of sea turtles, marine mammals, and seabirds if only circle hooks are used. Retention of additional amounts of swordfish bycatch would reduce discards of dead or injured swordfish and optimize the use of the resource.

*National Standard 10 states that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.*

The preferred alternative is consistent with NS10 because fishermen will not be required to alter their method of fishing. Fishermen that choose to switch to circle hooks or retain more swordfish that are incidentally caught would take the same precautions to prevent injuries during fishing activities. Switching to circle hooks from tuna hooks would likely not have any impacts on safety at sea. Retaining more swordfish is not expected to increase the risk of injuries to those that currently retain swordfish and understand how to bring them aboard safely. The proposed action would not result in large changes to the fishery therefore impacts to public health or safety is not expected. For example, the proposed action would not force any vessels to operate farther from shore, in adverse weather conditions, or use new gear that could be detrimental to public health or safety at sea.

## 6.3 Information Quality Act

To the extent practicable, this information complies with the Information Quality Act and NOAA standards (NOAA Information Quality Guidelines, September 30, 2002) that recognize information quality is composed of three elements - utility, integrity, and objectivity. Central to the preparation of this environmental assessment and regulatory amendment document is the objectivity of two distinct elements: presentation and substance. The presentation element includes whether disseminated information is presented in an accurate, clear, complete, and

unbiased manner and in a proper context. The substance element involves a focus on ensuring accurate, reliable, and unbiased information. In a scientific, financial, or statistical context, the original and supporting data shall be generated, and the analytic results shall be developed, using sound statistical and research methods.

The proposed fishery management action was developed and subject to review by members of the Western Pacific Fishery Management Council and its Scientific and Statistical Committe. The information used to develop this document was subject to a wide review within a number of agencies including the staff of the Western Pacific Fishery Management Council and NOAA National Marine Fisheries Service's Pacific Islands Regional Office which includes reviewers from the Divisions of Sustainable Fisheries and Protected Resources, as well as the Pacific Islands Fishery Science Center and the State of Hawaii. The document will also be disseminated for public review.

At the same time that information is required to be accurate, clear, complete and unbiased, the Federal government has recognized that "information quality comes at a cost. In this context, agencies are required to weigh the costs and the benefits of higher information quality in the development of information, and the level of quality to which the information disseminated will be held." (OMB Guidelines, pp. 8452-8453).

One of the important potential costs in acquiring "perfect" information (which is never available), is the cost of delay in decision-making. The precautionary principle[5] suggests that decisions should be made (precautionary) in favor of the environmental amenity at risk when insufficient information is available to evaluate the outcome and there is a risk that taking an action could cause grave harm to the environmental amenity. However, this principle does not suggest that perfect information is required for any selected alternative to proceed; rather, it suggests that caution be taken but that it not result in management paralysis until perfect information is available. This document has used the best available information and made a broad presentation of it. Council public meetings and the process of public review of this document provided opportunities for comment and challenge to this information, as well as for the provision of additional information. The analysis concludes it is unlikely the proposed action would have an unintentional risk of causing substantial harm to the environment including fishery resources, fishermen, and protected resources because minor changes to the fishing gear are proposed and the fishery will continue to be subject to reporting, review and monitoring.

# 7.0 Preparers

The environmental assessment was prepared and reviewed by Western Pacific Fishery Management Council staff in coordination with the National Marine Fisheries Service.
An interdisciplinary approach was used in the preparation of this document. The proposed action was coordinated with the State of Hawaii's Coastal Zone Management Program office (for CZM compliance), NMFS' Pacific Islands Regional Office, Division of Protected Resources (to coordinate on potential impacts to marine mammals, listed species, and other

[5] The precautionary principle or precautionary approach states that if an action or policy has a suspected risk of causing harm to the public or to the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is *not* harmful falls on those taking the action.

protected resources), the NMFS PIRO Habitat Division (to coordinate on potential impacts to essential fish habitat and habitat areas of particular concern) and U.S. Fish and Wildlife Service (to consult on potential protected seabird interactions).

Primary authors were Western Pacific Fishery Management Council staff:
Paul Dalzell, Chief Scientist

Primary reviewers were NMFS Pacific Islands Regional Office (PIRO) Sustainable Fisheries Division staff:

Brett Wiedoff, Fishery Policy Analyst
Phyllis Ha, NEPA Specialist
Ethan Brown, Natural Resources Specialist, NEPA
Lewis Van Fossen, NEPA

Other reviewers:
Judith Lee; Environmental Planning Strategies, Inc.

# 8.0 Draft Proposed Regulations

The Council's proposed action would revise the limits on the number of swordfish that may be landed or possessed during any given Hawaii-based deep-set longline fishing trip north of the Equator. Currently, a deep-set vessel may keep up to 10 swordfish on any given trip. Under the proposed regulations, there would be no limit on the number of swordfish retained on a trip with a NMFS observer on board, regardless of the type of hook used. There would be a limit of 25 swordfish on a trip using only circle hooks without an observer on board. For a trip not using circle hooks and not carrying a NMFS observer, the current limit of 10 fish would remain unchanged. This proposed action would also revise the definition of deep-set longline fishing to be consistent with the proposed swordfish retention limits. All other measures applicable to the deep-set fishery would remain unchanged. This action would only apply to longline fishing north of the Equator, because specific rules on the retention of swordfish and gear configurations apply to longline fishing south of the Equator (see 50 CFR 665.813(k)).

The definition of Deep-set would be revised to:

§ 665.800 Definitions.

*Deep-set or Deep-setting* means the deployment of longline gear in a manner consistent with all the following criteria: All float lines are at least 20 meters in length; a minimum of 15 branch lines are attached between any two floats (except basket-style longline gear which may have as few as 10 branch lines between any two floats); and no light sticks are used. As used in this definition, "float line" means a line used to suspend the main longline beneath a float, and "light stick" means any type of light emitting device, including any fluorescent "glow bead," chemical, or electrically-powered light that is affixed underwater to the longline gear.

§ 665.813 Western Pacific longline fishing restrictions.

(j) Swordfish limits. When fishing north of the Equator (0° lat.), owners and operators of vessels registered for use under a Hawaii longline limited access permit, fishing on a trip for which the permit holder notified NMFS under §665.803(a) that the vessel would deep-set, may possess or land no more than the following number of swordfish for such trip:

(1) If an observer is on board, there is no limit.

(2) If there is no observer on board, and if only circle hooks are used, the limit is 25.

(3) If there is no observer on board, and if any type of hook other than a circle hook is used, the limit is 10.

# 9.0 References


Alvarado Bremer, J.R., J. Mejuto, T.W. Greig, and B. Ely. 1996. Global population structure of the swordfish (*Xiphias gladius*) as revealed by analysis of the mitochondrial DNA control region. J. Exp. Mar. Biol. Ecol., 197(2):295-310.

Arita, S., M. Pan, J. Hospital, and P. Leung. 2011. Contribution, Linkages and Impacts of the Fisheries Sector to Hawaii's Economy: A Social Accounting Matrix Analysis, Joint Institute for Marine and Atmospheric Research, SOEST Publication 11-01, JIMAR Contribution 11-373. University of Hawaii: Honolulu, HI, 54 p.

Bartoo, N., and A. Coan. 1989. An assessment of the Pacific swordfish resource. pp: 137-151 *In:* R. Stroud, (Ed.), Second International Billfish Symposium (1988) Proceedings. Savannah, GA: National Coalition for Marine Conservation. Part 1, Fishery and stock synopses, data needs and management.

Beckett J. 1974. Biology of swordfish, *Xiphias gladius* L., in the Northwest Atlantic Ocean. pp: 105-106 *In*: R. Shomura and F. Williams (Eds.), Proc. International Billfish Symposium. 9-12 August 1972. Kailua-Kona, HI. Part 2, Review and contributed papers. NOAA Technical Report, NMFS SSRF-675.

Boggs, C., and R. Ito. 1993. Hawaii's pelagic fisheries. NOAA-NMFS Marine Fisheries Review 55 (2): 69-82.

Boggs, C.H., and Y. Swimmer. 2007. Developments (2006-2007) in scientific research on the use of modified fishing gear to reduce longline bycatch of sea turtles. NMFS Pacific Islands Fisheries Science Center, PIFSC Working Paper, WCPFC-SC3-EB SWG/WP-7, 9 pp.

Bolten, A., K. Bjorndal. 2005. Experiment to evaluate gear modification on rates of sea turtle bycatch in the swordfish longline fishery in the Azores – Phase 4. Final Project Report submitted to the National Marine Fisheries Service. Archie Carr Center for Sea Turtle Research, University of Florida, Gainesville, Florida, USA.

Brodziak, J. and G. Isimura. 2010. Stock Assessment of North Pacific Swordfish (*Xiphias gladius*) in 2009. Pacific Islands Fisheries Science Center, National Marine Fisheries Service, NOAA, Honolulu, HI 96822-2396. Pacific Islands Fisheries Science Center Administrative Report H-10-01, 37 pp.

Carey, F., and B. Robison. 1981. Daily patterns in the activities of swordfish, *Xiphias gladius*, observed by acoustic telemetry. NMFS U.S. Fish. Bull. 79(2): 277-292.

Curran D., and K. Bigelow. 2010. Catch and bycatch effects of large circle hooks in a tuna longline fishery. Proceedings of the 61st Annual Tuna Conference, May 17-20. Lake Arrowhead, California, p 26 (abstract only).

Hawaii Department of Business, Economic Development and Tourism (DBEDT). 2010. Research and Economic Analysis Division. Statistics and Data Support Branch. Hawaii State Data Center. Island population and housing units, State of Hawaii: 2010. Honolulu: 2011. Hawaii State Data Center Report Number 2010-3.

DeMartini, E.E., J.H. Uchiyama, and H.A.Williams. 1999. Sexual maturity, sex ratio, and size composition of swordfish, *Xiphias gladius*, caught by the Hawaii-based pelagic longline fishery. Fish. Bull., 98:489-506.

DeMartini, E.E., J.H. Uchiyama, R.L. Humphreys Jr., J.D. Sampaga and H.A. Williams. 2006. Age and growth of swordfish (*Xiphias gladius*) caught by the Hawaii-based pelagic longline fishery. Fish. Bull., 105:356-367.

Dewar, H., and J. Polovina. 2005. Deploying satellite tags on swordfish using the California harpoon fleet. Pacific Fisheries Research Program Newsletter. Vol.10(4):4-6.

Dewees, C. 1992. Swordfish. pp: 148-150 *In:* W. Leet, C. Dewees, and C. Haugen (Eds.),

Evans, K., N.P. Clear, T. Patterson, J.S. Gunn, and J. Hampton. 2005. Behaviour and habitat preferences of bigeye tuna (*Thunnus obesus*) tagged in the western Coral Sea. WCPFC–SC1 BI WP–7, 1st Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission WCPFC–SC1, Noumea, New Caledonia, 8–19 August 2005.

False Killer Whale Take Reduction Team (FKWTRT). 2010. Draft False Killer Whale Take Reduction Plan. Submitted on behalf of the FKWTRT to the NMFS Pacific Islands Regional Office, Protected Resources Division. 199 pp.

Forney, K.A., D.R. Kobayashi, D.W. Johnston, J. A. Marchetti and M. G. Marsik. 2011. What's the catch? Patterns of cetacean bycatch and depredation in Hawaii-based pelagic longline fisheries. Marine Ecology. ISSN 0173-9565. 12p.

Gilman, E., E. Zollett, S. Beverly, H. Nakano, K. Davis, D. Shiode, P. Dalzell and I. Kinan. 2006. Reducing sea turtle by-catch in pelagic longline fisheries. Fish and Fisheries, 7:2-23.

Gilman, E., D. Kobayashi, T. Swenarton, P. Dalzell, I. Kinan-Kelly, and N. Brothers. 2007. Reducing sea turtle interactions in the Hawaii-based longline swordfish fishery. Biological Conservation,139:19-28.

Harley, S. J., S. Hoyle, J. Hampton, and P. Kleiber. 2010. Stock assessment of bigeye tuna in the western and central Pacific Ocean. WCPFC-SC6-2010/SA-WP-04. Nuku'alofa, Tonga, 10-19 August 2010.

Holdsworth, J.C., T.J. Sippel, and P.J. Saul. 2007. An Investigation into Swordfish Stock Structure Using Satellite Tag and Release Methods. A paper presented at the Western and Central Pacific Fisheries Commission, Scientific Committee Third Regular Session, 13-24 August, 2007. WCPFC-SC3-BI SWG/WP- 3.

Holts, D., N. Bartoo, and D. Bedford. 1994. Swordfish tracking in the Southern California Bight. NMFS, SWFSC, Admin Report No. LJ 94-15. 9 pp.

International Scientific Committee (ISC). 2009. Report of the Ninth Meeting of the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean: Plenary Session 15-20 July 2009, Kaohsiung, Taiwan.

Joseph, J., W.H. Bayliff, and M.G. Hinton. 1994. A review of information on the biology, fisheries, marketing and utilization, fishing regulations, and stock assessment of swordfish *Xiphias gladius,* in the Pacific Ocean.

Kerstetter, D.W., and J.E. Graves. 2006. Effects of circle versus J-style hooks on target and non-target species in a pelagic longline fishery. Fisheries Research, 80(3): 239-250.

Langley, A., J. Hampton, and S. Hoyle. 2011. Stock assessment of yellowfin tuna in the western and central Pacific Ocean. WCPFC-SC7-2011/SA- WP-03 (Rev.1-03Aug2011). Pohnpei, Federated States of Micronesia, 9-17 August 2011.

Largacha, E., M. Parrales, L. Rendon, V. Velasquez, M. Orozco, and M. Hall. 2005. Working with the Ecuadorian fishing community to reduce the mortality of sea turtles in longlines: The first year, March 2004-March 2005. Prepared for the Western Pacific Regional Fishery Management Council, Honolulu, Hawaii.

Li, Y., Y. Jiao, and J. Browder. 2011. Effects of hook type and hook size on seabird bycatch in the U.S. Atlantic pelagic longline fisheries, 1992-2009. Pre-publication manuscript. Presented at the International Symposium on Circle Hooks. Miami, FL, USA.

McCracken, M.L. 2009. Estimation of incidental interactions with sea turtles and seabirds in the 2008 Hawaii longline deep set fishery. Pacific Islands Fisheries Science Center, PIFSC Internal Report IR-09-011.pdf, 4 pp.

McCracken, M.L. 2010. Estimation of incidental interactions with sea turtles and seabirds in the 2009 Hawaii longline deep-set fishery. Pacific Islands Fisheries Science Center, PIFSC Internal Report IR-10-009, 3 pp.

Nakamura, I. 1985. Billfishes of the world, an annotated and illustrated catalogue of marlins, sailfishes, spearfishes and swordfishes known to date. Rome: Food and Agriculture Organization. FAO Fish. Synop. 5 (125). 58 pp.

Nakamura, I., T. Iwai, and K. Matsubara. 1968. A review of the sailfish, spearfish, marlin and swordfish of the world. *In:* Japanese. Kyoto Univ. Misaki. Mar. Biol. Ins. Spec. Rep. 4. 95 pp.

Nakano, H., and W. Bayliff. 1992. A review of the Japanese longline fishery for tunas and billfishes in the eastern Pacific Ocean, 1981-1987. Inter-Am. Trop. Tuna Comm. Bull., 20(5):183-355.

National Marine Fisheries Service (NMFS). 2001. Endangered Species Act Section 7 consultation on the authorization of pelagic fisheries under the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region. National Marine Fisheries Service, Southwest Region Sustainable Fisheries Division. 165p.

NMFS 2004. Biological Opinion issued in accordance with the Endangered Species Act for Proposed Regulatory Amendments to the Fisheries Management Plan for the Pelagic Fisheries of the Western Pacific Region. National Marine Fisheries Service, Pacific Islands Region, Sustainable Fisheries Division, Honolulu. 263 p.

NMFS. 2005a. Biological Opinion issued in accordance with the Endangered Species Act for the continued authorization of the Hawaii-based Pelagic Deep-set Tuna Longline Fishery. National Marine Fisheries Service, Pacific Islands Region, Sustainable Fisheries Division, Honolulu. 187 p.

NMFS. 2008b. Biological Opinion issued in accordance with the Endangered Species Act on Management Modifications for the Hawaii-based Shallow-set Longline Swordfish Fishery:Implementation of Amendment 18 to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. Issued October 15, 2008. Pacific Islands Regional Office. 91 pp.

NMFS. 2009. Programmatic Environmental Assessment Research to Support Reduction of Sea Turtle Bycatch in Domestic and International Fisheries Pacific Islands Fisheries Science Center, Bycatch Reduction Program. Honolulu, Hawaii. 49 pp.

NMFS. 2011. Draft Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis. For the Proposed False Killer Whale Take Reduction Plan. Pacific Islands Regional Office. Honolulu, HI. 178 pp.

NMFS. 2012. Biological Opinion for the 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. Pacific Islands Regional Office, Protected Resources Division. January 30, 2012. 162 pp.

Palko, B., G. Beardsley, and W. Richards. 1981. Synopsis of the biology of the swordfish, *Xiphias gladius* Linnaeus. NOAA Technical Report NMFS Circular 441. 21pp.

Polovina, J.J., E. Howell, D.M. Parker, and G.H. Balazs. 2003. Dive-depth distribution of loggerhead (*Caretta caretta*) and olive ridley (*Lepidochelys olivacea*) sea turtles in the central North Pacific: Might deep longline sets catch fewer turtles? Fishery Bulletin, 101(1):189-193.

Polovina, J.J., G.T. Mitchum, N.E. Graham, M.P. Craig, E.E Demartini, and E.N. Flint.. 1994. Physical and biological consequences of a climate event in the central North Pacific. Fisheries Oceanography (3): 15–21.

Polovina, J.J., J.P. Dunne, P.A. Woodworth, and E.A. Howell. 2011. Projected expansion of the subtropical biome and the contraction of temperate and equatorial upwelling biomes in the North Pacific under global warming. ICES Journal of Marine Science 68(6): 1030-1044.

Read, A.J. 2007. Do circle hooks reduce the mortality of sea turtles in pelagic longlines? A review of recent experiments. Biological Conservation, 135: 155-169.

Sakagawa, G. 1989. Trends in fisheries for swordfish in the Pacific Ocean. Pp: 61-79 *In:* R. Stroud (Ed.), Planning the future of billfishes. Research and management in the 90s and beyond. Mar. Recr. Fish. 13: 61-79 pp.

Sosa-Nishizaki O. 1990. A study on the swordfish (*Xiphias gladius*) stocks in the Pacific Ocean. Ph.D. Dissertation. University of Tokyo, Fac. Agric. Tokyo. 246 pp.

Uchiyama, J.H., E.E. DeMartini, and H.A. Williams. 1999. Length-weight interrelationships for swordfish, *Xiphias gladius* L., caught in the central North Pacific. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-284, Honolulu, Hawaii, 91 pp. http://swfsc.noaa.gov/publications/TM/SWFSC/NOAA-TM-NMFS-SWFSC-284.PDF

U.S. Fish and Wildllife Service (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. (2011-F-0436), January 6, 2012.

Walsh, W.A., and S.G. Pooley. 2002. Discards of target and incidentally caught fishes by the Hawai'i-based longline fishery. PowerPoint Presentation: 53rd International Tuna Conference, Lake Arrowhead, CA.

Walsh, W.A., P. Kleiber, and M. McCracken. 2002. Comparison of logbook reports of incidental blue shark catch rates by Hawaii-based longline vessels to fishery observer data by application of a generalized additive model. Fisheries Res., 58:79-94.

Ward, P. and S. Elscot. 2000. Broadbill Swordfish. Status of world fisheries. Bureau of Rural Science. Canberra, Australia.

Watson, J., D. Foster, S. Epperly, and A. Shah, 2005. Fishing methods to reduce sea turtle mortality associated with pelagic longlines. Canadian Journal of Fisheries and Aquatic Sciences, 62.

Western Pacific Fishery Management Council (WPFMC). 2004. Regulatory Amendment for Management Measures to Implement New Technologies for the Western Pacific Longline Fisheries. Western Pacific Regional Fishery Management Council, Honolulu, Hawaii.

WPFMC. 2009a. Fishery Ecosystem Plan for the American Samoa Archipelago. Western Pacific Fishery Management Council, Honolulu, Hawaii.

WPFMC. 2009b. Fishery Ecosystem Plan for the Hawaii Archipelago. Western Pacific Fishery Management Council, Honolulu, Hawaii.

WPFMC. 2009c. Fishery Ecosystem Plan for the Marianas Archipelago. Western Pacific Fishery Management Council, Honolulu, Hawaii.

WPFMC. 2009d. Fishery Ecosystem Plan for the Pacific Remote Island Areas. Western Pacific Fishery Management Council, Honolulu, Hawaii.

WPFMC. 2009e. Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region. Western Pacific Fishery Management Council, Honolulu, Hawaii.

WPFMC. 2009f. Management Modifications for the Hawaii-based Shallow-set Longline Swordfish Fishery that Would Remove Effort Limits, Eliminate the Set Certificate Program, and Implement New Sea Turtle Interaction Caps. Amendment 18 to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region, Including a Final Supplemental Environmental Impact Statement.

WPFMC 2010. Options Paper presented to the 147th meeting of the Western Pacific Fishery Management Council. 12 pp

WPFMC. 2011. Pelagic Fisheries Annual Report, 2009. Western Pacific Regional Fishery Management Council, Honolulu, Hawaii.

Yabe, H., S. Ueyanagi, S. Kikawa, and H. Watanabe. 1959. Study on the life-history of the swordfish, *Xiphias gladius* Linnaeus. Rep. Nankai Reg. Fish. Res. Lab. 10:107-150.

# Appendix A

# Regulatory Impact Review

# Revised Swordfish Trip Limits in the Hawaii Deep-set Longline Fishery

May 14, 2012

## *1. Introduction*

This document is a regulatory impact review (RIR) prepared under Executive Order (E.O.) 12866, "Regulatory Planning and Review." The regulatory philosophy of E.O.12866 stresses that in deciding whether and how to regulate, agencies should assess all costs and benefits of all regulatory alternatives, including the alternative of not regulating, and choose those approaches that maximize the net benefits to the society. Costs and benefits are to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider.

To comply with E.O. 12866, NMFS prepares an RIR for regulatory actions that are of public interest. The RIR provides a review of the problems, policy objectives, and anticipated impacts of regulatory actions.

This RIR is for proposed modification of the swordfish trip limit in the Hawaii deep-set tuna longline fishery to reduce regulatory discards, as recommended by the Western Pacific Fishery Management Council (Council).

## *2. Problem Statement and Management Objective*

Currently, the Hawaii-based deep-set longline fishery may not retain or land more than 10 swordfish per trip. As a result, fishermen may end up discarding incidentally caught swordfish that may be marketable. The original need to regulate swordfish bycatch retention in the deep-set fishery has not changed (i.e., prevent targeting of swordfish on trips declared as deep-set tuna trips to protect sea turtles), but a recent analysis of deep-set incidental catch indicates that the deep-set fishery catches more incidental swordfish now than the previous analysis indicated. Therefore, the Council is proposing to modify the longline regulations that, under certain circumstances, would allow retention of an additional number of swordfish that are already incidentally caught on tuna fishing trips. Retention of more of the incidentally caught swordfish would permit fishermen to better optimize the responsible use of the nation's fishery resources and optimize economic benefits for participants in the fishery, while maintaining safeguards for sea turtles and other protected species.

The proposed measures are designed to maintain the distinct differences between deep- and shallow-set fisheries and ensure that incentives are not created for tuna fishermen to target swordfish on the same trip. The proposed changes are also intended to provide additional safeguards for sea turtles by encouraging the use of circle hooks. The proposed changes would further support MSA National Standards 1, 5, and 9, respectively, whereby, they would assist in achieving the optimum yield (OY) from the fishery; they would assist in harvesting the OY of swordfish with the minimum use of economic inputs such as labor, capital, interest, and fuel; and they would reduce bycatch, including regulatory discards, in the fishery.

## *3. Description of the Alternatives Considered*

**Alternative 1. No action:** Under the No-action Alternative, the current limit of 10 swordfish per vessel, per trip for the deep-set fishery targeting tuna would remain in place.

**Alternative 2. Modify the swordfish trip limit:**

**Alternative 2a.** Alternative 2a would modify the trip limit to 25 swordfish per vessel, per trip for the deep-set fishery when using circle hooks but retain the 10 swordfish per vessel, per trip when using tuna hooks.

**Alternative 2b (preferred)**. Alternative 2b would modify the trip limit to 25 swordfish per vessel, per trip for the deep-set fishery when using circle hooks but retain the 10 swordfish per vessel, per trip when using other hooks. In addition, vessels carrying an observer, regardless of the type of hook being used, would be able to retain and land all swordfish. This is the Council's preferred alternative.

**Alternative 3. Remove the swordfish trip limit,** Alternative 3 would remove the swordfish trip limit for the Hawaii deep-set tuna targeting fishery.

## *4. Description of Affected Fishery and Economic Environment*

This section provides succinct information on the deep-set fishery, which is the fishery directly affected by this rule, and of the economic environment within which this fishery operates. Section 3.0 of the EA provides more detailed description of the deep-set fishery and other Hawaii-based fisheries.

***Hawaii-based swordfish fisheries***

Swordfish landings by Hawaii-based pelagic fisheries peaked in 1993 and subsequently decreased. The trend in swordfish landings reflected both an increase in the number of vessels in the longline fishery and widespread targeting of swordfish by the shallow-set fishery. Landings remained relatively steady from the mid 1990's to 2000 but dropped dramatically with the prohibition on targeting swordfish using shallow-set gear by the longline fishery. Although the longline shallow-set fishery targeting swordfish was reopened under a new set of regulations in April 2004, landings have remained substantially lower than historical levels. The longline fishery lands the vast majority of swordfish, while the main Hawaiian Islands (MHI) commercial troll and handline fisheries catch far fewer swordfish. Logbook data show that in 2010, the deep-set component of the longline fishery kept 2,774 swordfish out of 2,995 caught, compared with

the shallow-set component of the longline fishery, which kept 15,766 swordfish out of 16,708 caught. In 2010, the average price per pound of swordfish was $2.31[6].

***Hawaii-based Deep-set Longline Fishery***

The longline fishery operates in two modes based on gear deployment: deep-set longline which primarily targets bigeye tuna and shallow-set that primarily targets swordfish. A limited access program was established in 1994 allowing for a maximum of 164 transferable longline permits. But the active vessel participation has been closer to 120-130 during the past decade. In 2010, 122 longline vessels participated in the deep-set fishery and 28 participated in both the shallow-set and deep-set fishery[7]. None fished using only shallow-set gear throughout the year. All Hawaii-based longline fishermen must declare each trip as either deep-set or shallow-set at least 72 hours in advance of departure. Approximately 20 percent of the deep-set longline trips are assigned an observer.

In general, the deep-set fishery is based in Hawaii and fishes around the main Hawaiian Islands in deep pelagic waters beyond 25 or 75 nm from shore[8] in the U.S. EEZ and on the high seas and offloads their catch in Hawaii. In 2010, approximately 122 deep-setting vessels fished for bigeye and yellowfin tuna, and data from logbooks show the fishery made 1,205 trips, 16,070 sets and deployed 37,197,582 hooks. The deep-set fishery caught 135,510 bigeye tuna (kept 133,384), 92,252 mahimahi (kept 89,962), and caught 2,995 swordfish (kept 2,774). By weight, the deep-set fishery landed 552,813 lbs of swordfish in 2009 and 429,719 lbs of swordfish in 2010. Currently, each vessel fishing using deep-set longline gear, may not retain more than 10 swordfish. The shallow-set fishery landed over 3.4 million lbs of swordfish in 2009 and 3.2 million lbs in 2010. Almost all of the Hawaii-based longline catch is sold at the United Fishing Agency auction in Honolulu.

In 2010, 43 percent of the deep-set fishery used only circle hooks, and an additional 27 percent used more than one hook type.

***Hawaii's Regional Economy***

Hawaii's economy is dominated by tourism and defense, with tourism by far the leading industry in terms of employment and expenditures. Defense expenditures in 2009 is estimated to be $8.3 billion (http://hawaii.gov/dbedt/info/economic/databook/db2010/db2010.pdf), while spending by visitors who travelled to Hawaii by air or cruise ship is estimated to be $11.1 billion (http://hawaii.gov/dbedt/info/visitor-stats/visitor-research/2010-annual-visitor.pdf). The two represent the largest shares of direct income from "export" industries (http://hawaii.gov/dbedt/info/economic/databook/). Hawaii's Gross Domestic Products for 2010 and 2011 were $66.7 billion and $68.9 billion respectively.
NMFS estimates 2010 ex-vessel value of pelagic fish landed by the Hawaii-based longline fishery to be about $70 million and about $79 million regardless of gear type

[6] WPacFIN information accessed at http://www.nmfs.hawaii.edu/wpacfin/reportlanding.php on 3/20/2012.
[7] Hawaii longline logbook summary statistics available at http://www.pifsc.noaa.gov/fmb/reports/hlreports/areport_items.php?yr=2010&type=tbl&num=8 and http://www.pifsc.noaa.gov/fmb/reports/hlreports/areport_items.php?yr=2010&type=tbl&num=7, accessed 3/20/2012
[8] A large vessel closed area around the Hawaiian Islands varies from 25 to 75 nm depending on the location and time of year (50 CFR 665.806).

(http://www.nmfs.hawaii.edu/wpacfin/hi/Data/Pelagic/hpel4.htm; accessed 3/20/2012). The seafood industry is an important component of local and tourist consumption, and recreational and subsistence fishing represent a substantial proportion of the local population

## *5. Analysis of the Alternatives*

None of the proposed changes are expected to result in adverse effects to fishery participants or communities. Under the No-action Alternative, fishermen would continue to use both circle and tuna hooks and discard marketable swordfish in compliance with the regulations limiting swordfish retention to 10 per trip.

Compared to the No-action Alternative, Alternatives 2a, 2b (preferred) and 3 could have an economic benefit for the Hawaii deep-set longline fishery. The level of potential increases in landed swordfish and increased swordfish revenues under each action alternative cannot be easily quantified.

Under Alternative 2a, fishermen who use circle hooks while on a deep-set longline trip would be allowed to retain up to 25 swordfish per trip, compared to 10 under the No-action Alternative. Between 2004 and 2010, an average of 41,720 lb of swordfish was discarded[9]. Fishermen might discard swordfish for reasons besides the current swordfish retention limit. These include the fact that the discarded fish is of low value because of their small size, low weight, damaged while being caught, or would take up vessel hold space that could go to more valuable catch. Since NMFS does not have information on the reasons that specific swordfish were discarded, the value of potentially retained fish will be estimated based on the assumption that all discarded fish because of the cap on swordfish retention. If all deep-set fishermen were to use circle hooks, then, in a typical year, the fleet would keep an additional 41,720 lb of fish. Given that most discarded swordfish are smaller (less than 50 lb) and fetch a lower price per lb at auction relative to larger swordfish, the analysis assumes the discarded swordfish would sell for $1.16 (which is half of the average price of swordfish in 2010). This gives an overall estimate of potential revenue gain fleetwide of $48,395 or about $384 per vessel, relative to the No-action Alternative. However, in reality, Alternative 2a is more restrictive that the other action alternatives in terms of the number of vessels that would meet the conditions to retain more than 10 swordfish, and the potential revenue gain would be lower under this alternative than for the other action alternatives.

Fishermen who currently do not use circle hooks would have the option of switching to circle hooks in order to be able to retain more than 10 swordfish per trip. On average, switching from tuna hooks to circle hooks would cost between $876 and $1,315 per vessel. Those fishermen already using circle hooks on deep-set trips could earn revenue for the additional swordfish that they would be allowed to retain under this alternative. As mentioned earlier, 43 percent of fishermen used circle hooks exclusively while an additional 27 percent used more than one type of hook in 2010.

[9] Based on information in Table 9 of the EA, which provides estimates of swordfish discards based on data obtained from the 20% of deep-set longline trips carrying observers.

Under Alternative 2b, which is the preferred alternative, fishermen could keep up to 25 swordfish if they fish using circle hooks during a deep-set and could keep all swordfish catch if there is an observer onboard. The costs to fishermen of voluntarily switching to circle hooks would be the same as under Alternative 2a, but the potential gain in revenue would be higher, in other words, closer to reaching the potential fleetwide revenue gain of $48,395 since vessels that use tuna hooks that carry observers could retain all swordfish, whereas under Alternative 2a, those vessels could only keep 10 swordfish. In addition, vessels that carry observers and use circle hooks could retain all swordfish, rather than having swordfish retention capped at 25.

Alternative 3 is the least restrictive among all of the action alternatives as well as the No-action Alternative. Since all deep-set longline fishing vessel trips could keep all incidental swordfish catch, regardless of whether or not an observer is onboard, or whether or not circle hooks are used, Alternative 3 would provide the most potential revenue gain. Furthermore, deep-set vessels that currently do not use circle hooks would not need to expend resources, crew time, and money in order to switch to circle hooks in order to benefit.

The proposed action and action alternatives would likely have a negligible impact on the overall supply of swordfish, both locally and nationally, and would not directly influence the price that consumers pay for swordfish. As noted earlier, the deep-set longline fishery lands far fewer swordfish than the shallow-set longline fishery that targets swordfish. Furthermore, in recent years, an average of just over 41,000 lb of swordfish were discarded. Even if the deep-set fishery had been able to keep the discards, this value is very small relative to the 1,600 mt of North Pacific swordfish landed by U.S. fishermen in 2010. Currently discarded swordfish, could be retained under any of the action alternatives, are likely to be of lower value than swordfish retained by both the shallow-set and deep-set fishery.

## *6. Impacts of the Preferred Alternatives on Net National Benefits*

Due to limited data availability, as well our limited understanding of the biological, economic, and social linkages of Hawaii's deep-set longline fishery and associated economic sectors, it is difficult to predict how fishery participants and other stakeholders would respond to the preferred alternative and how production operations and markets would be affected. It is thus difficult to predict how the total future stream of national benefits and costs (to both producers and consumers) would be affected. However overall this action is anticipated to have positive net national benefits as it is designed to enhance domestic harvests of Pacific swordfish by Hawaii-based longline vessels without jeopardizing the existence of any protected species or their habitats.

## *7. Distributional Changes in Net Benefits*

The action alternative is expected to have little, if any, distributional effects among different fisheries. It is not likely that other domestic fisheries catch will be noticeably different as a result of the occasional increased retention rate and landings of swordfish by the Hawaii-based deep-set longline fishery.

## *8. Changes in Income and Employment*

Alternative 2b and the other non-preferred action alternatives might increase the amount of swordfish landed and therefore swordfish landing revenues by deep-set longline fishermen,

although probably only by a small amount, relative to overall revenues. It is unlikely that businesses providing fuel, supplies, equipment and provisioning services would notice any change in income as a result of this action.

## *9. Cumulative Impacts*

None of the alternatives considered here are expected to result in cumulatively significant adverse impacts when considered in conjunction with other existing or future conservation and management measures that affect the Hawaii-based longline fishery. If NMFS issues a final rule for the false killer whale take reduction plan, the final rule may require the Hawaii-based deep-set longline fishery to use circle hooks with a specified hook wire diameter. Provided that the deep-set longline fishery participants who choose to buy circle hooks in order to receive the potential benefit of retaining more swordfish, buy circle hooks within the acceptable range of hook wire diameter under the potential final rule for the FKWTRP, there would be no cumulative economic impacts to the affected fishery.

## *10. Determination of Significance under Executive Order 12866*

In accordance with E.O. 12866, NMFS has made the following determinations:
This rule is not likely to have an annual effect on the economy of more than $100 million or adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.
This rule is not likely to create any serious inconsistencies or otherwise interfere with any action taken or planned by another agency. This rule is not likely to materially alter the budgetary impact of entitlements, grants, user fees or loan programs or the rights or obligations of recipients thereof. This rule is not likely to raise novel or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.