United States Department of Commerce

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

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# Draft Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis

## For the Proposed False Killer Whale Take Reduction Plan

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**Abstract:** This document analyzes management alternatives that would reduce the level of incidental mortality and serious injury (M&SI) of false killer whales in the Hawaii-based commercial longline fisheries. This action is needed because incidental M&SI levels of false killer whales in these fisheries exceed the thresholds established under the Marine Mammal Protection Act and must be reduced. Based on the alternatives considered, the National Marine Fisheries Service is proposing a False Killer Whale Take Reduction Plan that consists of eight regulatory measures and six non-regulatory measures, and research and data collection priorities. The proposed Plan is based on the consensus recommendations of the federally-appointed False Killer Whale Take Reduction Team, with some modifications.

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# EXECUTIVE SUMMARY

This Draft Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis analyzes the effects on the quality of the human environment caused by the implementation of a proposed rule, pursuant to the authority of the Marine Mammal Protection Act (MMPA), creating the False Killer Whale Take Reduction Plan (FKWTRP). The proposed FKWTRP is based on the recommendations of the False Killer Whale Take Reduction Team (FKWTRT), with some modifications, and contains both regulatory and non-regulatory measures. The regulatory measures include: (1) require the use of "weak" circle hooks with a specified maximum wire diameter and other specific characteristics in the Hawaii-based deep-set longline fishery; (2) establish a minimum diameter for monofilament leaders and branchlines in the Hawaii-based deep-set longline fishery; (3) prohibit commercial longline fishing year-round in an area north of the Main Hawaiian Islands; (4) require annual certification in marine mammal interaction mitigation techniques for longline vessel owners and operators; (5) require a NMFS-approved marine mammal handling and release informational placard to be posted onboard all active longline vessels; (6) require the captain of the longline vessel to supervise the handling and release of any hooked or entangled marine mammal; (7) require a NMFS-approved placard that instructs the vessel crew to notify the captain if a marine mammal is hooked or entangled, be posted onboard all active longline vessels; and (8) establish a Southern Exclusion Zone that is closed to deep-set longline fishing for varying periods of time, when triggered by specific observed levels of serious injuries or mortalities of false killer whales within the U.S. EEZ around Hawaii.

The non-regulatory measures in the proposed FKWTRP include: (1) increase the precision of bycatch estimates in the Hawaii-based deep-set longline fishery; and (2) make specific changes to the observer training and data collection protocols. Four other non-regulatory measures are part of the proposed action, but because they are either solely administrative or do not constitute a specific action that would be expected to have any effect on the environment, they are not analyzed within this EA.

NOAA's National Marine Fisheries Service (NMFS) is issuing this proposed action to fulfill its obligations under the MMPA to reduce the serious injury and mortality of false killer whales in the Hawaii-based deep-set and shallow-set longline fisheries.

NMFS evaluated the following alternatives:

- Alternative 1: No Action Alternative: Maintain the status quo with existing regulations for the Hawaii-based deep-set and shallow-set longline fisheries under the Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region (PFEP).
- Alternative 2: Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team, as described above.
- Alternative 3: Close the EEZ around Hawaii to commercial longline fishing year-round.

The No Action alternative is unlikely to sufficiently reduce the level of serious injuries and mortalities of false killer whales, and thus would not meet the requirement of the MMPA. NMFS believes that the combination of regulatory and non-regulatory measures in the Preferred Alternative would greatly decrease serious injuries and moralities to false killer whales and meet the requirements of the MMPA. The Preferred Alternative would also have a lower socioeconomic impact on Hawaii's longline fisheries and associated communities than a complete closure of the EEZ around Hawaii, as in Alternative 3. For this reason, NMFS is proposing to implement the Preferred Alternative.

# ACRONYMS

| | |
|---|---|
| APA | Administrative Procedure Act |
| BCA | Benefit-Cost Analysis |
| CEQ | Council on Environmental Quality |
| CH | Critical Habitat |
| CITES | Convention on International Trade in Endangered Species of Wild Flora and Fauna |
| CML | Commercial Marine License |
| CNP | Central North Pacific |
| CPUE | Catch Per Unit Effort |
| CV | Coefficient of Variation or Contingent Valuation |
| CZMA | Coastal Zone Management Act |
| DAR | Hawaii Department of Land and Natural Resources' Division of Aquatic Resources |
| DLNR | Hawaii Department of Land and Natural Resources |
| DPS | Distinct Population Segment |
| EA | Environmental Assessment |
| EEZ | Exclusive Economic Zone |
| EFH | Essential Fish Habitat |
| ENP | Eastern North Pacific |
| EO | Executive Order |
| ESA | Endangered Species Act |
| FEP | Fishery Ecosystem Plan |
| FKWTRP | False Killer Whale Take Reduction Plan |
| FKWTRT | False Killer Whale Take Reduction Team |
| FEIS | Final Environmental Impact Statement |
| FEP | Fishery Ecosystem Plan |
| FMP | Fishery Management Plan |
| FONSI | Finding of No Significant Impact |
| FPEIS | Final Programmatic Environmental Impact Statement |
| FSEIS | Final Supplemental Environmental Impact Statement |
| GIS | Geographic Information Systems |
| HAPC | Habitat Area of Particular Concern |
| HMRFS | Hawaii Marine Recreational Fishing Survey |
| HRS | Hawaii Revised Statutes |

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|---|---|
| IRFA | Initial Regulatory Flexibility Act Analysis |
| LOF | List of Fisheries |
| M&SI | Mortality and Serious Injury |
| MHI | Main Hawaiian Islands |
| MMAP | Marine Mammal Authorization Program |
| MMPA | Marine Mammal Protection Act |
| MSA | Magnuson-Stevens Fishery Conservation and Management Act |
| MUS | Management Unit Species |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NWHI | Northwestern Hawaiian Islands |
| OMB | Office of Management and Budget |
| OSP | Optimum Sustainable Population |
| PBR | Potential Biological Removal |
| PFEP | Pacific Pelagics Fishery Ecosystem Plan |
| PIRO | Pacific Islands Regional Office |
| PMNM | Papahanaumokuakea Marine National Monument |
| POCTRP | Pacific Offshore Cetacean Take Reduction Plan |
| PSW | Protected Species Workshop |
| RFA | Regulatory Flexibility Act or Regulatory Flexibility Analysis |
| RFMO | Regional Fishery Management Organization |
| RIR | Regulatory Impact Review |
| RP | Revealed Preference |
| SAR | Stock Assessment Report |
| SBA | Small Business Administration |
| SEZ | Southern Exclusion Zone |
| SP | Stated Preference |
| SPLASH | Structure of Populations, Levels of Abundance and Status of Humpbacks |
| TAC | Total Allowable Catch |
| USCG | United States Coast Guard |
| USFWS | United States Fish and Wildlife Service |
| VMS | Vessel Monitoring System |
| WPRFMC | Western Pacific Regional Fishery Management Council |
| WTP | Willingness-to-Pay |

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| ZMRG | Zero Mortality Rate Goal |

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# 1.0 INTRODUCTION

## 1.1 Background and Objectives

This document is an Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA). An EA/RIR/IRFA provides assessments of the environmental impacts of an action and its reasonable alternatives (the EA), the economic benefits and costs of the action alternatives, as well as their distribution (the RIR), and the impacts of the action on directly regulated small entities (the IRFA). This EA/RIR/IRFA addresses the statutory requirements of the National Environmental Policy Act (NEPA), Presidential Executive Order 12866, and Regulatory Flexibility Act (RFA). This EA/RIR/IRFA provides the analytical background for decision-making.

## 1.2 Statutory Requirements for Marine Mammal Take Reduction

NOAA's National Marine Fisheries Service (NMFS) is mandated by the MMPA (16 USC 1361 *et seq.*) to reduce incidental mortality and serious injury (M&SI) of marine mammals associated with commercial fisheries. Section 118(f)(1) of the MMPA requires the preparation and implementation of take reduction plans to assist in the recovery or prevent the depletion of strategic marine mammal stocks that interact with Category I or II fisheries. NMFS may also develop and implement take reduction plans for any other marine mammals stocks that interact with a Category I fishery which NMFS determines, after notice and opportunity for public comment, has a high level of mortality and serious injury across a number of such marine mammal stocks.

The MMPA defines a strategic stock as a marine mammal stock in which direct human-caused mortality exceeds the potential biological removal (PBR) level for that stock, which is listed as a threatened or endangered species under the Endangered Species Act of 1973 (ESA), or which is declining and likely to be listed as a threatened or endangered species under the ESA or as depleted under the MMPA within the foreseeable future. PBR, as defined by the MMPA, is the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

NMFS regulations at 50 CFR 229.2 define a Category I fishery as a commercial fishery that has frequent incidental M&SI of marine mammals, a Category II fishery as a commercial fishery that has occasional incidental M&SI of marine mammals, and a Category III fishery as a commercial fishery that has a remote likelihood of, or no known incidental M&SI of marine mammals. "Incidental," as per 50 CFR 229.2, means, "with respect to an act, a non-intentional or accidental act that results from, but is not the purpose of, carrying out an otherwise lawful action."

As specified in MMPA section 118(f)(2), the immediate goal of a take reduction plan is to reduce, within six months of its implementation, the incidental M&SI of marine mammals from commercial fishing to levels less than PBR. The long-term goal is to reduce, within five years of its implementation, the incidental M&SI of marine mammals from commercial fishing operations to insignificant levels approaching a zero rate (i.e., zero mortality rate goal, or ZMRG), taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans (FMPs). NMFS has established the insignificance threshold for ZMRG as 10% of PBR (69 FR 43338, July 20, 2004).

The MMPA specifies that NMFS establish a take reduction team for each strategic marine mammal stock, and may establish take reduction teams for non-strategic stocks interacting with Category I fisheries. Take reduction teams develop and submit to NMFS "draft" take reduction plans. As per MMPA section

118(f)(7), NMFS takes the team's draft take reduction plan into consideration, and publishes in the *Federal Register* a proposed take reduction plan and implementing regulations, including any changes proposed by NMFS and an explanation of the reasons therefore, for public review and comment. Following consideration of public comments, NMFS then issues a final take reduction plan and implementing regulations.

# 1.3 Purpose and Need for Action

The purpose of this proposed action is to implement a proposed take reduction plan, pursuant to section 118(f) of the MMPA, to reduce incidental M&SI of three stocks of false killer whales in the Category I Hawaii-based deep-set longline fishery and the Category II Hawaii-based shallow-set longline fishery. This action is needed because incidental M&SI levels for these stocks in these fisheries exceed the thresholds established under the MMPA. These levels are therefore inconsistent with the mandates of the MMPA, and must be reduced.

## 1.3.1 Marine Mammal Stocks Addressed by the Proposed Action

Three false killer whale stocks identified in the U.S. Pacific Marine Mammal Stock Assessment Reports (SAR) (Carretta et al. 2011) would be addressed by the proposed action:

(1) False killer whale, Hawaii Pelagic stock. The Hawaii Pelagic stock includes false killer whales inhabiting waters greater than 40 km (22 nm) from the main Hawaiian Islands; the Hawaii Pelagic and Hawaii Insular stocks overlap between 40 km and 140 km from shore. The Hawaii pelagic stock has been designated as strategic because the average annual mortality and serious injury (M&SI) of false killer whales incidental to the Category I Hawaii-based deep-set longline fishery (7.3 animals per year) exceeds the stock's PBR level (2.5 animals per year) (Carretta et al. 2011).

(2) False killer whale, Hawaii Insular stock. The Hawaii Insular stock includes false killer whales inhabiting waters within 140 km (approximately 75 nm) of the main Hawaiian Islands; the Hawaii Pelagic and Hawaii Insular stocks overlaps between 40 m and 140 km from shore. The level of M&SI of this stock incidental to the Hawaii-based deep-set longline fishery (0.60 animals per year) is not above the stock's PBR level (0.61 animals per year), and the stock is not strategic (Carretta et al. 2011). NMFS proposed to list Hawaiian insular false killer whales as an endangered distinct population segment under the ESA (75 FR 70169, November 17, 2010).

(3) False killer whale, Palmyra Atoll stock. The Palmyra Atoll stock includes false killer whales found within the EEZ around Palmyra Atoll. The level of M&SI incidental to the Hawaii-based deep-set longline fishery (0.3 animals per year) does not exceed this stock's PBR (6.4 animals per year), and this stock is not strategic (Carretta et al. 2011). However, this stock was included in the scope of the FKWTRT's deliberations and is addressed by this proposed action because there are documented interactions between the Category I Hawaii-based deep-set longline fishery and this stock. Additionally, NMFS estimated the take rate of false killer whales in longline fisheries as over 4-times higher within the EEZ around Palmyra Atoll (3.3 per 1000 sets) compared to the EEZ around Hawaii (0.7 per 1000 sets) and waters outside the EEZ (0.8 per 1000 sets) (Forney and Kobayashi, 2007).

In addition, data indicate that false killer whale depredation (preying on longline bait and/or catch) is increasing in the Hawaii-based longline fisheries. False killer whales have been observed while vessels are in transit, indicating that they may be following fishing boats. This behavior is likely to increase interactions, and in fact, for the first time, there were multiple false killer whale takes documented per set and per trip during 2008 and 2009 (NMFS Observer Program). Based on this information, NMFS is concerned that the Palmyra Atoll stock may also have an increasing potential to interact with the longline fisheries in the near future. NMFS included the Palmyra Atoll stock of false killer whales in the scope of this proposed take reduction plan based on the documented high take rates of false killer whales by

Hawaii-based longline fisheries operating within the EEZ around Palmyra as described above, as well as the potential for increased interactions in the future.

## 1.3.2 Marine Mammal Stocks Not Addressed by the Proposed Action

NMFS considered additional marine mammal stocks, but determined not to include the following within the scope of the proposed action:

(1) False killer whale, American Samoa stock. This stock was newly defined for the 2010 Draft SAR, and includes false killer whales found within the EEZ around American Samoa. No abundance estimate or PBR level is currently available for this stock. Therefore, the level of M&SI occurring incidental to commercial fisheries, particularly the American Samoa longline fishery, cannot be assessed relative to PBR. However, NMFS analysis suggests that the estimated rate of fisheries-related M&SI within the American Samoa EEZ (7.8 animals per year) exceeds the range of likely PBRs (0.4 – 7.5) (NMFS, unpublished data). Additional research on the abundance of false killer whales in American Samoa is needed to resolve the stock's status. Because NMFS lacks population structure and abundance data, this stock was not addressed by the proposed action.

(2) Other marine mammal stocks in the Pacific Islands Region**.** The 2011 MMPA List of Fisheries (LOF) (75 FR 68468, November 8, 2010) identifies several other species or stocks of marine mammals that have been observed as seriously injured or killed incidental to the Hawaii-based deep-set and shallow-set fisheries, including: Blainville's beaked whale, HI stock (*Mesoplodon densirostris*); bottlenose dolphin, HI Pelagic stock (*Tursiops truncatus*); humpback whale, Central North Pacific (CNP) stock (*Megaptera novaeangliae*); pantropical spotted dolphin, HI stock (*Stenella attenuata*); Risso's dolphin, HI stock (*Grampus griseus*); short-finned pilot whale, HI stock (*Globicephala macrorhynchus*); striped dolphin, HI stock (*Stenella coeruleoalba*); Bryde's whale, HI stock (*Balaenoptera edeni*); Kogia *spp*. whale (Pgymy sperm whale (*Kogia breviceps*) or dwarf sperm whale (*Kogia sima*); HI stock). With the exception of humpback whales, the M&SI of all of these stocks is at or below the insignificance threshold (i.e., 10% of PBR, as per definition in 50 CFR 229.2), and were therefore not addressed by the proposed action. The CNP stock of humpback whales, although a strategic stock because of its endangered status, is not designated as "strategic" because of fishery interactions, and NMFS has determined that incidental taking from commercial fishing is rare and will have a negligible impact on CNP humpback whales (75 FR 29984, May 28, 2010). For these reasons, the proposed FKWTRP also does not address M&SI of humpback whales.

## 1.3.3 Commercial Fisheries Addressed by the Proposed Action

The proposed action addresses the following two fisheries:

(1) Hawaii-based deep-set longline fishery. The Category I Hawaii-based deep-set longline fishery operates both within and outside of the Hawaii EEZ (defined on the MMPA LOF as the "HI deep-set (tuna target) longline/set line" and "Western Pacific Pelagic (Deep-set component)" fisheries). There have been numerous M&SI of false killer whales documented in this fishery, including an estimated 7.3 animals per year from the strategic Hawaii Pelagic stock of false killer whales, 0.6 animals per year from the non-strategic Hawaii Insular stock, 0.3 animals per year from the non-strategic Palmyra Atoll stock, and 5.3 animals per year on the high seas, where no U.S. stocks are currently defined under the MMPA (Carretta et al. 2011). At minimum, this fishery meets the MMPA requirement for the development of a Take Reduction Plan because of the level of incidental M&SI of false killer whales from the strategic Hawaii Pelagic stock.

(2) Hawaii-based shallow-set longline fishery. The Category II Hawaii-based shallow-set longline fishery operates both within and outside of the Hawaii EEZ (defined on the MMPA LOF as the "HI shallow-set (swordfish target) longline/set line" and "Western Pacific Pelagic (Shallow-set component" fisheries).

No documented interactions with false killer whales have been reported in the 2010 SAR (Carretta et al. 2011). However, there was an observed interaction with a false killer whale from the Hawaii Pelagic stock in 2008 that was determined to be a non-serious injury, and another observed interaction that resulted in a serious injury of either a false killer whale or a short-finned pilot whale, in waters outside of the EEZ (Forney 2010). Additionally, a serious injury to a Hawaii pelagic false killer whale was documented in 2009 (K. Forney pers. comm.., and unpublished data presented at the 2010 Pacific Scientific Review Group meeting, Kona, Hawaii). Due to the concern over the rapid increase in the number of false killer whale takes that are occurring in the deep-set longline fishery, and the shallow-set fishery's recent interactions with false killer whales (potentially with a strategic stock), this fishery was included in the scope of the proposed action.

## 1.3.4 Commercial Fisheries Not Addressed by the Proposed Action

The following fisheries were considered, but are not addressed in the proposed action:

(1) American Samoa longline fishery. This Category II fishery differs from the Hawaii-based longline fisheries in terms of gear and fishing practices, target species, and geographical area of operation. Observer coverage has been less than 10% since a mandatory observer program began in 2006, but increased to 25% in 2010. As stated above, there is little information on the level of interactions with false killer whales, or the effect of the interactions on the stock. Two false killer whales were observed killed or seriously injured by the fishery in 2008 (Oleson 2009), but it is unknown whether this level is unsustainable because an abundance estimate and calculation of PBR for the newly-defined American Samoa stock of false killer whales are not available.

Because NMFS lacks information about the impact this fishery is having on the poorly understood American Samoa stock of false killer whales, and because the differences between this fishery and the two Hawaii-based longline fisheries would likely have detracted from the focus of the FKWTRT, NMFS did not address this fishery in the proposed action. NMFS will continue to evaluate incidental interaction rates in the American Samoa longline fishery as observer coverage in this fishery increases, and will consider additional conservation and management measures if warranted by the information developed.

(2) Hawaii shortline fishery and other near-shore state fisheries. The shortline fishery was added to the 2010 LOF as a Category II fishery, classified by analogy (50 CFR 229.2, definition of "Category II fishery") to the two Hawaii-based longline fisheries, based on the similarities between the gear used, areas fished, and target species in the three fisheries, and anecdotal reports of interactions with marine mammals off the north side of the island of Maui. These reports have not been confirmed, and thus the species involved and extent of the interactions are unknown. The Western Pacific Fishery Management Council (Council) is considering management of the fishery. Information gathered by Council staff indicates that the shortline fishery is very small, with few participants and low levels of landings. There is also a small amount of data available and no observer coverage. Data confidentiality would likely be an issue, making an understanding of the fishery and its potential impacts on false killer whale stocks difficult.

In addition to the shortline fishery, there are other near-shore state-managed hook-and-line fisheries that may pose a risk to marine mammals, though there is not sufficient information available to determine the extent, if any, of their interactions with marine mammals. The proposed action considers the potential impacts to the marine mammal stocks from the Hawaii shortline and kaka line fisheries, mainly through information gathering research recommendations; however, because information concerning actual impacts is currently undeveloped, NMFS is not proposing regulations for these fisheries at this time. These and other nearshore hook-and-line fisheries may be brought under the scope of the take reduction plan in the future if new information shows impacts that warrant the fisheries' consideration and inclusion.

### 1.3.5 Specific Goals of the Proposed Action

The specific short-term and long-term goals of the proposed action are defined to meet the bycatch reduction requirements of MMPA section 118(f). M&SI of the Hawaii pelagic stock of false killer whales that occurs incidental to the Hawaii-based longline fisheries is known to exceed the stock's PBR level. The short-term goal of the proposed FKWTRP, therefore, is to reduce, within six months of its implementation, incidental M&SI of the Hawaii pelagic stock of false killer whales in the Hawaii-based longline fisheries, within the EEZ around Hawaii, to less than the stock's PBR level (2.5 false killer whales per year, as of the 2010 SAR, Carretta et al. 2011).

The Hawaii pelagic stock is a transboundary stock that inhabits waters both within and outside of the EEZ around Hawaii; however, the offshore extent of the stock's range into the high seas is unknown. The Hawaii-based longline fisheries also operate both within the EEZ and on the high seas, and incidental M&SI of the Hawaii pelagic stock of false killer whales have been documented both within the EEZ and on the high seas. Better information on the full geographic range of this stock and quantitative estimates of bycatch in international fisheries are needed to reduce the uncertainties regarding impacts of false killer whales takes on the high seas, but these uncertainties do not change the current assessment that the Hawaii pelagic false killer whale stock is strategic. To ensure that conservation measures of the FKWTRP do not simply displace fishing effort and its corresponding impacts on the Hawaii Pelagic false killer whale from the EEZ to the high seas, NMFS is requiring that incidental M&SI of the high seas component of the Hawaii Pelagic stock does not increase above current levels (5.3 false killer whales per year, as of the 2010 SAR, Carretta et al. 2011).

The long-term goal of the proposed FKWTRP is to reduce, within five years of its implementation, the M&SI of the Hawaii pelagic, Hawaii insular, and Palmyra Atoll stocks of false killer whales to insignificant levels, as defined at 50 CFR 229.2 (i.e., less than 10% of their respective PBR levels).

## 1.4 FKWTRT and Development of Consensus Recommendations

NMFS announced the establishment of the False Killer Whale Take Reduction Team (FKWTRT) on January 19, 2010 in the *Federal Register* (70 FR 36120). The selection of team members followed guidance provided by section 118 of the MMPA. NMFS strove to select an experienced and committed team with a balanced representation of stakeholders. Members of the FKWTRT included representatives of the Hawaii-based deep-set and shallow-set longline fisheries, conservation organizations, scientific and research organizations, the State of Hawaii, the Marine Mammal Commission, the Western Pacific Regional Fishery Management Council (WPRFMC, or Council), and NMFS.

Four professionally facilitated meetings were held between February 2010 and July 2010. All meetings were open to the public, and public comments were accepted during the course of each meeting. The FKWTRT reached consensus at the July 2010 meeting, and on July 19, 2010, submitted to NMFS a "Draft FKWTRP" including recommendations for bycatch reduction measures, as well as research needs, thus meeting the statutory requirements of the MMPA (FKWTRT 2010). NMFS carefully considered the consensus recommendations of the FKWTRT and is, through this proposed action, implementing a proposed FKWTRP.

## 1.5 Regulatory Requirements

As discussed previously, this document contains the EA, required under NEPA; the RIR analysis, required under Executive Order 12866 (EO 12866); and the IRFA, required by the RFA. The following summarize the requirements of each of the three components of this document.

### 1.5.1 Requirements of Environmental Assessment

NEPA (42 U.S.C. 4321, *et seq*.) establishes a national environmental policy, provides an interdisciplinary framework for environmental planning by Federal agencies, provides opportunities for public involvement in agency decision-making, and contains procedures to ensure that Federal decision-makers take environmental factors into account. NEPA does not require that the most environmentally desirable alternative be chosen, but does require that the environmental effects of the alternatives be analyzed for the benefit of decision-makers and the public.

NEPA has two principal purposes:

1. To require Federal agencies to evaluate the potential environmental effects of any major planned Federal action to ensure that public officials make well-informed decisions about the potential impacts; and
2. To promote public awareness of potential impacts at the earliest planning stages of major Federal actions by requiring Federal agencies to prepare a detailed environmental evaluation for any major Federal action significantly affecting the quality of the human environment.

NEPA requires an assessment of the biological, social and economic consequences of major Federal actions and provides members of the public with an opportunity to be involved in and to influence decision-making on Federal actions. In short, NEPA ensures that environmental information is available to government officials and the public before decisions are made and actions taken.

NMFS has prepared this Environmental Assessment (EA) in compliance with NEPA, regulations issued by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508), and guidance issued by NOAA in Administrative Order 216-6.

CEQ regulations at 40 CFR 1508.9 define an EA as "a concise public document for which a Federal agency is responsible that serves to:

1. Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.
2. Aid an agency's compliance with the Act when no environmental impact statement is necessary.
3. Facilitate preparation of a statement when one is necessary.

The regulation specifies four required components of an EA. These include the need for the proposal (section 1.3 of this document), alternatives (section 2), the environmental impacts of the proposed action and alternatives (section 4), and a listing of agencies and persons consulted (section 8).

### 1.5.2 Requirements of Regulatory Impact Review

The following statement from EO 12866 summarizes the requirements of an RIR:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood 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. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach. (Executive Order 12866, Regulatory Planning and Review, Section 1(a), September 30, 1993.)

EO 12866 requires that the Office of Management and Budget (OMB) review proposed regulatory programs that are considered to be "significant regulatory action". The RIR serves as a basis to determine whether the proposed regulation would be significant according to the following criteria specified in EO 12866:

1. Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.
2. Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency.
3. Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof.
4. Raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in this EO.

The key elements of the RIR include:

1. A description of the management goals and objectives;
2. A description of the fishery and/or affected entities;
3. A comprehensive description of each alternative (including the No Action alternative);
4. A thorough description of the expected effects (both positive and negative) of each alternative, on *each* potentially impacted group; and
5. An economic analysis of the expected effects of each alternative relative to the baseline. When adequate data are available, expected benefits and costs should be *quantified* to the fullest extent that these can be usefully estimated. [Emphasis added]

### 1.5.3 Requirements of Initial Regulatory Flexibility Act Analysis

The purpose of the RFA is to inform the agency, as well as the public, of the expected economic impacts of a proposed action, to ensure that the agency considers alternatives that minimize expected significant adverse economic impacts of the rule on substantial numbers of small entities, while meeting the goals and objectives of the final action. As such, the RFA does not contain decision criteria, per se. Major goals of the RFA are as follows:

1. To increase agency awareness and understanding of the impact of their regulations on small business;
2. To require that agencies communicate and explain their findings to the public; and
3. To encourage agencies to use flexibility and to provide regulatory relief to small entities.

The RFA emphasizes predicting impacts on small entities as a group, distinct from other entities, and on the consideration of alternatives that may minimize adverse economic impacts, while still achieving the stated objective of the action. Under 5 U.S.C., Section 603(b) and (c) of the RFA, each IRFA is required to contain the following elements:

1. A description of the reasons why action by the agency is being considered;
2. A succinct statement of the objectives of, and legal basis for, the proposed rule;
3. A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;

4. A description of the projected reporting, recordkeeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
5. An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap or conflict with the proposed rule; and
6. A description of any significant alternatives to the proposed rule which accomplish the stated objectives (of the proposed action), consistent with applicable statutes, and which would minimize any significant adverse economic impact of the proposed rule on directly regulated small entities.

# 2.0 DESCRIPTION OF THE ACTION AND ALTERNATIVES

## 2.1 Objective of the Action and Alternatives

NMFS is proposing to implement a FKWTRP to reduce incidental M&SI of Hawaii pelagic false killer whales in the Hawaii-based deep-set and shallow-set longline fisheries to below the stock's PBR level within 6 months of implementation, and incidental M&SI of Hawaii pelagic, Hawaii insular, and Palmyra Atoll false killer whales to insignificant levels approaching a zero rate within 5 years of implementation. This section describes the proposed action (the preferred alternative) and two alternatives considered, which were developed through discussions and recommendations of the FKWTRT and analyses conducted by NMFS scientists.

## 2.2 Geographic Scope of the Action and Alternatives

For the purposes of this analysis, the action area is the EEZ around the U.S. Pacific islands and the high seas waters where Hawaii-based fishing vessels using deep-set and shallow-set longline gear configurations are managed under the Fishery Ecosystem Plan for Pacific Pelagic Fisheries of the Western Pacific Region Pacific (PFEP). These areas include the EEZ around Hawaii, and the remote U.S. Pacific islands of Johnston Atoll, Kingman Reef, Palmyra, Jarvis, Howland, Baker, Midway, and Wake Islands. The Hawaii-based pelagic longline fisheries operate inside and outside the EEZ, mainly between 175° W – 130° W longitude and 0° to 40° N latitude (Figure 2.1).

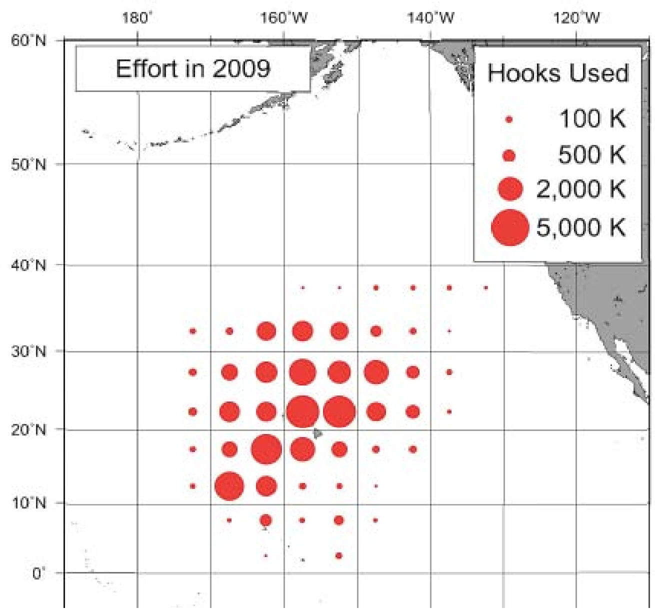


**Figure 2.1**. Spatial distribution of reported logbook fishing effort by the U.S. longline fleet, in thousands (K) of hooks, in 2009. Effort in some areas is not shown in order to preserve data confidentiality (NMFS 2010c).

# 2.3 Alternatives Considered

This section describes the proposed action and two alternatives considered for the proposed FKWTRP.

## 2.3.1 Alternative 1. No Action (Status Quo)

Under the No Action alternative, which is required by CEQ regulations (40 CFR § 1502.14), NMFS would take no additional regulatory action to protect false killer whales from bycatch in the Hawaii-based longline fisheries. This alternative would maintain status quo management of the Hawaii-based deep-set and shallow-set longline fisheries under the PFEP. The implementing regulations for the Western Pacific Pelagic Fisheries are located at 50 CFR Part 665, Subpart F.

## 2.3.2 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team

The preferred alternative is based on the consensus recommendations of the FKWTRT identified in the Draft FKWTRP, with some modifications (FKWTRT 2010). It includes the regulatory and non-regulatory measures described below.

### Regulatory measures

### *2.3.2.1 Require small circle hooks (size 16/0 or smaller) with 4.0 mm maximum wire diameter and other specific characteristics in the Hawaii-based deep-set longline fishery*

Size

Analysis of observer data and predictive simulations indicate that the use of small circle hooks (size 16/0 or smaller; small circle hooks in the Hawaii-based fishery have historically included only 14/0, 15/0, and 16/0) in the deep-set longline fishery would likely reduce the number of false killer whale takes (i.e., prevent some hookings) by approximately 6%, and may reduce the severity of injuries (e.g., mouth hookings rather than ingestion) following interactions (FKWTRT 2010). Small circle hooks are also generally weaker (i.e., straighten with less force) than the Japanese-style tuna hooks used by a portion of the longline fleet, so some false killer whales that are hooked in the lip, jaw, body, or flukes may be able to pull free (i.e., straighten the hook) if tension is placed on the line. Thus, the required use of small circle hooks may further reduce the number of incidental M&SI of false killer whales in the deep-set longline fishery.

Wire Diameter

The standard wire diameter for small circle hooks in the deep-set longline fishery is 4.5 mm [0.177 in]. The FKWTRT believes that small circle hooks with a smaller wire diameter (e.g., 4.0 mm [0.157 in]) would provide even greater conservation benefits to false killer whales. Such "weak" circle hooks exploit the size and weight disparity between the fishery's target species and other species, and promote the release of larger, non-target or bycatch species (Bigelow et al. 2011). In this case, it would be expected that the weak circle hooks would be strong enough to retain target catch, but would bend and straighten under the pull strain of a hooked marine mammal, allowing the animal to release itself and thereby reduce the severity of the animal's injury. However, these weak circle hooks are not currently used in the fishery, and their effects on rates of target catch, and therefore their commercial viability, have not been tested. Consequently, the FKWTRT recommended that weak circle hooks (i.e., circle hooks with wire diameter less than or equal to 4.0 mm [0.157 in]), size 16/0 or less, be required in the deep-set longline fishery if it could be demonstrated through additional research that such weak hooks do not have a substantial negative impact bigeye tuna catch rates (i.e., the aggregate weight of bigeye tuna caught on 4.0 mm [0.157 in] circle hooks is not more than 10% less than the weight of bigeye tuna caught on 4.5 mm [0.177 in] circle hooks). The rate of false killer whale bycatch is so low that a very large sample size (number of hooks) would be required to detect a difference in bycatch between hook types; however, the FKWTRT recommended the required use of weak, small circle hooks based on the effects to target species alone, given the expected, though unverified, reduction in the severity of injuries to hooked false killer whales.

NMFS, in partnership and collaboration with the Hawaii-based deep-set longline fishery and independent researchers, conducted a study to quantify the effects of strong (4.5 mm [0.177 in] wire diameter) and weak (4.0 mm [0.157 in] wire diameter) 15/0 circle hooks on bigeye tuna catch. The study examined catch rates of target, incidental (retained non-target), and bycatch (discarded) species; size selectivity; and frequency of straightened hooks. Analysis of data from 127 longline sets conducted between October-December 2010 showed no significant differences in catch per set between hook types for 20 species, including bigeye tuna. There were also no significant differences in bigeye tuna catch per set in either the number of individuals or weight estimated from fork lengths (Bigelow et al. 2011). Weak hooks had a statistically significant higher rate of straightening, though the rate of straightening was relatively low (0.462 per 1,000 weak hooks, and 0.291 with no catch), and lower than studies of weak hooks in other fisheries (Bigelow et al. 2011).

The researchers note that the study was conducted during a time of year when landed bigeye tuna have a lower mean weight, and it is unknown whether similar results would have been obtained if the research were conducted when bigeye tuna of a larger average size were available to the fishery. However, the study shows that weak hooks can retain even very large bigeye tuna (~122 kg [269 lb], Bigelow et al. 2011).,Based on the results of this study showing no statistically significant reduction in target species catch rates, and given the expected positive reduction in the severity of injuries to marine mammals, as recommended by the FKWTRT, NMFS is proposing the required use of weak circle hooks.

Summary

The FKWTRT recommended, and NMFS proposes, the required use of circle hooks size 16/0 or smaller in the deep-set longline fishery, with the following characteristics: wire diameter not to exceed 4.0 mm (0.157 in); the shank composed of round, non-flattened wire; and 10 degree offset or less. Any hook not meeting the requirement would not be allowed to be used on deep-set trips, though other hooks may be on board the fishing vessel if stowed and unavailable for use.

#### 2.3.2.2 Establish a minimum diameter for monofilament leaders and branchlines in the Hawaii-based deep-set longline fishery

Observer data indicate that a substantial number of marine mammals that were entangled or hooked externally or in the mouth were released because the branchline snapped (FKWTRT 2010). Animals that are released with substantial trailing gear (with the potential to wrap around pectoral fins/flippers, peduncle, or head; be ingested; or accumulate drag) are usually considered seriously injured (Andersen et al. 2008). The FKWTRT believed that, had the line not broken in these cases, the animals might have been able to pull free (i.e., straighten the hook), or attempts could have been made by the captain, crew, or observer to disentangle or dehook the animals. As such, the FKWTRT recommended a minimum breaking strength for leaders and branchlines, via a minimum diameter requirement.

In this proposed action, any monofilament line used in branchlines or leaders in the deep-set longline fishery must be 2.0 mm or larger in diameter. The breaking strength of 2.0 mm diameter monofilament is around 400 pounds. Any other materials used in branchlines or leaders must meet or exceed the intent of this measure by having a breaking strength of 400 pounds ore greater. The intent is that the gear be assembled and maintained such that the hook is the weakest component of the terminal tackle.

#### 2.3.2.3 Establish a year-round Main Hawaiian Islands Longline Fishing Prohibited Area that is closed to longline fishing

An existing longline exclusion zone prohibits commercial longline fishing year-round around the MHI (MHI) (50 CFR 665.806(c)). Regulations specify that the outer extent of the boundary contracts (moves shoreward) seasonally to allow longline fishing to occur closer to the windward shores of the MHI between October and January (WPRFMC 2009); this seasonally open area covers 71,384 km$^2$ (20,812 nm$^2$). Incidental M&SI of false killer whales and blackfish (animals where the species could not be identified, but are identified as either false killer whales or pilot whales) have been documented in the area where longline fishing is only allowed between October and January. This area falls within the area of overlap between the Hawaii insular and Hawaii pelagic stocks of false killer whales as defined in the 2010 SAR (Carretta et al. 2011).

Given that longline fishing in this area may impact both false killer whale stocks, the proposed action would revise the boundaries of the existing MHI longline fishing prohibited area at 50 CFR 665.806(c) to eliminate the seasonal boundary contraction (Figure 2.2). Such an exclusion would, in effect, maintain the current boundary of the February-September longline exclusion zone prohibitions throughout the entire year. NMFS would also prohibit commercial longline fishing in this MHI Longline Fishing Prohibited Area in the take reduction plan regulations under 50 CFR part 229. It is anticipated that this closure would substantially reduce the risk the deep- and shallow-set longline fisheries pose to the Hawaii insular stock of false killer whales, because longline fishing would thereby be prohibited from nearly the entire range of the insular stock. It would also likely reduce M&SI of the Hawaii pelagic false killer whale stock in that area.

#### 2.3.2.4 Require annual certification in marine mammal interaction mitigation techniques for longline vessel owners and operators

The FKWTRT recommended NMFS develop and implement a mandatory, annual certification program to educate owners and operators of Hawaii-based longline vessels about ways to reduce M&SI of marine mammals. The FKWTRT believes specific training will significantly increase the potential for captains and crew to free hooked or entangled false killer whales from gear in a manner that would reduce the severity of the injury (FKWTRT 2010). The FKWTRT recommended NMFS expand the existing Protected Species Workshops, required under 50 CFR 665.814, to incorporate additional information regarding marine mammal interactions, including an MMPA regulatory overview; species identification; marine mammal handling and release techniques; and best practices for reducing marine mammal bycatch. The FKWTRT also recommended that NMFS develop a voluntary component of the training on marine mammal photo-identification techniques for owners and operators interested in participating in the research.

Under existing regulations for Western Pacific Pelagic fisheries (50 CFR 665.814, Protected Species Workshop), owners and operators of all western Pacific Pelagic longline vessels must successfully complete a workshop each year, and a valid workshop certificate is needed for owners to maintain or renew permits and for operators at sea. Sea turtle and seabird handling is specified in these regulations; there is no regulatory requirement for training in marine mammal handling, but since 2004, NMFS has incorporated into these workshops education on marine mammal identification, careful handling and release techniques, and an overview of, as well as an explanation of the purpose and justification for marine mammal bycatch reporting requirements that apply to the longline fisheries. NMFS proposes to expand the content of the workshops in consultation with the FKWTRT, as appropriate, to meet the needs of the FKWTRP. To ensure the marine mammal component is maintained by regulation as part of the workshops, NMFS is also proposing to add the requirement for certification to the take reduction plan regulations, under MMPA authority.

### *2.3.2.5 Require posting of marine mammal handling and release informational placard on longline vessels*

Under this alternative, NMFS proposes to require a NMFS-approved marine mammal handling and release informational placard be posted onboard all active longline vessels in the Hawaii-based fleet, in a location where it would be visible by the captain and crew. NMFS believes this proposed requirement would facilitate the careful handling and release of false killer whales and other small cetaceans caught incidentally during longline fishing. The posting requirement would ensure NMFS' guidelines are readily available for reference during a hooking or entanglement event.

### *2.3.2.6 Require captains' supervision of marine mammal handling and release*

Longline vessel captains are required to attend and be certified annually in protected species interaction mitigation techniques (50 CFR 665.814), and as part of this Alternative (see 2.2.2.4 above), NMFS proposes to expand the content of these workshops to include more specific training in marine mammal handling and release. Vessel crew members are not required to receive certification. Therefore, the captain may be the only person on the vessel trained in marine mammal handling and release protocols, particularly on trips without an observer. However, captains may not always be on deck while the gear is being hauled and thus may not observe or be aware of marine mammal bycatch events. Under this alternative, NMFS proposes to require the captain of each longline vessel to supervise the handling and release of any hooked or entangled marine mammal. The captain would not necessarily need to be on deck, but could, for example, oversee and direct specific actions from the wheelhouse, if he or she were in visual and/or verbal contact with the crew.

### *2.3.2.7 Require posting of placard instructing crew to notify the captain of marine mammal interactions*

NMFS proposes to require a NMFS-approved placard that instructs the vessel crew to notify the captain immediately if a marine mammal is hooked or entangled, be posted onboard all active longline vessels in the Hawaii-based fleet, in a location where it would be visible by the captain and crew. It is expected that this measure would facilitate crew notification of the captain, thereby ensuring the captain is aware of any marine mammal interactions and supervises the handling and release.

### 2.3.2.8 Establish a Southern Exclusion Zone and specific triggers for closure

The proposed action includes a series of contingency measures, including an area closure, to protect false killer whales should the other proposed regulatory (described above in sections 2.3.2.1-2.3.2.7), non-regulatory (described below in sections 2.3.2.9-2.3.2.10), and other measures prove ineffective in the near-term. Under this alternative, NMFS proposes to establish a Southern Exclusion Zone (SEZ) that would be closed to deep-set longline fishing upon reaching a specified threshold level (or “trigger”) of observed false killer whale mortalities or serious injuries inside the EEZ around Hawaii. The SEZ would be bounded on the east at 154.5° W. longitude, on the west at 165° W. longitude, on the north by the existing February-September MHI Longline Exclusion Zone and the Papahanaumokuakea Marine National Monument (PMNM), and on the south by the boundary of the EEZ around Hawaii (Figure 2.2). The SEZ closure would cover 386,122 $km^2$ (112,575 $nm^2$), that if implemented, would reduce the area available to longline fishing within the EEZ around Hawaii by approximately 17%.

The FKWTRT recommended these boundaries because they encompass an area with a high historical concentration of observed false killer whale and blackfish takes in the deep-set longline fishery. As such, the FKWTRT and NMFS determined that this is an area where protective measures (i.e., a closure) would be likely to have the greatest conservation benefit. A closure would prevent further false killer whale M&SI in the deep-set longline fishery in that area. The FKWTRT and NMFS also believe that, to be effective, the proposed closure must be sufficiently large to prevent false killer whales from simply following boats and gear to areas outside of the closure. NMFS believes the closure of the SEZ, when triggered by specific levels of observed false killer whale M&SI, would be necessary and appropriate to eliminate future interactions in the area and to reduce the overall level of false killer whale interactions in the deep-set longline fishery.

NMFS is proposing to manage the SEZ on the cycle on the fishing year, which is currently defined to be the same as the calendar year (50 CFR 665.12), rather than using “Plan Years” as recommended by the FKWTRT. Under this alternative, M&SI would be counted toward the trigger immediately upon the effective date of the final FKWTRP. If that date does not coincide with the beginning of the fishing year, M&SI would be counted against the trigger from that point forward for the remaining portion of the first fishing year. Any M&SI in that first year that was observed before the effective date of the final FKWTRP would not be counted retroactively against the trigger.

The following paragraphs describe the five proposed steps NMFS would take when determining whether or not to prohibit deep-set longline fishing in the SEZ. These steps are based on the FKWTRT’s recommendations, but NMFS’ proposed modifications are noted.

(a) Defining the trigger.

The SEZ would be managed in real-time based on observed M&SI of false killer whales, so that false killer whale M&SI in the deep-set longline fishery inside the EEZ around Hawaii does not exceed the Hawaii Pelagic stock’s PBR level. Therefore, the FWKTRT recommended that the real-time estimated M&SI be calculated using a simple extrapolation from the observed number of false killer whale M&SI, using the level of observer coverage for that year. Because of inter-annual variability in M&SI, NMFS typically calculates 5-year average annual M&SI levels for comparison against PBR, rather than relying on single-year estimates. Therefore, NMFS would convert this extrapolated estimate of M&SI to a 5-year average for comparison against PBR. This is consistent with the FKWTRT’s deliberations. For example, at the current level of 20% observer coverage, two observed mortalities or serious injuries of false killer whales inside the EEZ around Hawaii would result in an estimate of 10 false killer whales for that year, which exceeds the stock’s current PBR level of 2.5. But, if no other false killer whales were taken in the following 4 years, a 5-year average M&SI would be approximately 2 animals per year, which is below the stock’s PBR level. Any additional observed mortalities or serious injuries would cause the estimated M&SI level to exceed the stock’s PBR level, thus indicating the existing management measures in the FKWTRP were not sufficiently reducing levels of M&SI and additional management measures (i.e., a closure of the SEZ) would be necessary. Thus, under this scenario where PBR was 2.5 and observer coverage was 20%, the trigger would be set at 2 observed false killer whale mortalities or serious injuries.

NMFS acknowledges that, for purposes of calculating the trigger, using a 5-year average M&SI level that assumes zero mortalities or serious injuries in the following four years may be unrealistic. However, if the trigger were based only on a single-year estimate of M&SI, and if PBR were as low as the current value (2.5), the proposed trigger would be less than one observed false killer whale per year (effectively zero), requiring a closure before even one false killer whale mortality or serious injury was observed. NMFS considered alternate scenarios for calculating the trigger and implementing the closure (see Appendix I), including several whereby the trigger was "discounted" to allow for anticipated M&SI in future years; however, if PBR were as low as the current value (2.5), this would result in even lower triggers, also potentially less than one observed false killer whale per year and effectively zero.

The two factors upon which the trigger is based -- observer coverage and the PBR for the Hawaii pelagic stock of false killer whales -- may change from one year to the next. NMFS proposes to specify the equation used to calculate the trigger in the FKWTRP regulations, and to publish a notice in the *Federal Register* upon initial FKWTRP implementation and whenever the trigger was changed, specifying the levels of PBR and observer coverage used to calculate the trigger.

Under this alternative, NMFS would calculate the trigger for implementing additional required management measures using the following equation:

$$\text{trigger} \leq 5 * (\text{observer coverage}) * (\text{PBR}).$$

The following process described how this equation would be used for calculating the trigger for closing the SEZ:

(i) Divide the (unknown) trigger (i.e., the number of observed animals that are determined have been killed or seriously injured) by the level of observer coverage to obtain the extrapolated annual estimate of M&SI: (trigger) / (observer coverage) = annual M&SI estimate;

(ii) If it is assumed there would be no additional M&SI in the following four years, divide the estimate from step (i) by 5 to obtain the 5-year average annual M&SI level: (trigger) / (observer coverage) / 5 = 5-year average M&SI estimate;

(iii) Set the 5-year average annual M&SI estimate from step (ii) to less than or equal to PBR: (trigger) / (observer coverage) / 5 ≤ PBR;

(iv) Solve for the trigger: trigger ≤ 5 * (observer coverage) * (PBR); and

(v) Round the trigger down to the nearest whole number, because the trigger is based on numbers of observed (whole) animals that are determined to have been killed or seriously injured.

For example, if PBR were 2.5 and observer coverage were 25%, the trigger would be set at 3, that is (5 * (0.25) * (2.5) = 3.125, rounded down to nearest whole number). If the trigger were zero, NMFS would close the SEZ at the beginning of the fishing year without waiting for a single observed false killer whale mortality or serious injury.

NMFS notes that these figures would not represent the official bycatch estimates for false killer whales stocks in the fishery; the official bycatch estimates are calculated by separate methods and are presented in the annual SARs. For example, the official bycatch estimates include prorations for takes of false killer whales of unknown stock origin within the Hawaii insular/pelagic stock overlap zone, and prorations based on the proportions of observed interactions that resulted in death or serious injury, or non-serious injury. Additionally, the estimates used in calculating the trigger would be necessarily less accurate and precise than the official estimates because they would calculated in real-time as false killer whales were observed taken by the fishery throughout the year, without the benefit of the entire year's data.

The proposed trigger would apply only to the Hawaii pelagic stock of false killer whales, given the stock's strategic status, the stated short-term goal of the proposed FKWTRP, and the location of the proposed closure. For the purposes of identifying the SEZ trigger and implementing contingency measures, any false killer whale taken inside the EEZ around Hawaii would be assumed to be part of the Hawaii pelagic stock, unless the animal could be positively identified as belonging to the insular stock through photo-identification or genetic analysis of a tissue sample. Additionally, only observed serious injuries or mortalities would be counted when determining whether the trigger was met; injuries determined to be non-serious would not count toward the trigger. The FKWTRT recommended that NMFS expedite the process of making serious injury determinations for these animals, to allow for the timely implementation of specified contingency measures (see "Other Measures" below).

(b) <u>Observed M&SI below the trigger</u>.

For each mortality or serious injury in the deep-set longline fishery inside the EEZ around Hawaii that is below the established trigger in a given fishing year, NMFS would notify the FKWTRT, and for the last mortality or serious injury before the trigger is met, NMFS would convene the FKWTRT by teleconference to discuss the circumstances of the event. For example, if the trigger is set at 4 observed false killer whales, NMFS would notify the FKWTRT of the first and second mortalities or serious injuries, and would convene the FKWTRT by teleconference after the third observed mortality or serious injury. This process is a slight modification from the FKWTRT's recommendations; the FKWTRT only explicitly considered the case of a trigger of 2, and thus did not make specific recommendations regarding NMFS' actions for observed M&SI other than the single mortality or serious injury just before the trigger would be met. However, NMFS believes this proposed action meets the FKWTRT's intent regarding notification and discussion of observed false killer whale M&SI.

(c) <u>Observed mortality or serious injury that meets the trigger</u>.

The FKWTRT recommended, and NMFS proposes, that if there is an observed false killer whale mortality or serious injury in the deep-set longline fishery inside the EEZ around Hawaii that meets the established trigger for a given year, NMFS would convene the FKWTRT for an in-person meeting, and would immediately close the SEZ until the end of that year. For example, if the trigger is set at 4 observed false killer whales, NMFS would convene the FKWTRT for an in-person meeting following the 4$^{th}$ observed false killer whale mortality or serious injury, and would close the SEZ to deep-set longline fishing until the end of the year. NMFS would reopen the SEZ at the beginning of the next year. There is no change in this step from the FKWTRT's recommendation.

If a closure of the proposed SEZ is triggered, NMFS would notify the fishery and close the area for the specified time period (the rest of the year) through a *Federal Register* notice. The notice would include the specifics of the closure, as well as when and how the SEZ would be reopened.

Additional mortalities or serious injuries of false killer whales in the deep-set longline fishery in the EEZ after the SEZ is closed may warrant review of FKWTRP implementation or effectiveness. Therefore, if during the same calendar year following closure of the SEZ, there is an observed false killer whale mortality or serious injury on a deep-set longline trip anywhere in the EEZ around Hawaii, then NMFS would again convene the FKWTRT to discuss the circumstances of the event and consider the effectiveness of the SEZ closure. The FKWTRT may be convened by teleconference or other efficient means.

(d) <u>Observed mortality or serious injury in the next consecutive year(s)</u>.

NMFS proposes that if the SEZ is closed in a given year, and there is one observed false killer whale mortality or serious injury in the deep-set longline fishery inside the EEZ around Hawaii in any of the next four consecutive years, NMFS would convene the FKWTRT for an in-person meeting, and would immediately close the SEZ to deep-set longline fishing, until reopened by NMFS in consultation with the FKWTRT.

This proposed measure differs from the FKWTRT's recommendation. The FKWTRT recommended that if NMFS closed the SEZ in a given year upon meeting the established trigger (and reopened the SEZ at the beginning of the next year), NMFS would again close the SEZ in the next consecutive year only if the same trigger was met. NMFS believes the FKWTRT's recommendation for this step is incompatible with the statutory requirement to bring incidental M&SI below PBR within six months of plan implementation, and to insignificant levels within 5 years. As stated in "(a) Defining the trigger" above, the calculation for the trigger assumes there would be no additional M&SI in the four years following the initial, temporary SEZ closure. In almost all cases (except for the unlikely scenarios where there are very high levels of observer coverage and a high PBR), a single additional mortality or serious injury in any of those four years would cause the 5-year average M&SI level to exceed PBR, thus necessitating closure of the SEZ. Additionally, the FKWTRT developed the SEZ and its associated closures as a "backstop" to reduce false killer whale M&SI should the other measures in the plan fail to achieve the required reductions. The fact that false killer whales may continue to be hooked or entangled in the shallow-set longline fishery anywhere it operates, and in the deep-set longline fishery in open areas of the EEZ around Hawaii and on the high seas provides support for a more protective set of restrictions in the SEZ.

For example, if PBR were 4 and observer coverage were 20%, the trigger would be set at 4. If 4 false killer whale M&SI were observed in the current year ("year 1"), the annual M&SI estimate would be 20, and assuming zero M&SI in the next four years, the 5-year average annual M&SI level would be 4, which is equal to PBR. Under this scenario, NMFS would close the SEZ immediately after the fourth observed false killer whale mortality or serious injury, and reopen the SEZ at the beginning of the next year. If there were 1 false killer whale mortality or serious injury observed in the following year ("year 2"), the annual M&SI estimate would be 5, and the 5-year average annual M&SI level (including the estimated 20 M&SI from year 1 and the estimated 5 M&SI from year 2, and assuming zero M&SI for the following 3 years) would be 5, which exceeds PBR. Therefore, NMFS would close the SEZ following the first observed mortality or serious injury in year 2.

If a closure of the proposed SEZ is triggered, NMFS proposes to notify the fishery and close the area through a *Federal Register* notice. The notice would include the specifics of the closure, as well as conditions NMFS would consider in determining when and how to re-open the SEZ.

(e) Reopening the SEZ.

The FKWTRT recommended that NMFS re-open the SEZ if one of the follow criteria were met: (i) NMFS determines, upon consideration of the FKWTRT's recommendations and evaluation of all relevant circumstances (e.g., the mortality or serious injury was a result of non-compliance with gear requirements), that re-opening of the SEZ is warranted; (ii) in the 2-year period immediately following the date of the closure, the deep-set longline fishery has zero observed false killer whale M&SI inside the EEZ around Hawaii; (iii) in the 2-year period immediately following the date of the closure, the deep-set longline fishery has reduced its rate of false killer whale M&SI within the EEZ around Hawaii and on the high seas (which includes the EEZ around Johnston Atoll, but not Palmyra Atoll) in an amount proportionate to the rate required to reduce false killer whale M&SI within the EEZ around Hawaii to a level equivalent to the applicable false killer whale PBR (e.g., if the PBR for the Hawaii pelagic stock inside the EEZ around Hawaii was 2.5 and false killer whale M&SI inside the EEZ around Hawaii was 7.3, an approximately 66% reduction in estimated M&SI for the entire deep-set fishery would be necessary to meet the threshold); or (iv) the average estimated level of false killer whale M&SI in the deep-set longline fishery inside the EEZ around Hawaii for up to the 5 most recent years following implementation of the final FKWTRP is below the PBR for the Hawaii pelagic stock of false killer whales at that time.

NMFS may consider these and other criteria when determining when to reopen the SEZ, but is not proposing to include the criteria in regulations. NMFS needs to maintain flexibility in management and be able to consider scenarios not addressed by the criteria developed by the FKWTRT. For example, if the

FKWTRT recommended and NMFS adopted additional measures intended to reduce false killer whale M&SI, NMFS could reopen the SEZ before the criteria outlined above were met. Alternatively, NMFS could consider keeping the SEZ closed for a period longer than specified in the criteria above, if the total number of false killer whale M&SI, including those taken in open areas of the EEZ, exceeded PBR to such a degree that the 5-year average M&SI level could not drop below PBR.

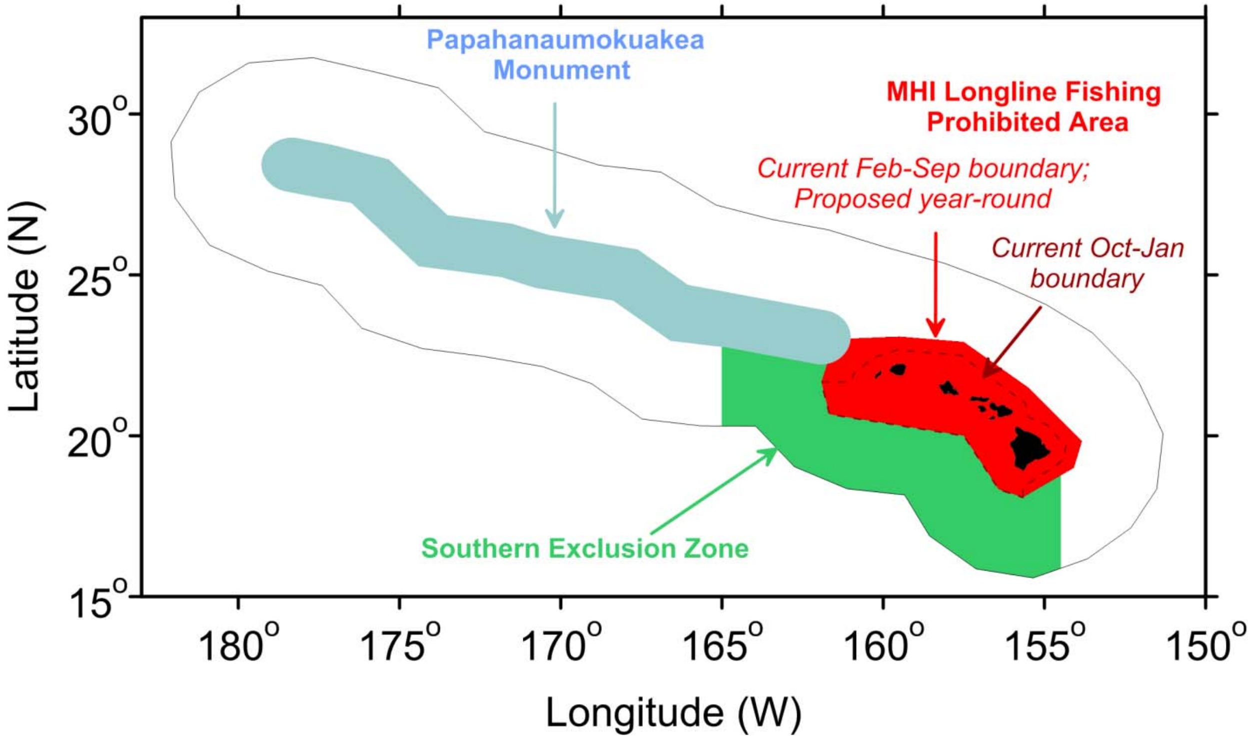


**Figure 2.2**. Proposed MHI Longline Fishing Prohibited Area and Southern Exclusion Zone, shown with boundaries of existing longline prohibited area and Papahanaumokuakea Marine National Monument.

## Non-regulatory Measures

### *2.3.2.9 Increase precision of bycatch estimates in the Hawaii-based deep-set longline fishery*

Observer coverage in the deep-set longline fishery is currently targeted at approximately 20%. Coverage levels vary throughout the year because of fluctuation in the longline fleet's activity level, the demands of 100% coverage in the shallow-set longline fishery, and an influx of observers after completion of the NMFS PIRO observer training course (McCracken 2009). Observed trips in the deep-set longline fishery are selected using two sampling schemes to accommodate this fluctuating coverage and to utilize observers efficiently. The primary scheme is a systematic sample of "call numbers," which are assigned when longline vessels call the NMFS PIRO observer program contractor before departing on a fishing trip (McCracken 2009). Currently, the quarterly sample selected under this systematic design is targeted at 15%, but it may be closer to 10%, particularly in the first quarter of the year. Additional trips needed to reach the full targeted level (i.e., 20%) are selected using a secondary sampling scheme, when all trips selected by the systematic sample are already covered and an observer is ready to be deployed. The additional trips are randomly selected with equal probability from the calls received that day that had not already been selected. This secondary sampling, or "day coverage," is flexible and dependent on the need to deploy observers (McCracken 2009).

The FKWTRT recommended NMFS increase observer coverage in the deep-set longline fishery to at least a 25% average quarterly coverage rate, to increase the precision (decrease the error) of the bycatch estimate in the fishery. Following the submission of the FKWTRT's recommendations, NMFS conducted an analysis to determine how the error in estimated bycatch of cetaceans could be reduced by increases in observer coverage (McCracken and Boggs 2010). NMFS analysis indicates that ensuring the systematic coverage is at a minimum of 15% year-round provides a greater benefit in relation to error reduction than a systematic sample increase from 15% to 20%, or an overall sample increase from 20% to 25%.

Under this alternative, NMFS proposes to implement an increase in systematic observer coverage in the deep-set longline fishery, though there would be no increase in overall coverage. Day sampling would continue to be used to meet the additional minimum of 5% to attain the targeted 20% coverage for the deep-set longline fishery. NMFS would work with the observer contractor to reallocate observers and schedule observer trainings appropriately to ensure enough observers are available to meet the new sampling targets for the deep-set longline fishery. NMFS has already begun to implement these changes.

#### *2.3.2.10 Changes to observer training and data collection protocols*

The FKWTRT recommended that NMFS modify existing observer data forms to allow collection of the following types of information: (a) differentiation among marine mammal mouth hooking types (lip, jaw, internal, ingested, other), when possible; (b) more detail on handling of bycaught marine mammals and any efforts made to release it without gear; (c) hook type and terminal tackle configuration of the gear involved in the interaction, when possible; (d) whether sets are split, and the configuration of split sets; (e) details of vessel light configuration and how the lights are utilized; (f) presence/absence of false killer whales during setting and haul-back of gear; (g) false killer whale sighting data (e.g., location, group size, behavior) during transits, as well as visual sighting effort data; and (h) injuries to vessel crew that are incurred associated with gear changes and release of protected species. Some of the information is already being collected on existing data forms, so the forms may require only small changes to collect the additional data. NMFS may also develop a list of specific questions to ask the observer during debriefing to prompt for further detail.

The FKWTRT also made recommendations regarding observer protocol during and after marine mammal interactions. The FKWTRT recommended that observers should: (a) encourage the vessel crew to inform the captain immediately if/when a marine mammal is hooked or entangled; (b) encourage the vessel crew not to cut the line unless instructed by the vessel captain or the observer; (c) encourage captains to comment on the observer's Marine Mammal Biological Data Form after an interaction when a captain can offer additional information; and (d) retain gear from interactions, including branchlines/leaders even in the absence of a hook, and collect any marine mammal tissues that may be present on the gear.

The FKWTRT made the following recommendations regarding observer training: (a) include videos from prior marine mammal hookings and entanglements and subsequent releases; (b) provide better photographic equipment to experienced observes and train them in photo-identification to support false killer whale research, depending on available funding; and (c) train a highly-qualified sub-set of observers to obtain biopsy samples of bow-riding false killer whales, after authorization through a research permit.

NMFS proposes to implement the recommended changes, as possible, through appropriate changes to the data collection forms and/or training, but notes that some of the recommendations are already being implemented through existing training and data forms. For example, the Marine Mammal Biological Data form prompts the observer to differentiate between mouth hookings and ingested hooks, if known, and would only require the addition of check boxes for lip or jaw hookings. The form also contains check boxes for each gear type that remained on the animal (e.g., branchline, weight), boxes to note the hook type and size involved in the interaction, and a comment section specifically for describing the gear remaining on the animal. The form also has space for other comments and drawings of the interaction, and observers are instructed to provide as much detail as possible on all aspects of the interaction, including any efforts to remove gear from the animal. NMFS may develop a list of specific questions to ask the observer during debriefing to prompt for further detail. For these specific items, the forms may need only minor changes to address the FKWTRT's recommendations.

**Other Measures**

The proposed action also includes the following four measures:

- NMFS proposes to notify the FKWTRT when there is an observed interaction of a known or possible false killer whale, and provide the FKWTRT with any non-confidential information regarding the interaction;
- When there is an observed interaction of a known or possible false killer whale, NMFS proposes to confirm the identification of the species and make the serious injury determination as soon as possible after the observer debriefing and data approval for the interaction, and provide the non-confidential information to the FKWTRT with the rationale for the determination;
- NMFS proposes to expedite the processing of the data from the 2010 cetacean assessment survey in the EEZ around Hawaii (Hawaiian Islands Cetacean and Ecosystem Assessment Survey, or HICEAS II), and provide preliminary results to the FKWTRT; and
- NMFS proposes to reconvene the FKWTRT at regular intervals, depending on available funding, to monitor the progress of the FKWTRP in reaching its short- and long-term goals, and discuss amending the FKWTRP if warranted.

These measures are part of the proposed action, but because they are either solely administrative or do not constitute a specific action that would be expected to have any effect on the environment, these specific measures are not analyzed within this EA.

### 2.3.3 Alternative 3: Close the EEZ around Hawaii to commercial longline fishing year-round

Under this alternative, all commercial longline fishing would be prohibited within the entire EEZ around Hawaii. This alternative was designed to ensure the MMPA-specified take reduction goals would be met. Incidental M&SI of false killer whales in the longline fisheries inside the EEZ around Hawaii would be eliminated; bycatch of the strategic Hawaii pelagic stock of false killer whales would be reduced to below its PBR level (and below 10% of its PBR level), since the PBR level in the 2010 SAR applies only to animals within the EEZ around Hawaii. Additionally, incidental M&SI of the Hawaii insular stock of false killer whales in the longline fisheries would be reduced to less than 10% of its PBR level. Levels of incidental M&SI of the Palmyra stock is already below the stock's PBR level.

Incidental M&SI of the Hawaii pelagic stock of false killer whales occurring outside of the EEZ around Hawaii would likely still occur, as would incidental M&SI of the Palmyra Atoll stock.

A large portion of the fishing effort already occurs outside of the EEZ around Hawaii: in 2008, 59% of hooks set by the Hawaii-based longline fisheries were outside the EEZ, while 27% of hooks were inside the EEZ around the MHI, 11% inside the EEZ around the Northwestern Hawaiian Islands (NWHI), and 3% in the EEZ around Pacific Remote Island Areas (WPRFMC 2010b). Displacement (i.e., relocation or redistribution) of some, but not all, of the current longline fishing effort from inside the EEZ around Hawaii to other areas would be expected. Some Hawaii-based vessels would likely be unable to bear the increased operational costs of fishing only outside of the EEZ around Hawaii, and thus overall longline fishing effort would be expected to decrease.

## 2.4 Alternatives Considered but Not Analyzed Further

NMFS and the FKWTRT discussed numerous other potential management measures, including strategies for avoiding marine mammals' exposure to vessels and gear, strategies or gear modifications to minimize active depredation of bait and/or catch (since incidental hookings frequently occur during depredation), and strategies to minimize M&SI of false killer whales once the animal is in contact with the gear. A selection of these is included in Table 2.1 below.

NMFS and the FKWTRT did not select these measures as alternatives to be analyzed further for various reasons. For many of them, there is a lack of data to suggest that they would reduce M&SI of marine mammals. For others, there were concerns regarding readiness or availability of the technology, feasibility or practicality, or cost, or more information or testing was needed on how to implement the measure. Finally, a few were not seen as promising based on past research results. Though these and other measures were discussed and considered by NMFS and the FKWTRT, they were not included in the alternatives analyzed in this document.

**Table 2.1**. Actions and measures discussed by NMFS and the FWKTRT, but not analyzed further.

| Category | Possible Actions or Measures |
|---|---|
| Strategies to reduce false killer whale chances of finding vessels | - Change vessel lighting characteristics (e.g., lower-profile deck lighting; intermittent use of spotlights instead of constant lighting to find buoys; intermittent lights on buoys)<br>- Use of oceanographic buoys (NMFS, naval, other) to foster location and avoidance of FKW<br>- Real-time fleet communication, possibly including VMS, to foster avoidance of whales<br>- Use of hydrophones from longlines to identify presence of and/or depredation by FKW<br>- Annual haul-out to reduce vessel noise profile (change rudder, cutlass bearing, etc.)<br>- Degaussing of steel boats (demagnetize)<br>- Direct current through vessel hull to eliminate electric profile<br>- Diminish hydraulic profile (pumps, hoses, reel, steering) to background levels<br>- Decoy buoys<br>- Spotters (air or vessel-based)<br>- Line changes (e.g., color, coating, diameter, snaps)<br>- Set splitting or gaps between baskets |
| Strategies or gear modifications to minimize active depredation of bait and/or catch | - Small solid structures (i.e., plastic beads) to alter acoustic target profile of bait/catch<br>- Streamers deployed alongside hook to change acoustic target profile of bait/catch<br>- Different leaders to change acoustic target profile<br>- Use of nails/metal tabs in bait tail to change acoustic target profile<br>- Revised rules to allow fishermen to retain gills/guts on board<br>- Bait/discard/offal retention, or offal processed on-board into an on-vessel commodity<br>- Limits on line length and/or soak time<br>- Noise deterrents<br>- Taste deterrents |

| | |
|---|---|
| Strategies to minimize serious injuries and mortalities | - Use of barbless hooks<br>- False killer whale sedation (to foster gear removal) |

In addition to the measures in Table 2.1 above, which were not analyzed as separate alternatives or as part of the suite of measures in the Preferred Alternative, NMFS also considered variations of measures that were recommended by the FKWTRT. Specifically, NMFS considered other ways to implement the trigger and closure of the SEZ. NMFS carefully considered the FKWTRT's recommendation regarding the SEZ trigger and closure, and also looked at several other methods, before selecting the Preferred Alternative for further analysis. The details of these alternate methods are described in Appendix I. Appendix I also describes the SEZ specifications in the Preferred Alternative to allow direct comparison.

## 2.5 Research Needs

The Draft FKWTRP includes numerous research strategies and data collection recommendations (FKWTRT 2010). The recommendations are important for focusing research to fill critical information gaps. Information gained from research would aid in further refining the FKWTRP's management measures in the future.

The FKWTRT identified research strategies that addressed information needs for the following: (1) avoiding exposure to vessel/gear, (2) reducing the probability of an interaction once whales are in the vicinity of longline gear, and (3) minimizing impacts of an interaction once it has occurred. The FKWTRT developed a list of 35 research recommendations, which were prioritized within and across four categories: false killer whale biology; longline gear and fishing; shortline and kaka line fishing; and false killer whale assessment. The FKWTRT also listed five additional research topics that were not included in the ranked list. Details of all of the recommended research topics can be found in section 9 of the Draft FKWTRP (FKWTRT 2010). The FKWTRT noted the iterative process inherent in research and the need to maintain the list of research priorities as a "living document," with changes and additions anticipated over the course of the take reduction process.

The research recommendations do not constitute specific proposed projects and are not included in the alternatives considered, nor are they being analyzed in this EA. However, NMFS will consider the FKWTRT's recommendations for additional research and data collection when establishing funding priorities, and will follow the recommendations to the extent that good scientific practice and resources allow. As feasible and appropriate, NMFS will consult and coordinate with FKWTRT members during this process.

# 3.0 AFFECTED ENVIRONMENT

Section 3 describes the natural and human environment and resources potentially affected by the alternatives described in section 2. The information presented in section 3 represents a general summary of the potentially affected environment that the impact analysis in section 4 will use as the environmental baseline.

## 3.1 Physical Environment

The physical area affected by the alternatives is the pelagic Pacific Ocean. The dynamics of the Pacific Ocean's physical environment have direct and indirect effects on the occurrence and distribution of life in marine ecosystems. Section 3.2 of the Final Programmatic Environmental Impact Statement prepared in association with the development and implementation of Fishery Ecosystem Plans (WPRFMC and NMFS 2009a) provides information on the physical environment of the Pacific Ocean, including a description of the geology and topography of the ocean basin, ocean water characteristics, ocean layers, depth zones, circulation, currents, prominent meteorological features, and island geography; this section is incorporated by reference.

### 3.1.1 Climate Change

Section 3.1.3 of the Final Supplemental Environmental Impact Statement (FSEIS) for Amendment 18 to the FMP for Pelagic Fisheries of the Western Pacific Region (WPRFMC and NMFS 2009b) describes the potential impacts of global climate change on the physical environment of the Pacific Ocean from rising water temperatures and related changes in ice cover, salinity, oxygen levels, and circulation. These changes include shifts in ranges and changes in algal, plankton, and fish abundance and growth rates. This section is also incorporated by reference.

### 3.1.2 Essential Fish Habitat, Habitat Areas of Particular Concern, and Critical Habitat

The Council has declared essential fish habitat (EFH) and habitat areas of particular concern (HAPC; 64 FR 19068). Western Pacific EFH and HAPC include the water column above the ocean bottom and/or the ocean bottom itself. Water column EFH and HAPC have been designated for Pelagic, Bottomfish, Precious Corals, Crustacean, and Coral Reef Ecosystem management unit species (MUS) (Table 3.1). Areas of ocean bottom have been designated EFH and HAPC for Precious Corals, Crustaceans, Bottomfish, and Coral Reef Ecosystem MUS (Table 3.1). No fishery under Council jurisdiction has been found to adversely affect the EFH or HAPC of any Western Pacific Region MUS.

**Table 3.1**. EFH and HAPC for Western Pacific Region MUS. WPRFMC and NMFS 2009a.

| FMP | EFH (Juveniles and Adults) | EFH (Eggs and Larvae) | HAPC |
|---|---|---|---|
| **Bottomfish and Seamount Groundfish** | **Bottomfish**: Water column and bottom habitat down to 400 meters<br><br>**Seamount Groundfish (adults only)**: Water column and bottom from 80 to 600 m, bounded by 29°– 35° N and 171°E–179° W | **Bottomfish**: Water column down to 400 m<br><br>**Seamount Groundfish (including juveniles)**: epipelagic zone (0–200 m) bounded by 29°–35° N and 171° E–179° W | **Bottomfish**: All escarpments and slopes between 40 and 280 meters, and three known areas of juvenile opakapaka habitat<br><br>**Seamount Groundfish**: Not identified |
| **Coral Reef Ecosystem** | Water column and benthic substrate to a depth of 100 meters | Water column and benthic substrate to a depth of 100 meters | All MPAs identified in FMP, all PRIA, many specific areas of coral reef habitat |
| **Crustaceans** | **Lobsters**: Bottom habitat from shoreline to a depth of 100 meters<br><br>**Deepwater shrimp**: The outer reef slopes at depths between 300-700 m | **Lobsters**: Water column down to 150 meters<br><br>**Deepwater shrimp**: Water column and associated outer reef slopes between 550 and 700 m | **Lobsters**: All banks with summits less than 30 meters<br><br>**Deepwater shrimp**: Not designated |

| | | | |
|---|---|---|---|
| **Precious Corals** | Keahole Point, Makapuu, Kaena Point, Westpac, Brooks Bank, and 180 Fathom Bank deepwater precious coral (gold and red) beds and Milolii, Au'au Channel, and S. Kauai black coral beds | NA | Makapuu, Westpac, and Brooks Bank deepwater precious coral beds and the Au'au Channel black coral bed |
| **Pelagics** | Water column down to 1,000 meters | Water column down to 200 meters | Water column above seamounts and banks down to 1,000 meters |

Except for the Hawaiian monk seal, no critical habitat (CH) has been designated for any threatened or endangered species in the Pacific Ocean. In 1986, CH for the Hawaiian monk seal was designated at all beach areas, sand spits and islets, including all beach crest vegetation to its deepest extent inland, lagoon waters, inner reef waters, and ocean waters out to a depth of 10 fathoms (18.3 m) around Kure Atoll, Midway Islands (except Sand Island), Pearl & Hermes Reef, Lisianski Island, Laysan Island, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island in the NWHI (51 FR 16047; April 30, 1986). In 1988, CH was expanded to include waters around previously designated areas out to the 20 fathom (36.6 m) isobath and to include Maro Reef (53 FR 18988; May 26, 1988). A 2005 Biological Opinion on the deep-set longline fishery found that the deep-set longline fishery does not overlap CH for the endangered Hawaiian monk seal and is not likely to adversely affect CH that has been designated for the Hawaiian monk seal (NMFS 2005b). NMFS has found that Hawaiian monk seals and their designated CH are not likely to be adversely affected by the shallow-set longline fishery (NMFS 2008).

A proposed revision to monk seal CH (76 FR 32026, June 2, 2011) would establish new CH in the MHI from shore to the 500 m isobath. This area is completely within the existing longline exclusion zone around the MHI, and thus would not be affected by the longline fisheries.

None of the proposed measures presented in section 2 of this EA/RIR/IRFA are likely to modify fishing practices in a manner that would aversely affect EFH, HAPC, or Hawaiian monk seal CH, or the habitat of false killer whales, or any other protected or listed marine species.

## 3.2 Biological Environment

Marine waters of the Pacific Ocean provide habitat to a diversity of aquatic organisms, including federally managed and commercial important fish species, endangered and threatened marine animals, and additional protected marine mammals.

### 3.2.1 Protected Species

Table 3.2 lists protected species found in the waters where the Hawaii-based longline fisheries operate and notes which species may be affected by the fisheries and management actions under the proposed FKWTRP. Note that while all marine mammals are protected under MMPA, a number of the large whales and the Hawaiian monk seal are also listed as endangered under the ESA. Additionally, all sea turtles and one species of bird are found within the affected environment and are listed as endangered or threatened under the ESA.

Many of the protected species that occur in the Pacific Ocean have never been observed as bycatch in longline fisheries in the areas and managed under the proposed FKWTRP and analyzed in this EA. These species are listed as "not likely to be affected" in Table 3.2. Detailed species accounts are given below only for those species that have been observed incidentally taken in the Hawaii-based longline fisheries, and could be affected by the measures of the proposed FKWTRP.

Most of the information regarding marine mammal distribution, abundance, and sources of injury and mortality discussed in this section is taken from the 2010 SARs (Carretta et al. 2011), prepared as required by Section 117 of the 1994 amendments to the MMPA.

**Table 3.2**. Protected species found in the area of operation of the Hawaii-based longline fisheries. All marine mammals are protected under the MMPA. Those identified as threatened or endangered are also protected under the ESA. All sea turtles are protected under the ESA, and seabirds and shorebirds are subject to protections of the Migratory Bird Treaty Act.

| Effects of the FKWTRP | Category | Common Name | Scientific Name | Status |
|---|---|---|---|---|
| Not likely to be affected by the False Killer Whale Take Reduction Plan | Large Whales | Blue Whale | *Balaenoptera musculus* | Endangered |
| | | Fin Whale | *Balaenoptera physalus* | Endangered |
| | | Minke Whale | *Balaenoptera acutorostrata* | Protected |
| | | Sei Whale | *Balaenoptera borealis* | Endangered |
| | | Sperm Whale | *Physeter macrocephalus* | Endangered |
| | Dolphins & Small Whales | Killer Whale | *Orcinus orca* | Protected |
| | | Longman's Beaked Whale | *Indopacetus pacificus* | Protected |
| | | Cuvier's Beaked Whale | *Ziphius cavirostris* | Protected |
| | | Melon-headed Whale | *Peponocephala electra* | Protected |
| | | North Pacific Right Whale | *Eubalaena japonica* | Endangered |
| | | Pygmy Killer Whale | *Feresa attenuata* | Protected |
| | | Common Dolphin | *Delphinus delphis* | Protected |
| | | Fraser's Dolphin | *Lagenodelphis hosei* | Protected |
| | | Rough-toothed Dolphin | *Steno bredanensis* | Protected |
| | | Spinner Dolphin | *Stenella longirostris* | Protected |
| | Pinnipeds | Hawaiian Monk Seal | *Monachus schauinslandi* | Endangered |
| | | Northern Elephant Seal | *Mirounga angustirostris* | Protected |
| | Seabirds | Christmas shearwater | *Puffinus nativitatis* | Protected |
| | | Newell's shearwater | *Puffinus auricularis newelli* | Threatened |
| | | Masked Booby | *Sula dactylatra* | Protected |
| | | Petrels | *Pseudobulweria spp., Pterodroma spp.* | Protected |
| | | Hawaiian Dark-rumped Petrel | *Pterodroma sandwichensis* | Endangered |
| | | Short-tailed Albatross | *Phoebastria albatrus* | Endangered |
| | | Frigatebirds | *Fregata spp.* | Protected |
| | | Terns | *Sterna spp.* | Protected |
| | | Tropicbirds | *Phaethon spp.* | Protected |
| | | Noddies | *Anous spp.* | Protected |
| Potentially affected by the False Killer Whale Take Reduction Plan | Large Whales | Humpback Whale | *Megaptera novaeangliae* | Endangered |
| | | Bryde's Whale | *Balaenoptera edeni* | Protected |
| | Dolphins & Small Whales | Blainville's Beaked Whale | *Mesoplodon densirostris* | Protected |
| | | Dwarf Sperm Whale | *Kogia simus* | Protected |
| | | False Killer Whale | *Pseudorca crassidens* | Protected; Hawaii insular stock proposed as Threatened |
| | | Pygmy Sperm Whale | *Kogia breviceps* | Protected |

| | | | | |
|---|---|---|---|---|
| | | Short-finned Pilot Whale | *Globicephala macrorhynchus* | Protected |
| | | Bottlenose Dolphin | *Tursiops truncatus* | Protected |
| | | Pantropical Spotted Dolphin | *Stenella attenuata* | Protected |
| | | Risso's Dolphin | *Grampus griseus* | Protected |
| | | Striped Dolphin | *Stenella coeruleoalba* | Protected |
| | Sea Turtles | Green Turtle | *Chelonia mydas* | Threatened |
| | | Hawksbill Turtle | *Eretmochelys imbricata* | Endangered |
| | | Leatherback Turtle | *Dermochelys coriacea* | Endangered |
| | | Loggerhead Turtle | *Caretta caretta* | Threatened |
| | | Olive Ridley Turtle | *Lepidochelys olivacea* | Threatened |
| | Seabirds | Black-footed Albatross | *Phoebastria nigripes* | Protected |
| | | Lasayan Albatross | *Phoebastria immutabilis* | Protected |
| | | Brown Booby | *Sula leucogaster* | Protected |
| | | Red-footed Booby | *Sula sula* | Protected |
| | | Wedge-tailed shearwater | *Puffinus pacificus* | Protected |
| | | Sooty shearwater | *Puffinus griseus* | Protected |

### 3.2.1.1 Marine Mammals

Endangered Marine Mammals

**Humpback Whale** *(Megaptera novaeangliae)*

The International Whaling Commission first protected humpback whales in the North Pacific in 1965. Humpback whales were listed as endangered under the ESA in 1973. They are also protected by the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) and the MMPA. CH has not been designated for this species.

Humpback whales typically migrate between tropical/sub-tropical and temperate/polar latitudes. Humpback whales feed on krill and small schooling fish on their summer grounds. The whales occupy tropical areas during winter months when they are breeding and calving, and polar areas during the spring, summer, and fall, when they are feeding, primarily on small schooling fish and krill (Caldwell and Caldwell 1983).

Humpback whales occur off all eight Hawaiian Islands during the winter breeding season, but particularly within the shallow waters of the “four-island” region (Kahoolawe, Molokai, Lanai, Maui), the northwestern coast of the island of Hawaii (Big Island), and the waters around Niihau, Kauai and Oahu (Wolman and Jurasz 1977, Herman et al. 1980, Baker and Herman 1981).

As part of the international SPLASH (Structure of Populations, Levels of Abundance and Status of Humpbacks) project, a recent study has estimated the abundance of North Pacific humpbacks to be just under 20,000, an estimate that is about double estimates made previously (Calambokidis et al. 2007). Over 50% of this population is estimated to winter in Hawaiian waters with large populations also inhabiting Mexican waters. The abundance estimates of humpback whales wintering in Asia and Central America were fairly low (1,000 or less). Among feeding areas, regional estimates differed greatly among models. Average estimates of abundance ranged from about 100-700 for Russia, 6,000-14,000 for the Bering Sea and Aleutians, 3,000-5,000 each for the Gulf of Alaska and the combined Southeast Alaska and Northern British Columbia area, 200-400 for Southern British Columbia-Northern Washington, and 1,400-1,700 for California-Oregon (Calambokidis et al. 2008).

Reports of entangled humpback whales found swimming, floating, or stranded with fishing gear attached have been made in both Alaskan and Hawaiian waters. The overall U.S. commercial fishery-related minimum mortality and serious injury rate for the entire stock is 3.8 humpback whales per year, based on observer data from Alaska (0.2), stranding records from Alaska (3.4), and observer data from Hawaii (0.2) (Allen and Angliss 2010).There have been two interactions observed between the shallow-set longline fishery and humpback whales since 2004, and three observed interactions with humpback whales in the deep-set longline fishery since 2001.

Non-ESA Listed Marine Mammals

**False Killer Whales** (*Pseudorca crassidens*)

False killer whales are found worldwide mainly in tropical and warm-temperate waters (Stacey et al. 1994). In the North Pacific, this species is well known from southern Japan, Hawaii, and the eastern tropical Pacific. There are six stranding records from Hawaiian waters (Nitta 1991; Maldini et al. 2005). One on-effort sighting of false killer whales was made during a 2002 shipboard survey of waters within the EEZ around Hawaii (Barlow 2006). Smaller-scale surveys conducted around the MHI show that false killer whales are also encountered in nearshore waters (Baird et al. 2008, Mobley et al. 2000). This species also occurs in the EEZ around Palmyra Atoll, Johnston Atoll, and American Samoa (Barlow and Rankin 2007, Carretta et al. 2011).

Genetic analyses of tissue samples collected within the Indo-Pacific indicate restricted gene flow between false killer whales sampled near the MHI and false killer whales sampled in all other regions (Chivers et al. 2007, 2010). The recent update from Chivers et al. (2010) included additional samples and analysis of 8 nuclear DNA (nDNA) microsatellites, revealing strong phylogenetic patterns that are consistent with local evolution of haplotypes that are nearly unique to the separate insular population around the MHI. Further, the recent analysis also revealed significant differentiation, in both mitochondrial and NDNA, between pelagic false killer whales in the Eastern North Pacific (ENP) and Central North Pacific (CNP) strata defined in Chivers et al. (2010), although the sample distribution to the east and west of Hawaii is insufficient to determine whether the sampled strata represent one or more stocks, and where stock boundaries would be. Since 2003, observers of the Hawaii-based longline fisheries have been collecting tissue samples of caught cetaceans for genetic analysis whenever possible. Between 2003 and 2010, eight false killer whale samples (four collected outside the EEZ around Hawaii and four collected more than 100 nautical miles (185 km) from the MHI) were determined to have Pacific pelagic haplotypes (Chivers et al. 2010).

Recent satellite telemetry studies, boat-based surveys, and photo-identification analyses of false killer whales around Hawaii have demonstrated that the insular and pelagic stocks have overlapping ranges, rather than a clear separation in distribution. Insular false killer whales have been documented as far as 112 km from the MHI, and pelagic stock animals have been documented as close as 42 km to the islands (Baird et al. 2008, Baird 2009, Baird et al. 2010, Forney et al. 2010). Based on a review of new information (Forney et al. 2010), the 2010 SAR recognized a new, overlapping stock structure for insular and pelagic stocks of false killer whales around Hawaii: unless stock identity can be confirmed through other evidence (e.g., genetic data), animals within 40 km of the MHI are considered to belong to the insular stock; animals beyond 140 km of the MHI are considered to belong to the pelagic stock, and the two stocks overlap between 40 km and 140 km from shore.

The 2010 SAR also clarifies that the pelagic stock includes animals found both within the EEZ around Hawaii and in adjacent high seas; however, because data on false killer whale abundance, distribution, and human-caused impacts are largely lacking for the high seas, the status of this stock is evaluated based on data from the EEZ around Hawaii (NMFS 2005a). The Palmyra Atoll stock of false killer whales remains a separate stock, because comparisons amongst false killer whales sampled at Palmyra Atoll and those sampled from the insular stock of Hawaii and the pelagic ENP revealed restricted gene flow, although the sample size remains low for robust comparisons (Chivers et al. 2007, 2010). NMFS will continue to obtain and analyze additional tissue samples for genetic studies of stock structure, and will evaluate new information on stock ranges as it becomes available.

In the 2010 SAR, there are currently four Pacific Islands Region management stocks of false killer whales: 1) the Hawaii insular stock, which includes false killer whales inhabiting waters within 140 km (approx. 75 nm) of the MHI; 2) the Hawaii pelagic stock, which includes false killer whales inhabiting waters greater than 40 km (22 nm) from the MHI; 3) the Palmyra Atoll stock, which includes false killer whales found within the EEZ around Palmyra Atoll; and 4) the American Samoa stock, which includes false killer whales found within the EEZ around American Samoa. The American Samoa stock is not affected by the Hawaii-based longline fisheries, and thus is not further described in this EA.

*Hawaii Insular Stock*

In the 2010 SAR, the Hawaii insular stock's population size was estimated as 123 (coefficient of variation, or CV=0.72), based on a mark-recapture study of photo-identification data from 2000-2004 (Baird et al. 2005). The minimum population estimate is the number of distinct individuals identified in this population during the 2002-2004 studies, 76 individuals (Baird et al. 2005). The current population trend is believed to be declining, and no data are available on current or maximum net productivity rates for this species in Hawaiian waters.

The status relative to the optimum sustainable population level (OSP) of false killer whales belonging to the insular stock is unknown, although this stock appears to have declined during the past two decades (Reeves et al. 2009, Baird 2009, Chivers et al. 2010, Oleson et al. 2010). A recent study (Ylitalo et al. 2009) documented elevated levels of polychlorinated biphenyls (PCBs) in three of nine insular false killer whales sampled, and biomass of some false killer whale prey species may have declined around the main Hawaiian Islands (Boggs & Ito 1993, Reeves et al. 2009). False killer whales are not listed as "threatened" or "endangered" under the ESA, nor as "depleted" under the MMPA. In September 2009, a petition was submitted to NMFS to list the Hawaiian insular false killer whale stock as an endangered species under the ESA, and NMFS completed a status review and issued a proposed rule to list them as endangered (75 FR 70169, November 17, 2010). The estimated average annual human-caused M&SI for this stock (0.60 animals per year) is slightly less than the PBR (0.61); therefore, the insular false killer whale stock is not considered "strategic." However, the current estimate of mortality and serious injury does not include additional unidentified animals that may have been false killer whales (blackfish) and were taken within the insular stock range, and the status of this stock is likely to change once methods have been developed to prorate these additional takes.

*Hawaii Pelagic Stock*

In the 2010 SAR, the best estimate of the Hawaii pelagic stock's population size is 484 (CV=0.93) false killer whales within the EEZ around Hawaii, with a minimum population estimate of 249 false killer whales (Carretta et al. 2011). No data are available on current population trend or current or maximum net productivity level.

The status of the Hawaii pelagic stock of false killer whale relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. No habitat issues are known to be of concern for this stock. They are not listed as "threatened" or "endangered" under the ESA, nor as "depleted" under the MMPA. Following the NMFS Guidelines for Assessing Marine Mammal Stocks (NMFS 2005a), the status of this transboundary stock of false killer whales is assessed based on the estimated abundance and estimates of mortality and serious injury within the EEZ around Hawaii, because estimates of human-caused mortality and serious injury from all U.S. and non-U.S. sources on the high seas are not available, and because the geographic range of this stock beyond the EEZ around Hawaii is poorly known. Because the rate of mortality and serious injury to false killer whales within the EEZ around Hawaii (7.3 animals per year) exceeds the PBR (2.5), this stock is considered a "strategic stock." Furthermore, additional M&SI of unidentified cetaceans that may have been false killer whales (blackfish) is known to occur in the U.S. longline fisheries, but these animals have not yet been included in the Hawaii pelagic stock status assessment. The total fishery M&SI for Hawaiian the Hawaii pelagic stock of false killer whales cannot be considered to be insignificant and approaching zero, because it exceeds the PBR.

The National Marine Fisheries Service recognizes that the assessment of this transboundary stock based only on abundance and human-caused mortality and serious injury within the EEZ around Hawaii introduces uncertainty and has considered whether the status assessment would change if animals outside the Hawaiian Islands EEZ are considered. Using all available peer-reviewed information on the abundance of false killer whales on the high-seas and within the EEZ around Johnston Atoll , a PBR can be calculated as the lower 20th percentile of the Barlow and Rankin (2007) abundance estimate (530), times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.5 (for a stock of unknown status with a mortality and serious injury rate CV≤0.30; Wade and Angliss 1997), resulting in 5.3 false killer whales per year. The abundance estimate may be based on a smaller geographic area than the (unknown) full range of the pelagic stock, because areas to the north of the EEZ around Hawaii are not included; however, the estimate meets the definition of a 'minimum population estimate' under the MMPA. Bycatch information for the high seas is incomplete, because the levels of false killer whale takes in non-U.S. fisheries are not known. The average annual estimated M&SI by U.S. longline vessels operating on the high seas and within the EEZ around Johnston Atoll is 5.4 (CV=0.3; McCracken and Forney 2010). This value is greater than the PBR of 5.3, and the combined U.S. and international mortality and serious injury is likely substantially higher, because fishing effort by foreign vessels may be up to six times greater than that of the US fleet (NMFS, unpublished data). Better information on the full geographic range of this stock and quantitative estimates of bycatch in international fisheries are needed to reduce the uncertainties regarding impacts of false killer whale takes on the high seas, but these uncertainties do not change the current assessment that the pelagic false killer whale stock is strategic.

*Palmyra Atoll Stock*

In the 2010 SAR, the Palmyra stock's population size was estimated at 1,329 (CV=0.65) based on a line transect survey of the EEZ around Palmyra Atoll. The minimum population estimate was 806 false killer whales. No data are available on current population trend or current or maximum net productivity level.

The status of false killer whales in the EEZ around Palmyra Atoll relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. No habitat issues are known to be of concern for this stock. They are not listed as "threatened" or "endangered" under the ESA, nor as "depleted" under the MMPA. The rate of mortality and serious injury to false killer whales within the Palmyra Atoll EEZ in the Hawaii-based longline fishery (0.3 animals per year) does not exceed the PBR (6.4) for this stock and thus, this stock is not considered "strategic." The total fishery-related M&SI for Palmyra Atoll false killer whales is less than 10% of the PBR and, therefore, can be considered to be insignificant and approaching zero. Additional injury and mortality of false killer whales is known to occur in U.S and international longline fishing operations on the high seas, and the potential effect on the Palmyra stock is unknown.

A discussion of false killer whales' sensory abilities and foraging ecology, which are relevant to the nature of their interactions with the longline fishery, appears in section 4 of the Draft FKWTRP (FKWTRT 2010), and is incorporated by reference. These animals' behavior around commercial longline gear, particularly depredation activity (preying on longline bait and/or catch), may be a key factor leading to hooking and entanglement. A description of the nature of these interactions can be found in section 3.3 of the Draft FKWTRP (FKWTRT 2010), and is incorporated by reference.

**Risso's dolphin** *(Grampus griseus)*

Risso's dolphins are found in tropical to warm-temperate waters worldwide (Perrin et al. 2009), but are considered to be rare in the waters around Hawaii. There are five stranding records of Risso's dolphins from the MHI (Nitta 1991, Maldini et al. 2005). Risso's dolphins have also been sighted near Guam and the Northern Mariana Islands (Reeves et al. 1999). Risso's dolphins within the Pacific U.S. EEZ are divided into two discrete, noncontiguous areas: 1) Hawaiian waters, and 2) waters off California, Oregon, and Washington (Carretta et al. 2011). The Hawaiian stock includes animals found both within the EEZ around Hawaii and in adjacent high seas; however, because data on abundance, distribution, and human-caused impacts are largely lacking for the high seas, the status of this stock is evaluated based on data from the EEZ around Hawaii. A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 2,372 (CV=0.79) Rissos's dolphins (Barlow 2006). This is currently the best available abundance estimate for this stock (Carretta et al. 2011). Based on observer data from 2004-2008, the average 5-year estimates of M&SI are 2.6 (CV=0.40) Risso's dolphins outside of the EEZ, and none within the EEZ around Hawaii.

The status of Risso's dolphins in Hawaii's waters relative to their optimum sustainable population is unknown, and there are insufficient data to evaluate trends in abundance (Carretta et al. 2011). No habitat issues are known to be of concern for this species. It is not listed as "threatened" or "endangered" under the ESA, nor as "depleted" under the MMPA. Given the absence of recent fishery-related M&SI within the EEZ around Hawaii, the Hawaiian stock of Risso's dolphins is not considered strategic, and the total fishery-caused M&SI can be considered insignificant and approaching zero. However, the potential effects of injuries sustained by Risso's dolphins in U.S. pelagic longline fisheries on the high seas is not known, because no abundance or bycatch estimates are available for the high seas.

**Common bottlenose dolphin** *(Tursiops truncatus truncatus)*

Common bottlenose dolphins are widely distributed throughout the world in tropical and warm-temperate waters (Perrin et al. 2009). The species is primarily coastal, but there are also populations in offshore waters. Bottlenose dolphins are common throughout the Hawaiian Islands (Shallenberger 1981). Data suggest that the bottlenose dolphins in Hawaii belong to a separate stock from those in the eastern tropical Pacific (Scott and Chivers 1990). Furthermore, recent photo-identification and genetic studies off Oahu, Maui, Lanai, Kauai, Niihau, and Hawaii suggest limited movement of bottlenose dolphins between islands and into offshore waters (Baird et al. 2009, Martien et al. in review). These data suggest the existence of demographically distinct resident populations at each of the four main Hawaiian Island groups. In addition, the genetic data indicate that the deeper waters surrounding the MHI are utilized by a larger pelagic population. Bottlenose dolphins within the Pacific U.S. EEZ are divided into seven stocks: 1) California, Oregon and Washington offshore stock, 2) California coastal stock, and five Pacific Islands Region management stocks: 3) Kauai and Niihau, 4) Oahu, 5) the "4-Island Region" (Molokai, Lanai, Maui, Kahoolawe), 6) Hawaii Island and 7) the Hawaiian Pelagic Stock, including animals found both within the EEZ around Hawaii and in adjacent high seas.

Based on the locations of observed M&SI in the longline fisheries, the takes are considered to have been from the Hawaiian Pelagic stock. Average 5-yr estimates of annual M&SI for the Pelagic Stock during 2004-2008 are 0.6 (CV = 0) bottlenose dolphins outside of the EEZ, and 0.4 (CV = 0.68) within the EEZ around Hawaii (Carretta et al. 2011).

The status of bottlenose dolphins in Hawaii's waters relative to their optimum sustainable population is unknown, and there are insufficient data to evaluate trends in abundance (Carretta et al. 2011). A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 3,215 (CV= 0.59) bottlenose dolphins (Barlow 2006), equivalent to a density of 1.31individuals per 1000 km2. Applying this density to the 2,464,486 km2 area of the Pelagic Stock between the 1000misobath and the EEZ around Hawaii boundary, the stock-specific abundance is estimated as 3,178 (CV=0.59). This is currently the best available abundance estimate for the Hawaiian Pelagic stock..

**Pantropical spotted dolphin** *(Stenella attenuata attenuata)*

The pantropical spotted dolphin are primarily found in tropical and subtropical waters worldwide (Perrin et al. 2009). Pantropical spotted dolphins are common in Hawaii, primarily on the lee sides of the islands and in the inter-island channels (Shallenberger 1981). Morphological differences and distribution patterns have been used to establish that the spotted dolphins around Hawaii belong to a stock that is distinct from those in the eastern tropical Pacific (Perrin 1975, Dizon et al. 1994, Perrin et al. 1994). Twelve strandings of this species have been documented in Hawaii (Nitta 1991, Maldini et al. 2005). A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 8,978 (CV=0.48) pantropical spotted dolphins (Barlow 2006). This is currently the best available abundance estimate for this stock in the EEZ around Hawaii (Carretta et al. 2011). Average 5-yr estimates of annual M&SI for 2004-2008 are 0.5 (CV=0.7) spotted dolphins outside of the EEZ, and none within the EEZ around Hawaii.

The status of pantropical dolphins in Hawaii waters relative to their optimum sustainable population is unknown, and there are insufficient data to evaluate trends in abundance (Carretta et al. 2011). No habitat issues are known to be of concern for this species. It is not listed as “threatened” or “endangered” under the ESA, nor as “depleted” under the MMPA. Given the absence of recent fishery-related M&SI within the EEZ, the Hawaiian stock of pantropical spotted dolphins is not considered strategic, and the total fishery-caused M&SI can be considered insignificant and approaching zero. However, the potential effects of injuries sustained by pantropical spotted dolphins in U.S. pelagic longline fisheries on the high seas is not known, because no abundance or bycatch estimates are available for the high seas.

**Striped dolphin** *(Stenella coeruleoalba)*

The striped dolphin occurs in tropical and warm-temperate waters worldwide (Perrin et al. 2009). In Hawaii, striped dolphins have been reported stranded 20 times (Nitta 1991; Maldini et al. 2005), yet at-sea sightings of this species are infrequent (Shallenberger 1981; Mobley et al. 2000). Striped dolphin population estimates are available for the waters around Japan and in the eastern tropical Pacific, but it is not known whether any of these animals are part of the same population that occurs in Hawaii (Carretta et al. 2011). For the Marine Mammal Protection Act (MMPA) stock assessment reports, striped dolphins within the Pacific U.S. EEZ are divided into two discrete, non-contiguous areas: 1) waters off California, Oregon and Washington, and 2) waters around Hawaii, including animals found both within the EEZ around Hawaii and in adjacent high seas. Because data on abundance, distribution, and human-caused impacts are largely lacking for the high seas, the status of this stock is evaluated based on data from the EEZ around Hawaii.

A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 13,143 (CV=0.46) striped dolphins (Barlow 2006). This is currently the best available abundance estimate for this stock in the EEZ around Hawaii (Carretta et al. 2011). Average 5-yr estimates of annual M&SI for 2004-2008 are zero dolphins outside of EEZ, and 0.9 (CV=0.6) within the EEZ around Hawaii.

The status of striped dolphins in Hawaii’s waters relative to their optimum sustainable population is unknown, and there are insufficient data to evaluate trends in abundance (Carretta et al. 2011). No habitat issues are known to be of concern for this species. It is not listed as “threatened” or “endangered” under the ESA, nor as “depleted” under the MMPA. The Hawaiian stock of striped dolphins is not considered strategic because the estimated rate of fisheries-related M&SI within the EEZ around Hawaii (0.9 animals per year) is less than the PBR (82). Total fishery M&SI for striped dolphins can be considered insignificant and approaching zero because the average annual takes are less than 10% of the PBR.

**Short-finned pilot whale** *(Globicephala macrorhynchus)*

Short-finned pilot whales are found in all oceans, primarily in tropical and warm temperate waters. often in sizable herds (Reeves et al. 1999). It is one of the most frequently observed cetaceans around Guam (Reeves et al. 1999). Short-finned pilot whales are commonly observed around the MHI, and are present around the NWHI (Shallenberger 1981; Barlow 2006). Stock structure of short-finned pilot whales has not been adequately studied in the North Pacific, except in the waters around Japan where two stocks have been identified based on pigmentation patterns and differences in the shape of the heads of adult males (Kasuya et al. 1988). The pilot whales in Hawaiian waters are similar morphologically to the Japanese “southern form.” Preliminary photo-identification work with pilot whales in Hawaii indicated a high degree of site fidelity around the main island of Hawaii (Shane and McSweeney 1990) and around Kauai and Niihau (Baird et al. 2006).

Genetic analyses of tissue samples collected near the MHI indicate that Hawaiian short-finned pilot whales are reproductively isolated from short-finned pilot whales found in the eastern Pacific Ocean (S.Chivers, NMFS/SWFSC, unpublished data); however, the offshore range of this Hawaiian population is unknown. Fishery interactions with short-finned pilot whales demonstrate that this species also occurs in the EEZ around Palmyra Atoll and Johnston Atoll, but it is not known whether these animals are part of the Hawaiian stock or whether they represent separate stocks of short-finned pilot whales. Based on patterns of movement and population structure observed in other island-associated cetaceans (Norris and Dohl 1980, Norris et al.1994, Baird et al. 2001, 2003, S. Chivers, pers. comm. in Carretta et al. 2011), it is possible that the animals around Palmyra Atoll and Johnston Atoll are one or more separate stocks (Carretta et al. 2011).

A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 8,846 (CV=0.49) short-finned pilot whales (Barlow 2006). This is currently the best available abundance estimate for short-finned pilot whales within the EEZ around Hawaii (Carretta et al. 2011). Average 5-yr estimates of annual M&SI for 2004-2008 are 2.0 (CV = 0.5) short-finned pilot whales outside of the EEZ, 0.7 (CV=1.4) within the EEZ around Hawaii, and 0.5 (CV=0.8) within the Johnston Atoll EEZ (McCracken & Forney 2010). Eight additional unidentified cetaceans, which may have been short-finned-pilot whales, were also taken during 2004-2008. Six of these were taken in the deep-set longline fishery in EEZ around Hawaii waters, one was taken in the deep-set longline fishery on the high seas, and one was taken in the shallow-set longline fishery on the high seas.

The status of short-finned whales in Hawaii’s waters relative to their optimum sustainable population is unknown, and there are insufficient data to evaluate trends in abundance (Carretta et al. 2011). The status of short-finned pilot whales in Hawaiian waters relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. No habitat issues are known to be of concern for this species. It is not listed as “threatened” or “endangered” under the ESA, nor as “depleted” under the MMPA. The Hawaiian stock of short-finned pilot whales is not considered strategic because the estimated rate of mortality and serious injury within the EEZ around Hawaii (0.7 animals per year) is less than the PBR (52). Although no estimates of abundance or PBR are currently available for short-finned pilot whales around Johnston Atoll, the estimated average rate of mortality and serious injury of short-finned pilot whales within the EEZ around Johnston Atoll (0.5 animals per year) is below the range of likely PBRs (7.1 to 65) for this region. There have been no serious injuries or mortality of short-finned pilot whales within the Palmyra Atoll EEZ. The potential effects of mortality and serious injuries of short-finned pilot whales in the Hawaii-based fishery on the high seas are not known, because no abundance estimates or international bycatch estimates are available. Based on the available data, which indicate total fishery-related takes are less than 10% of PBR, the total fishery mortality and serious injury for short-finned pilot whales is can be considered to be insignificant and approaching zero.

**Blainville’s beaked whale** *(Mesoplodon densirostris)*

Blainville’s beaked whale has a cosmopolitan distribution in tropical and temperate waters (Mead 1989). Sixteen sightings of this species were reported from the MHI by Shallenberger (1981). Resightings of individual Blainville’s beaked whales during a 21-year study suggests long-term site fidelity and year round occurrence off the island of Hawaii (McSweeney et al. 2007). Recent analysis of Blainville’s beaked whale movements off the Island of Hawaii suggest the existence of insular and offshore populations of this species in Hawaiian waters; however, further movement and genetic studies are needed to better understand individual movements and stock structure of Blainville’s beaked whales in Hawaii (McSweeney et al. 2007, Baird et al. 2009, Schorr et al. 2009).

A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 2,872 (CV=1.17) Blainville's beaked whales (Barlow 2006), including a correction factor for missed diving animals. This is currently the best available abundance estimate for this stock in the Hawaii EZZ (Carretta et al. 2011). Average 5-year estimates of annual M&SI for 2004-2008 are 0.7(CV=0.9) Blainville's beaked whales outside of the EEZ, and zero within the EEZ around Hawaii.

In recent years, there has been increasing concern that loud underwater sounds, such as active sonar and seismic operations, may be harmful to beaked whales (Malakoff 2002). The use of active sonar from military vessels has been implicated in mass strandings of beaked whales in the Mediterranean Sea during 1996 (Frantzis 1998), the Bahamas during 2000 (U.S. Dept. of Commerce and Secretary of the Navy 2001), and the Canary Islands 2002 (Martel 2002). Similar military active sonar operations occur around the Hawaiian islands. It has been suggested that quick ascent from deep dives in response to acoustic exposure could lead to death in beaked whales (Cox et al. 2006). A modeling exercise based on dive data from Blainville's, Cuvier's and northern bottlenose whales suggest that the dive habits of all three species produce tissue nitrogen saturation levels that would normally cause decompression sickness in terrestrial mammals (Hooker et al. 2009). The impact of sonar exercises on resident versus offshore beaked whales may be significantly different with offshore animals less frequently exposed, possibly subject to more extreme reactions (Baird et al. 2009). No estimates of potential mortality or serious injury are available for U.S. waters.

The status of Blainville's beaked whales in Hawaii's waters relative to their optimum sustainable populations is unknown, and there are insufficient data to evaluate trends in abundance (Carretta et al. 2011). It is not listed as "threatened" or "endangered" under the ESA, nor as "depleted" under the MMPA. Given the absence of recent fishery-related mortality or serious injuries within the EEZ, the Hawaiian stock of Blainville's beaked whales is not considered strategic, and the total fishery mortality and serious injury can be considered to be insignificant and approaching zero. However, the effect of potential interactions of Blainville's beaked whales and unidentified beaked whales (some of which may have been Blainville's beaked whales) with the Hawaii-based longline fishery in the U.S. EEZ and the high seas is not known. The increasing levels of anthropogenic noise in the world's oceans has been suggested to be a habitat concern for whales (Richardson et al. 1995), particularly for deep-diving whales like Blainville's beaked whales that feed in the oceans' "sound channel."

**Pygmy sperm whale** *(Kogia breviceps)*

Pygmy sperm whales are found throughout the world in tropical and warm-temperate waters (Caldwell and Caldwell 1989). Between 1949 and 2008, at least 35 strandings of this species were reported in the Hawaiian Islands (Shallenberger 1981, Tomich 1986, Nitta 1991, Maldini et al. 2005, NMFS database). Nothing is known about stock structure for this species. For the MMPA SARs, pygmy sperm whales within the Pacific U.S. EEZ are divided into two discrete, non-contiguous areas: 1) Hawaiian waters, and 2) waters off California, Oregon and Washington. The Hawaiian stock includes animals found both within the EEZ around Hawaii and in adjacent high seas; however, because data on abundance, distribution, and human-caused impacts are largely lacking for the high seas, the status of this stock is evaluated based on data from the EEZ around Hawaii (Carretta et al. 2011).

A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 7,138 (CV=1.12) pygmy sperm whales (Barlow 2006), including a correction factor for missed diving animals. This is currently the best available abundance estimate for this stock in the EEZ around Hawaii (Carretta et al. 2011). Between 2004 and 2008, one pygmy or dwarf sperm whale was observed hooked in the shallow-set longline fishery (100% observer coverage), and based on an evaluation of the observer's description of the interaction and following the most recently developed criteria for assessing serious injury in marine mammals (Andersen et al. 2008), this animal was considered not seriously injured (Forney 2010). No pygmy sperm whales were observed hooked or entangled the deep-set longline fishery (20-28% observer coverage).

The status of pygmy sperm whales and dwarf sperm whales in Hawaii's waters relative to their optimum sustainable populations is unknown, and there are insufficient data to evaluate trends in abundance (Carretta et al. 2011). It is not listed as "threatened" or "endangered" under the ESA, nor as "depleted" under the MMPA. Given the absence of recent fishery-related mortality or serious injuries within the EEZ around Hawaii, the Hawaiian stock of pygmy sperm whales is not considered strategic, and the total fishery M&SI can be considered to be insignificant and approaching zero. The increasing levels of anthropogenic noise in the world's oceans has been suggested to be a habitat concern for whales (Richardson et al. 1995), particularly for deep-diving whales like pygmy sperm whales that feed in the oceans' "sound channel."

**Dwarf sperm whale** *(Kogia sima)*

Dwarf sperm whales are found throughout the world in tropical to warm-temperate waters (Nagorsen 1985). For the MMPA SARs, pygmy sperm whales within the Pacific U.S. EEZ are divided into two discrete, non-contiguous areas: 1) Hawaiian waters, and 2) waters off California, Oregon and Washington. The Hawaiian stock includes animals found both within the EEZ around Hawaii and in adjacent high seas; however, because data on abundance, distribution, and human-caused impacts are largely lacking for the high seas, the status of this stock is evaluated based on data from the EEZ around Hawaii (Carretta et al. 2011).

Baird (2005) reports that dwarf sperm whales are the sixth most commonly sighted odontocete around the MHI. This species' small size, tendency to avoid vessels, deep-diving habits, combined with the high proportion of Kogia sightings that are not identified to species, may result in negatively biased relative abundances in this region (R.W. Baird, pers. comm. in Carretta et al. 2011). A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 17,519 (CV=0.74) dwarf sperm whales (Barlow 2006), including a correction factor for missed diving animals. This is currently the best available abundance estimate for this stock. Between 2004 and 2008, one pygmy or dwarf sperm whale was observed hooked in the shallow-set longline fishery (100% observer coverage), and based on an evaluation of the observer's description of the interaction and following the most recently developed criteria for assessing serious injury in marine mammals (Andersen et al. 2008), this animal was considered not seriously injured (Forney 2010). No dwarf sperm whales were observed hooked or entangled the deep-set longline fishery (20-28% observer coverage).

The status of dwarf sperm whales and dwarf sperm whales in Hawaii's waters relative to their optimum sustainable populations is unknown, and there are insufficient data to evaluate trends in abundance (Carretta et al. 2011). It is not listed as "threatened" or "endangered" under the ES, nor as "depleted" under the MMPA. Because there have been no reported fishery-related M&SI within the EEZ around Hawaii, the Hawaiian stock of dwarf sperm whales is not considered strategic, and the total fishery M&SI can be considered to be insignificant and approaching zero. The increasing levels of anthropogenic noise in the world's oceans has been suggested to be a habitat concern for whales (Richardson et al. 1995), particularly for deep-diving whales like dwarf sperm whales that feed in the oceans' "sound channel."

**Bryde's whale** *(Balaenoptera edeni)*

Bryde's whales occur in tropical and warm temperate waters throughout the world. Available evidence provides no biological basis for defining separate stocks of Bryde's whales in the central North Pacific (Carretta et al. 2011). For the MMPA SARs, Bryde's whales within the Pacific U.S. EEZ are divided into two areas: 1) Hawaiian waters, and 2) the eastern tropical Pacific (east of 150° W and including the Gulf of California and waters off California). The Hawaiian stock includes animals found both within the EEZ around Hawaii and in adjacent high seas; however, because data on abundance, distribution, and human-caused impacts are largely lacking for the high seas, the status of this stock is evaluated based on data from the EEZ around Hawaii (Carretta et al. 2011).

A 2002 shipboard line-transect survey of the entire EEZ around Hawaii resulted in an abundance estimate of 469 (CV=0.45) Bryde's whales (Barlow 2006). This is currently the best available abundance estimated for this stock in the EEZ around Hawaii (Carretta et al. 2011). Between 2004 and 2008, one Bryde's whale was observed hooked or entangled in the shallow-set longline fishery (100% observer coverage) on the high seas (McCracken & Forney 2010). Based on an evaluation of the observer's description of the interaction and following the most recently developed criteria for assessing serious injury in marine mammals (Andersen et al. 2008), this animal was considered not seriously injured (Forney 2010). No Bryde's whales were observed hooked or entangled the deep-set longline fishery (20-28% observer coverage).

The status of Bryde's whales in Hawaiian waters relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. It is not listed as "threatened" or "endangered" under the ESA, nor as "depleted" under the MMPA. Given the absence of recent fishery-related M&SI within the EEZ around Hawaii, the Hawaiian stock of Bryde's whales is not considered strategic, and the total fishery M&SI can be considered to be insignificant and approaching zero. The increasing level of anthropogenic noise in the world's oceans has been suggested to be a habitat concern for whales (Richardson et al. 1995).

### *3.2.1.2 Sea Turtles*

Five of the six species of sea turtles found in U.S. waters are potentially impacted by the Hawaii-based longline fisheries, including olive ridley (*Lepidochelys olivacea*), leatherback (*Demochelys coriacea*), hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*), and green sea turtles (*Chelonia mydas*). The breeding populations of Mexico's olive ridley sea turtles, are currently listed as endangered, while all other ridley populations are listed as threatened. Leatherback sea turtles and hawksbill turtles are also classified as endangered. Loggerhead and green sea turtles are listed as threatened (the green sea turtle is listed as threatened throughout its Pacific range, except for the endangered population nesting on the Pacific coast of Mexico). These five species of sea turtles are highly migratory, or have a migratory phase in their life history.

A thorough review of the life history, status and trends, threats, and conservation efforts for sea turtles is available in section 5 of the October 15, 2008 Biological Opinion on the Hawaii-based shallow-set longline fishery (NMFS 2008), and that section is herein incorporated by reference. Additional information, including the range, abundance, status, and threats, can be found in the recovery plans for each species, available in the NMFS website and is herein incorporated by reference:

Green turtle: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_pacific.pdf
East Pacific 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 2011)

Specific regulatory requirements are in place to reduce and control bycatch of sea turtles in the Hawaii-based longline fisheries. Vessel owners and operators must follow specific guidelines for handling, dehooking, resuscitating, and releasing turtles that interact with longline fishing gear. Longline vessels are required to carry and use specific equipment for handling and releasing sea turtles, and to follow specific procedures if a sea turtle is hooked or entangled. The requirements apply to all Hawaii longline limited entry permitted vessels. Some requirements change depending on what type of fishing trip is declared (i.e., shallow- or deep-set trip). Equipment includes line clippers, dip nets, and dehookers. NMFS specifications governing these gears can be found in 50 CFR 665.812(a), and requirements for sea turtle handling are specified in 50 CFR 665.812(b).

The shallow-set longline fishery is required to use only 18/0 (or larger) circle hooks (≤10° offset) and mackerel-type bait (50 CFR 665.813(f) and (g)), and observer are placed on 100% of vessels. The shallow-set fishery has maximum annual interaction limits (hookings or entanglements) on leatherback and loggerhead sea turtles. If any interaction limit is reached, the shallow-set fishery is closed for the remainder of the calendar year, and if either annual limit is exceeded in any year, the annual limit for the following year is reduced by the number by which the limit was exceeded. When closed, Hawaii longline vessels are prohibited from shallow-set fishing north of the Equator for the remainder of the calendar year (50 CFR 665.813(b)). Data collected after implementation of these measures in the shallow-set fishery show an 89% reduction in incidental take rates for all sea turtle species in the shallow-set longline fishery.

### *3.2.1.3 Seabirds*

Migratory seabirds and shorebirds are subject to the protections of the Migratory Bird Treaty Act and the ESA under jurisdiction of the U.S. Fish and Wildlife Service (USFWS). Within the Hawaii Archipelago there are several seabird colonies in the MHI; however, the NWHI colonies harbor more than 90% of the total Hawaii seabird population. The NWHI provide most of the nesting habitat for more than 14 million Pacific seabirds. More than 99% of the world's Laysan albatross and 98% of the world's black-footed albatross return to the NWHI to reproduce.

Albatrosses and petrels that forage by diving are some of the most vulnerable species to bycatch in fisheries (Brothers et al. 1999). Birds are attracted to baited hooks, particularly during setting, dive on the hooks, become caught and drown. BirdLife International estimated that 300,000 seabirds are killed each year in this way, including 100,000 albatrosses. These species are long-lived, have delayed sexual maturity, small clutches and long generation times, resulting in populations that are highly sensitive to changes in adult mortality. Seventeen of the world's 22 albatross species are now globally at risk of extinction according to the International Union for Conservation of Nature (IUCN 2010), and incidental catch in fisheries, especially longline fisheries, is considered one of the principal threats to many of these species (Veran et al. 2007).

Hawaii-based longline fisheries may overlap with the short-tailed albatross but no interactions have been observed or reported. However, this species is of special concern because of its endangered status, and because short-tailed albatross have been sighted by observers during longline fishing, though no interactions occurred (NMFS 2010b). USFWS Biological Opinions have found that the level of mortality expected to result from the deep-set (15 over a 7-year period) and shallow-set longline fishery (one per year) is not likely to jeopardize the continued existence of the short-tailed albatross (USFWS 2000, 2002a, 2004). The Hawaii-based longline fisheries do interact on low levels with black-footed and Laysan albatross, and on rare occasions, wedge-tailed and sooty shearwaters and brown and red-footed boobies are also incidentally caught (NMFS 2010b). There have been no observed interactions with Newell's shearwaters or Hawaiian dark-rumped petrels (NMFS observer data). Sections 3.3.2 and 3.4 of the FSEIS for Amendment 18 to the Pelagics FMP (WPRFMC and NMFS 2009b) provide more information on these seabirds, including life history, population abundance, trends, and distribution; these are incorporated by reference. In addition, three USFWS Biological Opinions provide detailed information on short-tailed, Laysan, and black-footed albatrosses (USFWS 2000, 2002a, and 2004). Specifically sections 2 and 3 provides information on the status of the species and the environmental baseline, including species description, life history, population dynamics, distribution, population status, and threats and other factors affecting the species' environment (e.g., disease and parasites, predation, contaminants, fisheries). These sections of these three documents are also incorporated by reference.

A variety of seabird deterrence methods have been tested and found to reduce interaction rates and/or mortality of seabirds with longline fisheries (e.g., Brothers et al. 1995 and 1999, McNamara et al. 1999, Gilman et al., 2003, 2005, and 2007). When employed effectively, seabird avoidance measures have the potential to nearly eliminate seabird interactions (Naughton et al. 2007). Fishery interactions with seabirds under the Pelagics FMP have been drastically reduced since 2000 by new gear requirements and innovative technology resulting from research. Hawaii-based pelagic longline fishermen must comply with NMFS seabird mitigation measures depending on the declared trip type and where the vessel is fishing (50 CFR 665.815). Longline fishermen may side-set their gear or set gear from the stern. Both setting options require mitigation measures, some of which include weighted branchlines, completely thawed and blue-dyed bait, strategic offal discards, and mandatory night-setting. These measures have reduced incidental interactions with seabirds, primarily North Pacific albatrosses, by over 90%. In 2000, it was estimated that the fisheries has 2,433 incidental interactions with albatrosses. Since the seabird mitigation measures became effective, seabird bycatch has been greatly reduced. In 2010, there were 80 incidental interactions with seabirds in the shallow-set longline fishery (NMFS observer data) and an estimated 220 incidental interactions with seabirds in the deep-set longline fishery (McCracken 2011), none of which are ESA-listed species.

### 3.2.2 Target and Non-target Fish Species

A suite of PMUS are managed under the Pelagics FMP. The major species that are caught and landed by the deep-set and shallow-set longline fisheries include swordfish, various tunas (including bigeye, yellowfin, and albacore), and billfish. Non-target species are those which are normally discarded, either due to low commercial value or by regulations regarding retention. Information on these species, including life history, landings, and stock status can be found in the FSIES for Amendment 18 to the Pelagics FMP (WPRFMC and NFMS 2009b), the Pelagics FEP (WPRFMC 2009c), and the 2001 FEIS for the Pelagics FMP (NMFS 2001).

## 3.3 Social and Economic Environment

This section provides a description of the socioeconomic environment within the project area that may be affected by the FKWTRP. The objective of this section is to provide a baseline against which the alternatives may be evaluated and compared. The project area for the socioeconomic analysis is defined as the State of Hawaii, with particular focus on the City and County of Honolulu. 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 (NMFS 2001). Given that the population of the City of Honolulu makes up a significant portion of the population of the City and County of Honolulu, and because more consistent data are available at the county level, separate information for the City of Honolulu is not presented in this section. Where relevant and available from reliable sources, information is also presented for the Island of Oahu. The key social and economic topics addressed in this section include population trends; area economy (employment, income, and unemployment); commercial fishing; recreation and tourism; recreational and subsistence fishing; and social and cultural role of marine mammals in Hawaii. Commercial fishing is described as this is the social and economic community that will be directly regulated by the FKWTRP. Recreation and tourism and subsistence fishing are also described, as these economic activities may be indirectly affected by the FKWTRP.

### 3.3.1 Demographic Overview

The population of Hawaii grew by over 9% between 1990 and 2000, and approximately 12% between 2000 and 2010 (U.S. Census Bureau 1990, 2000, and 2010) (see Table 3.3). In comparison, the population of the City and County of Honolulu increased more slowly, with increases of almost 5% from 1990 to 2000, and about 9% from 2000 to 2010. As shown in Table 3.3, the 2010 population of Hawaii is approximately 1.4 million. The City and County of Honolulu has the highest population and population density in the state, with almost 0.95 million people and 1,589 people per square mile.

**Table 3.3**. Population and Population Change.

| Area | Population | | | Population Change (%) | | | Population Density in 2010 (People per Square Mile) |
|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2010 | 1990-2000 | 2000-2010 | 1990-2010 | |
| City and County of Honolulu | 836,231 | 876,156 | 953,207 | 4.8% | 8.8% | 14.0% | 1,589 |
| State of Hawaii | 1,108,229 | 1,211,537 | 1,360,301 | 9.3% | 12.3% | 22.7% | 212 |
| U.S.A. | 248,709,873 | 281,421,906 | 308,745,538 | 13.2% | 9.7% | 24.1% | 87 |

Sources:

U.S. Census Bureau (2010). *2010 Census National Summary File of Redistricting Data, Tables P1 and H1*. Website (http://factfinder2.census.gov/), accessed April 19, 2011.

U.S. Census Bureau (2000). *Census 2000 Summary File 1*. Website (http://factfinder.census.gov/), accessed April 19, 2011.

U.S. Census Bureau (1990). *DP-1, General Population and Housing Characteristics: 1990, 1990 Summary Tape File 1 (STF 1) - 100-Percent Data, United States*. Website (http://factfinder.census.gov/), accessed April 19, 2011.

## 3.3.2 Economic Overview

The economy of Hawaii and its counties is described in this section based on the following characteristics: employment by industry, income, and the unemployment rate.. Data in this section are presented at the state and county levels, the levels for which consistent data for economic indicators are available from reliable and published sources. To the extent that sufficient island-level information/data are relevant and available, these are also presented.

### *3.3.2.1 Employment*

Industry-specific employment indicates the structure of an economy in terms of the relative importance of different industries in the regional economy. Total non-farm employment in Hawaii consisted of 861,789 jobs in November 2008 (BEA 2010) (see Table 3.4). About 78% of non-farm employment in the state is private, while the rest is government. Reflecting the importance of tourism in the Hawaii economy, the industry with the highest level of employment in the state is accommodation and food services (11%). This is followed by state and local government (military) and then retail trade. This dependence on accommodation and food services, government, and retail trade is also reflected in the employment data for the City and County of Honolulu. Table 3.4 presents employment by industry in 2008 the state and the City and County of Honolulu.

**Table 3.4.** Employment by Industry in 2008**.**

| | City and County of Honolulu | | State of Hawaii | |
|---|---|---|---|---|
| | Employees | % of Total Employment | Employees | % of Total Employment |
| **Total employment** | 626,137 | 100% | 873,749 | 100% |
| Farm employment | 2,108 | 0% | 11,960 | 1% |
| Nonfarm employment | 624,029 | 100% | 861,789 | 99% |
| **Private employment** | 473,274 | 76% | 681,277 | 78% |
| Forestry, fishing, and related activities | 1,116 | 0% | 3,471 | 0% |
| Mining | 573 | 0% | 892 | 0% |
| Utilities | 2,074 | 0% | 3,341 | 0% |
| Construction | 32,672 | 5% | 50,787 | 6% |
| Manufacturing | 14,298 | 2% | 19,108 | 2% |
| Wholesale trade | 17,787 | 3% | 22,831 | 3% |
| Retail trade | 60,126 | 10% | 88,956 | 10% |
| Transportation and warehousing | 23,468 | 4% | 30,971 | 4% |
| Information | 9,795 | 2% | 12,269 | 1% |
| Finance and insurance | 23,980 | 4% | 29,286 | 3% |
| Real estate and rental and leasing | 26,755 | 4% | 42,091 | 5% |
| Professional, scientific, and technical services | 36,316 | 6% | 46,679 | 5% |
| Management of companies and enterprises | 6,694 | 1% | 7,594 | 1% |
| Administrative and waste services | 40,891 | 7% | 57,611 | 7% |
| Educational services | 14,781 | 2% | 18,408 | 2% |
| Health care and social assistance | 54,523 | 9% | 71,856 | 8% |
| Arts, entertainment, and recreation | 12,900 | 2% | 23,003 | 3% |
| Accommodation and food services | 58,824 | 9% | 99,939 | 11% |
| Other services, except public administration | 35,701 | 6% | 52,184 | 6% |
| **Government and government enterprises** | 150,755 | 24% | 180,512 | 21% |
| Federal, civilian | 29,483 | 5% | 32,244 | 4% |
| Military | 52,918 | 8% | 56,045 | 6% |
| State and local | 68,354 | 11% | 92,223 | 11% |
| State government | 56,046 | 9% | 73,352 | 8% |
| Local government | 12,308 | 2% | 18,871 | 2% |

Source:
Regional Economic Information System, Bureau of Economic Analysis (BEA), US DOC. (April 2010). *CA25N Footnotes*. Retrieved from http://www.bea.gov/regional/docs/footnotes.cfm?tablename=CA25N
Note:
(D) - Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

Between 2001 and 2008, employment in Hawaii increased by 14%, while that in the City and County of Honolulu increased by about 12% (see Table 3.5). The highest gains for both the state and the county are in the mining industry at almost 62% and 70%, respectively, followed by construction. Jobs in the tourism-related sectors of accommodation and food services and arts, entertainment, and recreation increased by over 9% and over 16% in the State of Hawaii, respectively. In the City and County of Honolulu, jobs in these two sectors increased by 10% and more than 6%, respectively. Three sectors that experienced job losses in both the state and the county during this period include forestry, fishing, and related activities; information; and manufacturing.

**Table 3.5.** Industry Employment Growth, 2001-2008 (% Change).

| | City and County of Honolulu | State of Hawaii |
|---|---|---|
| **Total employment** | 11.8% | 14.0% |
| Farm employment | -26.1% | -2.7% |
| Nonfarm employment | 12.0% | 14.3% |
| **Private employment** | 13.6% | 16.2% |
| Forestry, fishing, and related activities | -38.6% | -13.3% |
| Mining | 70.0% | 61.9% |
| Utilities | 22.4% | 23.2% |
| Construction | 50.4% | 50.5% |
| Manufacturing | -3.3% | -2.8% |
| Wholesale trade | 8.9% | 11.4% |
| Retail trade | 1.8% | 5.0% |
| Transportation and warehousing | 3.6% | 6.9% |
| Information | -13.4% | -10.8% |
| Finance and insurance | 17.4% | 21.3% |
| Real estate and rental and leasing | 33.0% | 34.0% |
| Professional, scientific, and technical services | 19.5% | 21.0% |
| Management of companies and enterprises | 22.5% | 22.0% |
| Administrative and waste services | 17.2% | 23.1% |
| Educational services | 17.2% | 24.2% |
| Health care and social assistance | 19.5% | 19.5% |
| Arts, entertainment, and recreation | 6.1% | 16.3% |
| Accommodation and food services | 10.0% | 9.1% |
| Other services, except public administration | 12.8% | 17.5% |
| **Government and government enterprises** | 7.1% | 7.8% |
| Federal, civilian | 7.5% | 10.1% |
| Military | 5.2% | 4.5% |
| State and local | 8.5% | 9.1% |
| State government | 9.7% | 9.4% |
| Local government | 3.4% | 8.2% |

Source:
Regional Economic Information System, Bureau of Economic Analysis (BEA), US DOC. (April 2010). *CA25N Footnotes*. Retrieved from http://www.bea.gov/regional/docs/footnotes.cfm?tablename=CA25N

### *3.3.2.2 Income*

Hawaii has a slightly higher per capita personal income compared to the nation, at $39,242, with the annualized growth rate of 6% between 2001 and 2007 (DBEDT 2009a) (see Table 3.6). The City and County of Honolulu has a per capita personal income in 2007 of $42,015, which is the highest among all

Hawaii counties. See Table 3.6 for a summary of personal income the U.S., Hawaii, and the City and County of Honolulu.

**Table 3.6.** Personal Income in 2007.

| Area | Per Capita Personal Income ($) | | |
|---|---|---|---|
| | 2001 | 2007 | Annualized Rate of Change (%) |
| City and County of Honolulu | 30,759 | 42,015 | 6.1% |
| State of Hawaii | 28,840 | 39,242 | 6.0% |
| U.S.A. | 30,582 | 38,615 | 4.4% |

Source:
DBEDT (2009). *County Social, Business and Economic Trends in Hawai'i: 1990 – 2008.*

### 3.3.2.3 Unemployment

The unemployment rate is a key economic indicator providing important insight into the economic health of a region. High unemployment is a sign of an unhealthy economy, which can lead to reduced spending, a decreased tax base, and more unemployment. In the current recession, Hawaii and its counties have faced high unemployment. As of 2009, the unemployment rate in Hawaii is 6.8%, up from 4.0% in 2008. At 5.7%, the City and County of Honolulu has the lowest unemployment rate among the counties (see Figure 3.1). The national unemployment rate has grown faster than the State of Hawaii's.

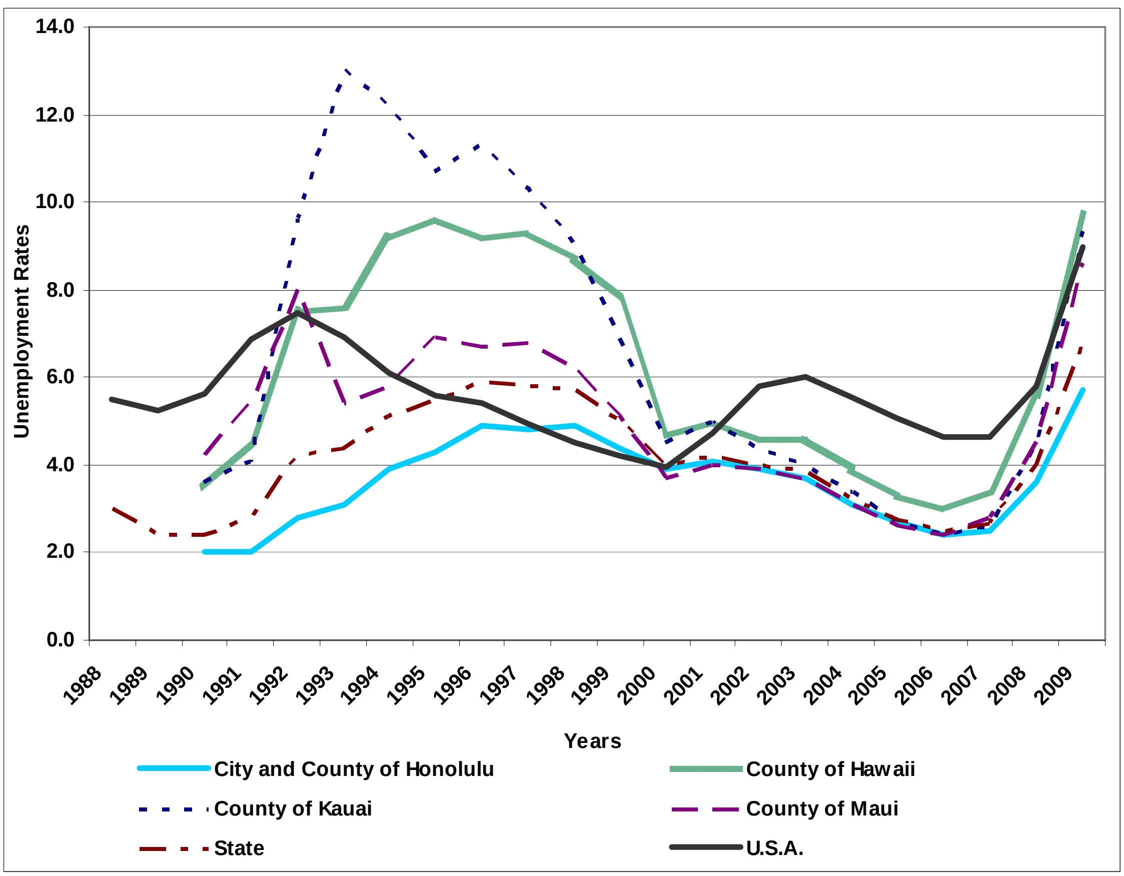


**Figure 3.1**. Historic Unemployment Rates in the Counties in Hawaii, the State of Hawaii, and the United States.

## 3.3.3 Commercial Fishing

Commercial fisheries in Hawaii are extensive, and include fish caught for sale as well as charter fishing services. Individuals or vessels engaged in taking, selling, or offering for sale any marine life for commercial purposes (including charter fishing services) are required to have an annually renewable commercial marine license (CML) through the State of Hawaii Department of Land and Natural Resources (DLNR). Based on CML data, there were 4,263 licensed commercial fishermen in 2008 (Hawaii Division of Aquatic Resources (DAR) and WPacFin 2010). In addition, Federal permits are required for fishing in Federal waters (3-200 nm) around Hawaii. There are 168 current Federal permits issued by the NMFS Pacific Islands Regional Office for commercial fisheries in the EEZ around Hawaii, including the Hawaii Longline Limited Entry, Western Pacific Receiving Vessel, Western Pacific Pelagic Squid Jig, MHI Non-commercial Bottomfish, and Western Pacific Precious Coral. Other Federal and High Seas Fishing Compliance Act permits are required to fish in other areas of the Pacific.

In 2009, about 27 million pounds of fish were caught for commercial purposes in the state, worth over $71 million (WPacFIN 2010) (see Table 3.7), while more than 28 million pounds of fish were caught in 2010 (WPacFIN 2011). These data do not distinguish what portion of the catch was in federal water and what portion was in state waters. The average value of commercial landings between 1990 and 2009 exceeds $63 million (WPacFIN 2010). The overall average price per pound (based on amount paid to commercial fishermen by dealers) for all commercial fish in 2009 was approximately $2.65. Key fishery categories include pelagic, coral reef, bottomfish, precious corals, and crustaceans.

**Table 3.7**. Quantity, Value, and Price per Pound of Commercial Landings in Hawaii, 1990-2009.

| Year | Quantity (Millions of Pounds) | Value (Millions of Dollars) | Price per Pound (Dollars) |
|---|---|---|---|
| 1990 | 17.95 | $48.05 | $2.68 |
| 1991 | 26.68 | $64.38 | $2.41 |
| 1992 | 26.83 | $67.98 | $2.53 |
| 1993 | 29.39 | $73.45 | $2.50 |
| 1994 | 23.23 | $62.67 | $2.70 |
| 1995 | 25.99 | $59.22 | $2.28 |
| 1996 | 24.10 | $57.70 | $2.39 |
| 1997 | 27.53 | $61.60 | $2.24 |
| 1998 | 28.52 | $61.04 | $2.14 |
| 1999 | 28.99 | $62.91 | $2.17 |
| 2000 | 28.62 | $68.21 | $2.38 |
| 2001 | 23.48 | $48.08 | $2.05 |
| 2002 | 23.97 | $52.38 | $2.19 |
| 2003 | 23.74 | $52.75 | $2.22 |
| 2004 | 24.46 | $57.68 | $2.36 |
| 2005 | 28.14 | $71.04 | $2.52 |
| 2006 | 25.66 | $66.12 | $2.58 |
| 2007 | 28.94 | $75.70 | $2.62 |
| 2008 | 30.68 | $85.12 | $2.77 |
| 2009 | 26.91 | $71.17 | $2.65 |

Source:
WPacFIN. (2010). 1982-2009 *Commercial Landings* (various data tables and charts).
Retrieved from http://www.pifsc.noaa.gov/wpacfin/central/Pages/central_data.php

### Pelagic Fisheries

Among the various categories of fisheries, the pelagic fishing industry is the largest and most valuable one, accounting for almost 96% of commercial landings with 25.7 million pounds of pelagic fish caught commercially in 2009 (see Table 3.8). Pelagic fisheries primarily use longline gear, but also includes the MHI troll and handline, offshore handline, and the aku boat (pole and line) fisheries (NMFS 2005). Tunas (especially bigeye tuna) and billfish (particularly blue marlin, striped marlin, and swordfish) are the main target species for pelagic fishing, but other species, such as mahimahi, ono (wahoo), and moonfish are also important (NMFS 2005).

### Coral Reef Fisheries

Coral reef fish made up about 1% of commercial landings in 2009 (see Table 3.8). With presently no active commercial coral reef fisheries in the NWHI, the commercial catch primarily comes from nearshore reef areas around the MHI (NMFS 2005). However, there has been a notable decline in nearshore coral reef fishery resources in recent decades because of overfishing (NMFS 2005). Coral reef fish species popular for commercial purposes include akule (which dominates nearshore commercial landings), soldierfishes, surgeonfishes, goatfishes, squirrelfishes, unicornfishes, and parrotfishes (WPRFMC 2010b). Numerous fishing gears are used to target these species, including nets, traps, hook and line, spear, hand, and other methods.

### Bottomfish Fisheries

Catches of bottomfish accounted for about 2% of commercial landings in 2009 (see Table 3.8). Target species include snappers, jacks, and a single species of grouper that is concentrated at depths of 30 to 150 fathoms (fm) (NMFS 2005). The most desirable species are seven deepwater species known as the Deep 7 (opkapaka, onaga, hapuupuu, ehu, kalekale, gindai, and lehi), which made up 54% of the commercial bottomfish catch in 2008 (WPRFMC 2010a).

After the establishment of the NWHI Marine National Monument in 2006 (later renamed Papahānaumokuākea Marine National Monument), bottomfishing was scheduled to end in the Monument in 2011 (WPRFMC 2010b). However, this fishery was closed in 2009 when permit holders surrendered their permits in lieu of compensation from the federal government. Bottomfishing continues to take place in the MHI, where roughly about 50% of bottomfish habitat is located in state waters (WPRFMC 2010b). While bottomfishing around the MHI is conducted both commercially and by recreational fishermen, fishing in the NWHI was solely for commercial purposes (NMFS 2005). Methods and gear used in these fisheries are highly selective for desired species and sizes. In 2008, the Deep 7 fishery in the MHI was managed through the implementation of a federally-mandated total allowable catch (TAC) limit of 241,000 lbs, as a means to end overfishing of these species (DAR and WPacFin 2010). The fishing season opened on November 15, 2008 and was closed July 6, 2009 (WPacFin 2010). None of the other MHI commercial fisheries are constrained by TAC management measures.

### Precious Coral Fisheries

The discovery of two species of commercially valuable black coral in 1958, including Au‘au, led to the establishment of a small black coral cottage industry for manufacturing black coral jewelry. Recently, this industry is threatened by changes in harvesting pressure and the introduction of an alien pest species (WPRFMC 2010b). Over the past 30 years, almost all of the black coral has been harvested from state waters and from a bed located in the Au‘au Channel (WPRFMC 2010b). The domestic fishery for pink, gold, and bamboo precious coral resumed in 1999 (NMFS 2005). Harvest of precious corals is only allowed by selective gear with submersibles or by hand (NMFS 2005).

### Crustaceans Fisheries

The main target species under this category are a species of spiny lobster and the common slipper lobster. Kona crab, and another species of spiny lobster and other slipper lobster species belonging to the family

Scyllaridae are also desirable (WPRFMC 2010b). In the MHI, commercial catch of spiny lobsters dropped by 75% to 85% by the early 1950s (NMFS 2005). The NWHI had the largest crustacean fishery in Hawaii, until it was closed by NMFS in 2000 due to uncertainties regarding accurate lobster stock assessments. This fishery remains closed due to the establishment of the Papahānaumokuākea Marine National Monument (NMFS 2005).

**Table 3.8.** Hawaii Annual Reported Commercial Landings (Millions of Pounds) for Pelagic, Bottom, Reef, and Other Fisheries Categories, 2000 to 2009.

| Year | Pelagic Fishes | Bottomfishes | Reef Fishes | Other Fishes |
|---|---|---|---|---|
| 2000 | 26.74 | 0.72 | 0.20 | 0.95 |
| 2001 | 22.00 | 0.65 | 0.24 | 0.59 |
| 2002 | 22.34 | 0.62 | 0.35 | 0.67 |
| 2003 | 22.06 | 0.62 | 0.33 | 0.73 |
| 2004 | 23.03 | 0.62 | 0.24 | 0.56 |
| 2005 | 26.91 | 0.53 | 0.22 | 0.48 |
| 2006 | 24.51 | 0.44 | 0.20 | 0.51 |
| 2007 | 27.73 | 0.44 | 0.23 | 0.54 |
| 2008 | 29.57 | 0.43 | 0.27 | 0.41 |
| 2009 | 25.70 | 0.45 | 0.27 | 0.49 |

Source:
NMFS, PIFSC. (2010). *Annual Reported Commercial Landings of Pelagic Fishes, Bottomfishes, Reef Fishes, Other Fishes*. Retrieved from http://www.pifsc.noaa.gov/wpacfin/hi/Data/Landings_Charts/hr3a.htm

### 3.3.3.1 Hawaii Fishing Community

Section 3.5.2 of the FEIS for Amendment 18 to the FMP for Pelagic Fisheries of the Western Pacific Region (WPRFMC and NMFS 2009b) describes the Hawaii fishing community, which may be affected by the proposed FKWTRP, and is incorporated by reference. This is the community that is likely to experience the greatest impact from any change involving the management of the Hawaii-based longline fisheries.

The Magnuson-Stevens Fishery Management and Conservation Act (MSA) defines a "fishing community" as "...a community that is substantially dependent upon 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 fish processors that are based in such communities" (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)".

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). 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).

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 (NMFS 2001). However, as presented in

Section 3.3.2 for the City and County of Honolulu, 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. Oahu contains approximately three-quarters of the state's total population, and over one-half of Oahu's residents live in the "primary urban center," which includes greater Honolulu. Thus, although Oahu has a high level of engagement in fishing and especially 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.

The nature and magnitude of Hawaii communities' dependence on and engagement in pelagic fisheries have also been affected by the overall condition of the state's economy. As described in NMFS' 2001 and 2004 FEISs (NMFS 2001, 2004) and based on data presented in Section 3.3.2, tourism is by far the leading industry in Hawaii in terms of generating jobs and contributing to gross state product. In the first years of the new century, Hawaii's tourism industry suffered major external shocks, including the September 11, 2001 terrorist attacks and SARS (severe acute respiratory syndrome) epidemic (Brewbaker 2003). The market for tuna weakened due to the decline in tourists arriving from Japan and elsewhere and due to a weak export demand. More recently, the decline in the value of the U.S. dollar compared with other currencies such as the Euro and the Japanese yen has made it more expensive for Americans to travel overseas and cheaper for foreign visitors to visit Hawaii. However, recent increases in fuel prices are raising both operating and consumer costs, which are believed to be impacting global tourism markets.

More information on the affected communities can be found in the RIR (Section 5) and IRFA (Section 6) of this document.

### 3.3.3.2 Hawaii-based Longline Fisheries

The proposed FKWTRP would affect the Hawaii-based deep-set and shallow-set longline fisheries. The domestic pelagic longline fleet is also fishing within the context of a broader international pelagic longline fishery.

The Hawaii-based longline fisheries are the largest of all the commercial pelagic fisheries in Hawaii. In 2008, the longline represented 85% of the total commercial pelagic landings and 89% of the ex-vessel revenue (WPRFMC 2010b). The longline fleet has historically operated in two distinct modes based on gear deployment: deep-set longline to target primarily bigeye tuna (*Thunnus obesus*) and shallow-set longline used to target swordfish (*Xiphias gladius*).

The Council and NMFS have regulated the Hawaii-based longline fishery as two distinct segments, deep-set and shallow-set, since the shallow-set fishery reopened in 2004. The 2009 MMPA LOF (73 FR 73032) considered the two longline segments separately when assessing their impacts on marine mammals. Vessel operators must notify NMFS prior to departure whether the vessel is undertaking a deep-set or shallow-set trip. Once the trip type is set, it cannot be changed during the trip (50 CFR 665.813(h)). Data below on trips are presented for both the deep-set and shallow-set Hawaii longline fishery.

#### 3.3.3.2.1 Shallow-set Longline Fishery

Shallow-set longline gear targets swordfish and typically consists of a continuous mainline set near the surface and supported in the water column horizontally by floats with branch lines (gangions) connected at intervals to the mainline (Figure 3.6). Mainline is made of 3.2-4.0 mm diameter monofilament and stored on large hydraulic reels. Hooks are set at depths of 30-90 m. The portion of the mainline with branch lines attached is suspended between floats at about 20-75 m depth, and the branch lines hang off the mainline another 10-15 m. Only 4-5 branch lines are clipped to the mainline between floats, and a typical set for swordfish uses between 700-1,000 hooks. Shallow swordfish-targeting sets are required to use size 18/0 (or larger) circle hooks with no more than a 10 degree offset and mackerel-type bait (the use of squid bait is prohibited). Seabird mitigation regulations require gear to be set at night, which also coincides with the swordfish nocturnal feeding behaviors, and hauls during the day.

The most productive swordfish areas for Hawaii-based longline vessels are north of Hawaii outside the U.S. EEZ on the high seas, and this fishery operates primarily north of Hawaii (north of approximately 20° N). In some years, when influenced by seawater temperature, this fishery may operate mostly north of 30° N. The fishery operates year-round, with effort highest in winter and spring months and dropping off substantially during the rest of the year.

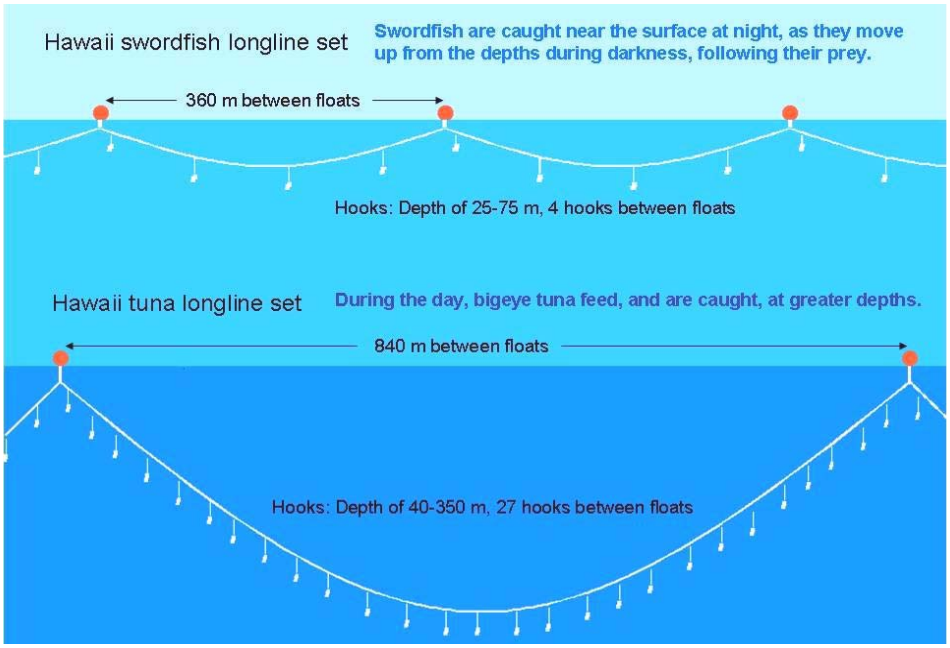


**Figure 3.2.** Configuration of shallow-set (swordfish target) and deep-set (tuna target) longline gear (NMFS 2009).

### 3.3.3.2.2 Deep-set Longline Fishery

The deep-set fishery primarily targets bigeye tuna, which accounts on average for about 40% of the total landings for the Hawaii fleet, followed by yellowfin tuna, which accounts for approximately 8% of landings. Deep-set longline gear typically consists of a continuous mainline set below the surface and supported in the water column horizontally by floats with branch lines attached at intervals on the mainline (Figure 3.6). Mainline is 3.2-4.0 mm diameter monofilament and stored on large hydraulic reels. In addition, radio buoys are also used to keep track of the mainline as it drifts at sea. Hawaii-based tuna longline vessels typically deploy about 25 to 45 nmi of mainline in the water and use a line shooter to deploy the mainline faster than the speed of the vessel, thus allowing the longline gear to sink to its target depth. Both 3.6-3.8 mm tuna hooks and 14/0-16/0 circle hooks are used in the deep-set fishery, and hooks are set at depths of 40-350 m (average target depth is 167 m, WPRFMC 2010a). A minimum of 15, but typically 25 to 30 (average of 27), weighted branch lines are clipped to the mainline at regular intervals between the floats. All float lines must be at least 20 m in length. The branch lines are typically 11 to 15 m long. Sanma (saury, *Cololabis saira*) or sardines are used for bait. There are approximately 66 floats and an average of 1,690 hooks deployed per set (WPRFMC 2010a). The use of light sticks (or any light emitting device) is prohibited. Unlike the shallow-set fishery, the deep-set does not have regulations regarding the time of day that the gear may be set. However, it is common for fishermen to set their gear in the morning, allow the gear to soak during the day, and haul in the afternoon/night, mainly to maximize their target catch rates. Total fishing time typically lasts about 19 hours, including the setting and hauling of gear.

Tuna vessels may currently range out to 1,000 nmi but generally make trips within 500 nmi from Honolulu. This fishery operates inside and outside the U.S. EEZ, primarily around the MHI and NWHI, with some trips to the EEZs around the U.S. Pacific Remote Island Areas. Vessels vary their fishing grounds depending on their target species. Most of the deep-set fishing occurs north and south of the Hawaiian Islands, according to fishing conditions. This fishery operates year-round, although vessel activity increases during the fall and is greatest during the winter and spring months.

### 3.3.3.2.3 History and Regulatory Baseline of Hawaii-Based Longline Fisheries

The Hawaii-based longline fishery began around 1917 and was based on fishing techniques brought to Hawaii by Japanese immigrants. The early Hawaiian sampan-style flagline boats targeted large yellowfin and bigeye tuna using traditional basket gear with tarred rope mainline. This early phase of Hawaii longline fishing declined steadily into the 1970s due to low profitability and lack of investment in an aging fleet (Boggs and Ito 1993). During the 1980s, tuna longline effort began to expand to supply developing domestic and export markets for high quality fresh and sashimi grade tuna. In the late 1980s and early 1990s, the nature of the fishery changed completely with the arrival of swordfish and tuna-targeting fishermen from longline fisheries of the Atlantic and Gulf States. In 1985, the longline fishery surpassed landings of the skipjack pole-and-line fleet and has remained the largest Hawaii-based fishery to date. Longline effort increased rapidly from 37 vessels in 1987 to 138 vessels in 1990 (Ito and Machado 2001). Swordfish landings rose rapidly from 600,000 pounds in 1989 to 13.1 million pounds in 1993 (WPRFMC 2003). The influx of large, modern longline vessels promoted a revitalization of the fishery, and the fleet quickly adopted new technology to better target bigeye tuna at depth. The near-full adoption of monofilament mainline longline reels further modernized the fleet and improved profitability.

An emergency moratorium was placed on the rapidly expanding fishery in October 1991 (FMP Amendment 4). Also in October 1991, longline fishing was prohibited within a 50 nmi radius of the NWHI to prevent interactions with the endangered Hawaiian monk seal (Figure 3.3) (FMP Amendment 3). Another area closure was implemented in March 1992 in which longline fishing was prohibited around the MHI to reduce gear conflicts between small troll and handline boats and longline vessels (FMP Amendment 5) (see Figure 3.4). The areas of these closures are presented in Table 3.9. A limited access program was established in 1994 allowing for a maximum of 164 transferable longline permits for vessels ≤ 101 feet in overall length (FMP Amendment 7). During the same year, the Hawaii Longline Observer Program was initiated, primarily to monitor interactions with protected species. Selected changes to the fishery's management are summarized in Table 3.10.

**Table 3.9**. Areas of longline fishing restricted areas.

| **Location** | **Area ($nmi^2$)** | **Percentage of EEZ** |
|---|---|---|
| EEZ around Hawaiian archipelago | 725,915 | |
| MHI longline winter closed area | 53,610 | 7% EEZ, 74% of MHI longline summer closed area |
| MHI longline summer closed area | 72,640 | 10% EEZ |
| NWHI Protected Species Zone | 102,300 | 14% EEZ |

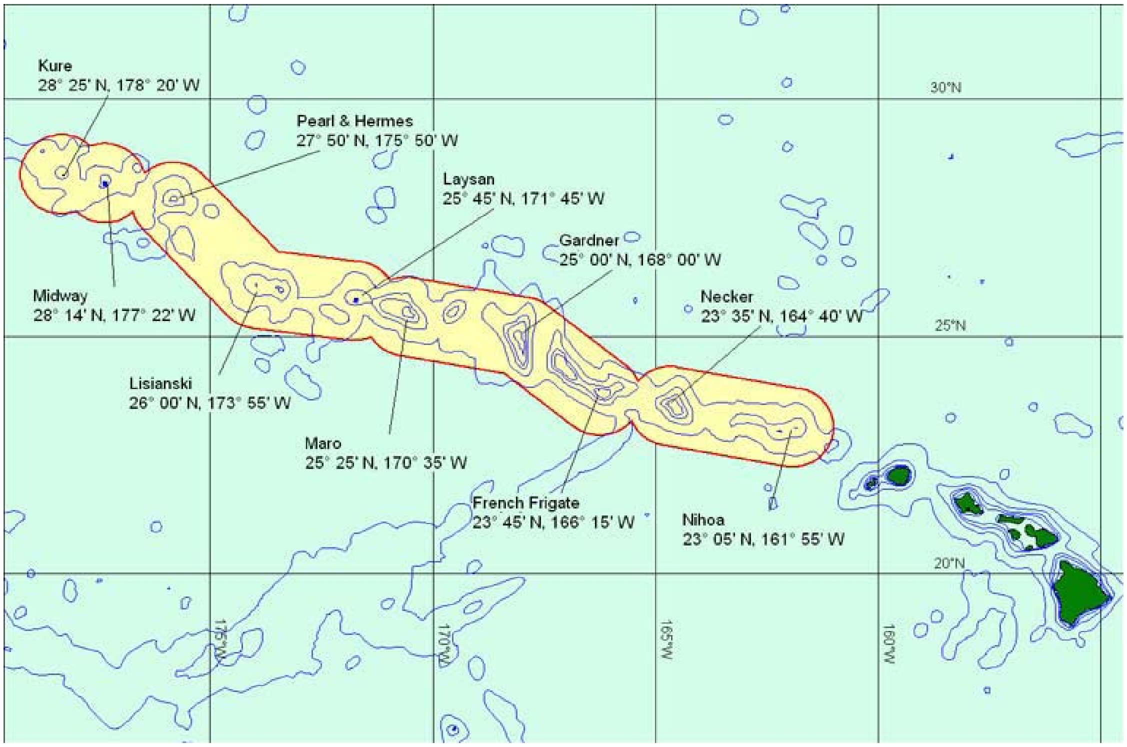


**Figure 3.3**. Boundary of Northwest Hawaiian Islands Longline Protected Species Zone.

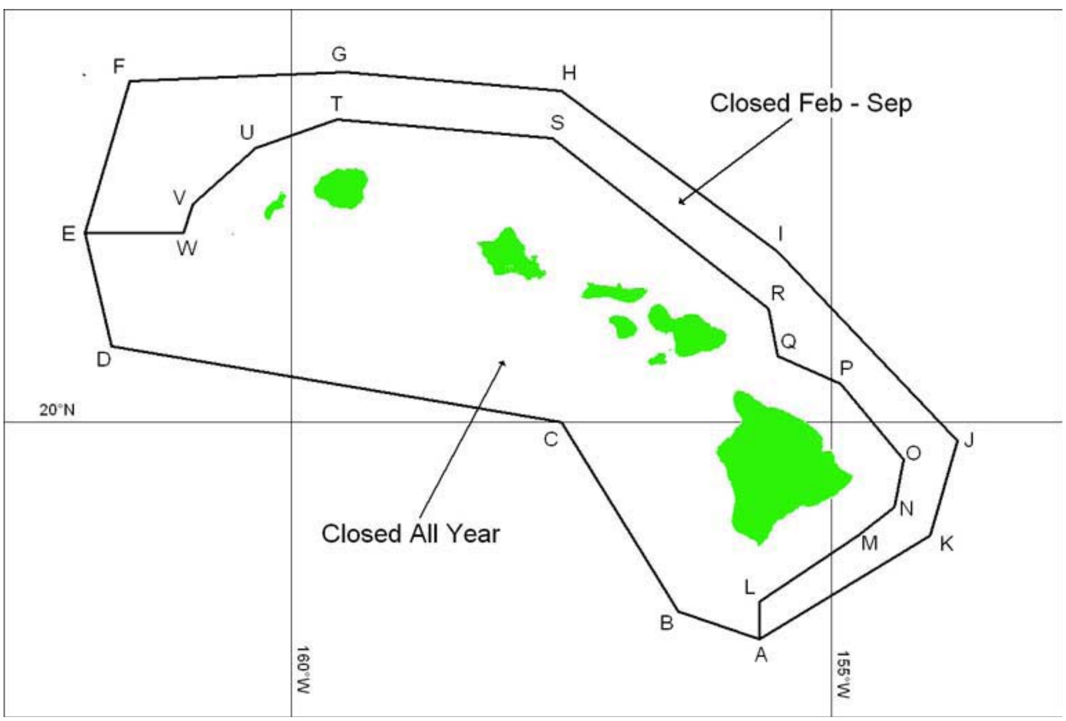


**Figure 3.4.** Boundary of MHI Longline Fishing Prohibited Area.

**Table 3.10**. Selected Regulatory and Monitoring Changes for the Hawaii-based Longline Fisheries. (Adapted from Baird 2009).

| Year/Month (Effective Date) | Action | Regulatory or monitoring changes |
|---|---|---|
| 1991 May | FMP Amendment 2 | Implementation of permitting and logbook program for recording of catch and fishing effort |
| 1991 Oct | FMP Amendment 3 | Created longline exclusion zone around NWHI (50 nmi) to protect monk seals |
| 1991 Oct | FMP Amendment 4 | Three-year moratorium on new entry into fishery imposed |
| 1991 Oct | FMP Amendment 4 | Requirement for implementation of NMFS-owned vessel monitoring system (VMS) transmitters, with VMS data monitored by NMFS Office of Law Enforcement to ensure no fishing within prohibited areas |
| 1992 Mar | FMP Amendment 5 | Created longline exclusion zone around MHI (25-75 nmi) to reduce conflict with near-shore fisheries |
| 1994 Jun | Final rule, 50 CFR Part 685, FR Doc. 94-9325, April 19, 1994 | Start of NMFS Hawaii Longline Observer Program and mandatory observer coverage |
| 1994 Jun | FMP Amendment 7 | Limited entry program with transferable permits instituted (164 vessels maximum, maximum vessel length 101 feet) |
| 2000 | | Significantly increased in observer coverage |
| 2001 Mar | Court Order, implemented by emergency rule 66 FR 31561, June 12, 2001 | Swordfish fishery closed by court order |
| 2002 Jun | Framework Measure 2 | Required use of blue-dyed bait, strategic offal discards, and line shooters with weighted branch lines to mitigate seabird interactions when fishing north of 23° N. Also requirement for owners and operators to attend NMFS' protected species workshop annually |
| 2002 Jun | Regulatory Amendment 1 | Ban on swordfish fishing north of the equator for turtle protection; closed waters between 0° and 15° N from April - May; instituted sea turtle handling requirements in EEZ waters. |

| | | |
|---|---|---|
| 2004 Apr | Regulatory Amendment 3 Final Rule, 69 FR 17329, April 2, 2004 | Reopened swordfish fishery in Hawaii with requirement to use mackerel type bait and 18/0 circle hooks, effort limit of 2,120 sets/year, hard caps on loggerhead and leatherback turtle takes, and 100% observer coverage. |
| 2004 Sep | Final rule, 69 FR 48407, August 10, 2004 | Hawaii longline fishery reclassified as Category I fishery in 2004 MMPA List of Fisheries (LOF). |
| 2006 Jan | Regulatory Amendment 5 | Allowed vessels fishing north of 23° N and those targeting swordfish south of 23 N to utilize side-setting to reduce seabird interactions in lieu of the measures required in Framework Measure 1. |
| 2006 Mar | Temporary rule, 71 FR 14824, March 24, 2006 | Shallow-set fishery closed north of the equator for rest of calendar year after reaching interaction limit for loggerhead sea turtles |
| 2006 Jun | Proclamation 8031, 71 FR 36443, June 26, 2006 | Establishment of PMNM around NWHI with exclusion of longline fishing (boundaries similar to “50 nmi” exclusion zone) |
| 2009 Jan | Final rule, 73 FR 73032, December 1, 2008 | Hawaii longline fishery split into the Hawaii deep-set (tuna target) longline and Hawaii shallow-set (swordfish target) longline fisheries in the 2009 MMPA LOF. |
| 2010 Jan | Final rule, 74 FR 65460, December 10, 2009 | Annual limit on the number of shallow sets removed, and loggerhead sea turtle take limit increased. |
| 2011 Mar | Final Rule 76 FR 13297, March 11, 2011 | Annual number of allowable incidental interactions that may occur between the Hawaii-based shallow-set pelagic longline fishery and loggerhead sea turtles revised to 2004 levels in accordance with settlement agreement approved by U.S. District Court for the District of Hawaii. |

### 3.3.3.2.4 Vessels, Ownership, Trips, and Effort

The limited access program allows for 164 vessels in the fishery, but active vessel participation has been closer to 130 in recent years. In 2010, 124 vessels actively participated in the fishery (Figure 3.5), with 96 vessels targeting tunas primarily and 2 vessel targeting swordfish primarily throughout the year; 26 vessels targeted both swordfish and tunas at some point during 2010 (extrapolated from NMFS 2001-2010 Longline Logbook Data). Between 2006 and 2010, there were between 124 and 129 vessels in the longline fleet, with two years (2007 and 2008) with 129 vessels. Given that the maximum number of active vessels in the past five years is 129, it is assumed that the fleet consists of 129 vessels. Further, in 2007, 129 vessels were active in the deep-set longline fishery, so it is assumed that all longline vessels participate at times in the deep-set fishery.

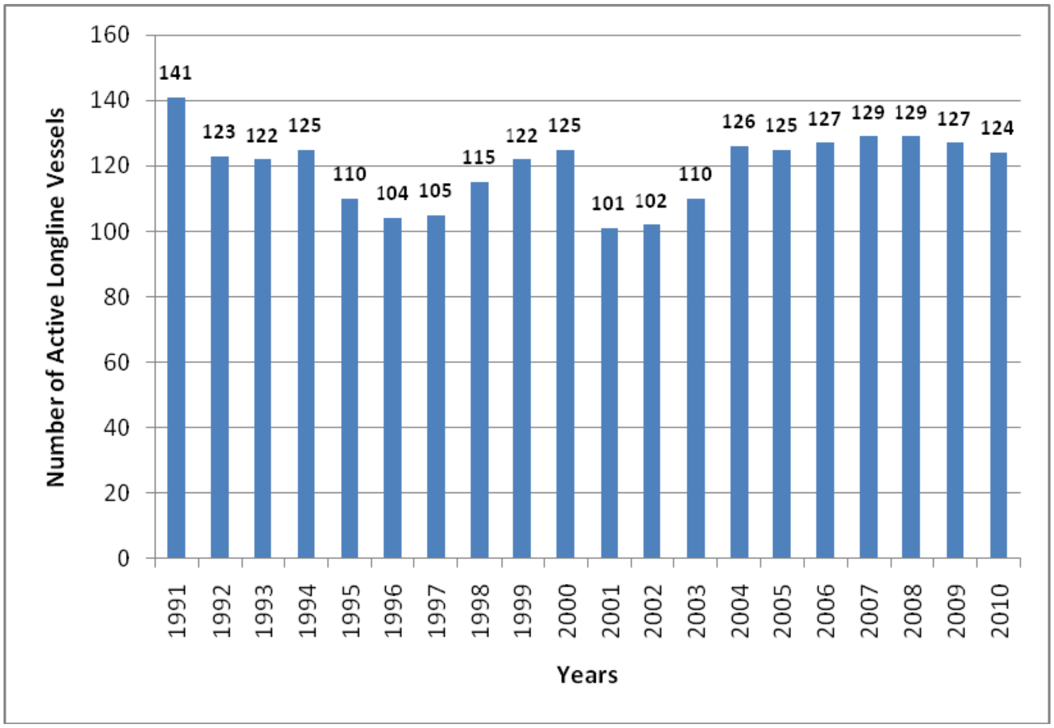


**Figure 3.5.** Number of Active Longline Vessels Based and Landing in Hawai'i by Year, 1991-2010 (NMFS 2001-2010 Longline Logbook Data)

Longline effort increased rapidly from 37 vessels in 1987 to 138 vessels in 1990 (Ito and Machado 2001). The limited access program currently allows for 164 vessels in the fishery, but active vessel participation has been closer to 130 in recent years. In 2010, 124 vessels actively participated in the fishery (Figure 3.5), with 96 vessels targeting tunas primarily and 2 vessels targeting swordfish primarily throughout the year; 26 vessels targeted both swordfish and tunas at some point during 2010 (extrapolated from NMFS 2001-2010 Longline Logbook Data). While a few older wooden boats persist in the fishery, most of the vessels are of steel construction and use flake ice to hold catch in fresh/chilled condition. Some of the boats have mechanical refrigeration that is used to conserve ice, but catch is not frozen in this fishery. Many of these steel vessels were brought along by fishermen who moved to Hawaii from the Atlantic and Gulf states in the 1980s and 1990s. Vessel sizes range up to nearly the maximum 101-foot limit, but the average size is closer to 65 – 70 ft. Based on a survey of Hawaii-based longline fleet in 1993, out of a total of 122 vessels in the fleet, 44 were 74 ft. long or longer (large), 48 ranged between 56 and 74 ft. (medium), and 30 were equal to or shorter than 30 ft. (small) (Hamilton et al. 1996) (Table 3.11). In addition to the influx of large, modern longline vessels, the near-full adoption of monofilament mainline longline reels further modernized the fleet and improved profitability.

**Table 3.11**. Number and Size of Active Vessels per Category in the Hawaii-based Longline Fleet in 1993.

| Target/Size | Tuna | Swordfish | Mixed | Varied | Total |
|---|---|---|---|---|---|
| Small | 22 | 1 | 4 | 3 | 30 |
| Medium | 16 | 10 | 15 | 6 | 48 |
| Large | 3 | 15 | 22 | 3 | 44 |
| Total | 41 | 26 | 41 | 12 | 122 |

Note: Given that the source of these data is a survey conducted on the 1993 fleet, it does not factor in the movement of many swordfish fishermen to California or to tuna fishery because of the 2001 closure of swordfish fishery in Hawaii (see Section 3.3.3.2 for more detail).

Source: Hamilton, Marcia S., Rita E. Curtis, and Michael D. Travis. 1996. *Cost-Earnings Study of the Hawaii-based Domestic Longline Fleet*.

The vessels in the fleet are all U.S. flagged and generally fish with a captain and a crew of three to five people (Allen and Gough 2006). The captain of a vessel may not necessarily be the owner. The vessel-owners in Hawaii-based longline fishery belong to three main ethnicities; Vietnamese-Americans, Korean-Americans, and Euro-Americans (Allen and Gough 2007). Table 3.12 presents the distribution of vessels by ethnicity of owners. Because so many owners relocated to the Hawaii longline fishery in the 1980s and 1990s, there is a great degree of diversity among vessel owners (Allen and Gough 2006). In 2004, more than one third of the owners were Vietnamese-Americans, while ownership of the remaining vessels is split almost equally between Korean-Americans and Euro-Americans. Prior to the 2001 closure of swordfish fishery in Hawaii, nearly all of the Vietnamese-American longline fishermen targeted swordfish. However, after the closure, many Vietnamese-American owners either moved into tuna fishery or relocated to California (Allen and Gough 2006).

**Table 3.12**. Number and Ethnicity of Vessel Owners in Hawaii-based Longline Fleet in 2004.

| Ethnicity | Number of Vessels Owned | Number of Families Owning Vessels |
|---|---|---|
| Vietnamese-Americans | 44 | 35 |
| Korean-Americans | 33 | 25 |
| Euro-Americans* | 35 | 25 |
| Total** | 112 | 85 |

Notes:

The Euro-American category includes 19 individuals born in the U.S. and 6 individuals of varied descent, born outside the U.S., who are generally now U.S. citizens within Hawaii's longline community. The latter individuals share opinions with and socially interact predominantly with the American (Euro-American) network of longline fishermen – in Hawaii considered 'haole.'

**Total number of vessels does not add to 126 (number of vessels in the fleet presented in Figure 3.5).

Source: Stewart, D. Allen and Amy Gough. February 2007. *Hawaii Longline Fishermen's Experiences with the Observer Program* – NOAA Technical Memorandum NMFS-PIFSC-8.

In terms of crew, while some vessel owners tend to hire laborers from their own ethnicities, the largest group of crew is from the Philippines, supplemented by crew from the Republic of Kiribati, Indonesia, and the Federated States of Micronesia (Allen and Gough 2006). There is a very small pool of Hawaii-based laborers, as well, who work a number of vessels on a transitional basis (Allen and Gough 2007). In 2004, of the 250 laborers working as crewmen on active vessels in the Hawaii-based longline fleet, 75% were from the Philippines (Allen and Gough 2007).

The total number of sets by the Hawaii-based longline fleet has remained relatively stable for the past few years and above the long-term average, with the large majority (94%) of trips targeting tunas (Figures 3.6(a) and 3.6(b)). Over the past few years, most of these trips have occurred outside the U.S. EEZ around Hawaii. In 2010, over 74% of trips targeting tunas were outside the U.S. EEZ around Hawaii.

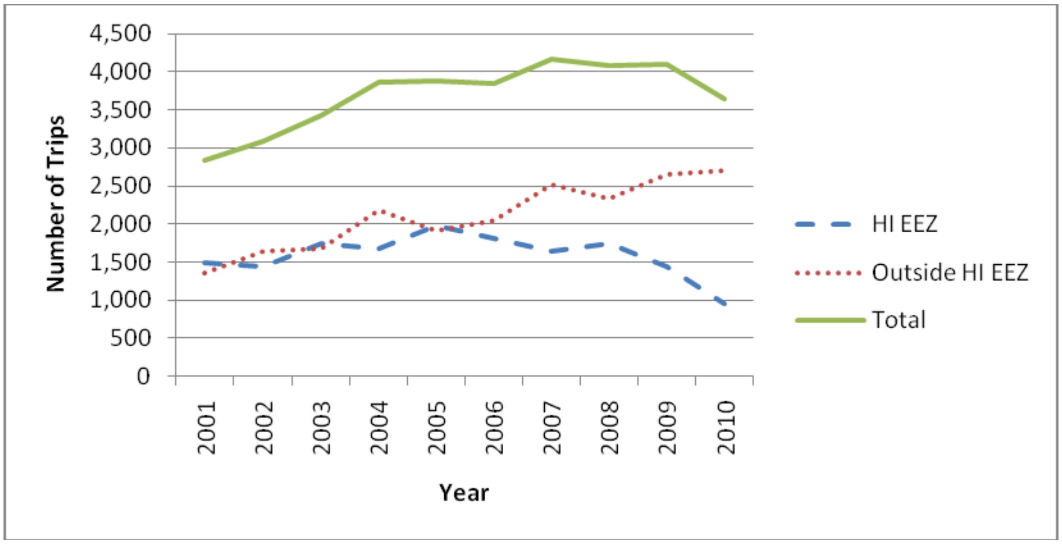


**Figure 3.6(a).** Number of Trips by Hawai'i-based Deep-set Longline Fishery by Year and Fishing Area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to the aggregated nature of the Logbook Data provided by NMFS for this analysis in order to preserve confidentiality, some data points might be missing).

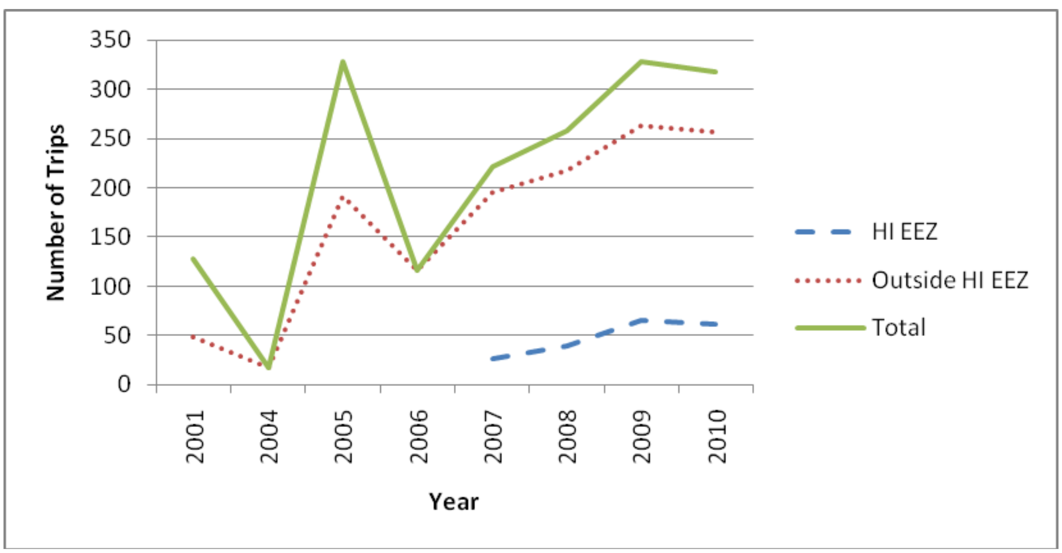


**Figure 3.6(b).** Number of Trips by Hawai'i-based Shallow-set Longline Fishery by Year and Fishing Area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to the aggregated nature of the Logbook Data provided by NMFS for this analysis in order to preserve confidentiality, some data points might be missing).

The total number of hooks set by the Hawaii-based longline fisheries steadily increased since 1994 to a record 41.5 million hooks in 2008 (Figures 3.7(a) and 3.7(b), NMFS 2001-2010 Longline Logbook Data), and then declined to about 37.3 million hooks in 2010. Much of the increase in recent years is due to the shift in effort from swordfish and mixed target to tuna (primarily bigeye tuna). Tuna sets typically set more hooks per day than swordfish and mixed target set types. Most of the hooks set in 2010 were in areas outside of the U.S. EEZ around Hawaii (almost 75%) (NMFS 2001-2010 Longline Logbook Data). Further, for the deep-set longline fishery, the number of hooks set outside the U.S. EEZ around Hawaii has increased since 2008 (see Figure 3.7(a)).

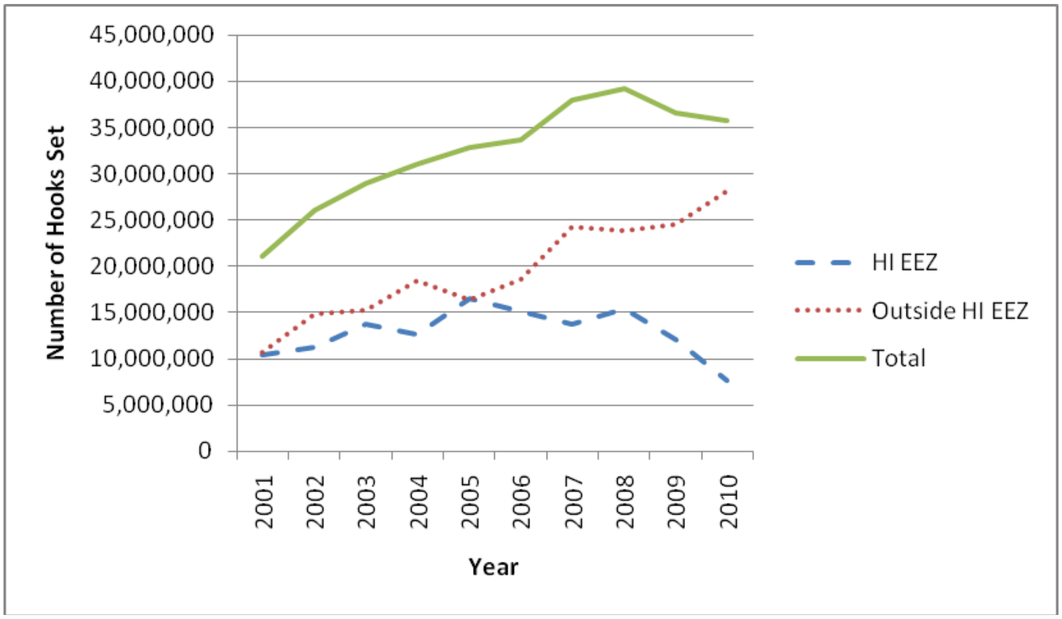


**Figure 3.7(a).** Number of Hooks Set by Hawai'i-based Deep-set Longline fishery by Year and Fishing Area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to the aggregated nature of the Logbook Data provided by NMFS for this analysis in order to preserve confidentiality, some data points might be missing).

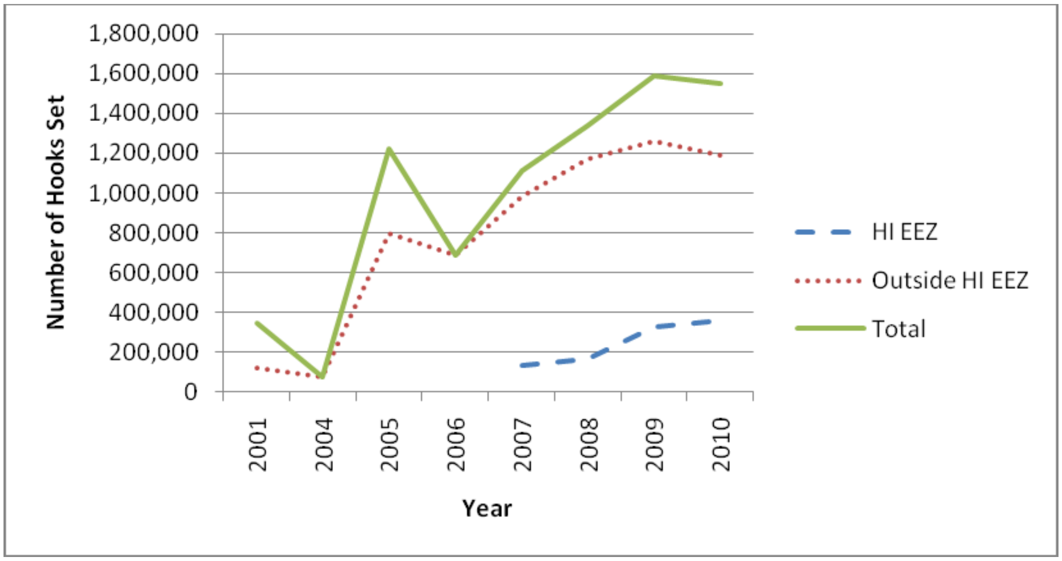


**Figure 3.7(b).** Number of Hooks Set by Hawai'i-based Shallow-set Longline fishery by Year and Fishing Area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to the aggregated nature of the Logbook Data provided by NMFS for this analysis in order to preserve confidentiality, some data points might be missing).

All longline vessels carry mandatory Vessel Monitoring Systems (VMS) monitored by NMFS, and must submit mandatory logbook data at the completion of every trip. VMS are satellite-based vessel monitoring systems whereby each unit transmits a signal (typically once per hour) identifying the exact latitude and longitude of a vessel.

### 3.3.3.2.5 Market and Value of Hawaii-Based Longline Fisheries

Almost all of the Hawaii-based longline catch is sold at the United Fishing Agency auction in Honolulu. It is believed that very little of the longline catch is directly marketed to retailers or exported by the fishermen; however, there are significant exports by wholesalers and retailers who buy their fish from the auction (HIPA 2009). Tuna and swordfish are the primary exports from Hawaii. Seafood from Hawaii is exported to the U.S. Mainland, Japan, and to a lesser extent, Europe (HIPA 2009). The Japanese market is especially lucrative, given that it rewards top quality seafood products, especially tuna. The local demand for swordfish is fairly limited, therefore most of the swordfish caught by the Hawaii-based longline fishery is exported to the U.S. Mainland (HIPA 2009).

Hawaii longline landings in 2008 were nearly 26.7 million pounds, with revenue of $71.9 million. Following a dip in 2009, the landings increased to 23.7 million pounds in 2010 with revenue of $70.1 million. Landings have generally trended upward since 2001, and total landings and revenue in 2010 were 8% and 13% higher, respectively, than the long-term average (see Figure 3.8).

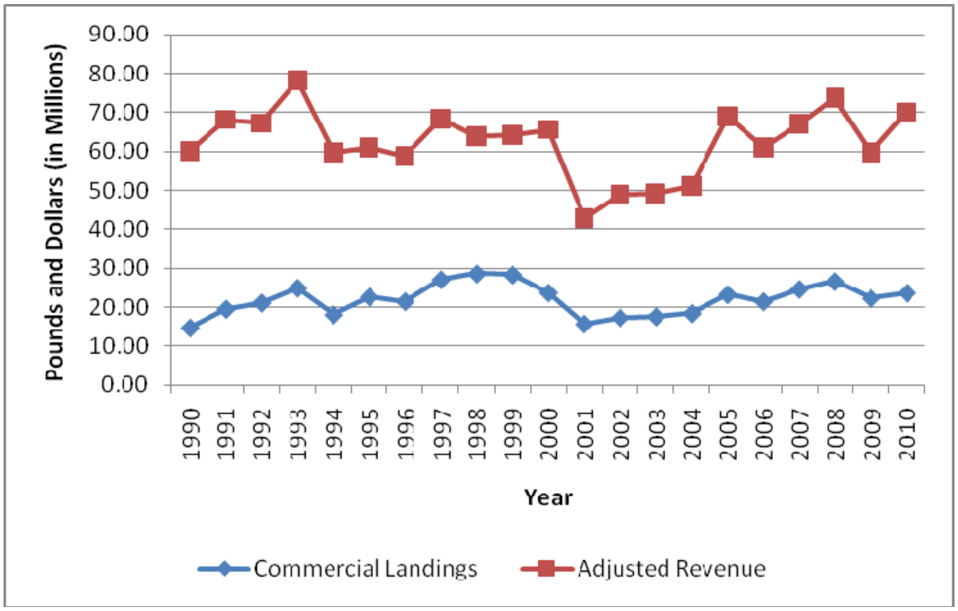


**Figure 3.8.** Commercial Landings (in Millions of Pounds) and Revenues (in Millions of Dollars) for Hawaii-based Longline Fisheries, 1990-2010 (WPacFIN 2010).

Table 3.13 presents the commercial landing in pounds caught and sold, as well as the average annual price per pound sold and value for key species in the Hawaii-based longline fisheries. Among the various tuna species, bigeye tuna is the most valuable species for commercial longline fishermen in Hawaii, with the largest number of pounds caught. In 2010, the average annual price per pound for bigeye tuna was $3.89, and with about 13.1 million pounds sold, its value was over $50.8 million.

The landings and prices presented in Table 3.11 are annual averages for specific fish species, but there is some variation in fish prices when more detailed monthly and daily auction data are examined. In addition to the fish species, factors that may affect market prices for fish include size, quantity, quality, and shelf life of fish landed. For the export market, primary considerations are quality and shelf life. Shorter fight times during the fishing process and faster chilling results in better quality fish, and tuna caught by longline is generally perceived to be of better quality. This is because tuna caught by other methods, such as handline, can suffer from the "burnt tuna syndrome," a condition that alters the body chemistry and temperature of the fish and is thought to occur due to the time the fish struggles on the line.

**Table 3.13**. Commercial Landings (in Pounds) and Prices per Pound (in 2010 Dollars) for Key Species for the Hawaii-based Longline Fisheries.

| | | Bigeye Tuna | Albacore Tuna | Yellowfin Tuna | Skipjack Tuna | Tunas (unknown) | Blue Marlin | Striped Marlin | Moonfish | Mahimahi | Wahoo | Swordfish | Other Billfishes | Sharks | Average for these Select Species |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2006** | **Caught** | 10,560,374 | 788,327 | 3,213,926 | 1,082,532 | 10,289 | 1,216,357 | 1,434,630 | 1,088,066 | 1,535,112 | 1,005,894 | 3,200,426 | 9,143 | 375,902 | |
| | **Sold** | 9,965,857 | 765,692 | 3,031,474 | 867,532 | 344 | 946,133 | 1,434,388 | 1,071,178 | 1,341,649 | 891,278 | 2,513,807 | 271 | 270,718 | |
| | **Value** | $37,781,602 | $1,442,821 | $8,908,491 | $1,342,807 | $1,154 | $1,093,046 | $1,769,735 | $2,102,562 | $4,078,094 | $2,609,172 | $5,751,897 | $389 | $167,005 | |
| | **Price per Pound** | $3.79 | $1.88 | $2.94 | $1.55 | $3.35 | $1.16 | $1.23 | $1.96 | $3.04 | $2.93 | $2.29 | $1.44 | $0.62 | $2.17 |
| **2007** | **Caught** | 13,619,340 | 764,994 | 3,521,227 | 997,156 | 10,337 | 853,963 | 667,457 | 1,239,715 | 1,660,167 | 856,475 | 3,903,809 | 5,152 | 443,696 | |
| | **Sold** | 12,872,750 | 735,183 | 3,246,552 | 729,391 | 5,107 | 747,896 | 623,175 | 1,226,428 | 1,388,466 | 715,283 | 3,643,173 | 736 | 364,314 | |
| | **Value** | $44,902,673 | $1,211,433 | $7,746,588 | $850,688 | $21,366 | $976,302 | $1,186,898 | $2,322,729 | $3,728,999 | $2,234,828 | $8,264,164 | $402 | $206,602 | |
| | **Price per Pound** | $3.49 | $1.65 | $2.39 | $1.17 | $4.18 | $1.31 | $1.90 | $1.89 | $2.69 | $3.12 | $2.27 | $0.55 | $0.57 | $2.09 |
| **2008** | **Caught** | 13,771,330 | 853,488 | 3,467,141 | 1,297,977 | 10,813 | 1,167,763 | 1,030,688 | 1,333,015 | 1,449,895 | 976,583 | 4,248,857 | 5,165 | 443,129 | |
| | **Sold** | 13,377,125 | 803,249 | 3,206,876 | 910,564 | 4,537 | 922,288 | 1,023,462 | 1,313,319 | 1,252,472 | 852,662 | 3,834,729 | 121 | 339,332 | |
| | **Value** | $50,931,985 | $1,376,641 | $8,885,868 | $1,214,808 | $11,035 | $1,041,150 | $1,071,336 | $2,250,819 | $3,264,793 | $2,292,620 | $7,359,193 | $93 | $153,226 | |
| | **Price per Pound** | $3.81 | $1.71 | $2.77 | $1.33 | $2.43 | $1.13 | $1.05 | $1.71 | $2.61 | $2.69 | $1.92 | $0.77 | $0.45 | $1.88 |
| **2009** | **Caught** | 10,992,814 | 729,897 | 2,795,675 | 1,094,699 | 14,500 | 1,165,753 | 654,195 | 1,918,852 | 1,461,045 | 746,754 | 4,327,003 | 1,814 | 406,743 | |
| | **Sold** | 10,750,160 | 649,683 | 2,478,242 | 709,952 | 607 | 1,032,652 | 644,135 | 1,884,043 | 1,286,857 | 604,807 | 3,881,196 | 0 | 296,218 | |
| | **Value** | $40,170,131 | $1,094,442 | $6,376,047 | $1,029,259 | $1,339 | $1,212,437 | $966,722 | $2,462,113 | $2,903,553 | $1,704,249 | $7,489,186 | $0 | $142,140 | |
| | **Price per Pound** | $3.74 | $1.68 | $2.57 | $1.45 | $2.21 | $1.17 | $1.50 | $1.31 | $2.26 | $2.82 | $1.93 | $0.00 | $0.48 | $1.78 |
| **2010** | **Caught** | 13,221,895 | 969,905 | 2,658,390 | 660,408 | 37,491 | 959,186 | 386,145 | 1,847,138 | 1,661,031 | 746,980 | 3,699,413 | 2,729 | 297,394 | |
| | **Sold** | 13,059,807 | 921,063 | 2,405,108 | 299,811 | 17689 | 878,279 | 342,332 | 1,823,832 | 1,517,631 | 600,155 | 3,153,143 | 827 | 224,326 | |
| | **Value** | $50,802,649 | $1,307,909 | $6,998,864 | $548,654 | $46,522 | $1,124,197 | $633,314 | $2,589,841 | $3,293,259 | $1,746,451 | $7,315,292 | $571 | $112,163 | |
| | **Price per Pound** | $3.89 | $1.42 | $2.91 | $1.83 | $2.63 | $1.28 | $1.85 | $1.42 | $2.17 | $2.91 | $2.32 | $0.69 | $0.50 | $1.99 |

## 3.3.4 Recreation and Tourism

The economy of Hawaii has been dependent on tourism and tourism-related activities since statehood in 1959. In 2008, over 14% of jobs in the state were in industries directly involved with tourism, with many other jobs were indirectly associated with the industry (see Table 3.4). Hawaii is a popular destination for both national and international tourists, with Japanese and Canadian tourists being the top two international tourist groups. Due to the recent downturn in the national and international economies, tourism in the state has suffered over the past couple of years. However, the industry is showing signs of recovery since September of 2010, with total visitor spending increasing by double digits for all islands between September and November.

Total spending by visitors to Hawaii between January and November of 2010 was $10.3 billion, an increase of 16% compared to the same period in 2009 (HTA 2010) (see Table 3.14). Among the islands, the highest percent increase was in Maui with 21.3%, while Oahu topped the list in terms of total spending at $5.1 billion. Per person per day spending increased by 6.5% and reached $172.2. Approximately 6.5 million people visited Hawaii in the first 11 months of 2010, an increase of 8.6% from the same period in 2009. About 4 million of these visited Oahu, while almost 2 million visited Maui. Overall, the total visitor days increased 8.9% to 59.8 million in Hawaii (HTA 2010) (see Table 3.14).

**Table 3.14.** Key Tourism Statistics for the State of Hawaii and the Island of Oahu – January to November, 2010 and Percent Change from January to November 2009

| YTD thr Nov 2010 | Oahu | % Change | State Total | % Change |
|---|---|---|---|---|
| Total Arrivals | 3,943,244 | 7.6% | 6,450,795 | 8.6% |
| Total Visitor Days | 28,929,138 | 9.4% | 59,848,716 | 8.9% |
| Total Expenditures ($mil.) | 5,146.9 | 13.7% | 10,304.8 | 16.0% |
| PPPD* Spending ($) | 177.9 | 3.9% | 172.2 | 6.5% |
| Domestic Arrivals | 2,359,802 | 5.4% | | |
| Int'l Arrivals | 1,583,442 | 11.0% | | |

Notes:
* PPPD - Per Person Per Day.
Source:
Hawaii Tourism Authority, DBEDT-Research and Economic Analysis Division (2010). *November 2010 Visitor Spending Climbed 30.4 Percent.* December 28, 2010 (10-32).

Recreation activities in Hawaii are primarily centered on the ocean, although non-ocean recreation is also popular. Ocean-based recreation includes surfing, pleasure boating (for various activities), fishing, swimming, snorkeling, SCUBA-diving, whale-watching, water-skiing, kite-boarding, kayaking, relaxing at beaches, and cruises, among others. Ocean recreation in Hawaii supports an $800 million industry (DOBOR 2011). As a result of population growth and demand for new products and destinations, ocean recreation in the state is increasing (DOBOR 2009).

Various federal, state, and local agencies have specific roles and responsibilities for managing ocean-based recreation use in Hawaii. Some of these include the USCG, NOAA, DLNR, Hawaii State Department of Transportation, Hawaii State Department of Health, and city and county governments (DOBOR 2009). Some of the regulatory tools for managing ocean-based recreation in the state include, among others, Designated Ocean Recreation Management Areas, Non-Designated Ocean Recreation Management Areas, Fishery Management Areas, Local and Special Rules – Ocean Waters, Marine Life Conservation Districts, and Commercial Ocean Recreational Activity permits (DOBOR 2009).

### 3.3.4.1 Whale Watching and Wildlife Viewing

Whale watching is an important component of Hawaii's ocean-based recreation industry, and humpback whale watching in particular makes a contribution to the economy of Hawaii. The few studies with relevant economic and other data on whale watching and other such activities are relatively outdated, sparse, and hard to obtain from public sources. However, a 1999 study that collected survey information on whale watching trips provides some information. This study found that 52 vessels offered whale watching trips during the 1999 season, of which four were based in Oahu. On average, these vessels ran 87 trips per day, with the four vessels in Oahu running six trips per day. These vessels took approximately 3,100 people for whale watching per day in the state, of which 609 were taken on vessels based in Oahu (Utech 2000). It is estimated that the number of whale watchers was 370,000 in Hawaii in 1999. Approximately two-thirds of these passengers (1,989) whale watched around Maui, which is considered the heart of the whale watching industry in the state. The industry generated $11 to $16 million in revenue during 1999; the lower end of the range representing revenue directly from whale watching tours only and the upper end of the range taking into account a portion of snorkeling trip revenues that included whale watching (Utech 2000). The industry also supported the equivalent of 280 to 390 jobs in 1999 in the state (Utech 2000).

In addition to exclusive whale watching tours, whale watching and wildlife viewing are also components of several other types of ocean tours during the whale season. Considering the broader ocean tour boat industry, in 1999, the direct revenues from the industry in the state were approximately $132 million (in 1999 dollars) (Utech 2000). The industry includes tour boats for whale watching, snorkeling, dinner cruises, and sunset cruises, and is a growing segment of Hawaii's economy. The largest share of the revenue was from snorkeling tours (approximately $67 million) and dinner cruises (approximately $47 million). By island, tours in Maui brought in the highest revenue, followed by those in Oahu. The total economic impact, including direct, indirect, and induced revenues was estimated to be $225 million (in 1999 dollars). The industry supported 3,232 jobs in 1999 (Utech 2000). Between 1990 and 1999, revenues from this industry in Big Island, Maui, and Kauai increased by 25% in real terms (Utech 2000).

Another large segment of ocean-based recreation industry in Hawaii is the cruise industry. According to the U.S. Maritime Administration, Hawaii was the seventh most popular cruise destination in North America in 2003 (DBEDT 2003). In 2003, over 83% of cruise visitors to Hawaii were from within the United States, followed by Canada at 6.5% and Europe at 2.8%. The total direct economic impact of the cruise industry in Hawaii in the same year (2003) was estimated at $268.7 million, with each cruise visitor bringing about $157 into the state's economy per day. The largest impact was from out-of-state visitors, including cruise visitors and crew members, followed by that from cruise lines (DBEDT 2003). The direct, indirect, and induced effects from the cruise industry amounted to $390.5 million of Gross State Product in 2003, and the industry generated 4,582 jobs (DBEDT 2003).

## 3.3.5 Recreational and Subsistence Fishing

Fishing is a popular pastime for people in Hawaii, with a quarter of the population participating in some form of fishing at least once a year (U.S. Department of the Navy 2008a). In addition, fishing is also popular with tourists visiting Hawaii. Popular target species among boat anglers in the state include blue marlin, striped marlin, tuna, wahoo, and mahimahi (NMFS 2011(b)). Annual fish consumption in Hawaii is about 90 pounds per capita, over twice the national average (U.S. Department of the Navy 2008a). Hawaii Revised Statutes (HRS) Section 188-22.6 defines subsistence fishing as the customary and traditional Native-Hawaiian uses of renewable ocean resources for direct personal or family consumption or sharing. Native Hawaiian in the HRS is defined as any descendant of the races inhabiting the Hawaiian Islands prior to 1778.

There is no license required for non-commercial saltwater fishing in Hawaii and, therefore, data on recreational and subsistence fishing are very limited. Without a requirement for recreation and subsistence fishing licenses, it is difficult to assess the overall level of such fishing activities due to a lack of detailed catch data. No formal attempt to assess the subsistence fishing contribution to island economies has been made in the past, but the value of fishing for subsistence by contemporary Native Hawaiians is known to be an important component of some communities, particularly rural communities (U.S. Department of the Navy 2008a).

In the case of recreational fishing, while occasional surveys have been fielded over the years, there has been no systematic collection of such data. The Marine Recreational Fisheries Statistical Survey collected data in Hawaii for a period ending about 20 years ago. The program was recently restarted in Hawaii as the Hawaii Marine Recreational Fishing Survey (HMRFS). HMRFS is collecting data through a dual approach including random telephone surveys, as well as fisherman intercept surveys conducted at boat launch ramps, small boat harbors, and shoreline fishing sites. Given the HMRFS is a relatively recent undertaking, some scattered information is made available through the newsletters released by NMFS, but not enough intercepts of fishermen have occurred to date to allow catch and effort determinations for Hawaii fisheries. Based on the 2006 HMRFS data, it is estimated that 396,413 recreational fishermen brought in 17.6 million pounds of fish (HIPA 2009). The U.S. Fish and Wildlife Service estimates the total number of recreational fishermen in Hawaii at 158,000 in 2006, a significantly lower number compared to HMRFS. This discrepancy in the two sources of data may be due to different survey methodologies and accuracy of data, and also the lack of licensing and reporting requirements for recreational fishermen (HIPA 2009).

A new initiative by NMFS, the Marine Recreational Information Program (MRIP), is anticipated to collect better data on produce improved estimates of, marine recreational catch and effort. The MRIP is anticipated to replace the HMRFS (MRIP 2011). An important component of MRIP is the National Saltwater Angler Registry. All Hawaii recreational fishermen (including indigenous fishermen) who fish more than 3 miles from shore (Federal waters) are required to register. The registration is valid for one year from the date of registration, and must be renewed

Hawaii likely has approximately 5,000 to 6,000 boats participating in recreational fishing, with an additional 1,900 non-commercial bottomfish vessels registered with the state in 2007 (NMFS 2011(b)). With about 25 small boat harbors and 20 boat ramps, the state has one of the most developed recreational fishing infrastructures in the U.S. Pacific. Over 100 recreational fishing tournaments occur in Hawaii, and the state has about 25 active fishing clubs (NMFS 2011(b)). Some sources indicate that there are about 125 active fishing charter boats operating out of 10 ports in the state, and these charters average about one trip every two days with approximately 70,000 people participating in charter fishing annually (NMFS 2011(b)). Direct annual expenditures on recreational fishing are estimated to be about $450 million (NMFS 2011(b)).

Absent systematic data on recreational and subsistence fishing in Hawaii, it is believed that offshore recreational and subsistence catch is likely equal to or greater than the offshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander et al. 2004).

The issue is further complicated by the overlapping behaviors of subsistence, commercial, and recreational fishermen. A recent study that surveyed the small boat pelagic fishermen reveals that within that specific fishery, while 42% of the survey respondents classified themselves as commercial fishermen, 60% actually sold fish in the 12 months preceding the study (NMFS 2011). Also, over 30% of fishermen classifying themselves as recreational sold fish in the past one year. Most fishermen within this fishery participate in fish sharing networks, with 97% of those surveyed indicating that they give away a portion of the catch to friends or relatives (not immediate family). About 62% consider the fish they catch to be an important source of food for their family (NMFS 2011).

### 3.3.6 Seafood Consumption in Hawaii

Annual fish consumption in Hawaii is about 90 pounds per capita, over twice the national average (U.S. Department of the Navy 2008a). According to another estimate, per capita seafood consumption in Hawaii is more than three times the national average of 17 pounds per person, with state residents consuming more than 60 million pounds of seafood in 2006 (HIPA 2009). About one-third of this demand is met by Hawaii's local fishing industry (HIPA 2009). Seafood consumers in Hawaii are known to be among the most knowledgeable and discriminating seafood consumers in the U.S. (WPRFMC 2011).

Almost all of the Hawaii-based longline catch is sold at the United Fishing Agency auction in Honolulu. Bidding is open at the auction and all levels of seafood market are represented, including private consumers (WPRFMC 2011). It is believed that very little of the longline catch is directly marketed to retailers or exported by the fishermen; however, there are significant exports by wholesalers and retailers who buy their fish from the auction (HIPA 2009). In addition to local consumption, seafood from Hawaii is exported to the U.S. Mainland, Japan, and to a lesser extent, Europe (HIPA 2009). The Japanese market is especially lucrative, given that it rewards top quality seafood products, especially tuna.

Tuna and swordfish are the primary exports from Hawaii. Around 70% of tuna longline catch is sold directly for final consumption (55% for local consumption and 15% for export), while the remaining 30% is sold for intermediate uses by other sectors such as hotels, eating and drinking establishments, food processing, etc. (Cai et al. 2001). The local demand for swordfish is fairly limited, therefore most of the swordfish caught by the Hawaii-based longline fishery is exported to the U.S. Mainland (HIPA 2009). In fact, only 6.5% of swordfish caught in Hawaii is sold for local consumption, while 90% is exported (total 96.5% directly sold for final consumption) (Cai et al. 2001).

### 3.3.7 Social and Cultural Role of Marine Mammals in Hawaii

Native Hawaiian culture is deeply rooted in the natural environment, with a cohesive relationship with the land and sea. In a traditional Hawaiian context, there is no division between nature and culture; they are considered one and the same (DLNR 2008). The wealth and limitations of the land and ocean resources gave birth to, and shaped the Hawaiian world view. Land, water, ocean, and sky were the foundation of life and the source of the spiritual relationship between people and their environs. Every aspect of life, whether in the sky, on land, or of the waters was believed to have been the physical body-forms assumed by the creative forces of nature, and the greater and lesser gods and goddesses of the Hawaiian people (DLNR 2008). Respect and care for nature, in turn, meant that nature would care for the people.

In this context, marine mammals, such as the false killer whale, have cultural and spiritual importance for the Native Hawaiians. For example, some marine mammals, such as the spinner dolphin and humpback whales, are considered 'aumakua' or family deity. The belief was that when a powerful ancestor died, he or she took the animal form and provided protection, healing, or guidance to the family ever after. In addition, the humpback whale was also believed to be a manifestation of one of the major demigods of Hawaiian folklore, kanaloa, who was the god of the sea.

# 4.0 ENVIRONMENTAL CONSEQUENCES

This section describes and analyzes the anticipated environmental consequences of implementing the preferred alternative and other alternatives on the resources described in the Affected Environment section (section 3).

# 4.1 Physical Effects of the Alternatives

The three alternatives would not change the nature of Hawaii-based longline fishing or any other use of the environment in a way that implementation would be expected to cause additional degradation of water quality, air quality, or the physical environment. No discernible increase in environmental contaminants or solid waste disposal is anticipated. Implementation of any of the alternatives is not expected to change the longline fisheries' effects on historic or cultural resources in the area; therefore, coordination with the State Historic Preservation Officer under the National Historic Preservation Act is not required.

## 4.1.1 Climate Change

Alternatives 2 and 3 include proposed area closures that would likely result in a redistribution of longline fishing effort to other, open areas. That redistribution of effort may result in increased fossil fuel consumption and carbon emissions if vessels move to areas farther from normal fishing grounds. This would be particularly true under Alternative 3, as longline fishing would be allowed only on the high seas. However, both the shallow-set and deep-set longline fisheries already operate extensively on the high seas; the increase in fuel consumption and emissions, even if all fishing effort from the EEZ around Hawaii were redistributed to the high seas, would therefore be only an incremental increase, and would likely have no measurable effect on the global climate.

# 4.2 Biological Effects of the Alternatives

## 4.2.1 Alternative 1. No Action (Status Quo)

The No Action alternative is the least restrictive of the alternatives. Under this alternative, no gear restrictions, effort reductions, or other management measures would be implemented. No additional monitoring or voluntary measures to reduce the effects of marine mammal bycatch in the Hawaii-based longline fisheries would occur. This alternative would not be expected to reduce serious injuries and mortalities of false killer whales resulting from interactions with longline gear. In fact, the risk of serious injury and mortality to false killer whales might increase because depredation is a learned behavior that may be passed down to successive generations of animals. Furthermore, this alternative would not achieve the reductions in false killer whale mortalities and serious injuries required by MMPA section 118. This alternative would result in no change to the Hawaii-based longline fisheries, so no change in impacts to other biological resources would be expected.

## 4.2.2 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team

### *4.2.2.1 Require small circle hooks (size 16/0 or smaller) with 4.0 mm maximum wire diameter and other specific characteristics in the Hawaii-based deep-set longline fishery*

The proposed required use of circle hooks size 16/0 or smaller, with a maximum wire diameter of 4.0 mm would be expected to have conservation benefits for false killer whales and other cetaceans that become hooked in the deep-set longline fishery. The use of these hooks would be expected to reduce both the severity of injury to hooked marine mammals (i.e., reduce the likelihood of a serious injury versus a non-serious injury) and the total number of injuries (i.e., prevent some hookings).

Reducing the severity of injury

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). Observer data provide some information on the proportion of marine mammals caught on tuna hooks versus 15/0 and 16/0 circle hooks that were determined to be not seriously injured versus killed or seriously injured (Table 4.1). Only interactions for which the hook type could be determined are included. The overall rate of non-serious injury across all hook types is about 9% for false killer whales, or 11% for false killer whales, blackfish, and short-finned pilot whales combined. The proportion of non-serious injuries for the few animals caught on circle hooks is greater (25-50%, depending on species groupings), but sample sizes are too small for meaningful statistical tests. The probabilities of obtaining at least 1 out of 3, 1 out of 4, or 3 out of 6 non-serious injuries by chance alone if the true probability of a non-serious injury were 11% (as is currently estimated) are 30%, 37% and 2%, respectively (FKWTRT 2010).

These data are difficult to interpret. The inclusion of pilot whales increases the sample size, but there may be important differences in entanglement or hooking characteristics and behavior of pilot whales that make them a poor proxy for false killer whales. However, if the observed pattern is not simply a small sample size artifact, then false killer whales hooked or entangled on small circle hooks might have a lower rate of M&SI than those hooked on tuna hooks. In the best case scenario (including the pilot whales), these data suggest that the M&SI rate could be reduced from the current estimate of 89% to 50% (a 44% reduction); in the worst case scenario, there is no difference, and no reduction in M&SI would be achieved.

**Table 4.1**. Number and proportion of non-serious injuries (NS) for hookings/entanglements of false killer whales, blackfish, and short-finned pilot whales when the involved hook type was known (FKWTRT 2010).

| | **15-16/0 Circle Hooks** | | | **Tuna Hooks** | | | **Total (Both Hook Types)** | | |
|---|---|---|---|---|---|---|---|---|---|
| **Species** | **# Takes** | **# NS** | **% NS** | **# Takes** | **# NS** | **% NS** | **# Takes** | **# NS** | **% NS** |
| False killer whale | 3 | 1 | 33% | 29 | 2 | 7% | 32 | 3 | 9% |
| False killer whale or blackfish | 4 | 1 | 25% | 36 | 2 | 6% | 40 | 3 | 8% |
| False killer whale, blackfish, or short-finned pilot whale | 6 | 3 | 50% | 39 | 2 | 5% | 45 | 5 | 11% |

The "weak" small circle hooks included in the Preferred Alternative (maximum wire diameter of 4.0 mm) are not used commercially in the Hawaii-based deep-set longline fishery, so the observer data above do not reflect the effects of using weak circle hooks. The experimental testing of weak (4.0 mm wire diameter) versus standard (4.5 mm wire diameter) 15/0 circle hooks in the Hawaii-based deep-set longline fishery did not have a sufficiently large sample size to quantify a difference in marine mammal bycatch or M&SI rates (Bigelow et al. 2011). However, it would be expected that the use of weak circle hooks, which straighten with less force, would release some hooked false killer whales, resulting in even fewer serious injuries or mortalities than using small circle hooks with the standard wire diameter (4.5 mm).

Reducing the total number of injuries

To support FKWTRT deliberations, NMFS developed a bootstrap simulation framework to evaluate potential effects of various gear configuration, seasonal or area restrictions, effort levels, or other factors. The simulations sampled longline sets from observer data, with replacement, to examine M&SI rates under various scenarios. The results indicate only what the patterns in the existing observer data are under these scenarios, and can inform future expectations to the extent that fishing practices otherwise remain the same. If either the fishing fleet or the false killer whales were to alter their behavior in response to certain scenarios, this would affect the outcome in unknown ways that are not presently measurable. Nonetheless, the simulations using this extensive observer database can be informative for identifying the potential magnitude of changes in bycatch rates, and for examining cumulative effects of multiple factors implemented simultaneously.

The simulations were structured to draw a pre-set level of fishing effort (number of sets) for the deep-set and shallow-set longline fishery, respectively. Sets were drawn from the observer data subset that met additional criteria of interest, e.g. that used small circle hooks during the set or that fished during a particular time of year or within a specified geographic area. Simulation output included summaries of the full data set and the simulation data subset, histograms of the simulated results, and a table summarizing the average take rates relative to the target take levels for the FKWTRT. Section 7.3 of the Draft FKWTRP contains more information on these simulations, and is incorporated by reference (FKWTRT 2010).

Based on the simulations, the FKWTRT identified the use of small circle hooks (16/0 or smaller) as a measure that could result in a 6% decrease in false killer whales killed or seriously injured (FWKTRT 2010). Combined with a simulated reduction in the M&SI rate from 89% to 50% (because hookings/entanglements might be less severe with circle hooks, as described above, and through the use of best practices to free animals from gear and release them with non-serious injuries), the simulations indicate an overall potential reduction in M&SI of up to 47% (Figure 4.1).

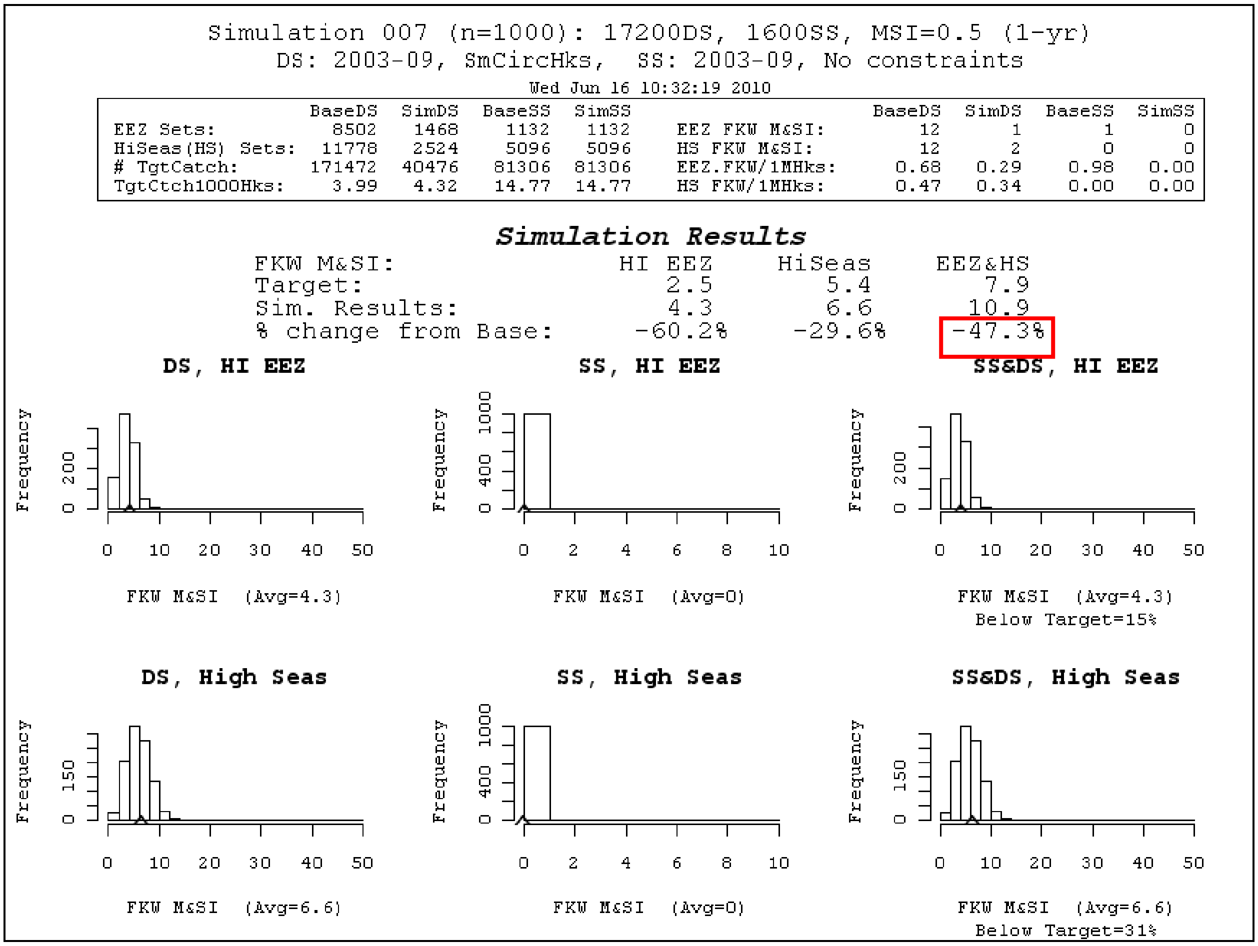


**Figure 4.1**. Sample simulation output for 17,200 deep sets per year, 1,600 shallow sets per year, a reduced M&SI rate of 50%, and the mandatory use of small circle hooks in the deep-set longline fishery. In this case, the simulation forecasts that M&SI of false killer whales would decrease by about 47.3% (see red box). FKWTRT 2010.

The required use of small, weak circle hooks 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 expected effect of the proposed hook type change on seabird bycatch in the deep-set longline fishery is unknown. NMFS' ability to perform a quantitative analysis of seabird bycatch by hook type is limited because observers do not record the hook type or size involved in seabird interactions. Up to a third of observed deep-set trips used a mix of hook types, so the hook type cannot be identified if the vessel is using several kinds of hooks on the set. However, the Agreement on the Conservation of Albatrosses and Petrels' Seabird Bycatch Working Group identified circle hooks (size unspecified) as a high priority for research on seabird bycatch mitigation in longline fisheries, noting that circle hooks are a safe, practical, relatively low-cost (in both capital investment and operational costs) measure, with a high ability to transfer technology to distant water fleets, and a high ability to monitor their use and performance (ACAP 2007). Given the existing seabird bycatch mitigation requirements for the deep-set longline fishery, and the already prevalent use of small circle hooks in the fishery (approximately 40% of the fleet based on observer data, NMFS unpublished data), the required fleet-wide use of small circle hooks is unlikely to increase current rates of seabird bycatch.

The expected effect of this measure on target and non-target fish species is unknown. There is some evidence that using small circle hooks in longline fisheries may increase or have no effect on the catch rates of target tuna species compared to tuna hooks (e.g., Kim et al. 2007, Kerstetter and Graves 2006), and as noted above, a large proportion of the Hawaii-based deep-set longline fishery already uses small circle hooks, so they are considered viable in the fishery. In the Western and Central Pacific Ocean, management of bigeye tuna is quota-based, and changes in catch rates or catch efficiency due to the fleet-wide use of small circle hooks would not affect the quota or the resource. However, the catch of non-target species may be affected by a change in hook type, to an unknown degree. In an experiment comparing large (18/0) circle hooks versus tuna and J hooks in the Hawaii-based deep-set longline fishery, the catch rate of billfish and a variety of bycatch species were reduced (Curran and Bigelow, unpublished data), which may provide a conservation benefit to those species but may be an economic concern to the fishery, with lost revenue due to lower catch rates of billfish and some pelagic sharks that are often retained and marketed. These results may not be transferrable to small circle hooks, but are an indication that catches of non-target species may be affected. However, Bigelow et al. (2011) found that there were no significant difference in catch rates of bigeye tuna between weak (wire diameter 4.0 mm) versus control (wire diameter 4.5 mm) 15/0 circle hooks, and no significant difference in mean length of 15 other species of non-target catch in the deep-set longline fishery.

#### *4.2.2.2 Establish a minimum diameter for monofilament leaders and branchlines in the Hawaii-based deep-set longline fishery*

Observer data indicate that monofilament leaders and branchlines may break during marine mammal hookings and entanglements, which causes animals to be released with often substantial amounts of gear still attached. According to the criteria NMFS uses to determine injury severity, small cetaceans that are released with gear attached with the potential to wrap around pectoral fins/flippers, peduncle, or head; be ingested; or accumulate drag would be considered seriously injured (Andersen et al. 2008). The FKWTRT believed that if the fishery used leaders and branchlines that were strong relative to the hook strength, during a marine mammal hooking or entanglement, tension could be placed on the line to allow the hook to straighten, or the animal could be brought close to the vessel for disentanglement and/or dehooking attempts.

The intent of this proposed measure is to prevent leaders and branchlines from breaking under the strain of a hooked or entangled marine mammal, and allow the hook to be the weakest part of the terminal tackle. The FKWTRT recommended a 2.0 mm minimum diameter for monofilament leaders and branchlines, which would have an approximate breaking strength of 400 pounds, compared to a breaking strength of approximately 300-310 for a 15/0 circle hook with 4.5 mm wire diameter (J. Hall, C. Funderburg, and F. Crivello, unpublished data).

The proposed required minimum diameter for monofilament leaders and branchlines, in combination with the required use of small circle hooks, would be expected to reduce the M&SI rate of marine mammals, though the reduction cannot be quantified. The average observed branchline diameter in the deep-set longline fishery between 2003-2009 was 1.98-2.00 mm, with a reported range of 1.5-2.5 mm (NMFS unpublished data). Individual vessels show a wide range of variability in reported branchline diameter from trip to trip, which might be explained by differences in technique between observers, variability in observer-issued equipment, branchline degradation over time, and vessels changing gear over time. Considering those caveats, a high proportion of the deep-set longline fishery is already using gear that would meet the proposed requirement. Between 2003 and 2009, 71-78% of observed deep-set trips used line with diameter 2.0 mm or larger, and 79-87% of trips used 1.9 mm or larger (NMFS unpublished data), which is within the plausible range of diameters of 2.0 mm line that has been stretched and relaxed over time (J. Hall and C. Funderburg, unpublished data).

Despite the already-high use of monofilament line with a diameter of 2.0 mm or greater, branchlines have been observed to break under the strain of a hooked marine mammal. Of 43 observed false killer whale and blackfish takes, the branchline broke in 7 interactions (5 false killer whales and 2 blackfish). The average reported branchline diameter in these interactions was 2.10 mm, with a range of range 2.0-2.1 mm. However, four of these seven were on 3.6 mm tuna hooks, which are much stronger than small circle hooks (450-600 pounds; J. Hall, C. Funderburg, and F. Crivello, unpublished data), so the hook was not the weakest link in the terminal tackle. One of the seven interactions was on a hook of unknown type/size, and two involved 15/0 circle hooks. Sample sizes are too small to discern whether there is a meaningful relationship between the branchline diameter and the rate of line breaks during marine mammal interactions. However, while it is anticipated that line breaks would decrease under the proposed minimum line diameter requirement, and therefore marine mammal interactions would be expected to decrease, some line breaks during marine mammal interactions (likely leading to serious injuries) would still be expected to occur.

Branchline breaks are not commonly reported during interactions with other protected species (e.g., seabirds and sea turtles), except rarely for leatherback sea turtles. This proposed measure is therefore not likely to have an effect on these species. If the requirement does reduce the chance of the branchline breaking under the strain of a hooked or entangled leatherback sea turtle, this may increase the chance of successfully dehooking and/or disentangling the turtle. There is also the chance that a turtle that might otherwise have broken the line and released itself may be retained in the gear and possibly drown. Neither of these effects can be quantified.

There would be no expected effect on target or non-target fish species from this measure.

### *4.2.2.3 Establish a year-round Main Hawaiian Islands Longline Fishing Prohibited Area that is closed to longline fishing*

The proposed year-round MHI Longline Fishing Prohibited Area includes 211,411 km$^2$ (81,626 mi$^2$) that is currently closed to longline fishing year-round under existing regulations (50 CFR 665.806(c)(1)), and an additional 71,384 km$^2$ (27,562 mi$^2$) that is currently closed to longline fishing for 8 months of the year under existing regulations (50 CFR 665.806(c)(2)). Therefore, the only proposed change from existing regulations would be to close the area north of the islands for the remaining four months of the year. This additional area represents approximately 3% of the EEZ around Hawaii that is currently available for longline fishing (i.e., the EEZ around Hawaii not including the existing year-round exclusion zone [the October-January boundary] or the PMNM, but including the area of the proposed SEZ). The total area of the proposed year-round MHI Longline Fishing Prohibited Area is 282,796 km$^2$ (109,188 mi$^2$).

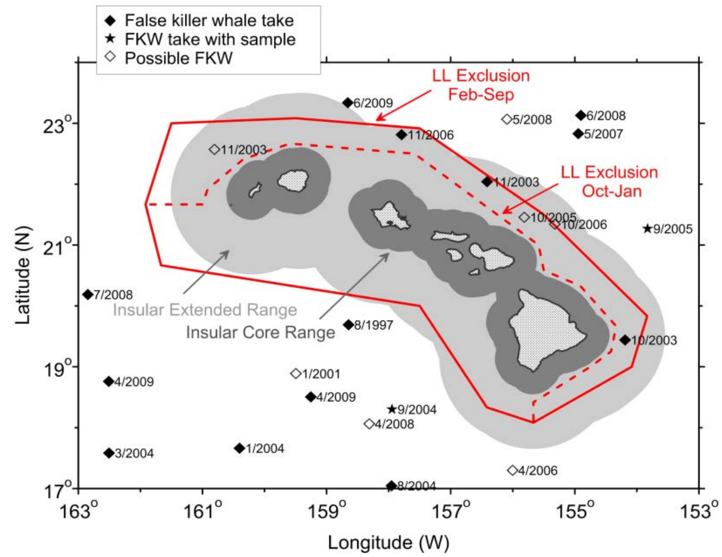


**Figure 4.2**. Core and extended ranges of the Hawaii insular stock of false killer whales, overlaid with the existing longline exclusion zone around the MHI. The proposed year-round MHI Longline Fishing Prohibited Area would eliminate the seasonal change in the boundary of the exclusion zone, and would maintain the solid red line boundary at all times. Locations of observed takes of false killers and possible false killer whales (blackfish) are noted, including those where a biopsy sample was obtained, as of July 2010.

The proposed MHI Longline Fishing Prohibited Area would be expected to nearly eliminate the risk of M&SI of the Hawaii insular stock of false killer whales in the longline fisheries. Longline fishing is already excluded year-round from the entire core range of the Hawaii insular stock and part of the extended range (i.e., the area of overlap between the Hawaii insular and Hawaii pelagic stocks). Longline fishing is also already excluded for 8 months of the year is a large portion of the remaining extended range (Figure 4.2). The proposed MHI Longline Fishing Prohibited Area would make this seasonal longline exclusion year-round, thus further restricting longlining within the insular stock's extended range. Approximately 26% of the overlap zone would remain open to longline fishing, at the offshore edges of the overlap zone (53,992 $km^2$ or 15,742 $nm^2$). Because Hawaii insular animals are more likely to range closer to shore and Hawaii pelagic animals farther from shore within the overlap zone, false killer whales in the open area are more likely to be from the Hawaii pelagic stock. Thus, insular false killer whales will be almost entirely protected from interactions with longline fishing. The proposed closure would also offer protection to the pelagic false killer whales in the area; however, fishing effort would be expected to shift to areas outside the prohibited area, as is seen during the existing seasonal closure of the area, so the risk of M&SI to pelagic false killer whales may simply be displaced, rather than reduced by this measure.

The proposed closure would likely be beneficial to other marine mammals and protected species in the area, particularly island-associated marine mammal populations, by reducing the risk of hooking or entanglement in longline fishing gear. However, as noted above, the proposed MHI Longline Fishing Prohibited Area is unlikely to cause a reduction in fishing effort, only a redistribution to the area just outside the closure, so any potential negative impacts to these species from longline fishing may be displaced or shifted, rather than reduced. No increase above current rates of bycatch of protected species would be expected from this measure.

There would be no expected effect on target or non-target fish species from this measure.

### 4.2.2.4 Require annual certification in marine mammal interaction mitigation techniques for longline vessel owners and operators

Under existing regulations for Western Pacific Pelagic fisheries (50 CFR 665.814, Protected Species Workshop), owners and operators of all western Pacific Pelagic longline vessels must successfully complete a workshop each year, and a valid workshop certificate is needed for owners to maintain or renew permits and for operators at sea. Sea turtle and seabird handling is specified in these regulations; there is no regulatory requirement for training in marine mammal handling. But, since 2004, NMFS has incorporated into these workshops education on marine mammal identification, careful handling and release techniques, and an overview of, as well as an explanation of the purpose and justification for marine mammal bycatch reporting requirements that apply to the longline fisheries. Under this alternative, NMFS proposes to expand the content of the workshops to meet the needs of the FKWTRP.

The FKWTRT believes specific training would significantly increase the potential for captains and crew to free hooked or entangled false killer whales from gear in a manner that would reduce the severity of the injury (FKWTRT 2010). Fisheries representatives to the FKWTRT explained that it was common practice to simply cut the line when cetaceans were entangled, much in the manner suggested for turtle entanglements. Improved training of captains and crew in successful methods of releasing cetaceans (that have not ingested a hook) appeared to hold promise of increasing the number of animals for which the outcome of an entanglement or hooking was a non-serious injury. If the actions and best practices included in the proposed expanded training are carried out, this would potentially reduce the severity of injuries to marine mammals during these interactions (FKWTRT 2010).

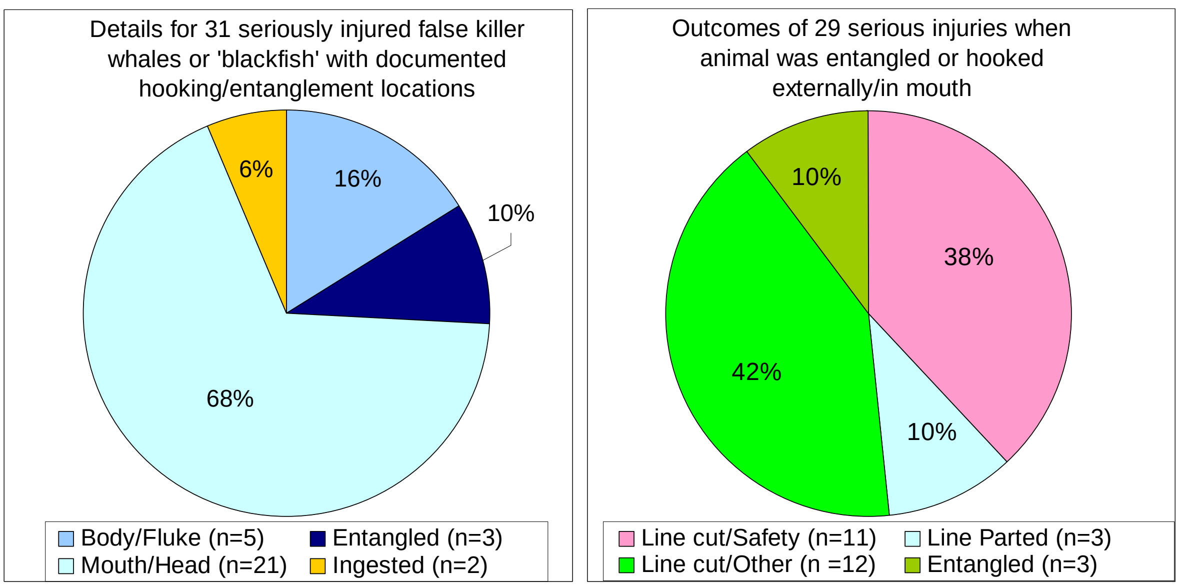


**Figure 4.3**. Information on seriously injured false killer whales reported by the observer program 1994-2009. Only interactions with sufficient detail to characterize where and how animals were hooked or entangled are show. Left panel shows nature of entanglement/hooking. Right panel shows outcome of interaction for the 29 animals that were entangled or hooked externally/in mouth and this might have been amenable to release attempts. Line cut/Safety represents interactions where the observer noted that the line was cut because of safety concerns or because the animal was too active for handling. Line cut/Other refers to interactions where the observer noted that the line was cut but without any indication that this was for safety reasons. FKWTRT 2010.

The FKWTRT examined observer data from marine mammal interactions from 1994-2009 to quantitatively estimate the potential reduction in the severity of marine mammal injuries that might be expected from improved handling and release training. While it is not known how many of the false killer whales and blackfish that were hooked or entangled might have been releasable with non-serious injuries, the observer data from the interactions that include sufficient detail on the nature of the hooking or entanglement can be used to assess a range of potential values (Figure 4.3).

In one scenario, if all animals that are not deep-hooked (i.e., have not ingested the hook) could potentially be freed from all gear and released with non-serious injuries, then the success rate would depend on the proportion of takes during which safety or the other constraints would have allowed an opportunity to handle the animal and attempt release. Based on the interactions with known circumstances, this would mean that 29 out of 31 false killer whales or blackfish (94%) were caught in a manner that would be amenable to a release attempt, and 18 out of 29 interactions (62%) did not document safety concerns or high activity of the animal that would have prevented such an attempt (Figure 4.3). Thus, in this scenario, up to 0.94*0.62 = 58% of the animals could potentially have been released with non-serious injuries.

In an alternate scenario, it is possible that the number of animals released with serious injuries could be further reduced if safety issues are less of a concern. Current handling techniques developed for sea turtles involve bringing the turtle close to the vessel. Trying to do this with an active animal the size of a false killer whale can be dangerous, and animals have, therefore, been cut loose without attempting to free them from gear. However, techniques that might allow an animal to pull out or straighten a hook would not necessarily require bringing the animal close to the vessel, and the safety concerns may be reduced. Therefore, the proportion of animals cut loose because of safety concerns might be reduced, which would allow a greater number of animals to be freed from gear.

In contrast, if it is acknowledged that in some cases it may not be possible to release an animal with non-serious injuries (e.g., because the hook location is in sensitive tissues and release attempts would cause additional serious injuries), or because the release attempt is unsuccessful, the success rate would be lower and in the worst case scenario, lead to no decrease in the proportion of animals released with serious injuries.

The limited data available suggest 0% to 58% of false killer whales or blackfish caught in a manner that would have led to serious injury could have been freed from gear and released with non-serious injuries. As noted above, these reductions in M&SI would be expected if the actions and best practices included in the proposed expanded training are carried out. Similar benefits would also be expected for other marine mammals that are hooked or entangled in the longline fisheries.

Because this proposed training is specific to marine mammal handling and release, it is not expected to have any impact on other protected species or other biological resources.

#### 4.2.2.5 Require posting of marine mammal handling and release informational placard on longline vessels

The required posting of the placard, in conjunction with the proposed requirement for vessel owners and operators to complete annual certification in marine mammal interaction mitigation techniques, is expected to facilitate improved handling and release of hooked or entangled marine mammals, potentially resulting in fewer marine mammals being released with hooks in their mouths or trailing gear after being hooked or entangled in longline gear. NMFS is unable to quantify these expected effects, but it is likely that these measures would reduce the marine mammal M&SI rate. These benefits would be expected for all marine mammals that interact with the longline fisheries, including false killer whales.

This component of the Alternative is not expected to have any impact on other protected species or other biological resources, as the informational placard is specific to marine mammal handling and release.

#### 4.2.2.6 Require captains' supervision of marine mammal handling and release; and require posting of placard instructing crew to notify the captain of marine mammal interactions

These two proposed measures are expected to result in improved response to marine mammal hookings and entanglement. A vessel captain is likely to be the only person on board to have received training in marine mammal handling and release (through the required annual Protected Species Workshops), especially if there is no observer on board. By requiring the captain to supervise the handling and release of the marine mammal, the most informed and qualified individual would direct the response. The placard instructing the crew to notify the captain in the event of a marine mammal hooking or entanglement would further facilitate the captain's response. It is expected that marine mammals would be handled and released in a manner that reduces the severity of injuries (e.g., by reducing the chances that the line is cut without attempts at dehooking). NMFS is unable to quantify these expected effects, but it is likely that these measures would reduce the marine mammal M&SI rate. These benefits would be expected for all marine mammals that interact with the longline fisheries, including false killer whales.

This component of the Alternative is not expected to have any impact on other protected species or other biological resources, as these recommendations are specific to captain and crew responses to marine mammal hookings or entanglements.

### 4.2.2.7 Establish a Southern Exclusion Zone and specific triggers for closure

The SEZ was designed to encompass an area with a high concentration of observed false killer whale and blackfish takes in the deep-set fishery, as this was determined to be an area where protective measures would be likely to have the greatest benefit. The area was thought to be large enough to protect the whales from hooking and entanglement, and prevent them from simply following boats and gear to areas outside of the closure.

Under this alternative, the SEZ would be closed for variable periods of time if the deep-set longline fishery reached a specified bycatch trigger. The trigger would depend on the input values used in the formula for the pelagic stock's PBR and the level of observer coverage. For this analysis, a range of pelagic stock PBRs was calculated based on the densities of false killer whales in other areas (Table 4.2). Using the area of the EEZ around the Hawaiian Islands (2,240,024 $km^2$), a net productivity rate ($R_{max}$) of 0.02, and recovery factor ($F_r$) of 0.5, PBR could range from 2.5 to 52. These values, other than the actual PBR of 2.5 (Carretta et al. 2011), are not considered by NMFS to be plausible PBRs, based on NMFS' knowledge of the physical and biological characteristics of the area, habitat productivity, and other information on sighting rates. In fact, they are highly unlikely, but they do represent an upper bound.

**Table 4.2**. Estimated PBRs for the Hawaii pelagic stock of false killer whales inside the EEZ around Hawaii, based on the density of false killer whales in other areas.

| Region | Density | CV | Abund | Nmin | PBR |
|---|---|---|---|---|---|
| HICEAS-outer EEZ (Barlow & Rankin 2007) | 0.0002 | 0.93 | 484 | 249 | 2.5 |
| Palmyra (Barlow & Rankin 2007) | 0.0038 | 0.65 | 8518 | 5181 | 52.0 |
| Other PICEAS (Barlow & Rankin 2007) | 0.0005 | 0.68 | 1101 | 655 | 6.6 |
| All Eastern Tropical Pacific (ETP) (Ferguson and Barlow 2003) | 0.0016 | 0.31 | 3664 | 2850 | 29.0 |
| ETP@ N10-20 or S10-20 (Ferguson & Barlow 2003) | 0.0017 | 0.74 | 3834 | 2199 | 22.0 |
| ETP W of 120; N10-20 (Ferguson & Barlow 2003) | 0.0030 | 0.93 | 6819 | 3508 | 35.0 |

A potential (though implausible) range of triggers was calculated using a range of values for observer coverage (15-30%) and PBRs (0.5-52) (Table 4.3). The resulting triggers ranged from 0 to 78. With a larger trigger, there is a reduced chance of the fishery incidentally taking enough false killer whales to reach the trigger, based on current interaction rates. Thus, there would be a lower chance of implementing the closure, or if it were implemented, it would likely be implemented later in the year. Conversely, a smaller trigger would be more likely to be reached, and a closure more likely to be implemented earlier in the year. In that case, there would also be a higher chance of an indefinite closure of the SEZ, because if the closure were triggered in a given year, there would only need to be a single observed false killer whale mortality or serious injury in the following year to trigger the indefinite closure.

If the trigger were met in a given year, the SEZ would be closed to the end of the year. This would close 17% of the fishable area of the EEZ around Hawaii to deep-set longline fishing. Any observed false killer whale M&SI inside the EEZ around Hawaii in the following year would result in the closure of the SEZ to deep-set longline fishing until reopened, potentially years later. Closures would prevent further false killer whale M&SI in the deep-set longline fishery in that area during the specified times, with the goal (based on the trigger) of maintaining the 5-year average false killer whale M&SI at or below PBR.

However, an unknown number of additional incidental false killer whale M&SI would still be expected. The shallow-set longline fishery would be unaffected by the closure of the SEZ, and would continue to interact with false killer whales at the current rate. The deep-set longline fishery would continue to operate in the open portion of the EEZ and on the high seas. Fishing effort from the SEZ may also be redistributed fully or partially to open areas, so overall fishing effort may stay constant or decrease only slightly. NMFS analysis performed in support of the FKWTRT indicated that fishing effort (number of hooks sets per 2x2 degree block) explains 43% of the pattern in bycatch rates in a generalized linear model, suggesting that takes are closely linked to overall fishing effort (FKWTRT 2010). Thus, redistribution of effort may displace at least some of the false killer whale bycatch to other areas.

Any displacement of false killer whale bycatch to the high seas may have a detrimental impact to the Hawaii pelagic stock, given the limitations of managing the stock on the high seas. Abundance and distribution information outside of U.S waters is incomplete and thus PBR is calculated and the status of the stock is evaluated based on data from the EEZ around Hawaii only. Because PBR is available only for the EEZ-portion of the stock, the takes on the high seas are virtually unaccounted for, and the stock might cease being a functioning element of the ecosystem even if takes inside the EEZ were below PBR.

In summary, closing the SEZ to deep-set longline fishing would be expected to eliminate false killer whale bycatch in the fishery in the area during the closure, but false killer whales would continue to be affected by incidental M&SI in both longline fisheries.

Effects on bycatch of other protected species (other marine mammals, sea turtles, and seabirds) are likely similarly dependent on the level of effort redistribution following the closure of the SEZ. Some conservation benefits might be expected through a reduction in bycatch if the SEZ closure were triggered earlier in the year, if that resulted in overall decrease in fishing effort (i.e., fishermen do not redistribute all of current effort from closed areas to open areas). Displacement of fishing effort to other areas of historically lower effort might result in different rates of bycatch. However, NMFS has no information with which to predict whether interactions with sea turtles and seabirds would change. Measures are already in place to mitigate potential bycatch of these species, including requirements to carry and use specific equipment for handling and releasing sea turtles or seabirds, and to follow specific procedures if a sea turtle or seabird is hooked or entangled, so effects on these species would likely be minimal.

The establishment and periodic closure of the SEZ would likely have little to no effect on target and non-target species. Any potential effects would depend on the level of effort redistribution following a closure. The closure would affect only the deep-set longline fishery; management of this fishery’s target species is quota-based, and the SEZ closure would not change the quota. The fishery would be expected to utilize open areas to achieve their target quota. Catch rates of non-target species would be expected to generally follow expected rends relative to changes in fishing effort (i.e., decrease with fewer hooks in the water, and increased with more hooks in the water), and would depend on the level of effort compensation (i.e., whether all fishing effort inside the closed areas is redistributed to open areas, or if instead there is an overall decrease in fishing effort).

#### *4.2.2.8 Increase precision of bycatch estimates in the Hawaii-based deep-set longline fishery*

As described in section 2.3.2.10, under this alternative, NMFS would increase the systematic observer coverage to 15% for all four quarters, and use day sampling to bring total to 20% coverage or greater.

This would improve the precision of marine mammal bycatch estimates. This information on the fishery's operations and its interactions with marine mammals would better inform management decisions and potentially increase the effectiveness of management measures implemented in the future. However, by itself, this measure would not provide any positive or negative impacts to marine mammals, other protected species, or any other biological resource because it is a tool for observation and does not directly reduce fishery interactions.

#### 4.2.2.9 Changes to observer training and data collection protocols

The proposed changes to observer training and observer data collection protocols would be expected to improve the quality of observer data on marine mammal interactions, and allow scientists examining the data to better detect trends or patterns regarding marine mammal interactions, including possible mechanisms of depredation and bycatch. As with the measures above, information on marine mammal interactions would better inform management decisions and potentially increase the effectiveness of management measures implemented in the future. However, by itself, this measure would not provide any positive or negative impacts to marine mammals or other protected species because it is a proposal to improve information collection and does not directly reduce fishery interactions.

The proposed changes are specific to marine mammals, and thus this component of the Alternative is not expected to have an impact on other protected species or other biological resources.

**Table 4.3**. Triggers for closing the Southern Exclusion Zone, calculated using a range of PBR and observer coverage levels. Triggers are calculated using the formula: Trigger < 5 * (Obs cov) * (PBR); and rounded down the nearest whole number to animals.

| | Observer Coverage | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PBR** | **0.15** | **0.16** | **0.17** | **0.18** | **0.19** | **0.2** | **0.21** | **0.22** | **0.23** | **0.24** | **0.25** | **0.26** | **0.27** | **0.28** | **0.29** | **0.3** |
| **0.5** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **1.5** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| **2** | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| **2.5** | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **3** | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| **3.5** | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 |
| **4** | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 6 |
| **4.5** | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 |
| **5** | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 |
| **5.5** | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 |
| **6** | 4 | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 |
| **6.5** | 4 | 5 | 5 | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 |
| **7** | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 9 | 10 | 10 |
| **7.5** | 5 | 6 | 6 | 6 | 7 | 7 | 7 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 10 | 11 |
| **8** | 6 | 6 | 6 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 12 |
| **8.5** | 6 | 6 | 7 | 7 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 11 | 12 | 12 |
| **9** | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 |
| **9.5** | 7 | 7 | 8 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 14 |
| **10** | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 14 | 14 | 15 |
| **11** | 8 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 13 | 13 | 14 | 14 | 15 | 15 | 16 |
| **12** | 9 | 9 | 10 | 10 | 11 | 12 | 12 | 13 | 13 | 14 | 15 | 15 | 16 | 16 | 17 | 18 |
| **13** | 9 | 10 | 11 | 11 | 12 | 13 | 13 | 14 | 14 | 15 | 16 | 16 | 17 | 18 | 18 | 19 |
| **14** | 10 | 11 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 16 | 17 | 18 | 18 | 19 | 20 | 21 |
| **15** | 11 | 12 | 12 | 13 | 14 | 15 | 15 | 16 | 17 | 18 | 18 | 19 | 20 | 21 | 21 | 22 |
| **20** | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| **25** | 18 | 20 | 21 | 22 | 23 | 25 | 26 | 27 | 28 | 30 | 31 | 32 | 33 | 35 | 36 | 37 |
| **30** | 22 | 24 | 25 | 27 | 28 | 30 | 31 | 33 | 34 | 36 | 37 | 39 | 40 | 42 | 43 | 45 |
| **35** | 26 | 28 | 29 | 31 | 33 | 35 | 36 | 38 | 40 | 42 | 43 | 45 | 47 | 49 | 50 | 52 |
| **40** | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 |
| **45** | 33 | 36 | 38 | 40 | 42 | 45 | 47 | 49 | 51 | 54 | 56 | 58 | 60 | 63 | 65 | 67 |
| **50** | 37 | 40 | 42 | 45 | 47 | 50 | 52 | 55 | 57 | 60 | 62 | 65 | 67 | 70 | 72 | 75 |
| **52** | 39 | 41 | 44 | 46 | 49 | 52 | 54 | 57 | 59 | 62 | 65 | 67 | 70 | 72 | 75 | 78 |

### 4.2.3 Alternative 3. Close the EEZ around Hawaii to commercial longline fishing year-round

This alternative would be expected to provide a conservation benefit to false killer whales. All false killer whale M&SI from longline fisheries inside the EEZ around Hawaii would be eliminated, and would thus be below PBR for both the insular and pelagic stocks. Similarly, bycatch of other marine mammals, sea turtles, and seabirds in longline fisheries would be reduced to zero within the EEZ.

The longline fisheries currently operate both in U.S. waters and on the high seas. A closure of the EEZ would likely shift fishing effort into the high seas, though full redistribution is unlikely; the increased costs of operating exclusively on the high seas might lead to an overall reduction in longline fishing effort. If fishing effort shifted to the high seas, there would likely be displacement of false killer whale and other protected species bycatch to high seas. Effects might be mitigated through implementation of other measures under this alternative (e.g., weak small circle hooks, marine mammal handling/release training). However, as noted above, NMFS lacks information on marine mammal stock structure, range, and abundance on the high seas, and because PBR cannot yet be calculated for the entire transboundary stock, M&SI of false killer whales on the high seas are virtually unaccounted for, as they cannot be compared to a PBR. NMFS might not be able to track the impacts of interactions on the high seas. Better information is available on sea turtle and seabird populations, so the effects of any potential increase in interactions on the high seas could be better tracked and managed.

If there were a reduction in total U.S. longline fishing effort (i.e., less than full redistribution from the EEZ to the high seas), the market demand for the target species could be filled by other countries. Market transfer effects are possible, whereby the market void left by the domestic fleet is filled by foreign fleets that do not have legal requirements to track, reduce, or mitigate their impacts to marine mammals and other protected species (Sarmiento 2006, Rausser et al. 2009). This might result in a greater negative impact to marine mammals and other protected species.

If the cost of longline fishing exclusively on the high seas were prohibitively expensive, fishermen might switch to different fisheries in more accessible fishing grounds. These fisheries may impact protected species, but their impacts are largely undocumented. For example, there is anecdotal evidence that there are interactions with blackfish in the Hawaii shortline fishery. The shortline fishery uses gear similar to longline gear, but mainlines are limited to less than 1 nm in length. Protected species mitigation requirements and other restrictions to the longline fisheries do not apply to the shortline fishery. The Council is considering management of the fishery. The Council is considering defining shortline fishing in a regulation under the PFEP, which would facilitate development and implementation of regulations should the need arise for management measures, but the Council has not yet taken action to do so (WPRFMC 2010c). Hooking and entanglement in nearshore hook-and-line fisheries was identified as a substantial threat to Hawaii insular false killer whales (Oleson et al. 2010), and also likely impact animals from the pelagic stock.

Under this measure, target and non-target species catches would generally follow expected trends relative to changes in fishing effort (i.e., decreased with fewer hooks in the water, and increased with more hooks in the water) depending on the level of effort compensation (i.e., whether all fishing effort inside the EEZ is redistributed to the high seas, or whether there is an overall decrease in fishing effort). Assuming some level of reduction in fishing effort due to the closure, catches of target and non-target species by U.S. vessels would be expected to decrease. However, as described above, effort from foreign fisheries could increase to fill the market void, so conservation benefits to the species may not be realized.

# 4.3 Economic Impacts of the Alternatives

The following is a brief discussion of expected effects to the socioeconomic resources by the preferred alternative and other alternatives. A full discussion of the socioeconomic consequences that would result from each alternative is contained within the Regulatory Impact Review (RIR) and Initial Regulatory Flexibility Analysis (IRFA) (sections 5 and 6 of this document). As discussed in the RIR, the potentially affected groups include:

- Hawaii-based longline fishery. Directly regulated group, with potential adverse effects related to increased costs and decreased revenues.

- Other Hawaii-based commercial fisheries. Potential benefits to fisheries from reduced congestion and competition as well as potential target-species conservation in longline exclusion zones.

- Fishing equipment suppliers. Indirectly affected entities, with potential adverse effects on ability to sell existing hook inventory and net revenue from selling different equipment.

- Seafood consumers. Indirectly affected group, with potential adverse impact if the price or availability of fish changes.

- Recreation and tourism. Indirectly affected group, with potential beneficial effects due to increased populations of recreationally-important species (whales and fish), and potential reduced congestion/conflict with commercial fishing vessels.

- Recreational/Subsistence fishing. Indirectly affected group, with potential beneficial effects due to increased populations of target species, and potential reduced congestion/conflict with commercial fishing vessels.

- Educational/Scientific/Passive users. Indirectly affected group, with potential beneficial impacts from increased knowledge/public awareness about false killer whales, and increased populations of false killer whales.

This section summarizes the potential changes in social and economic well-being of these groups, as estimated in the RIR section of this document. The key socioeconomic resources addressed are employment, income, consumer prices, and quality of life. Impacts are presented for each potentially affected group by Alternative.

The analysis is informed by the published literature of similar measures imposed on fisheries in the past, as well as interviews with potentially affected entities. Additionally, NMFS longline fishery data and reports (including data from the logbook and observer program), and academic literature on the economic value of species conservation are used to inform this analysis.

## 4.3.1 Alternative 1. No Action (Status Quo)

The no action alternative would produce no socioeconomic cost or benefit beyond the status quo. It would not limit longline gear in any way beyond what is already required by current regulations, nor would it restrict fishing in any additional areas of the Hawaii-based longline fisheries. Consequently, it would not impose any direct costs on Hawaii-based longline fishermen or indirect costs on related economic sectors, or affect the people and communities that participate in and depend on these fisheries, including seafood consumers and gear suppliers. However, marine mammal depredation would continue and potentially increase, resulting in increased damage to gear and loss of bait and catch.

This alternative would not meet the goal of the FKWTRP, or the mandates set forth in the MMPA, to reduce serious injuries and mortalities of false killer whales to below PBR for the Hawaii pelagic stock and to below insignificant levels approaching a zero rate for the Hawaii pelagic, Hawaii insular, and Palmyra Atoll stocks. With the no action alternative, there is the potential for increased false killer whale M&SI, given the reported increase in depredation, which might require even more restrictive management measures (i.e., more restrictive than the Action Alternatives) in the future such as additional time/area closures or effort limitations, which would likely impose more significant social and economic impacts for larger number of fishermen and fishing communities.

Increased M&SI would have potentially adverse impacts on groups that value the false killer whale for scientific, educational, recreational, or cultural/spiritual reasons. While all Americans may value the false killer whale for cultural reasons, groups particularly affected by losses in cultural/spiritual values include Native and resident Hawaiians. Furthermore, recreation and tourism groups, particularly those engaging in wildlife viewing, may be adversely affected by increased M&SI if false killer whale populations decline. Finally, the scientific community may be adversely affected by foregone opportunities to study and understand false killer whale biology and conservation.

## 4.3.2 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team

Under Preferred Alternative 2, regulatory measures for the Hawaii longline and non-regulatory measures for NMFS would be implemented. It is anticipated that the regulated community, including the deep-set and shallow-set fisheries, would incur costs and have reduced income related to replacement of fishing gear, increased travel time and fuel costs, increased certification requirements, and/or potential reduced revenue due to reduced catch and fishing effort. Likewise, there may be adverse impacts on income and revenue of Hawaii-based fishing gear suppliers due to some gear inventory being barred from use (and therefore potentially unsellable) by the FKWTRP. There are no anticipated effects on seafood consumer prices or availability, but there may be adverse effects on the quality of local seafood if fishing effort and catch is reduced, resulting in minor impacts on well-being or quality of life.

Due to anticipated reductions in M&SI, this alternative is expected to generate direct and indirect beneficial quality of life effects on groups that value the false killer whale, such as recreationists and tourists, wildlife viewers, scientists and educators, and members of present and future generations of the general public. Businesses that operate recreational boating excursions, whether for whale watching or other reasons, may benefit as well if sightings of false killer whales increases due to the Preferred Alternative, and this increases demand or value of such trips. Finally, the Preferred Alternative may generate some positive effects for non-longline commercial fisheries or recreational/subsistence fisheries if target fish population abundance rises or there is reduced congestion and/or gear conflicts for non-longline commercial fisheries in longline exclusion areas due to the FKWTRP.

Potential effects to each of these groups is discussed below. Methodology and data used to estimate impacts are provided in detail in the RIR in Section 5.

### *4.3.2.1 Longline Fishery*

This section describes expected socioeconomic impacts to Hawaii-based longline fisheries, which are directly regulated under the FKWTRP. Effects to both the Hawaii-based deep- and shallow-set fisheries are evaluated as appropriate. The Preferred Alternative would further restrict the location of shallow and deep-set longline fishing within the EEZ, would require the use of specific gear in the deep-set fishery, require additional education for vessel owners/operators, and require captain notification and supervision of marine mammal interactions. Adverse economic effects to the deep-set fishery are expected related to replacement of fishing gear (due to hook and monofilament branchline requirements), increased travel time and fuel costs (due to fishing effort relocation associated with exclusion zones), and increased certification requirements (due to additional time required to attend the enhanced Protected Species Workshop). The only proposed measures with projected impacts that affect the shallow-set fishery are the annual Protected Species Workshop certification for operators/owners and establishing the MHI Longline Fishing Prohibited Area. However, little to no additional costs are expected to the shallow-set fishery from these measures as 1) all or nearly all longline vessels participate in the deep-set fishery and would therefore already be required to attend the Protected Species Workshop as a deep-set vessel owner/operator, and 2) there is little to no existing shallow-set effort in the MHI Longline Fishing Prohibited Area.

There may also be potential adverse impacts to the deep-set fishery related to reduced catch of large bigeye tuna due to mandated use of the weaker small circle hook; as indicated in Table 4.4, of all costs there is the greatest uncertainty regarding the size of this potential impact. Based on research conducted by NMFS and others, the effect on total weight of bigeye tuna catch of using the using weak small circle hooks with maximum of 4.0 mm wire diameter would not be expected to exceed 10 percent. Study results found no statistically significant differences in catch per unit effort among small circle hooks with 4.0 mm wire diameter versus the small circle hooks with 4.5 mm wire diameter currently in use by much of the fishery, and no statistically significant differences in mean length of 15 species of interest (though on weak hooks, yellowfin tuna were statistically larger by a small margin and spearfish had slightly lower CPUE) (Bigelow et al. 2011). Study results strongly indicate that any impacts on catch weight in the deep-set fishery would be less than 10 percent. However, due to the timeframe of the study (conducted during the winter months when there are fewer large fish caught) and the sample size, it is possible that effects on catch weight would be as high as 10 percent. Potential adverse economic impacts due to reduced catch weight are estimated in terms of reduced income to the deep-set longline fishery.

Costs to the deep-set longline fishery were evaluated based on initial one-time capital costs (associated with gear replacement) and ongoing, annual costs. These expected costs are summarized in Table 4.4. To be able to compare and add together one-time costs with annual ongoing costs, this analysis converts one-time costs to annual costs using a three percent discount rate and a 20-year timeframe. The resulting ‘annualized’ cost represents the yearly cost to the longline fleet, assuming that one-time costs are spread out over 20-years. Furthermore, a present value is calculated that represents the total cost in today’s dollars of the stream of all initial and future costs of the Action Alternatives, again using a three percent discount rate and a timeframe of 20 years.

Table 4.4 summarizes total costs to the deep-set longline fishery associated with all measures in the Preferred Alternative (Alternative 2). Total one-time capital costs were estimated to range from $301,000 to $707,000. The one-time labor cost and material cost associated with replacing all hooks to meet the weak hook requirement is expected to be the most significant cost under Alternative 2, as this requirement would affect all active deep-set longline vessels (estimated to be 129 vessels). Annual ongoing costs in terms of gear changes and lost revenues incurred under Alternative 2 are, in turn, estimated to be between $3.0 and $8.0 million. The large range in annual ongoing cost is due to uncertainty in the effects, relative to status quo, of using 4.0 mm wire diameter circle hooks on total weight of bigeye tuna catch and associated revenue, with potential adverse effects varying from 0% to up to 10% of total bigeye tuna catch weight. Closure of the SEZ, if triggered, is anticipated to contribute to a significant portion of annual costs to the deep-set longline fishery, with increased travel costs (both time and fuel) due to closure of this zone estimated to be as high as $2.9 to $3.5 million annually for all vessels. These travel costs are estimated based on maximum increased travel distance; costs would be lower if vessels relocated to other, less distant areas. As noted above, all (or nearly all) of the annual and one-time costs would be incurred by the deep-set fishery.

**Table 4.4.** Preferred Alternative: Total Expected Income Reduction to the Deep-Set Longline Fishery.

| Proposed Measure | Initial, One-Time Cost | Annual Ongoing Cost | Total Annualized Cost | Net Present Value Cost (2011 – 2030) |
|---|---|---|---|---|
| Small, weak circle hook requirement | $284,000 - $682,000 | $0 - $4,378,000 | $2,000 - $4,424,000 | $31,000 - $65,815,000 |
| 2.0 mm line requirement | $17,000 - $26,000 | $2,000 - $4,000 | $4,000 - $5,000 | $53,000 – $79,000 |
| MHI Longline Fishing Prohibited Area | $0 | $76,000 – $87,000 | $76,000 – $87,000 | $1,126,000 -$1,296,000 |
| Annual Certification for Operators/Owners | $0 | $600 - $1,400 | $600 - $1,400 | $9,000 – $21,000 |
| Marine Mammal Handling/Release Placard | $0 | $0 | $0 | $0 |
| Captain Supervision of Marine Mammal Handling/Release | $0 | $0 | $0 | $0 |
| Captain Notification Placard | $0 | $0 | $0 | $0 |
| Southern Exclusion Zone | $0 | $2,941,000 - $3,483,000 | $2,941,000 - $3,483,000 | $43,756,000 - $51,824,000 |
| **Total Cost** | **$301,000 - $707,000** | **$3,003,000 – $7,954,000** | **$3,023,000 -$8,001,000** | **$44,974,000 - $119,036,000** |

Little to no impacts are expected for the shallow-set longline fishery. The only proposed measures with projected costs that affect the shallow-set fishery are the annual certification for operators/owners and establishing the MHI Longline Fishing Prohibited Area. However, little to no additional costs are expected to the shallow-set fishery from these measures as 1) all or nearly all longline vessels participate in the deep-set fishery and would therefore already be required to attend the Protected Species Workshop as a deep-set vessel owner/operator, and 2) there is little to no existing shallow-set effort in the MHI Longline Fishing Prohibited Area (i.e. less than one full trip each year).

There would also be potential adverse effects on revenue to the deep-set longline fishery related to reduced catch and fishing effort if costs rise to the extent that fishing effort declines (due to costs associated with closure areas or other regulatory measures). As there are little to no expected costs to the shallow-set longline fishery, there are no expected effects on fishing effort related to the Preferred Alternative. For the deep-set longline fishery, reduced profitability from rising costs and potential reduced revenue (if catch is decreased) may result in reduced fishing effort and/or exit of some vessels from the fishery. The effects on vessel earnings from implementing the Preferred Alternative as well as potential reduced effort or exit from the fishery are difficult to quantify. However, it is important to note that reduced effort would decrease longline fishing income and employment, and would potentially result in social or economic hardship for individual owner/operators or fishermen.

The economic costs in Table 4.4 to the deep-set longline fishery may not be distributed evenly across all vessels and communities in the fishery. In particular, not all vessels may currently be fishing in the area of the MHI Longline Fishing Prohibited Area that is open between October-January, or in the SEZ. Those vessels that currently concentrate fishing effort in proposed exclusion areas would be disproportionately impacted by closure of these areas, while other vessels currently not fishing in these areas would not be affected. Also, it is estimated that only 10 to 15 vessels in the fishery would incur costs to switch to 400-pound strength monofilament leader/branch line as all other vessels are believed to already be using this type of line. All vessels are expected to incur costs associated with the 4.0 mm diameter wire small circle hook requirement, as no vessels are believed to currently be using this type of hook.

### 4.3.2.2 Other Hawaii-based Commercial Fisheries

There are two potential impacts of the Preferred Alternative to non-longline commercial fishing: 1) positive impacts from reduced fishing boat congestion due to closure of areas to commercial longline fishing, and 2) increased target fish abundance due to decreased longline fishing effort or from area closures. Other commercial fisheries that target tuna include the MHI troll and handline, offshore handline, and the aku boat (pole and line) fisheries. There may be positive spillover effects on target-species abundance if there is reduced effort in the longline fishery or if the closure areas result in increased fish abundance. If target-species abundance increases then catch rates may increase, resulting in higher revenue per commercial trip. However, in a 30-year time series analysis of catch and CPUE in the Hawaiian EEZ, He and Boggs (1995) find no significant relationship between overall catch and CPUE of bigeye and yellowfin tuna, for either longline or troll fishermen (Chakravorty and Nemoto, 2002). Positive effects on the other commercial fisheries may therefore be limited.

### 4.3.2.3 Hawaii Fishing Equipment Suppliers

The Hawaii-based fishing gear suppliers may be adversely affected by the equipment requirements in the Preferred Alternative if gear currently in stock becomes obsolete and is not sellable to other fisheries. In particular, fishing gear suppliers may be affected by the small, weak circle hook requirement. This section describes the methodology and estimated cost to the gear suppliers of the one-time hook inventory cost, estimated at approximately $0 to $13,600.

Commercial fishing gear suppliers may not be able to sell their existing inventory of circle hooks with 4.5 mm diameter wire) and tuna hooks in the event that small, weak (4.0 mm diameter wire) hooks are required throughout the Hawaii-based deep-set longline fishery. Assuming that gear suppliers on average have approximately six months of 4.5 mm diameter circle hook and tuna hook inventory in stock to replace lost hooks in the longline fishery, we estimate that there may be approximately 17,500 hooks in supplier inventory at any one time. Depending on whether these hooks can be sold to other fisheries, the one-time cost to suppliers due to inventory lost is estimated at $0 to $13,600 **(**based on 35,000 hooks needing replacement due to loss annually or 17,500 over a 6-month period, and $0.81 weighted average hook price). According to owner/operator interviews, there are three Hawaii-based gear suppliers that supply the majority of Hawaii-based longline vessels. The one-time cost to individual suppliers of this inventory would therefore range from $0 to $4,500. Using a three percent discount rate over 20 years, the total annualized equipment inventory cost of hooks is estimated at $0 to $900, or up to $300 for individual suppliers. This cost may be an underestimate, however, as interviews with gear suppliers suggest that the cost of unsellable inventory may exceed $10,000 per supplier.

If fishing effort declines under the Preferred Alternative due to any of the proposed measures, and if this results in reduced demand for fishing gear, then suppliers may face ongoing reduced revenue and therefore reduced income.

### 4.3.2.4 Seafood Consumers

No measureable effect on Hawaii seafood consumer prices would be expected due to the Preferred Alternative. Although the Preferred Alternative may result in potential catch reduction, no impact is expected on price due to the global nature of seafood supply and demand, and the small fraction of total supply provided by the Hawaii longline fishery. It is anticipated that any reduction in Hawaii-based longline catch would be compensated by increased imports to Hawaii or by reduced exports to the mainland or Asia. Hawaii imports up to two-thirds of its seafood from the U.S. mainland and foreign sources. In 2006, 19.7 million pounds of seafood from foreign sources was imported, while 1.5 million pounds were exported to foreign countries (NMFS 2006). As the Hawaii longline fishery is known for the quality of fish it harvests, any reduction in catch, particularly large bigeye tuna catch, due to implementation of the Preferred Alternative may affect the quality of tuna and swordfish available in the local Hawaii market, with potential effect on consumer surplus associated with locally-caught seafood.

#### 4.3.2.5 Recreation and Tourism

The Preferred Alternative may generate benefits to recreation and tourism due to reduced M&SI of false killer whales and other wildlife. Nearly all recreational fishing and tourism in the Hawaiian Islands, including charter fishing and whale watching, is located within the existing longline exclusion zone of 50 nautical miles. For example, in between 1996 and 1997, the average charter vessel fished 24.4 miles from its home port, and only 7.5 miles from shore (Hamilton 1998). As there is little to no spatial overlap between recreation and tourism activities and commercial longline fisheries, there are no anticipated impacts of the Action Alternatives related to congestion or recreation-commercial vessel interactions. There may, however, be positive indirect effects of the Preferred Alternative on wildlife viewing recreation if the FKWTRP results in increased abundance of false killer whales or other wildlife that may be viewed by recreationists or tourists.

#### 4.3.2.6 Recreational and Subsistence Fishing

There are two potential beneficial impacts of the Preferred Alternative to recreational and subsistence fishing: 1) positive impacts from reduced fishing boat congestion due to closure of areas to commercial longline fishing, and 2) positive impacts from increased target fish abundance due to potential decreased longline fishing effort or from area closures. Nearly all subsistence fishing in the Hawaiian Islands is located within the existing longline exclusion zone of 50 nautical miles. As there is little to no spatial overlap between subsistence fisheries, there are no anticipated impacts related to congestion. There may, however, be positive effects on target-species abundance if there is reduced effort in the longline fishery or if the closure areas result in increased fish abundance. If target-species abundance increases then catch rates may increase, resulting in higher value per recreation or subsistence fishing trip. As discussed above, in a 30-year time series analysis of catch and CPUE in the Hawaiian EEZ, He and Boggs (1995) find no significant relationship between overall catch and CPUE of bigeye and yellowfin tuna, for either longline or troll fishermen (Chakravorty and Nemoto 2002). Positive effects on the recreational and subsistence fishery may therefore be limited.

#### 4.3.2.7 Educational / Scientific / Passive Users

With its expected reduction in M&SI of false killer whales, the Preferred Alternative would benefit all people who value the conservation of marine mammals. Additionally, the Preferred Alternative may lead to scientific and educational gains, particularly if the research in the FKWTRP is implemented. If the FKWTRP results in new and enhanced scientific understanding of the biology of the false killer whale or the impacts of human interactions, then natural resource managers and scientists, as well as the population as a whole, benefit in a number of ways. Additionally, benefits of species conservation include those derived from the knowledge of the existence and health of the false killer whale population in Hawaii. Existence value is derived from the knowledge that false killer whales are being protected, even if there is no likelihood of viewing the species or if there are no other interactions. These various benefits may accrue to many residents of Hawaii as well as the Nation.

### 4.3.3 Alternative 3. Close the EEZ around Hawaii to commercial longline fishing year-round

Under Alternative 3, the U.S. EEZ around the Hawaiian Islands would be closed to commercial longline fishing year-round. It is anticipated that the Hawaii-based deep-set and shallow-set longline fisheries, would incur costs and have reduced net income related to increased travel time and fuel costs and potential reduced revenue due to reduced fishing effort. There are no anticipated effects on seafood consumer prices or availability, but there may be adverse effects on the quality of local seafood if fishing effort and catch is reduced, resulting in minor impacts on well-being or quality of life of Hawaii residents.

Due to anticipated reductions in M&SI, this alternative is expected to generate direct and indirect beneficial quality of life effects on groups that value the false killer whales, such as recreationists and tourists, wildlife viewers, scientists and educators, and members of present and future generations of the general public. Businesses that operate recreational boating excursions, whether for whale watching or other reasons, may benefit as well if sightings of false killer whales increase due to the implementation of Alternative 3, and this increases demand or value of such trips. Finally, Alternative 3 may generate some positive effects for non-longline commercial fisheries or recreational/subsistence fisheries if target fish population abundance rises.

Potential effects to each of these groups are discussed below. Methodology and data used to estimate impacts are provided in detail in the RIR in Section 5.

### 4.3.3.1 Longline Fishery

Closing the U.S. EEZ around the Hawaiian Islands to the longline fishery is anticipated to result in adverse impacts to the deep-set and shallow-set longline fisheries. It is expected that the longline fisheries, particularly the deep-set fishery, would incur costs associated with increased travel time and fuel costs and potential reduced revenue due to reduced fishing effort. Costs to the longline fishery of implementing Alternative 3 are projected to be larger than costs under the Preferred Alternative. As summarized in Table 4.5, expected annual costs of Alternative 3 are between $8.6 and $10.2 million dollars, of which an estimated $7.6 million are associated with the opportunity cost of increased travel time. Nearly all of this cost (an estimated 94 percent) would be borne by the deep-set longline fishery.

**Table 4.5.** Alternative 3: Cost to Hawaii-Based Deep-Set and Shallow-Set Longline Fisheries.

| Closure of Economic Exclusion Zone | Annual Ongoing cost | Net Present Value 2011-2030 |
|---|---|---|
| Fuel Cost | $1,059,000 - $2,648,000 | $15,762,000 - $39,396,000 |
| Travel Time Cost | $7,553,000 | $112,376,000 |
| **Total** | $8,613,000 - $10,201,000 | $128,138,000 - $151,765,000 |

### 4.3.3.2 Other Hawaii-based Commercial Fisheries

Potential benefits to other Hawaii-based commercial fisheries would be similar to benefits under the Preferred Alternative.

### 4.3.3.3 Hawaii Fishing Equipment Suppliers

There are no measures related to fishing gear in Alternative 3, so there are no impacts to gear suppliers related to their existing inventory. However, if longline fishing effort declines under Alternative 3, and if this results in reduced demand for fishing gear, then suppliers may face ongoing reduced revenue and therefore reduced income.

### 4.3.3.4 Seafood Consumers

As under the Preferred Alternative, no measureable effects on Hawaii seafood consumer prices are expected due to Alternative 3. As the Hawaii longline fishery is known for the quality of fish it harvests, any reduction in catch due to the implementation of Alternative 3 may affect the quality of tuna and swordfish available in the local Hawaii market, with potential effect on consumer surplus associated with locally-caught seafood.

### 4.3.3.5 Recreation and Tourism

Potential benefits to recreation and tourism would be similar to benefits under the Preferred Alternative.

#### 4.3.3.6 Recreation and Subsistence Fishing

Potential benefits to recreational and subsistence fishing would be similar to benefits under the Preferred Alternative.

#### 4.3.3.7 Educational / Scientific / Passive Users

Benefits to educational/scientific/passive users under Alternative 3 would be similar to benefits under the Preferred Alternative.

# 4.4 Cumulative Effects Analysis

A cumulative effects analysis is required by the CEQ (40 CFR § 1508.7) to evaluate the total effects of many actions over time that would be missed by evaluating each action individually. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7). The purpose of the cumulative impacts analysis is to ensure that federal decisions consider the full range of an action's consequences, incorporating this information into the planning and decision making processes.

CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective. Rather, the intent is to focus on those effects that are truly meaningful. This section analyzes the potential direct and indirect effects of the alternatives (summarized in section 2), together with past, present, and reasonably foreseeable future actions and factors external to the alternatives that affect the baseline described in section 3. Although predictions of synergistic effects from multiple sources are inherently less certain than predicted effects of individual actions, cumulative effects analyses are intended to alert decision makers to potential "hidden" consequences of the Proposed Action.

Table 4.6 lists relevant past, present, and reasonably foreseeable future management actions, as described in sections 4.4.1-4.4.3 below, and can be found following section 4.4.3.

## 4.4.1 Physical Environment – Effects of Past, Present, and Reasonably Foreseeable Future Actions

In 1999, the Council designated EFH and HAPC for each management unit species in the region (64 FR 19068). In accordance with the MSA, the Council and NMFS must ensure that any activities do not adversely affect, to the extent possible, EFH or HAPC for any MUS. Destructive fishing methods such as bottom trawls, poisons, and explosives which may damage EFH and HAPC are prohibited in the Western Pacific Region, so negative impacts on the physical environment from authorized fishing activities are negligible (WPRMFC and NMFS 2009b).

The external factors or actions that have impacted, may be impacting, or may have impacts in the future include habitat degradation from land-based pollution and runoff, dredging of harbors and other coastal areas, ocean tourism activities, ocean drilling and mining, military exercises, shipping activities, research vessel activities, marine debris, and derelict fishing gear. The effects of the human activities listed above are largely unquantifiable and unknown; however, habitat degradation due to runoff is believed to adversely affect near-shore EFH and/or HAPC.

There are no reasonably foreseeable Council or NMFS actions that would significantly affect the physical environment in the Western Pacific Region.

## 4.4.2 Biological Environment – Effects of Past, Present, and Reasonably Foreseeable Future Actions

### *4.4.2.1 Marine Mammals*

Marine mammals are subject to incidental bycatch in fisheries. The MMPA requires that NMFS annually evaluate and classify all U.S. fisheries based on their levels of impacts to marine mammals. The fishery classification criteria consist of a two-tiered, stock- specific approach that first addresses the total impact of all fisheries on each marine mammal stock, and then addresses the impact of individual fisheries on each stock. Under existing regulations, all fishermen participating in Category I or II fisheries must register under the marine Mammal Authorization Certificate (MMAP), obtain an Authorization Certificate, and report to NMFS any interactions with marine mammals. Additionally, participants in Category I and II fisheries may be subject to a take reduction plan and carry an observer if requested (50 CFR 229). The Hawaii-based deep-set and shallow-set longline fisheries are Category I and II, respectively. The fisheries are subject to observer coverage, and participants must obtain an Authorization Certificate and report any interactions. The American Samoa longline fishery, Hawaii shortline fishery, and several Western Pacific Pelagic fisheries that operate on the high seas are also Category II fisheries, and may have occasional marine mammal bycatch. All other commercial fisheries in the region are considered Category III fisheries, though few, if any, of the State-managed fisheries have observer coverage to document potential marine mammal interactions.

There are currently no Take Reduction Plans to reduce bycatch of marine mammals in the Pacific Islands Region, but the Pacific Offshore Cetacean Take Reduction Plan (POCTRP) addresses incidental M&SI of beaked, pilot, pygmy sperm, sperm, and humpback whales in the California/Oregon swordfish drift gillnet fishery operating off the U.S. West Coast. The POCTRP requires a minimum depth for setting nets below the water surface, using pingers on all nets, reducing the number of “inactive” permittees, and education workshops for vessel operators. The POCTRP has achieved both the MMPA short-term goal of reducing M&SI of all strategic stocks to below PBR and the long-term goal of reducing M&SI of all marine mammals, except long-beaked common dolphins, to insignificant levels.

Some marine mammals (e.g., large whales) occurring in the western Pacific region are protected under the ESA as well as the MMPA, and NMFS must ensure that any action carried out, permitted, or funded by a Federal agency is not likely to jeopardize the continued existence and recovery of any threatened or endangered species or result in adverse impacts on the critical habitat of such species. Biological Opinions prepared by NMFS have 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.

Details on other factors affecting cetaceans, including incidental take in foreign fisheries; ship traffic, disturbance, and anthropogenic noise (e.g., from Naval exercises); and marine debris and waste disposal, can be found in section 4.4.2.2.3 of the FSEIS for Amendment 18 to the Pelagics FMP (WPRFMC and NFMS 2009b); this section is incorporated by reference.

Through this Proposed Action (the Preferred Alternative), NMFS plans to implement a False Killer Whale Take Reduction Plan to reduce the level of M&SI of false killer whales in the Hawaii-based longline fisheries. It is expected that the proposed Plan will also have conservation benefits for other marine mammals that are incidentally taken in the fisheries. Additionally, NMFS has proposed to list the Hawaii insular population (i.e., the Hawaii insular stock as defined under the MMPA) as an endangered distinct population segment (DPS) (75 FR 70169, November 17, 2010), which would provide further protection to the insular stock of false killer whales against commercial fishing interactions and other threats. NMFS has also initiated a status review of humpback whales under the ESA (74 FR 40568, August 12, 2009) to ensure the listing classification is accurate. The results of this review may lead

NMFS to split the global humpback population into DPSs, which may be proposed for separate reclassification or for removal from the list.

Through data collected from observer programs and other sources, NMFS will continue to monitor interactions between managed fisheries and marine mammals. NMFS scientists in association with other researchers will continue to collect biological samples to refine stock definitions as well as conduct surveys to monitor populations, which will inform management of these populations. The Council and NMFS will continue to conduct workshops with participation from the affected fisheries to develop mitigation methods as appropriate, and NMFS will continue to conduct mandatory annual protected species workshops for all longline permit holders that teach how to identify marine mammals and how to reduce and mitigate interactions.

### 4.4.2.2 Sea Turtles

Past management actions that potentially contribute to cumulative effects include ESA listing of all five sea turtle species in the U.S. in the 1970s; authorization of incidental take of sea turtles in various U.S. fisheries; a 2004 amendment for the Pelagics FMP requiring the use of 18/0 circle hooks, mackerel bait, sea turtle handling measures, including de-hooking equipment, and other measures in the Hawaii-based shallow-set longline fishery, which resulted in significant reductions of sea turtle interactions; Council and NMFS-supported sea turtle conservation projects throughout the Pacific to increase hatchling production and reduce juvenile and adult mortality; positive and negative transferred effects of regulatory regimes; and NMFS support of sea turtle related research, conservation, and management programs throughout the Pacific. More information on these past management actions is included in section 4.4.2.1.1 of the FSEIS for Amendment 18 to the Pelagics FMP (WPRFMC and NMFS 2009b); this section is incorporated by reference.

Existing threats to sea turtles include: human use and consumption, including legal and illegal harvest of adults, juveniles and/or eggs, most of which is unquantified; numerous impacts to sea turtle nesting and marine environments, including, for example, directed takes, predation, and coastal habitat development; pollution and marine debris (leading to entanglement and ingestion); fluctuation in the ocean environment, which may affect habitat quality and prey availability; global climate change and increasing sea surface temperatures; incidental capture in fisheries (trawl, gillnet and longline); and fluctuations in the ocean environment due to climate change. More information on these threats and their effects on sea turtles is included in section 4.4.2.1.3 of the FSEIS for Amendment 18 to the Pelagics FMP (WPRFMC and NMFS 2009b); this section is incorporated by reference.

Reasonably foreseeable future actions affecting sea turtles include continued support of sea turtle programs by NMFS; sea turtle monitoring, analysis, and research by NMFS; initiation of a U.S. West coast shallow-set longline fishery and the potential for sea turtle bycatch; potential ESA listing of the North Pacific loggerhead sea turtle; and continued outreach through NMFS' "TurtleWatch" project to assist fishermen in avoiding sea turtle interactions. More information on these actions is included in section 4.4.2.1.2 of the FSEIS for Amendment 18 to the Pelagics FMP (WPRMFC and NMFS 2009b); this section is incorporated by reference.

### 4.4.2.3 Seabirds

The management of seabirds falls under the jurisdiction of the USFWS. A primary goal of the USFWS is to identify bird species of high conservation concern with the intent to implement proactive management and conservation actions to alleviate the need for any future listings of seabirds under the ESA. These identified bird species are included in the USFWS' "Birds of Conservation Concern" (USFWS 2008). The U.S. is implementing a National Plan of Action to reduce the incidental catch of seabirds in U.S. fisheries. As part of this goal, the USFWS developed a Seabird Conservation Plan for the Pacific Region. The Plan identified the Service's priorities for seabird management, monitoring, research, outreach, planning, and coordination, and will serve as a guide to coordinate Service activities for seabird conservation at the Regional scale (USFWS 2005). Conservation actions conducted through this Plan are anticipated to have positive effects on the seabird species affected by the Hawaii-based longline fisheries.

Seabirds are incidentally taken in longline fisheries. Past management actions have resulted in a significant decrease in bycatch of seabirds in Hawaii's longline fisheries. Prior to 1999, the shallow-set fishery was estimated to interact with around 2,000 albatross (black-footed and Laysan) per year. The short-tailed albatross, which is listed as endangered under the ESA, is thought to forage in areas where the shallow-set fishery operates; however, no interactions between the short-tailed albatross and the Hawaii-based longline fleet have ever been reported or observed. In 2002, the Council amended the Pelagics FMP to require Hawaii-based longline vessels to use known seabird mitigation measures including blue-dyed bait, night-setting, line shooters, and weighted branch lines. In 2005, the Council amended the Pelagics FMP to allow longline vessels to side-set in lieu of most required alternative measures. Side-setting has been proven to nearly eliminate seabird interactions with longline vessels. The introduction of these regulations in the Hawaii-based longline fisheries reduced the seabird interaction rate by 67% on deep-sets (Gilman et al. 2008), and 96% on shallow-sets (WPRFMC and NMFS 2009b).

The Council and NMFS will continue to monitor seabird interactions with managed fisheries, and if a management need arises, will recommend/implement appropriate measures. The FSEIS for Amendment 18 to the Pelagics FMP notes that seabird bycatch could be substantially reduced in other North Pacific pelagic longline fisheries through adoption and enforcement of national regulations to control seabird bycatch and practical demonstrations of the effectiveness of seabird interaction avoidance measures (Gilman and Freifeld 2003). Broad multi-national longline industry compliance to reduce incidental seabird catch would have positive impacts on the seabird resource.

Albatross populations in the North Pacific Ocean live in an environment that has been substantially affected by anthropogenic factors. Major activities of the past include the intensive collection of short-tail albatross feathers in Japan during the early 20 century; the Battle of Midway during World War II and subsequent U.S. military use of Midway Island; and Asian high-seas drift net fisheries during the 1980s (WPRFMC and NMFS 2009b).Other factors that affect seabirds include: degradation of nesting habitats from human activities; continued exposure to environmental contaminants; continued exposure to concentrations of small plastic debris in the North Pacific Ocean; incidental mortality in foreign longline fisheries; efforts by Japan to require seabird interaction avoidance methods in its longline fisheries; and global climate change. More information on these factors is included in section 4.4.2.3 of the FSEIS for Amendment 18 to the Pelagics FMP (WPRFMC and NMFS 2009b); this section is incorporated by reference.

Research will continue to track the status of seabird colonies, populations, nesting success, migration and foraging habits, and on the impacts of fisheries on seabirds. Information from the Hawaii-based longline fisheries will continue to be collected and analyzed through observer reports, and fishery participant's logbook accounts of interactions with seabirds. If there are changes to the status of seabirds or the fishery interactions with seabirds, the Council and NMFS would work to implement new fishery regulations that will help ensure the fishery is sustainable. In the case of the listed short-tailed albatross, if there were to be changes to the status of this species or to the fisheries' interaction with it, NMFS would reinitiate consultation to ensure the fishery considers the impacts to this listed species (WPRFMC and NMFS 2009b).

#### *4.4.2.4 Target and Non-target Species*

Target and non-target species have been managed under the Pelagics FMP (now FEP) since 1987, and multi-lateral management through Regional Fishery Management Organizations, including the Western and Central Pacific Fisheries Commission and the Inter-American Tropical Tuna Commission. The Council managed five FMPs until 2010, when the five new FEPs were approved. The FEPs shift management focus from species-based to place-based. The FEPs require permits and catch reporting for the majority of managed fisheries. Annual stock assessments are conducted by NMFS for target species, and catch of non-target species is monitored through catch reports as well as through data collected by fishery observers. Fishing effort and capacity for several fisheries have been regulated through limited access programs as well as maximum vessel length regulations.

The MSA fishery management process is inherently an adaptive management process. As needs for management actions arise, appropriate measures will be developed by the Council and, as approved by the Secretary of Commerce, implemented by NMFS. The shift towards ecosystem fisheries management will likely include actions that will consider the dynamic variability of ocean ecosystems and may include the use of physical or biological indicators.

Factors that have the potential to contribute to cumulative effects on pelagic target and non-target stocks include fluctuations in the pelagic ocean environment causing regime shifts, Pacific-wide fishing effort, ocean noise, marine debris, and ocean productivity related to global climate change and greenhouse gases. More information on these threats is included in section 4.4.1.3 of the FSEIS for Amendment 18 to the Pelagics FMP (WPRFMC and NMFS 2009b); this section is incorporated by reference.

Reasonably foreseeable future actions include the Council's shift toward an ecosystem approach through the place-based FEPs, and Regional Fishery Management Organization (RFMO) management of North Pacific swordfish and bigeye tuna stocks and potential quota reductions and other restrictions through conservation and management measures. More information on these future management actions is included in section 4.4.1.2 of the FSEIS for Amendment 18 to the Pelagics FMP (WPRFMC and NMFS 2009b); this section is incorporated by reference. Additionally, the Council has taken final action on an increase in the swordfish retention limit in the deep-set longline fishery that may promote the use of circle hooks in the fishery (e.g., retention limit is increased if circle hooks are used).

### 4.4.3 Social and Economic Environment – Effects of Past, Present, and Reasonably Foreseeable Future Actions

Before the Pelagics FMP was implemented, fishery participants were subject to little to no regulation. Through the FMP and subsequent amendments, fishery participants have become subject to increasing regulation. Such regulations include but are not limited to, permit and reporting requirement, gear requirements, maximum vessel lengths, limited entry programs, observers, VMS, and protected species mitigation measures.

The 1996 reauthorization of the MSA required that the Council identify fishing communities under its jurisdiction. A fishing community, as defined by the MSA, means "a community which is substantially dependent or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes vessel owners, operators, and crew and Unites States fish processors that are based in such a community" (16 U.S.C. § 1802). The Council has identified American Samoa, Guam, CNMI, and each of the inhabited Hawaiian Islands, respectively, as fishing communities. The MSA requires that the Council or Secretary of Commerce describe the likely effects, if any, of conservation and management measures on fishing communities when developing FMPs or FMP amendments (16 U.S.C. § 1853).The impacts of Council/NMFS actions on fishery participants are often transferred to fishing communities. Observable effects on fishing communities from the regulation of fishery participants depend on the number of fishery participants affected and to what degree they are affected.

Fishery management measures implemented under the FMPs have impacted fishing participants and fishing communities on various levels and have been analyzed in associated FMP/NEPA documents. The Council and NMFS will continue to assess the impact of management actions on fishery participants and fishing communities, and where possible, minimize negative effects while developing appropriate measures for the conservation and management of fishery resources.

There are wide-ranging factors (that change over time) that affect fishing participants as well as fishing communities. Current factors include high fuel costs, increased seafood imports, and restricted access to traditional fishing grounds. High fuel costs affect fishing participants in that it is simply increasingly expensive to go fishing. The effect is that fishery participants reduce fishing trips, switch to less fuel-intensive fisheries, or simply do not go fishing at all. The amount of imported seafood is also increasing, and the U.S. now imports nearly 70% of consumed seafood. Increased seafood imports are significant as it relates to market competition, where a glut of fish products can flood the market and lower ex-vessel prices. Once market channels are lost to imported seafood products it may also be hard for fishery participants to regain those channels (WPRFMC and NMFS 2009b).

**Table 4.6**. Past, present, and reasonably foreseeable future management actions affecting the physical, biological, social, and economic environment, as described in sections 4.4.1-4.4.3.

| |
|---|
| **Physical Environment** |
| *Past and Present Management Actions* |
| Designation of EFH, HAPC, and Critical Habitat, and ongoing consultations to ensure activities do not adversely affect these designated areas |
| *Reasonably Foreseeable Management Actions* |
| None |
| **Biological Environment** |
| Marine Mammals |
| *Past and Present Management Actions* |
| - Management of incidental take in commercial fisheries<br>- MMPA section 118 incidental take authorization<br>- Fisheries observer programs (domestic and international)<br>- Protected Species Workshops for Hawaii-based longline owners and operators<br>- Pacific Offshore Cetacean Take Reduction Plan |
| - MMPA and ESA permitting (if applicable) |
| - International and domestic regulations on marine debris and waste disposal |
| - Proposed ESA listing of Hawaiian Insular false killer whales |
| - Status review of global humpback whale population; potential for designation of DPSs, separate reclassification or removal |
| *Reasonably Foreseeable Management Actions* |
| - False Killer Whale Take Reduction Plan (Preferred Alternative), including regulatory and non-regulatory measures, and implementation of recommended research |
| Sea Turtles |
| *Past and Present Management Actions* |
| - ESA listing of all 5 species of sea turtles in U.S. |
| - Authorization of incidental take in fisheries |
| - Pelagics FMP amendments and regulations requiring sea turtle mitigation in longline fisheries |
| - "Turtle Watch" project to assist fishermen in avoiding sea turtle interactions |
| - Sea turtle conservation projects throughout the Pacific |
| *Reasonably Foreseeable Management Actions* |
| - Continued NMFS support of sea turtle programs |
| - Sea turtle monitoring, analysis, and research |
| - Initiation of US West coast shallow-set longline fishery (and potential bycatch) |
| - Potential ESA listing of North Pacific loggerhead sea turtle |
| Seabirds |
| *Past and Present Management Actions* |
| - US National Plan of Action and Seabird Conservation Plan for the Pacific Region to reduce incidental take in fisheries |
| - Pelagic FMP amendments and regulations to reduce seabird take in Hawaii's longline fisheries |
| *Reasonably Foreseeable Management Actions* |
| - None |
| Fishery Target and Non-target Species |
| *Past and Present Management Actions* |
| - Management under Pelagics FEP and Regional Fishery Management Organizations |
| *Reasonably Foreseeable Management Actions* |
| - Shift to ecosystem based management through place-based FEPs |
| - RFMO management of Pacific swordfish and bigeye tuna stocks, with potential quota reductions or other restrictions through conservation and management measures |

| |
|---|
| - Increase in swordfish retention limit in Hawaii-based deep-set longline fishery to promote use of circle hooks in the fishery |
| **Social and Economic Environment** |
| *Past and Present Management Actions* |
| - Fishery regulations through Fishery Management Plans |
| Reasonably Foreseeable Management Actions |
| - Additional measures for conservation and management of fishery resources |

## 4.4.4 Consequences of the Alternatives Considered

An analysis of the direct and indirect impacts of the proposed FKWTRP and alternatives can be found in sections 4.1-4.3 of this document.

## 4.4.5 Cumulative Effects of the Alternatives

In this section, the incremental effects of the proposed FKWTRT and alternatives are considered in the context of the past, present, and reasonably foreseeable actions described in above. Cumulative impacts are assessed using the following terms:

- "Positive effect" means that the cumulative effects of an alternative are expected to improve the status of the resource relative to its current status under past, present, and reasonably foreseeable future actions.
- "Negative effect" means that the cumulative effects of an alternative are expected to adversely affect the status of the resource relative to its current status under past, present, and reasonably foreseeable future actions.
- "Neutral effect" means that the cumulative effects of an alternative are expected to be no different than they had been under past, present, and reasonably foreseeable future actions.
- "None identified" means that no cumulative effect is foreseen, but one might exist in the future.

### *4.4.5.1 Alternative 1. No Action (Status Quo)*

This alternative has no identified effect on the physical environment, EFH, HAPC, or designated CH, and no cumulative effects are foreseen on any of these resources.

This alternative is expected to have negative effects on false killer whales in light of the continued risk of hooking and entanglement. There would be no reduction in M&SI resulting from interactions with longline gear, and takes would likely continue at unsustainable levels. Given the lack of protection from other threats, and the proposed endangered status of the Hawaii insular stock of false killer whales, fisheries interactions in the Hawaii-based longline fisheries under the status quo would continue to threaten false killer whale stocks.

This alternative is expected to have a neutral effect on other protected species, including other marine mammals, sea turtles, and seabirds. The fishery would continue to interact with these species at current levels, and cumulative effects would be expected to be no different than they would under past, present, and reasonably foreseeable future actions.

This alternative is expected to have a neutral cumulative effect on target and non-target fish stocks. Under the no action alternative, the fishery would continue as it has been prosecuted, and cumulative effects on these stocks would expected to be no different than they had been under the past, present, and reasonably foreseeable future actions described in section 4.4.2.4.

There may be slightly negative cumulative social and economic impacts affecting fishing-dependent communities under this alternative. False killer whales may continue or increase their depredation on longline gear, potentially leading to increased damage to (and reduced value of) target catch and increased "stealing" of bait (and less ability to catch the target species). These two effects would be expected to slightly reduce the income generated by this fishery. If the level of M&SI of false killer whales continues to increase, or if the status of these stocks decreases, NMFS may be required to implement additional measures (e.g. effort reductions, additional time/area closures) to protect them, which would likely have a larger economic impact and negatively affect fishing-dependent communities. In the context of past, present, and reasonably foreseeable future actions, the cumulative effects of the No Action alternative are expected to be slightly negative.

#### *4.4.5.2 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team*

This alternative has no identified effect on the physical environment, EFH, HAPC, or designated critical habitat, and no cumulative effects are foreseen on any of these resources.

This alternative is expected to have positive cumulative effects on false killer whales and protected species. The anticipated benefits for false killer whales and other marine mammals of the proposed measures, including required gear changes, training in marine mammal handling, captain and crew response to marine mammal interactions, and the establishment of closed areas, in combination with the past, present, and reasonably foreseeable future actions addressing bycatch and other threats to these species, would likely improve the status of these stocks and, long-term, allow them to reach their optimum sustainable population levels. These measures may also provide ancillary benefits to protected species interacting with the fishery, and complement the positive actions being taken to protect and conserve these species.

Under this alternative, neutral cumulative effects to target and non-target fish stocks would be expected. The measures under this alternative would not substantially affect the way the fishery operates or its ability to catch target species. Fishing effort would be expected to be displaced to areas outside of the SEZ, if triggered, and thus catch of these species would likely be unaffected. Past, present, and reasonably foreseeable future actions are designed to maintain the sustainability of the fisheries and allow for the optimum yield of fishery resources, and this alternative would not affect these goals.

Cumulative effects on fishing-dependent communities resulting from measures in Alternative 2 would be slightly negative. Under this alternative, it is anticipated that the regulated community, including the deep-set and shallow-set fisheries, would incur costs and have reduced income related to replacement of fishing gear, increased travel time and fuel costs, increased certification requirements, and potential reduced revenue doe to reduced catch and fishing effort. Likewise, there may be adverse impacts on income and revenue of Hawaii-based fishing gear suppliers due to some gear inventory being barred from use (and therefore potentially unsellable) by the proposed Take Reduction Plan. However, there are expected direct and indirect beneficial effects expected from reducing false killer whale incidental M&SI, and there may be some positive effects for non-longline commercial fisheries or recreational/subsistence fisheries. In the context of past, present, and reasonably foreseeable future fishery management actions affecting the fishery and its dependent communities, the cumulative impact of this alternative is slightly negative.

### 4.4.5.3 Alternative 3: Close the EEZ around Hawaii to commercial longline fishing year-round

This alternative has no identified effect on the physical environment, EFH, HAPC, or designated critical habitat, and no cumulative effects are foreseen on any of these resources.

This alternative would be expected to have slightly positive cumulative effects on false killer whales, other marine mammals, and protected species. The elimination of incidental takes from fisheries inside the EEZ would benefit these species, particularly island-associated populations. However, the extent of this benefit would depend on where and how much effort is displaced, and the possibility of transfer effects. But because of the expected decrease in bycatch rates inside the EEZ, the alternative would be expected to improve the status of these species relative to their current status under past, present, and reasonably foreseeable future actions.

Neutral cumulative effects to target and non-target fish stocks would be expected under this alternative. These species are highly mobile and many are migratory, and the stocks would be impacted whether they were caught within the EEZ or on the high seas. If a reduction in fishing effort led the U.S. not to meet its quota for target species, the market demand would likely be filled by another country. Fishing effort would likely be partially displaced to areas outside of the EEZ or to other fisheries (both foreign and domestic), and thus there would be little, if any, impact to overall target or non-target catch. The cumulative effects of this alternative would be expected to be no different than they had been under past, present, and reasonably foreseeable future actions.

This alternative would be expected to have negative cumulative effects on fishing-dependent communities. A year-round closure of the EEZ around Hawaii would drastically reduce the fishing area available for the Hawaii-based fleet. Fishing effort would continue on the high seas, and some effort from the EEZ would be displaced to the high seas, but the increased operating costs of fishing exclusively on the high seas could potentially force many fishermen to leave the fishery or switch to other fisheries. Those fishermen that would fish exclusively outside the EEZ may have reduced landings or a reduced profit margin. While there would be some expected direct and indirect benefits from this alternative (e.g., quality of life effects from groups that value the false killer whale, such as recreationists and tourists, wildlife viewers, scientists and educators), the incremental impact of this alternative, in the context of past, present, and reasonably foreseeable future actions affecting this fishery and dependent communities, would result in negative cumulative effects.

## 4.4.6 Summary of Cumulative Effects

The cumulative effects of Alternatives 2 and 3 on false killer whales and other marine mammals are likely to be positive. Past and present actions (e.g., take reduction plans, changes in the fishery, and bycatch reduction measures) have contributed towards reduced M&SI of these cetacean species. The actions considered in this EA would reduce the risk of M&SI of marine mammals due to hooking and entanglement without exacerbating the risk associated with any of the remaining stressors (e.g., bycatch in other fisheries, pollutants and contaminants). Therefore, Alternatives 2 and 3 are expected to have an overall positive cumulative effect on these stocks' survival.

The actions considered in this EA would complement existing and forthcoming actions to reduce takes of other protected species. Hence, the cumulative effect of all of the alternatives, excluding the no action alternative, is expected to be slightly positive to positive.

The alternatives are likely to have no significant, long-term impact on affected target and non-target fishery resources, and neutral cumulative effects would be expected.

The cumulative impacts for fishing dependent communities are a function of current and forthcoming management actions, as well as the incremental impacts of the alternatives. Alternatives may have some short-term negative social or economic impacts, with Alternative 3 presenting the largest potential negative impact. The cumulative effects on fishing dependent communities, in the context of past, present, and reasonably foreseeable future management actions, for each of the alternatives range from slightly negative to negative.

# 4.5 Comparison of Alternatives

This section provides a summary of the expected impacts of implementing each alternative. Information in Table 4.7 is focused on activities and impacts where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

**Table 4.7.** Summary of the expected physical, biological, social, and economic impacts of the three alternatives.

| | Physical Environment | Biological Environment | Social and Economic Environment |
|---|---|---|---|
| **Alternative 1**<br><br>***No Action*** | No expected impacts to EFH, HAPC, CH, or physical features. | • Continued and possibly increased levels of serious injury and mortality of false killer whales.<br><br>• No effect on other protected species, target or non-target species. | • No socioeconomic costs or benefits beyond the status quo, but some potential for increased economic losses due to increased depredation by marine mammals. |
| **Alternative 2 (Preferred Alternative)**<br><br>***Regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team*** | No expected impacts to EFH, HAPC, CH, or physical features. | • Beneficial effects to false killer whales and other protected species due to:<br><br>- Potential reductions in interactions and/or injury severity from use of weak circle hooks, minimum line diameter, and closed areas;<br><br>- Increased precision of bycatch estimates better inform management and facilitate adapative management; and<br><br>- Potential for increased post-interaction survival of entangled or hooked marine mammals due to better training in handling/release, captains' supervision, crew notification of captains, and posting of handling/release guidelines.<br><br>• Potential negative effects to marine mammals if fishing effort is redistributed to the high seas following closure of the SEZ because no PBR to measure impacts to stocks.<br><br>• No effect on target and non-target species. | • Costs to regulated community for costs associated with replacement of fishing gear, increased travel time and fuel costs, increased certification requirements, and potential reduced revenue due to reduced catch and fishing effort.<br><br>• Potential reductions in revenue and income of fishing gear suppliers due to some gear inventory being unsellable to the Hawaii-based longline fisheries.<br><br>• Direct and indirect beneficial quality of life effects on groups that value the false killer whale, including recreationists and tourists, wildlife viewers, scientists and educators, and members of present and future generations of the general public.<br><br>• Some positive effect on non-longline commercial fisheries or recreational/subsistence fisheries if target fish population abundance rises. |

| | | | |
|---|---|---|---|
| **Alternative 3**<br><br>***Year-round closure of EEZ around Hawaii to commercial longline fishing*** | No expected impacts to EFH, HAPC, CH, or physical features. | • Beneficial effects on false killer whales and other protected species from elimination of interactions inside the EEZ.<br><br>• Potential negative effects due to:<br><br>- Transfer effects if U.S. fishing effort decreases and less-protective nations increase their effort to fill the market void<br><br>- Continued or increased longline effort on the high seas may increase takes of false killer whales and other marine mammals, with no PBR to measure the impacts to the stocks<br><br>- Potential shift in effort to non-longline hook-and-line fisheries may cause increase in (unobserved) bycatch of protected species<br><br>• No effect on target and non-target species | • Greatest costs and reduced income for longline fishermen due to increased travel time and fuel costs, and potential reduced revenue due to fishing effort.<br><br>• Direct and indirect beneficial quality of life effects on groups that value the false killer whale, including recreationists and tourists, wildlife viewers, scientists and educators, and members of present and future generations of the general public.<br><br>• Some positive effect on non-longline commercial fisheries or recreational/subsistence fisheries if target fish population abundance rises. |

# 5.0 REGULATORY IMPACT REVIEW

## 5.1 Introduction and Problem Statement

Incidental mortality and serious injury (M&SI) of false killer whales in the Hawaii-based commercial longline fisheries exceeds thresholds established under the Marine Mammal Protection Act (MMPA). Section 118 of the MMPA directs NMFS to develop and implement Take Reduction Plans (TRPs) for strategic marine mammal stocks that interact with Category I or II fisheries (fisheries that result in occasional or frequent incidental mortality or serious injury of marine mammals). In July 2010, the NMFS-appointed False Killer Whale Take Reduction Team (FKWTRT) submitted consensus recommendations to NMFS, in the form of a "Draft Take Reduction Plan," to reduce incidental false killer whale M&SI in the Hawaii-based deep-set and shallow-set longline fisheries to below specified levels, as required by the MMPA. The Draft FKWTRP focuses on the deep-set (tuna targeting) longline/set line fishery and the shallow-set (swordfish targeting) longline/set line fishery. The Draft FKWTRP does not recommend management measures for other commercial fisheries; however, the FKWTRT recommended basic research and information gathering on other fisheries, such as State-managed hook-and-line fisheries, to determine their potential for interactions with false killer whales.

NMFS considered the FWKTRT's recommendations when developing a proposed rule (the proposed action), and will make the proposed rule available for public comment. To comply with the statutory requirements of the National Environmental Policy Act (NEPA), Presidential Executive Order 12866, and the Regulatory Flexibility Act (RFA), NMFS also requires supporting analyses to assess the environmental impacts of the proposed action and its alternatives (the Environmental Assessment, or EA), the economic benefits and costs of the action alternatives and their distribution (the Regulatory Impact Review, or RIR), and the impacts of the action alternatives on directly regulated small entities (the Initial Regulatory Flexibility Analysis, or IRFA). After considering the public comments, NMFS will finalize and implement the FKWTRP. This is the RIR section of the integrated Draft EA/RIR/IRFA, and provides the analytical background for decision-making.

## 5.2 Purpose of Regulatory Impact Review

The proposed action being addressed in this RIR is the implementation of NMFS' proposed FKWTRP, pursuant to section 118(f) of the MMPA, to reduce incidental M&SI of three stocks of false killer whales in the Category I Hawaii-based deep-set longline fishery and the Category II Hawaii-based shallow-set longline fishery. This action is needed because incidental M&SI levels for these stocks in these fisheries exceed the thresholds established under the MMPA. These current levels are, therefore, inconsistent with the mandates of the MMPA, and must be reduced. The purpose of this RIR is to evaluate the economic, socioeconomic, and other costs and benefits of implementing the FKWTRP. This information allows NMFS to address the requirements of Executive Order 12866.

## 5.3 Requirements of Regulatory Impact Review

The following statement from EO 12866 summarizes the requirements of an RIR:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood 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. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential

economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

EO 12866 requires that the Office of Management and Budget (OMB) review proposed regulatory programs that are considered to be “significant regulatory action”. The RIR serves as a basis to determine whether the proposed regulation would be significant according to the following criteria specified in EO 12866:

1. Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.
2. Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency.
3. Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof.
4. Raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in this EO.

The key elements of the RIR include:

1. A description of the management goals and objectives;
2. A description of the fishery and/or affected entities;
3. A comprehensive description of each alternative (including the No Action alternative);
4. A thorough description of the expected effects (both positive and negative) of each alternative, on *each* potentially impacted group; and
5. An economic analysis of the expected effects of each alternative relative to the baseline. When adequate data are available, expected benefits and costs should be *quantified* to the fullest extent that these can be usefully estimated. [Emphasis added]

# 5.4 Description of the Proposed Action and Alternatives

This section summarizes the proposed action and two alternatives considered for the proposed FKWTRP. Details of the proposed action and alternatives are provided in Section 2.3 of this document.

## 5.4.1 Alternative 1. No Action (Status Quo)

Under the No Action alternative, which is required by CEQ regulations (40 CFR § 1502.14), NMFS would take no additional regulatory action to protect false killer whales from bycatch in the Hawaii-based longline fisheries. This alternative would maintain status quo management of the Hawaii-based deep-set and shallow-set longline fisheries under the PFEP. The implementing regulations for the Western Pacific Pelagic Fisheries are located at 50 CFR Part 665, Subpart F.

## 5.4.2 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team

The preferred alternative is based on the consensus recommendations of the FKWTRT identified in the Draft FKWTRP, with some modifications (FKWTRT 2010). It includes the regulatory and non-regulatory measures outlined below and described in Section 2.3 of this document.

### Regulatory measures

1. Require small (size 16/0 or smaller) circle hooks with 4.0 mm maximum wire diameter and other specific characteristics in the Hawaii-based deep-set longline fishery.
2. Establish a minimum diameter for monofilament leaders and branchlines in the Hawaii-based deep-set longline fishery.
3. Establish a year-round Main Hawaiian Islands Longline Fishing Prohibited Area that is closed to longline fishing.
4. Require annual certification in marine mammal interaction mitigation techniques for longline vessel owners and operators.
5. Require posting of marine mammal handling and release informational placard on longline vessels.
6. Require captains' supervision of marine mammal handling and release.
7. Require posting of placard instructing crew to notify the captain of marine mammal interactions.
8. Establish a Southern Exclusion Zone and specific triggers for closure.

### Non-regulatory Measures

1. Increase precision of bycatch estimates in the Hawaii-based deep-set longline fishery.
2. Changes to observer training and data collection protocols.

### Other Measures

The proposed action also includes the following four measures:

- NMFS proposes to notify the FKWTRT when there is an observed interaction of a known or possible false killer whale, and provide the FKWTRT with any non-confidential information regarding the interaction;
- When there is an observed interaction of a known or possible false killer whale, NMFS proposes to confirm the identification of the species and make the serious injury determination as soon as possible after the observer debriefing and data approval for the interaction, and provide the non-confidential information to the FKWTRT with the rationale for the determination;
- NMFS proposes to expedite the processing of the data from the 2010 cetacean assessment survey in the U.S. EEZ around Hawaii (Hawaiian Islands Cetacean and Ecosystem Assessment Survey, or HICEAS II), and provide preliminary results to the FKWTRT; and
- NMFS proposes to reconvene the FKWTRT at regular intervals, depending on available funding, to monitor the progress of the FKWTRP in reaching its short- and long-term goals, and discuss amending the FKWTRP if warranted.

## 5.4.3 Alternative 3: Close the U.S. EEZ around the Hawaiian Islands to commercial longline fishing year-round

Under this alternative, all commercial longline fishing would be prohibited within the entire U.S. EEZ around Hawaii.

# 5.5. Methodology and Framework for Analysis

This section describes the framework for the analysis. First, it describes the general framework for the analysis. It then describes, in economic terms, the general categories of economic effects that are the focus of regulatory impact analysis, including a discussion of both net benefit and distributional effects. Next, this section defines the baseline and incremental effects of the implementation of the proposed

FKWTRP. It concludes with a presentation of the time-frame for the analysis and information sources relied upon in the analysis.

## General Framework for the Analysis

A benefit-cost analysis (BCA) has been prepared to evaluate the alternatives under consideration in the FKWTRP. In addition to having strong scientific support, this approach has support from the White House's OMB, through its guidelines on regulatory analysis (OMB, 2003). A BCA is a well-established procedure for assessing the "best" course or scale of action, where "best" is that course which maximizes net benefits. Because an analysis of benefits and costs seeks to empirically measure the value of an activity in net benefit terms, it typically requires that a single metric, most commonly U.S. dollars, be used to gauge both benefits and costs. While all efforts are made to monetize the net benefits associated with the implementation of the proposed FKWTRP, these benefits and costs are quantified and/or discussed qualitatively where sufficient data are not available. Executive Order 12866 explicitly provides for, and OMB guidance concurs in, use of a non-quantitative BCA that is consistent with economic theory and with the best available information when meaningful quantification is not possible.

## 5.5.1 Categories of Potential Economic Effects

This economic analysis considers the net benefit to the Nation, economic efficiency, and distributional effects that may result from efforts to protect false killer whales. Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish, in this context, species conservation. For example, if the commercial catch by longline fishermen is limited as a result of implementing the proposed FKWTRP, and thus the revenues of the fishermen are reduced, this reduction in revenue represents one measure of opportunity cost or change in economic efficiency. The opportunity costs, attributable to the aforementioned limits, are in contrast to the welfare gains that accrue from not allowing unconstrained actions to incidentally take false killer whales without considering alternatives and trade-offs. Similarly, the costs to longline fishermen of replacing hooks represent opportunity costs of the FKWTRP implementation. The BCA framework is intended to comprehensively identify and assess all such trade-offs.

This analysis also addresses the distribution of costs and benefits associated with the implementation of the proposed FKWTRP, including an assessment of any local or regional economic effects of species conservation (and the potential effects of conservation efforts on small entities, which are assessed in Section 6.0 as part of IRFA). This information may be used by decision-makers to assess whether the costs and benefits of the implementation of the proposed FKWTRP inequitably burden or benefit a particular group or economic sector. For example, while conservation efforts may have a relatively small effect on the national economy as a whole, individuals employed in a particular sector of the regional or local economy may experience substantially greater economic effects. The differences between economic efficiency effects (i.e., consumers' and producers' surpluses), net benefits (i.e., net social welfare), and distributional effects (i.e., measures of change in economic activity), as well as their application in this analysis, are discussed in greater detail below.

### *5.5.1.1 Efficiency Effects*

At the guidance of the OMB and in compliance with EO 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be affected by a regulatory action. Economic efficiency is typically measured against a "baseline" or *status quo* condition (i.e., the No Action alternative), with all attributable gains and losses compared for each alternative regulatory path. In the context of regulations that would implement the proposed FKWTRP, society seeks to accrue benefits from the conservation, recovery, and stewardship of this species. At the same time, these welfare gains come at a cost to society. These costs reflect the opportunity cost of resources used or benefits foregone by society, as a result of the specific regulatory alternative considered. Economists generally characterize opportunity costs in terms of changes in producer and/or consumer surpluses in affected markets.[1] Economic efficiency analyses seeks to measure, to the extent practicable, the relative trade-offs of each competing regulatory alternative (including the No Action alternative) to assure; 1) that a full accounting of all relevant costs and benefits is made, and 2) that the most economically efficient available alternative is identified.

It is, however, not always possible to measure each cost and each benefit in a common metric (e.g., U.S. dollars). When the regulatory action bears on welfare changes with both market and non-market characteristics, as is the case for species management, conservation, and recovery efforts, markets (and, therefore, prices) do not exist for many important components of resource management. As will be demonstrated later in this analysis, the results of the analysis can be severely biased by excessive reliance on price signals from traditional markets and their interpretation in a BCA, especially within the context of environmental assets with complex and significant attributes not reflected in traditional market structures.

In some instances, compliance costs may provide a reasonable approximation of the economic burden associated with a regulatory action. For example, a longline fisherman may attend an extended workshop to better understand how to handle marine mammals. The effort required for the workshop (which, in practice, may be quite small), is an economic opportunity cost; because the fisherman's time and effort could have been spent on an alternative activity. However, this “burden” captures only one side of the equation. The investment of time and resources spent on the extended workshop also “yields” social benefits, by assuring that inadvertent, unintentional, or inappropriate actions that adversely affect false killer whales are not undertaken by the fishermen.

This analysis begins by measuring the costs and benefits associated with efforts undertaken to implement the proposed FKWTRP. Compliance costs may, under certain limiting assumptions, provide a first approximation of the direct “cost” side of the change in economic efficiency. However, if the cost of conservation efforts is expected to significantly affect markets, the analysis will be expanded to consider potential changes in consumers’ and/or producers’ surpluses in affected markets.

### 5.5.1.2 Net Benefits

Having examined and assessed the size and scope of market-based effects of the implementation of the proposed FKWTRP on economic efficiency, the analysis moves beyond this narrow characterization of “value,” to evaluate the comprehensive net benefits attributable to the implementation of the proposed FKWTRP. Net benefits are the benefits that remain after adjusting for the costs associated with the implementation of the proposed FKWTRP. As will become apparent, implementation of the proposed FKWTRP affects a complex suite of market and non-market, consumptive and non-consumptive, direct, indirect, and passive use values, inherent in conservation and protection of species.

### 5.5.1.3 Distributional and Regional Economic Effects

Measurements of change in economic benefits and costs focus on the net welfare outcome attributable to a specific regulatory action, without consideration of how certain users, sectors, or other groups of people are affected. Thus, an analysis of net benefit effects, alone, may miss important distributional considerations. The OMB encourages Federal agencies to consider distributional effects, separately from benefits and costs (OMB, 2003). This analysis considers several types of distributional effects, including effects on small entities; effects on energy supply, distribution, and use; and regional economic effects. It

[1] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see: Gramlich, Edward M., 1990, *A Guide to Benefit-Cost Analysis* (2nd Ed.), Prospect Heights, Illinois: Waveland Press, Inc.; and Environmental Protection Agency, 2000, *Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September, available at http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

is important to note that these measures are fundamentally different economic attributes from benefits and/or costs and, thus, cannot be added to or compared with estimates of net economic changes. Distributional effect estimators describe changes in "economic activity," not economic benefits and costs.

### Effects on Small Entities (presented in Section 6.0 as Part of IRFA)

This analysis also considers how small entities, including small businesses, not-for-profit organizations, and governments, as defined by the RFA, might be affected by future species conservation efforts.

### Regional Economic Effects

Regional economic impact analysis can provide an assessment of the potential localized effects of implementing the proposed FKWTRP. Specifically, regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in regional economic "activity", resulting from a regulatory action. Regional economic impacts are commonly measured using regional input/output models. These models rely on multipliers that represent the relationship between a change in one sector of the economy (e.g., expenditures by fishermen) and the effect of that change on economic output, income, or employment in other local sectors (e.g., suppliers of goods and services to fishermen). These economic data provide a numerical estimate of the magnitude of growth or contraction of jobs, income, and transactions in a specific local economy. These economic impacts reflect "activity" (i.e., they characterize "transfers" among local or regional components of the broader economy), not "net" changes in the economy, as a whole. As no change in economic activity (i.e. change in number of fishing trips) is quantified, this analysis does not analyze regional economic impacts.

## 5.5.2 Baseline

This analysis examines the state of the world with and without the implementation of the proposed FKWTRP. The "without FKWTRP" scenario represents the baseline (i.e., the No Action alternative) for the analysis, considering protections already extended to false killer whales under the MMPA or under other Federal, State, and local regulations, including collateral protections resulting from protection afforded other listed species. The "with FKWTRP" scenario attempts to describe the incremental effects associated specifically with and unique to the implementation of the proposed FKWTRP and alternatives.

## 5.5.3 Contextual Information: Potentially Impacted Groups

This section identifies and describes the groups anticipated to be potentially affected by the FKWTRP. While the proposed action will directly regulate and affect the Hawaii-based longline fishermen, the social and economic effects of the FKWTRP are anticipated to spill over to other related groups and sectors, as well. There are strong linkages between Hawaii's fisheries, including the longline fisheries, and the rest of the economy (Cai et al. 2001). The RIR analyzes potential impacts to the following groups:

- Hawaii-based deep-set and shallow-set longline fisheries. Directly regulated groups, with potential adverse effects related to increased costs and decreased revenues. The proposed FKWTRP would directly affect the Hawaii-based deep-set and shallow-set longline fisheries. In fact, this is the community that is likely to experience the greatest impact from any change involving the management of the Hawaii-based longline fisheries. 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 (NMFS 2001). The Hawaii-based longline fisheries are the largest of all the commercial pelagic fisheries in Hawaii. In 2008, the longline fishery represented 85% of the total commercial pelagic landings and 89% of the ex-vessel revenue (WPRFMC 2010b).Longline effort increased rapidly from 37 vessels in 1987 to 138 vessels in

1990 (Ito and Machado 2001). The limited access program currently allows for 164 vessels in the fishery, but active vessel participation has been closer to 130 in recent years.

- Other Hawaii-based commercial fisheries. Potential benefits to fishery from reduced congestion and target-species conservation in longline exclusion zones. Commercial fisheries in Hawaii are extensive, and include fish caught for sale as well as charter fishing services. An annually renewable commercial marine license (CML) is required for commercial fishing in the state. Based on CML data, there were 4,263 licensed commercial fishermen in 2008 (Hawaii Division of Aquatic Resources (DAR) and WPacFin 2010). In 2009, about 27 million pounds of fish were caught for commercial purposes in the state, worth over $71 million (WPacFIN 2010) (see Table 3.7), while more than 28 million pounds of fish were caught in 2010 (WPacFIN 2011). Key fishery categories include pelagic, coral reef, bottomfish, precious corals, and crustaceans.

- Fishing equipment suppliers. Indirectly affected entities, with potential adverse effects on ability to sell existing hook inventory and net revenue from selling different equipment. The majority of Hawaii-based longline fishermen purchase commercial fishing equipment from three primary distributors based in Hawaii. In addition, a small percentage of vessels in the fleet purchase supplies from smaller local suppliers, while a small number of others import supplies independently. Although there is some variability in gear prices across suppliers, estimated to be below 10%, inventory is equivalent (Personal communication with longline owners/operators, 2011).

- Seafood consumers. Indirectly affected group, with potential adverse impact if the price or availability of fish changes. Annual fish consumption in Hawaii is about 90 pounds per capita, over twice the national average (U.S. Department of the Navy 2008a). According to another estimate, per capita seafood consumption in Hawaii is more than three times the national average of 17 pounds per person, with state residents consuming more than 60 million pounds of seafood in 2006 (HIPA 2009). About one-third of this demand is met by Hawaii's local fishing industry (HIPA 2009). Seafood consumers in Hawaii are known to be among the most knowledgeable and discriminating seafood consumers in the U.S. (WPRFMC 2011).

- Recreation and tourism. Indirectly affected group, with potential beneficial effects due to increased populations of recreationally-important species (whales and fish), and potential reduced congestion/conflict with commercial fishing vessels. The economy of Hawaii has been dependent on tourism and tourism-related activities since statehood in 1959. In 2008, over 14% of jobs in the state were in industries directly involved with tourism, with many other jobs were indirectly associated with the industry (see Table 3.4). Recreation activities in Hawaii are primarily centered on the ocean, although non-ocean recreation is also popular. Ocean recreation in Hawaii supports an $800 million industry (DOBOR 2011). Whale watching is an important component of Hawaii's ocean-based recreation industry, and Humpback whale watching in particular makes a contribution to the economy of Hawaii. It is estimated that the number of whale watchers was 370,000 in Hawaii in 1999. In addition to exclusive whale watching tours, whale watching and wildlife viewing are also components of several other types of ocean tours during the whale season.

- Subsistence and recreational fisheries. Indirectly affected group, with potential beneficial effects due to increased populations of target species, and potential reduced congestion/conflict with commercial fishing vessels. Fishing is a popular pastime for people in Hawaii, and is also popular with tourists visiting Hawaii. Popular target species among boat anglers in the state include blue marlin, striped marlin, tuna, wahoo, and mahimahi (NMFS 2011(b)). Hawaii likely has approximately 5,000 to 6,000 boats participating in recreational fishing, with an additional 1,900 non-commercial bottomfish vessels registered with the state in 2007 (NMFS 2011(b)).

With about 25 small boat harbors and 20 boat ramps, the state has one of the most developed recreational fishing infrastructures in the U.S. Pacific. Some sources indicate that there are about 125 active fishing charter boats operating out of 10 ports in the state, and these charters average about one trip every two days with approximately 70,000 people participating in charter fishing annually (NMFS 2011(b)). Direct annual expenditures on recreational fishing are estimated to be about $450 million (NMFS 2011(b)).

- Educational/scientific/passive users. Indirectly affected groups, with potential beneficial impacts from increased knowledge/public awareness about false killer whales, and increased populations of false killer whales.

More detail on each of these groups is provided in Section 3.3 of the Environmental Assessment.

## 5.5.4 Analytic Time-Frame

The analysis estimates costs and benefits based on activities that are “reasonably foreseeable,” including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. This analysis considers economic effects of activities from 2011 (anticipated year of the implementation of the FKWTRP) through 2030 (20 years from the expected year of FKWTRP implementation). This interval of 20 years, widely employed in the policy analysis arena, allows sufficient scope over which longer-cycle trends may be observed (e.g., progress towards population recovery for false killer whales), yet is short enough to allow “reasonable” projections of changes in “use patterns” in an area, as well as exogenous factors (e.g., global demand and supply for tuna and swordfish, U.S. inflation rate trends) that may be influential.

## 5.5.5 Information Sources

The primary sources of information for this report are publicly available data and reports, as well as communications with, and data provided by, personnel from NMFS, other Federal action agencies, Hawaii-based longline fishermen, suppliers and distributors of equipment used by longline fishermen, potentially affected private parties, and State agencies. Specifically, the analysis relies on data collected in communication with personnel and published data from the following entities:

- Bureau of Economic Analysis (BEA)
- Bureau of Labor Statistics
- Department of Business Economic Development & Tourism (DBEDT)
- Hawaii Tourism of Authority (HTA)
- Interviews with Hawaii-Based Fishing Gear Suppliers
- Interviews with Hawaii-Based Longline Owner / Operators
- State of Hawaii Department of Land and Natural Resources
- U.S. Bureau of Labor Statistics (BLS)
- U.S. Census Bureau
- U.S. National Oceanic and Atmospheric Administration Fisheries Service (NMFS) Longline Observer Program
- U.S. National Oceanic and Atmospheric Administration Fisheries Service (NMFS) Longline Logbook Data
- U.S. National Oceanic and Atmospheric Administration Fisheries Service (NMFS), Protected Resources, Pacific Islands Regional Office
- U.S. National Oceanic and Atmospheric Administration Fisheries Service (NMFS), Sustainable Fisheries, Pacific Islands Regional Office
- Western Pacific Fishery Information Network (WPacFIN)

- Western Pacific Regional Fishery Management Council (WPRFMC)

# 5.6 Identifying Benefits of Action Alternatives

Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of all costs and benefits of proposed regulatory actions (e.g., effects on health, safety, environment, economy, and well-being). This section focuses on the benefits of the FKWTRP. Benefits that may accrue due to the FKWTRP include those related to wildlife viewing, subsistence and recreational fishing, commercial fishing (non-longline fisheries), environmental education and scientific knowledge, and cultural and passive use values that are enhanced by decreased M&SI of false killer whales or other effects of the FKWTRP.

This section includes three subsections. The first subsection provides a framework for understanding FKWTRP benefits (i.e., the beneficial changes that may occur due to the FKWTRP) and the economic theory of how changes due to the FKWTRP can generate economic value. The next subsection describes in detail the different types of benefits that may accrue from the FKWTRP, while the third subsection provides a summary of the methods commonly used to estimate the value of such benefits. The values for these types of benefits from the peer-reviewed literature for Hawaii and other areas of the United States are presented in the final subsection, followed by a brief summary. It is important to note that many of the values that are associated with the FKWTRP are non-market, meaning that they cannot be directly measured in the marketplace (as with typical economic goods and services that have a market price), but rather must be ascertained either indirectly through observing the behavior of people, or directly through asking people how much they value the resource.

## 5.6.1 Framework for Estimating Benefits

The primary driver for benefits from the FKWTRP is the anticipated decrease in the incidental M&SI of false killer whales. It is an incremental change in the M&SI, and not the value of the entire population of false killer whales, that is relevant to this evaluation. Along with reduced M&SI of false killer whales, there is the potential that public awareness, education, and scientific research associated with the FKWTRP will generate benefits.

The FKWTRP will generate economic benefits if it increases individual well-being, or “utility,” aggregated across all individuals in the nation as compared with what would otherwise occur. In the following discussion, a brief conceptual overview is provided of how economists measure an increase in well-being from consumption of a good or service. This understanding is useful in that it explains; 1) how the FKWTRP might translate into a source of economic benefit or increased individual well-being, and 2) how this benefit could be empirically measured (i.e., quantified).

Economists measure the increase in well-being to consumers of a good or service as the difference between the price consumers pay for the good or service, and the benefit they derive from it (which is measured as the maximum price they would be willing to pay, and commonly referred to as willingness-to-pay or WTP). For example, if a tourist is willing to pay $100 for a whale watching trip, but only has to pay $75, then the tourist has a net benefit, or increase in well-being, from the trip equal to $25. Assuming all other things equal, a change, or increase, in this well-being from the consumption of goods and services can thus occur either because the price falls, or because the quality of the good or service rises and results in increased value to (or WTP by) the consumer. In the case of the FKWTRP, such improved well-being may arise if there is reduced M&SI in the future (than would otherwise occur in the absence of the FKWTRP). This may result in increased well-being (and WTP) if decreased M&SI increases the quality of goods and services related to false killer whales, such as whale watching trips.

If increased investment in public education and scientific knowledge occurs due to the FKWTRP, this too may cause increased well-being by causing personal preferences to change. If personal preferences change, such that public perception and enjoyment of false killer whales increases for a given population of false killer whales, the FKWTRP will also increase well-being and WTP even without changes in the false killer whale M&SI.

## 5.6.2 Overview of Types of Economic Benefits

The benefits generated by a natural resource, such as the false killer whales, can be classified into several categories (see Figure 5.2). One important distinction is between use benefits that are generally associated with people's present use of the false killer whale resource, and nonuse (or passive use) benefits that do not require present use and, instead, are derived through simply the knowledge that false killer whales exists and steps are being taken for their protection. Within the use and nonuse benefit categories, there are further subcategories, which will be described below. Economists differ on the ways that these values are organized, in terms of use and nonuse classification, and sub-classifications. However, as the aim of this study is to account for all benefits, the specific categorical labels are less important than ensuring that all types of potential benefits accruing from the FKWTRP are identified and addressed.

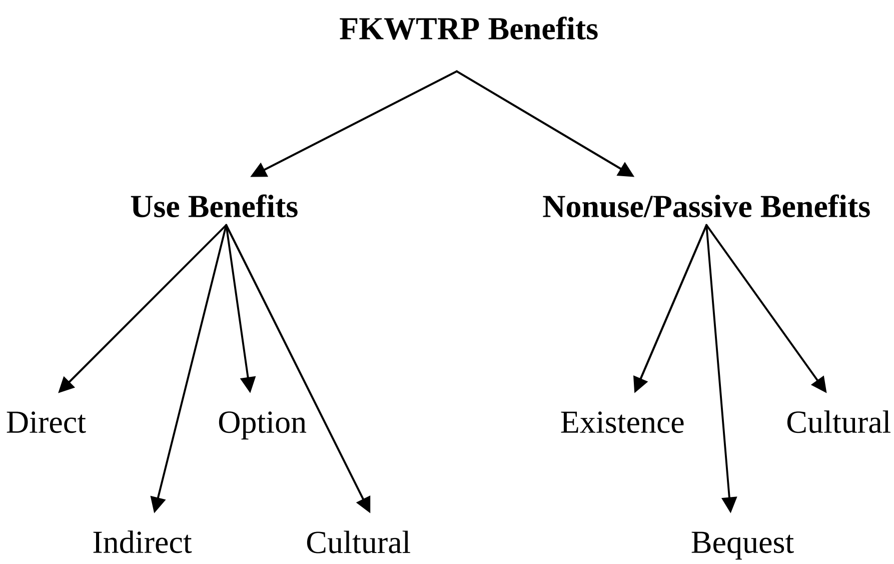


**Figure 5.2.** Benefits of FKWTRP

In addition to the categories shown in Figure 5.2 above, economic benefits arising from the use and passive use of false killer whales can be divided into consumptive or non-consumptive uses. The economic benefits of protecting false killer whales arise primarily from non-consumptive uses, which are uses associated with a good or service independent of its consumption and include use benefits from whale watching, shoreline recreation, public education, and scientific study and associated literature, as well as passive use benefits (e.g., values associated with the existence of the false killer whale for present and for future generations). Consumptive use or extraction benefits of the FKWTRP primarily consist of benefits to fishing related to changes in target species populations or reduced congestion. All consumptive use benefits are indirect benefits, as no intentional consumption or extraction of false killer whales is legal in US waters.

### 5.6.2.1 Use Benefits

Use benefits are described below in four distinct (i.e., additive), but related, categories: direct, indirect, option, and cultural. Direct use value would accrue from any positive change in the level of enjoyment or profitability of current activities due to decreased M&SI of false killer whales. For example, compared to the "without FKWTRP" conditions, the FWKTRP could increase the value of wildlife viewing, including but not limited to whale watching, if the population of false killer whales or other species viewed increases due to the FKWTRP. Waters in the EEZ around Hawaii support and sustain a myriad of other species, including ESA-listed species that people enjoy viewing. Viewing marine species is highly valued as critical components of the aesthetic reward, cultural heritage, and benefits associated with living in and visiting Hawaii.

Indirect use values are derived from using a resource that is enhanced by reduced false killer whale M&SI, such as changes in target fish populations. For example, if the FKWTRP reduces congestion of vessels or enhances fish abundance of a target species in an exclusion zone, then other commercial, subsistence, or recreational fisheries may benefit. Indirect use benefits also include scientific and educational gains attributable to the FKWTRP. If the FKWTRP results in new and enhanced scientific understanding of the biology of false killer whales or the impacts of human interactions, then natural resource managers and scientists, as well as the population as a whole, benefit in a number of ways. The FKWTRP also may contribute to education, informing individuals on the biological and ecological implications of species preservation.

Option use values derive from the preservation of the option for future use of a resource. In the present context, it is anticipated that the FKWTRP would reduce false killer whale M&SI. This action retains the option for individuals to 'use' or view false killer whales in the future. Conceptually, option value reflects an individual's WTP to avoid foreclosing future access to a resource or activity. Here, WTP reflects the current value to an individual of preserving the opportunity, at some unspecified point in the future, of using or viewing false killer whales.

Cultural values are different from other types of economic values, because they are specific to each group of people and, as such, do not readily lend themselves to monetary approximation. Economic monetization, in general, is typically based upon the premise that markets exist, or at least, can be approximated, within which trade can occur between two parties. This is not a valid assumption in the case of cultural values. Nevertheless, changes in individual well-being connected with enhanced cultural welfare of Native and resident Hawaiian groups through protection of marine resources constitute real, potentially significant, economic benefits attributable to the proposed FKWTRP.

#### *5.6.2.2 Nonuse or Passive Use Benefits*

Natural resources also have value to society independent of their use. Passive or nonuse values include, among others, existence, bequest, and cultural values. An increasing number of peer-reviewed, empirical studies have sought to estimate society's value, or WTP, to protect rare species, unique habitats, or whole ecosystems. These nonuse or passive use values of habitat, as they may pertain to the FKWTRP, are identified and briefly discussed here. Existence value is defined as individual utility or well-being derived from the knowledge of the existence of a natural resource, without the expectation of any form of use. For example, the mere knowledge of the existence of a relatively few California condors in the wild may elicit a large WTP (i.e., generate a large benefit) to assure the continued existence of that species in its natural ecological setting. This WTP, or benefit derived by an individual, may be substantial, even though the individual has no expectation of ever seeing the bird or visiting its habitat. The proposed FKWTRP could be expected to elicit a similar value.

Passive use benefits are also generated by the preservation of natural resources, such as plant and animal species, habitat, and ecosystems, for future generations' use. It has been empirically estimated that individuals derive utility from the knowledge that society preserves resources, so that they will be extant for the next generation, creating a bequest value. Again, economists disagree about whether bequest value is distinct from existence value, but, nonetheless, it represents an important conceptual element of passive use valuation. The potential change in the bequest value of false killer whales due to their increased protection is one element of the total benefit society may derive from the FKWTRP.

## 5.6.3 Valuation Methods

Economists typically rely on observed trades between willing buyers and willing sellers to identify the market-clearing price of a good or service. As described in the introduction to this section, environmental goods for which no market exists (non-market goods) are particularly challenging to value, because absent an observable market, no such "price" is revealed. The value of non-market goods may be estimated using either revealed preference (RP) or stated preference (SP) valuation approaches.

RP valuation methods use information on observed behavior to infer the value of the non-market good or service. As such, these methods require data on observable behavior to be linked to the non-market good in question. SP methods, on the other hand, involve asking individuals carefully worded hypothetical market questions to either directly or indirectly infer the value they place on a non-market good or service. Thus, the principal difference between RP and SP methods is the type of data used. Revealed preference methods use data on observed behavior to infer economic values, while stated preference methods use data on stated or intended behavior to infer economic values. Due to its reliance on observable behavior, revealed preference methods are generally not able to estimate nonuse values, which, by definition, are not tied directly to observable behavior. Thus, researchers generally utilize stated preference methods to estimate nonuse values. The obvious drawback with stated preference methods is that they represent hypothetical purchases, not real ones, and may be biased.

The most commonly used and best known stated preference method is the contingent valuation method (CV), which in actuality is a class of methods. In CV, economic values for a non-market good or service are revealed through survey questions that set up hypothetical markets for a non-market good or service, and involve asking the respondent to indicate their WTP (or willingness-to-accept compensation) for (or to forgo) the good or service. In a typical CV survey, a public good is described, such as a program to protect one or more "Threatened or Endangered" species, and respondents are asked questions to elicit their WTP for the public good through a payment vehicle, like taxes or contributions to a trust fund. One challenge with this method is that it is often very difficult to identify what exactly people are valuing: the species, the habitat, or the indication of overall ecosystem health. People's ability to understand the relative benefits of different conservation questions is also problematic. One study, for example, showed the average perceived benefits from preventing 2,000 birds from dying in oil-filled ponds was no different than the value from preventing 20,000 or 200,000 birds from dying. In addition, respondents know they do not actually have to pay the amount stated in the survey and are not as careful "spending" hypothetical dollars as they are spending their own real dollars. Finally, studies that evaluate willingness to pay for only one species or habitat may also overestimate economic benefits because they often do not address tradeoffs between species conservation and other priorities.

## 5.6.4 Description of Potential Benefits from the Action Alternatives

Previous economic studies have estimated the economic value of the types of benefits that could accrue from the Action Alternatives. A selection of these studies is reviewed below for each primary type of use value or activity associated with the Action Alternatives, including wildlife viewing, whale watching, recreational fishing, subsistence activities, education and scientific knowledge, and passive use. Using the Consumer Price Index, all values from the studies reviewed in this section were adjusted to 2010 dollars for comparison purposes. The literature and values cited in this section provide a general sense of the magnitude of the use benefit individuals and society derive from biological resources such as false killer whales. The benefits from these studies, however, are not directly associated with false killer whales, but instead demonstrate representative values. These cannot be directly translated to values of the Action Alternatives because it is not known with certainty how the Action Alternatives will affect M&SI, other environmental attributes, or the extent to which the Action Alternatives will increase public education, awareness, or scientific research on false killer whales and their habitat. The values from these studies do, however, provide important context for understanding the possible magnitude of the use values that may result from the Action Alternatives. As the magnitude of these benefits cannot be quantified with available information, only the groups that may benefit and the types of benefits of the Action Alternatives are identified below in the analysis of the expected economic costs and benefits of the Proposed Action and Alternatives.

### 5.6.4.1 Whale Watching and Wildlife Viewing

The Action Alternatives may benefit recreation users if wildlife viewing opportunities are enhanced due to increased wildlife populations, including false killer whales and other species such as sea turtles. Nearly all recreational fishing and tourism in the Hawaiian Islands, including charter fishing and whale watching, is located within the existing MHI Longline Fishing Prohibited Area. For example, in between 1996 and 1997, the average charter vessel fished 24.4 miles from its home port, and only 7.5 miles from shore (Hamilton, 1998). As there is little to no spatial overlap between recreation and tourism activities and commercial longline fisheries, there are no anticipated positive impacts of the Action Alternatives related to reduced congestion or recreation-commercial vessel interactions. There may, however, be positive indirect effects of an Action Alternative on wildlife viewing recreation if an Action Alternative results in increased abundance of false killer whales or other wildlife that may be viewed by recreationists or tourists.

The economic benefits of fishing and wildlife viewing have been studied extensively by economists, resulting in a wide range of values. In a 2001 study, Randall Rosenberger and John Loomis examined relevant literature to determine the value of outdoor recreation use in the United States. The final database includes 163 studies that provide over 750 benefit estimates of per day or per trip day recreation values. A trip day is defined as recreation occurring within a one-day period, and can last any length of time, from a half hour excursion to an all-day outing.

The one study specific to Hawaii that was cited in the database identified a value of $130.30 per trip day associated with fishing in Hawaii. Through a technique called benefits transfer in which values from one study are applied in another context, values from the database were analyzed for the nation and for the Pacific Coast Area, which includes Hawaii. Results showed that the national value of wildlife viewing was $39.39 per trip day, while wildlife viewing in the Pacific Coast area viewing was valued slightly less at $32.67 per trip day. Again, using benefits transfer, the value to anglers of fishing in the Pacific Coast Area was estimated at $42.08 per trip day. Additional studies on the recreational value of fishing and wildlife viewing (measured in terms of WTP) are provided below.

The economic value of wildlife viewing such as whale watching, can be substantial. For example, Utech (2000) estimates 1999 direct revenues for whale watching to be between $14.6 and $21.3 million, and a total estimated economic impact of whale watching in Hawaii of $25.3 - $35.9 million. In the same study, Utech pegs total direct revenues from Hawaii's ocean tour boat industry as a whole at $175.8 million. Moreover, in a 2006 review of whale watching studies, Linwood Pendleton presents a range of consumer surplus values between $39 and $52 per trip.

Two studies by John Loomis, in 1994 and 2000, use the CV method to estimate the value of whale watching to California whale watchers. The studies were based on a 1991 to 1993 survey of whale watchers conducted at four locations along the California coast during times of the gray whale migration. Whale watching from shore was available at all four sites, while boat whale watching trips were common at two of the sites. It is important to note that at the time of the survey, gray whales had recently been removed from the ESA threatened species list. In the 1994 study, John Loomis and Douglas Larson examined whale watchers' WTP for a 50 percent and 100 percent increase in the gray whale population, and a corresponding increase in sightings. The study finds the WTP for a 50 percent increase in gray whale sightings is $54, while a 100 percent increase in sightings elicits a WTP or benefit of $64.

A 2000 study by John Loomis, Shizuka Yorizane, and Douglas Larson estimated the consumer surplus associated with gray whale watching along the California coast, using the travel cost method. The study uses two estimation techniques, which provide the per person per day benefit values to whale watchers participating in several types of whale watching trips, including; (1) a whale watching trip to a single destination ($85 - $98), (2) single or multi-destination trip where whale watching is a main purpose of the trip ($102), and (3) a trip where whale watching is part of “a bundle of visits to related nearby sites” ($352). The higher values for multi-activity, multi-destination trips are consistent with the literature, since such trips are typically more valuable to participants due to the variety of experiences offered.

### *5.6.4.2 Recreational and Subsistence Fishing*

There are two potential impacts of the Action Alternatives to recreational and subsistence fishing: 1) positive impacts from reduced fishing boat congestion due to closure of areas to commercial longline fishing, and 2) increased target fish abundance due to decreased fishing effort or from area closures. Nearly all subsistence fishing in the Hawaiian Islands is located within the existing MHI Longline Fishing Prohibited Area. As there is little to no spatial overlap between subsistence fisheries, there are no anticipated impacts related to congestion. There may, however, be positive effects on target-species abundance if there is reduced effort in the longline fisheries or if the longline closure areas result in increased fish abundance. If target-species abundance increases then catch rates may increase, resulting in higher benefits per recreation or subsistence use trip. As discussed above, in a 30-year time series analysis of catch and CPUE in the Hawaiian EEZ, He and Boggs (1995) find no significant relationship between overall catch and CPUE of bigeye and yellowfin tuna, for either longline or troll fishermen (Chakravorty and Nemoto, 2002). Positive effects on the recreational and subsistence fishery may therefore be limited. Several studies are outlined below that provide general information on the value of recreational and subsistence fishing.

The economic benefits of recreational fishing have been estimated in many studies, creating a wide range of values. A 2000 DAR technical report, for example, examines the importance of ulua species to Hawaii’s subsistence and recreational fisheries, estimating that Hawaii’s recreational ulua fishery has a $31 million annual impact on Hawaii’s economy, and that expenditures by recreational fishermen amounted to $35.5 million, or $312 per angler.

An 1987 study by Meyer Resources Inc estimates a $569.7 million non-market value of the recreational fishing experience in Hawaii based on estimated direct expenditures of small-boat recreational and subsistence fishing of $56 million. Meyer recognizes the difficulty inherent in attributing this value directly to landings of fish, as opposed to other motivations. However, the magnitude of these estimates highlights the economic importance of the recreational fishing experience at large in Hawaii as well as the potential magnitude of value of potential improvements to the recreational fishing experience through reduced longline interactions or enhanced catch of target species.

### *5.6.4.3 Commercial Fishing (Non-Longline)*

There are two potential impacts of the Action Alternatives to non-longline commercial fishing: 1) positive impacts from reduced fishing boat congestion due to closure of areas to commercial longline fishing, and 2) increased target fish abundance due to decreased longline fishing effort or from longline area closures. Other commercial fisheries that target tuna include the MHI troll and handline, offshore handline, and the aku boat (pole and line) fisheries. There may be positive effects on target-species abundance if there is reduced effort in the longline fishery or if the closure areas result in increased fish abundance. If target-species abundance increases then catch rates may increase, resulting in higher revenue per commercial trip. However, as noted above, in a 30-year time series analysis of catch and CPUE in the Hawaiian EEZ, He and Boggs (1995) find no significant relationship between overall catch and CPUE of bigeye and yellowfin tuna, for either longline or troll fishermen (Chakravorty and Nemoto 2002). Positive effects on the other commercial fisheries may therefore be limited.

### 5.6.4.4 Environmental Education and Scientific Knowledge Benefits

The Action Alternatives may lead to scientific and educational gains. If the Action Alternatives result in new and enhanced scientific understanding of the biology of false killer whales or the impacts of human interactions, then natural resource managers and scientists, as well as the population as a whole, benefit in a number of ways. The Action Alternatives also may contribute to education, informing individuals on the biological and ecological implications of species preservation.

Stakeholders often seek to inform and/or influence the process of any measures pertaining to species conservation by developing and disseminating pertinent scientific information. The individuals involved in these efforts (i.e., educators, researchers, and recipients) are presumed to derive net welfare gains from their participation in such activities, which is considered a benefit of the implementation of the FKWTRP. Examples of such stakeholders include, but are not limited to, marine mammal researchers, non-profit organizations, and other conservation groups. In addition, benefits are derived from scientific investigations of false killer whale populations and habitat, intended to inform the process. Examples of these types of efforts include scientific studies, monitoring false killer whale populations and habitat, and training, equipping, and supporting volunteers.

Studies indicate that environmental education and increased scientific knowledge can provide substantial benefits to individuals and society as a whole. Many economic studies focus on the value of general education benefits, including wage, health, and improved social relationship benefits from increased education levels. Studies specifically focusing on the benefits of environmental education and increased scientific knowledge, such as those that may accrue from FKWTRP are few, however one study by Dana Dalrymple (2005) highlight the value to society of increasing public access to scientific knowledge. Dalrymple describes scientific knowledge as a public good, with importance to the economy and innovation.

### 5.6.4.5 Passive Use Benefits

With its expected reduction in M&SI of false killer whales, the Preferred Alternative would benefit all people who value the conservation of marine mammals. Additionally, benefits of species conservation include those derived from the knowledge of the existence and health of false killer whales in Hawaii. Passive use value is derived from the knowledge that false killer whales are being protected, even if there is no likelihood of viewing the species or if there are no other interactions. Passive use values may accrue to many residents of Hawaii as well as the Nation.

The intrinsic benefit of habitat and wildlife conservation not associated with use is difficult to measure and, therefore, controversial. Attempts to measure total value (use and non-use) of species conservation use survey methods that elicit hypothetical WTP. Because of the difficulties with these methods, this study reports some of the values found in the literature, but cannot validate their reliability or applicability to false killer whales. Studies about species and habitat conservation conclude that the annual per person WTP ranges from approximately $5 to $100 per species for significant increases in species protection rates. The value per species generally increases if it is a ‘charismatic’ and recognizable species, it is a bird or mammal or fish, and if the survey respondent is a visitor or recreational user in the conservation location (i.e., would hold use values as well).This section describes the literature on passive use values of mammals in Hawaii and whales in the Pacific.

A 1996 study by Loomis and White, meta-analysis of 20 U.S threatened and endangered species finds that annual willingness to pay for the protection of rare, threatened and endangered species to range between $8 per household for fish, to a high of $131 per household for the northern spotted owl. Their study notes that willingness to pay varies based on a number of factors including the type of specie being protected (e.g. mammal or bird) and whether the individual being surveyed is a user or non-user. Loomis and White update their estimate in a 2009 study, estimating the range of willingness to pay between $11 and $357 based on these same variables.

Studies estimating the non-market value of the publics' willingness to pay for marine mammals in the U.S. are particularly relevant to an assessment of the economic value of protecting false killer whales. Two studies focused on the economic values of U.S. whale species (Hageman, 1985; Samples and Hollyer, 1990; Loomis and Larson, 1994) are particularly relevant to the FKWTRP. In his 1985 study, Hageman estimates the willingness of California residents to pay for the protection of bottlenose dolphins, California sea otters, Northern elephant seals, gray whales, and blue whales. Willingness to pay, determined through a mail survey, ranged between $49.2 and $65.3, depending on the species. Samples and Hollyer (1990) additionally conducted an in-person WTP survey of Hawaii residents for protection of humpback whales and Hawaiian monk seals, and found that the WTP for the protection of humpback whales ranged from $284 to $322, whereas the WTP for the protection of monk seals ranged from $140 to $234. A third survey conducted by Loomis and Larson (1994) evaluate whether WTP for increases in whale stocks is dependent on the size of the stock increase through in-person intercepts and household mail surveys of California residents and whale watchers. The survey determined that visitors were willing to pay $35 per year on average, whereas residents were willing to pay $22.6 to $25.3 per year. Moreover, the study identified that WTP increased for larger whale populations.

The WTP values identified in these studies indicate that there is a positive nonuse value associated with whale preservation, although the magnitude of this value cannot be quantified for false killer whales.

### 5.6.5 Summary

It is clear, based on the preceding discussion, that there are numerous types of economic benefits that may accrue to Hawaii residents and to citizens throughout the U.S. These include potential benefits associated with recreational fishing, wildlife viewing, subsistence fishing, and environmental education and scientific knowledge benefits. The different types of expected benefits include direct use, indirect use, nonuse or passive use, and non-consumptive benefits. While the magnitude of some of these types of benefits has been studied, none of these types of benefits has been studied in direct association with false killer whales or the Action Alternatives. As a result, it is very difficult to quantify the total value of economic benefit to be expected from the Action Alternatives at this time. However, it is clear that the Action Alternatives will contribute to the types of economic benefits described in this section. As the magnitude of these benefits cannot be quantified with available information, only the groups that may benefit and the types of benefits of the Action Alternatives are identified below in the analysis of the expected economic costs and benefits of the Proposed Action and Alternatives.

## 5.7 Expected Economic Costs

This section discusses the expected economic costs of the RIR, considering the economic efficiency effects on impacted groups (i.e., consumers' and producers' surpluses), net benefits (i.e., the benefits that remain after adjusting for the costs), and distributional effects (i.e., measures of change in economic activity). Each of these is evaluated against a "baseline" or *status quo* condition (i.e., the No Action Alternative), with attributable gains and losses compared for each alternative regulatory path. In addition to economic costs and benefits, the distribution of impacts is evaluated in the RIR, including differential effects to sub-communities within the longline fleet such as small-vessel owners. Measures that do not have a significant economic impact to the longline fishery at large may, for example, have a significant impact on small vessels whose annual revenue is lower.

The analysis is informed by the literature of similar measures imposed on fisheries in the past, as well as interviews with potentially affected entities. Additionally, NMFS longline fishery data and reports (including data from the logbook and observer program), and academic literature on the economic value of species conservation are used to inform this analysis.

## 5.7.1 Hawaii-Based Longline Fisheries

This section evaluates potential costs to Hawaii-based longline fisheries, which would be directly regulated under the FKWTRP. Effects to both the Hawaii-based deep- and shallow-set fisheries are evaluated as appropriate. The impacts on the Hawaii-based longline fishery of each Action Alternative (Alternative 2 and Alternative 3) are discussed separately below. One measure common to both Action Alternatives is an area closure, specifically closure of an area north of the MHI and of the SEZ in the Preferred Alternative, and closure of the entire EEZ around Hawaii in Alternative 3.

The Action Alternatives are not expected to generate benefits to the longline fishery as both alternatives would further restrict the location of longline fishing, and in the case of the Preferred Alternative, require the use of specific gear, additional education, and response to marine mammal interaction. This section therefore focuses on costs to this fishery. For each alternative, costs were evaluated based on initial one-time capital costs (associated with gear replacement) and ongoing, annual costs. These expected costs are summarized in Table 5.3. To be able to compare and add together one-time costs with annual ongoing costs, this analysis converts one-time costs to annual costs using a three percent discount rate and a 20-year timeframe. The resulting 'annualized' cost represents the yearly cost to the longline fleet, assuming that one-time costs are spread out over 20-years. Furthermore, a present value is calculated that represents the total cost in today's dollars of the stream of all initial and future costs of the Action Alternatives, again using a three percent discount rate and a timeframe of 20 years.

Costs to the deep-set longline fishery under the Preferred Alternative and Alternative 3 are summarized in Tables 5.3 and 5.4, respectively. Total one-time capital costs associated with all measures in the Preferred Alternative (Alternative 2) were estimated to range from $301,000 to $707,000. The one-time labor cost and material cost associated with replacing all hooks to meet the 4.0 mm hook requirement is expected to be the most significant cost under Alternative 2, as this requirement would affect all active deep-set longline vessels (estimated to be 129 vessels). Annual ongoing costs incurred under Alternative 2 are, in turn, estimated at between $3.0 and $8.0 million. The large range in annual ongoing cost is due to uncertainty in the effects of 4.0 mm wire diameter circle hooks on total weight of tuna catch and associated revenue, with potential adverse effects varying from 0% to up to 10% of total weight caught. Closure of the SEZ, if triggered, is also anticipated to contribute to a significant portion of annual costs, with increase travel costs (both time and fuel) due to closure of this zone estimated to be as high as $2.9 to $3.5 million annually for all vessels.

Nearly all of the annual and one-time costs would be incurred by the deep-set fishery. The only proposed measures with projected costs that affect the shallow-set fishery are the annual Protected Species Workshop certification for operators/owners and establishing the MHI Longline Fishing Prohibited Area. However, little to no additional costs are expected to the shallow-set fishery from these measures as 1) all or nearly all longline vessels participate in the deep-set fishery and would therefore already be required to attend the Protected Species Workshop as a deep-set vessel owner/operator, and 2) there is little to no existing shallow-set effort in the MHI Longline Fishing Prohibited Area.

**Table 5.3**. Preferred Alternative: Total Expected Cost to Deep-Set Longline Fisheries.

| Proposed Measure | Initial, One-Time Cost | Annual Ongoing Cost | Total Annualized Cost | Net Present Value Cost (2011 – 2030) |
|---|---|---|---|---|
| Small, weak circle hook requirement | $284,000 - $682,000 | $0 - $4,378,000 | $2,000 - $4,424,000 | $31,000 - $65,815,0000 |
| 2.0 mm line requirement | $17,000 - $26,000 | $2,000 - $4,000 | $4,000 - $5,000 | $53,000 – $79,000 |
| MHI Longline Fishing Prohibited Area | $0 | $76,000 – $87,000 | $76,000 – $87,000 | $1,126,000 -$1,296,000 |
| Annual Certification for Operators/Owners | $0 | $600 - $1,400 | $600 - $1,400 | $9,000 – $21,000 |
| Marine Mammal Handling/Release Placard | $0 | $0 | $0 | $0 |
| Captain Supervision of Marine Mammal Handling/Release | $0 | $0 | $0 | $0 |
| Captain Notification Placard | $0 | $0 | $0 | $0 |
| Southern Exclusion Zone | $0 | $2,941,000 - $3,483,000 | $2,941,000 - $3,483,000 | $43,756,000 -$ 51,824,000 |
| **Total Cost** | **$301,000 - $707,000** | **$3,003,000 – $7,954,000** | **$3,023,000 -$8,001,000** | **$44,974,000 - $119,036,000** |

Little to no impacts are expected on the shallow-set longline fishery. The only proposed measures with projected costs that affect the shallow-set fishery are the annual certification for operators/owners and establishing the MHI Longline Fishing Prohibited Area. However, little to no additional costs are expected to the shallow-set fishery from these measures as 1) all or nearly all longline vessels participate in the deep-set fishery and would therefore already be required to attend the Protected Species Workshop as a deep-set vessel owner/operator, and 2) there is little to no existing shallow-set effort in the MHI Longline Fishing Prohibited Area (i.e. less than one full trip each year).

The complete closure of the EEZ to longline fishing under Alternative 3 is expected to incur more significant overall annual costs, although no one-time capital costs are anticipated. As summarized in Table 5.4, expected annual costs of Alternative 3 are between $8.6 and $10.2 million dollars, of which an estimated $7.6 million are associated with the opportunity cost of increased travel time. Nearly all (an estimated 94%) of costs associated with Alternative 3 are expected to be borne by the deep-set longline fishery.

**Table 5.4.** Alternative 3: Cost to Deep-Set and Shallow-Set Longline Fisheries.

| Closure of Economic Exclusion Zone | Annual Ongoing cost | Net Present Value (2011-2030) |
|---|---|---|
| Fuel Cost | $1,059,000 - $2,648,000 | $15,762,000 - $39,396,000 |
| Travel Time Cost | $7,553,000 | $112,376,000 |
| **Total** | $8,613,000 - $10,201,000 | $128,138,000 - $151,765,000 |

### Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team

This section describes the methodology to estimate costs to the longline fishery that are presented above in Table 5.3. Costs are described for each proposed measure in the Preferred Alternative, and are presented in terms of costs to the longline fleet as well as in terms of cost per vessel.

### Require small circle hooks (size 16/0 or smaller) with 4.0 mm maximum wire diameter and other specific characteristics in the Hawaii-based deep-set longline fishery

This measure would mandate that all deep-set longline vessels use a “weak”circle hook, size 16/0 or smaller, with a maximum wire diameter of 4.0 mm. As there are currently no known users of small circle hooks with 4.0 mm wire diameter in the Hawaii-based tuna-target longline fishery, all deep-set longline vessels would be required to replace their hooks under the Preferred Alternative. Because 4.0 mm wire diameter circle hooks are not yet commercially available in Hawaii, both the price and availability of hooks are subject to some uncertainty. Values used were determined from estimates provided by local and national hook suppliers.

We estimate four types of potential costs of replacing existing hooks with 4.0 mm diameter wire small circle hooks: 1) one-time capital and labor cost of replacing existing hooks, 2) ongoing hook replacement cost, 3) costs to suppliers of having inventory that is no longer in demand, and 4) ongoing change in catch weight and value. As summarized in Table 5.5 below, the results indicate that the requirement for the Hawaii-based deep-set longline fishery to use 4.0 mm diameter small circle hooks would cost approximately $284,000 to $682,000 in one-time capital and labor expenditures ($2,200 to $5,300 per vessel), with annual equipment cost savings of up to approximately $17,000 annually ($130 per vessel). Due to the uncertainty associated with costs of 4.0 mm diameter small circle hooks, this analysis assumes a zero cost associated with ongoing hook replacement.  Annualized costs for equipment are thus estimated at $150 to $360 per vessel.

If the weaker hooks result in reduced total bigeye tuna catch weight of zero to 10 percent, then annual ex-vessel revenue may be reduced by $0 to $4.4 million ($0 to $34,000 per vessel, which is approximately zero to 7% of average longline vessel revenue of $488,000 annually).  This estimate assumes only a decline in the total weight of bigeye tuna caught, and assumes that catch rates of other species, which are smaller in size, will be unaffected by the weaker hooks. It is important to note that revenue losses are estimated using annualized average per-pound prices received at auction, and does not account for variability in prices received based on the quality and size of fish. Because personal communication with longline owners/operators suggests that the per-pound price received for fish increases with the size of fish, these estimates may undervalue total revenue losses.

**Table 5.5.** Estimated Hook Replacement Cost Results to Deep-Set Longline Fishery.

| | **All Vessel Costs** | | **Per Vessel Costs** | |
|---|---|---|---|---|
| **Proposed Measure** | **One-time capital cost** | **Annual ongoing cost** | **One-time cost per vessel** | **Annualized cost per vessel[a]** |
| One-time replacement cost | $129,000 - $269,000 | N/A | $1,000 - $2,000 | $70- $140 |
| One-time replacement labor cost | $155,000 - $413,000 | N/A | $1,000 - $3,000 | $80- $220 |
| Ongoing hook replacement cost | N/A | $0 | N/A | $0 |
| Catch reduction costs | N/A | $0 - $4,378,000 | N/A | $0 - $34,000 |

| | | | | |
|---|---|---|---|---|
| Total | $284,000- $682,000 | $0 - $4,378,000 | $2,000 - $5,000 | $150 - $34,400 |

a/ Includes one-time and annual ongoing costs, over 20 years assuming a three percent discount rate

Table 5.6 summarizes the data used to estimate the one-time and ongoing capital and labor costs to replace existing hooks. Below the table, the methodology to estimate each of the four types of costs is provided.

**Table 5.6**. Hook Replacement Cost Data.

| Variable | Value Range | Sources |
|---|---|---|
| % of Fleet Using 4.0 mm Circle Hooks | 0% | Hook suppliers, Owner/Operator interviews |
| % of Fleet Using Small Circle Hooks (assumed to be 4.5 mm) | 63% | Observer Data, Consistent with Owner/Operator Interviews |
| Cost of 4.0 Small Circle Hooks | $0.44 - $0.81 | Gear Suppliers, Owner/Operator Interviews |
| Cost of Hooks in Current Use | $0.67 - $0.92 | Weighted average based on circle and tuna hook prices (owner operator interviews and suppliers) and observer data on hooks in current use |
| Number of Deep-set Hooks Per Set | 2,218 | 2006 – 2010 NMFS Hawaii Longline Logbook data: (Total Number of Hooks / Total Number of Sets) |
| Number of Deep-set Hooks Lost Annually | 34,253 | 2006 – 2010 NMFS Hawaii Longline Logbook data; Average across 2006 to 2010 |
| Number of Vessels in Longline Fleet, Number of Vessels in Deep-Set Longline Fleet | 129 | Between 2006 and 2010 there were between 124 and 129 vessels in the longline fleet, with two years (2007 and 2008) with 129 vessels. In 2007, 129 vessels were active in the deep-set longline fishery, so it is assumed that all longline vessels participate at times in the deep-set fishery. |
| Number of Individual Hooks In Use (In Use at Any Given Time) | 279,320 | 2006 – 2010 NMFS Hawaii Longline Logbook data, product of # hooks per set (averaged over 5 years) and # vessels in fishery |
| Annual Replacement Rate of Current Hooks due to Loss/Failure | 12% | 2006 – 2010 NMFS Hawaii Longline Logbook data; Consistent with Owner/Operator Interviews. Estimated as (# of hooks lost annually)/ (# of Individual Hooks in Use) |
| Potential Hook Requirement Phase-in Period (Months) | 0-12 months | NMFS |
| One-Time Labor Hours to Replace Hooks Per Vessel | 60-160 | Owner/Operator interviews |
| Opportunity Cost Per Labor Hour | $20 | Bureau of Labor Statistics, average of fishing supervisor and average fishing occupation wage. |

One-time Hook Replacement Cost

This section describes the methodology and estimated cost to the deep-set longline fishery of the initial, one-time cost of purchasing 4.0 mm wire diameter small circle hooks and paying for labor to replace existing hooks in good working condition. The one-time combined labor and equipment cost is estimated at $284,000 to $682,000 for all 129 vessels.

As indicated in Table 5.6, no vessels in the deep-set longline fleet are believed to be using small circle hooks with 4.0 mm wire diameter, so all vessels would be required to replace all hooks in current use. The cost of replacing hooks must consider the inventory of surplus hooks in addition to hooks in use, as vessels generally store several months of replacement hooks on board. Based on 2006 – 2010 NMFS logbook data, vessels on average replace 12% of hooks annually. This is within the range of hook loss provided by interviewed owner/operators, but may be an underestimate as it is not known what types of hook loss are reported by operators in their logbooks, and whether this includes straightened hooks and hooks replaced but not lost during a set. However, given an average of 2,200 hooks in use per fishing set, and assuming a three month supply of replacement hooks on each vessel, an estimated 2,300 hooks would need to be replaced per vessel.

NMFS is soliciting comments on the proposed rule (Preferred Alternative). Based on public comment, NMFS may consider a reasonable phase-in period for the 4.0 mm wire diameter small circle hook requirement. For this analysis, this phase-in period is assumed to potentially range from zero to twelve-months. We assume that owner/operators would cease purchasing current hooks at the beginning of the phase-in, and would begin replacing lost hooks with the 4.0 mm wire diameter small circle hooks. If the phase-in period is 12 months, we estimate that vessels would replace hooks at the 12 percent annual average rate of loss, or approximately 270 hooks. These hooks would be replaced regardless of the FKWTRP. Therefore, depending on the length of the phase in period, vessels may need to 'retire' or replace approximately 2,000 (12-month phase-in period) to 2,300 hooks that would not be replaced if not for the FKWTRP. Based on interviews with commercial fishing gear suppliers, the cost to vessel owner/operators of 4.0 mm wire diameter small circle hooks is estimated at $0.44 to $0.81 per hook and $0.05 per crimp (used to attach the hook). One-time equipment cost of this replacement of all hooks and crimps in the longline commercial fishing fleet is estimated at approximately $129,000 to $269,000, or an average of $1,000 to $2,000 per vessel (the product of 2,000 to 2,300 hooks per vessel and $0.49 to $0.86 cost per hook and crimp). Using a three percent discount rate over 20 years, the total annualized equipment cost of replacing hooks is estimated at $8,700 to $18,100, or an average of $70 to $140 per vessel.

Labor cost to replace hooks is estimated using a labor rate of $20 per hour, which is the average of hourly compensation for fishing industry supervisors and fishing industry employees. Interviews with owner/operators indicate that the labor requirement to replace all hooks per vessel is approximately 60 to 160 hours, depending on vessel size. Total one-time labor cost to replace hooks is thus estimated at approximately $155,000 to $413,000 for all 129 longline vessels, or an average of $1,200 to $3,200 per vessel. Using a three percent discount rate over 20 years, the total annualized labor cost of replacing hooks is estimated at $10,400 to $27,700, or an average of $80 to $220 per vessel.

<u>Ongoing Hook Replacement Costs</u>

This section describes the methodology and estimated cost to the deep-set longline fishery of the ongoing cost of purchasing 4.0 mm wire diameter small circle hooks compared to the cost of purchasing hooks currently in use. The annual cost savings is estimated at $0 to $17,000 for all 129 vessels.

Once all hooks are replaced in the fleet, the ongoing change in equipment costs for vessels is estimated based on the annual replacement rate and the difference in cost between currently used hooks and small circle hooks with 4.0 mm wire diameter. The 4.0 mm wire diameter small circle hooks are expected to cost approximately $0.00 to $0.50 less than hooks in current use, depending on the supplier. Assuming loss of approximately 34,300 hooks annually across the longline fleet (see Table 5.6), the cost savings of using 4.0 mm wire diameter small circle hooks is estimated at approximately $0 to $17,000 annually, or $0 to $130 per vessel. Actual cost savings estimated may be higher as the number of hooks replaced annually may be higher. This estimate is based on logbook data on hooks lost during trips and may not account for replacement of hooks that are not lost but are replaced due to rust or other wear and tear reasons. On the other hand, the cost savings estimate does not account for the possibility that the hook replacement rate may increase as a result of switching to a weaker hook (which has a higher straightening rate, Bigelow et al. 2011), which would lower cost savings.

<u>Catch Reduction Costs</u>

This section describes the methodology and estimated cost to the deep-set longline fishery of the potential reductions in catch due to the use of a weaker circle hook. As described below, catch reductions may range from 0% to up to 10%, with an annual cost of $0 to $4.4 million for all 129 vessels.

Interviewed fishermen and owner/operators expressed concern that using small circle hooks with 4.0 mm wire diameter would reduce catch of the biggest and highest revenue bigeye tuna (100-plus pound fish). NMFS conducted research designed to determine whether using small circle hooks with 4.0 mm wire diameter results in a 10 percent or greater change in the total weight of bigeye tuna catch (Bigelow et al. 2011). Study results found no statistically significant differences in catch per unit effort among 4.0 mm wire diameter small circle hooks and the 4.5 mm wire diameter small circle hooks currently in use by much of the fishery, and no significant differences in mean length of 15 species of interest (though using weak hooks resulted in CPUE being statistically significantly higher by a small margin for yellowfin tuna and statistically significantly lower for spearfish). Additionally, while 4.0 mm wire diameter hooks straightened at a higher rate than 4.5 mm wire diameter hooks, one 128 kilogram bigeye tuna was retained on a 4.0 mm hook. Study results strongly indicate that any impacts on catch weight in the deep-set fishery would be less than 10 percent. However, due to the timeframe of the study (conducted during the winter months when there are fewer large fish caught) and the sample size, it is possible that effects on catch weight would be as high as 10 percent.

Results from the NMFS study suggest that effects on bigeye tuna catch are expected to be between zero to 10 percent. Moreover, any catch weight reduction due to weaker hooks would likely be limited to bigeye tuna catch, which are bigger on average, and would be unlikely to affect other tuna that are smaller fish. From 2006 to 2010, the average annual weight of bigeye tuna catch in the deep-set longline fishery was 11.37 million pounds. A ten percent reduction in this weight would be equal to 1.14 million pounds. As the annual average price from 2006 to 2010 (in 2010 adjusted dollars) was $3.84 per pound for bigeye tuna, the estimated reduced catch from use of 4.0 mm small circle hooks would cost the deep-set longline fishery $0 to $4,378,000 in annual revenue ($0 to $34,000 per vessel). Revenue in the shallow-set and deep-set fisheries averaged $488,000 per vessel from 2006 to 2010, so reduced bigeye tuna catch weight would result in an estimated zero to seven percent reduction in total average annual revenue in the deep-set fishery. It is expected that this would be a change in net revenue (or producer surplus), as there is little to no expected reduction in fishing costs or fishing effort associated with this reduced catch weight.

Reduction in the average size of catch may also affect the average price per pound, as larger fish may command higher prices. Although quantitative data on the factors determining price per pound is not available, a number of factors, including the size and freshness of a fish and harvest methods used directly affect the quality of fish and price obtained at auction (Pan and Pooley 2004). Based on interviews with longline vessel owners/operators, catch of larger bigeye tuna is often a determinant of profitability, and estimating potential economic impact based on average auction price may therefore underestimate total impacts.

### *Monofilament Leader/Branchline Requirement*

This section describes the cost of implementing the requirement that all branchlines/leaders in the deep-set longline fishery have a breaking strength of 400 pounds or greater, or be 2.0 mm or larger in diameter.

Based on interviews with longline owner/operators, all, or nearly all, deep-set longline vessels are believed to be using monofilament branchline/leaders. Boats that are not using 2.0 mm diameter monofilament line are believed to be using 1.8 mm as this is the smallest leader/branchline diameter commercially sold in Hawaii. The NMFS PIRO Hawaii Longline Observer Program collects data on the diameter of branchline/leaders on longline vessels. The data collected over time shows some inconsistency in observer measurement, as records for a given vessel sometimes indicate different branchline/leader diameter. However, the data indicates that over 85 percent of monofilament leaders/branchlines in use in the deep-set longline fishery are 2.0 mm diameter or larger. It is assumed that any line recorded with diameter greater than 1.8 mm was originally purchased as 2.0 mm diameter line that may have stretched in use.

Observer program data on all longline vessels show that there are 10 vessels for which the average recording of branchline diameter is equal to or less than 1.8 mm diameter, and an additional five vessels for which half or more of observations recorded use of branchline that is 1.8 mm diameter or smaller. Therefore, we estimate that there are 10 to 15 vessels that may have leaders/branchlines less than 2.0 mm diameter. This is consistent with information from interviews with owner/operators who indicate that almost all vessels use 2.0 mm diameter or greater line.

For the vessels that are not currently using 2.0 mm diameter or larger leader/branchline monofilament, we anticipate two types of potential costs of replacing existing line: 1) one-time capital cost of replacing existing line, and 2) ongoing change in line replacement cost. As summarized in Table 5.7, results indicate that the monofilament strength requirement for the Hawaii-based deep-set longline fishery is estimated to cost approximately $17,000 to $26,000 in one-time capital expenditures ($1,000 to $2,000 per affected vessel), with annual increased equipment costs of approximately $2,000 to $4,000 annually ($240 per affected vessel). On an annualized basis, these equipment costs are estimated to total $3,500 to $5,000 ($350 per affected vessel). Data sources include interviews with Hawaii-based, deep-set longline owner/operators, NMFS logbook data, and NMFS observer program data. Detailed information on how these costs were calculated are provided below.

**Table 5.7**: Estimated 2.0 mm Monofilament Replacement Cost Results to Deep-Set Longline Fleet.

| | All Vessel Costs | | Per Vessel Costs | |
|---|---|---|---|---|
| **Proposed Measure** | **One-time capital cost** | **Annual ongoing cost** | **One-time cost per vessel** | **Annualized cost per affected vessel[a]** |
| Replacement cost | $17,000 - $26,000 | $2,000 - $4,000 | $1,000 - $2,000 | $350 |

a/ Includes one-time and annual ongoing costs, over 20 years assuming a three percent discount rate

<u>One-time line replacement cost</u>
On average, approximately 40 feet of leader/branchline is used for every hook set (POP catalog, personal communication with owner/operator), amounting to 90,000 feet of line per vessel (2,200 hooks multiplied by 40 feet). Monofilament line is sold in five-pound coils, with a price of approximately $40 per coil. As there are approximately 430 feet per pound for 2.0 mm monofilament, an estimated 210 pounds of monofilament, or 42 coils are required per boat. One-time equipment cost to replace leader/branchline monofilament is thus estimated at approximately $1,700 per boat, or $17,000 to $26,000 for all 10 to 15 boats that may currently use weaker line (Table 5.7). Using a three percent discount rate over 20 years, the total annualized equipment cost of replacing hooks on ten to fifteen boats is estimated at approximately $1,000 to $2,000, or $100 per boat. Based on conversations with owner/operators, labor time to replace hooks would cover the labor requirement to replace branchline/leaders.

<u>Ongoing replacement cost</u>
Boats that are not using 2.0 mm diameter monofilament line are expected to be using 1.8 mm as this is the smallest leader/branchline diameter commercially sold in Hawaii. Monofilament that is 1.8 mm in diameter weighs 530 feet per pound, while monofilament that is 2.0 mm in diameter weighs 430 feet per pound. The stronger, 2.0 mm diameter line therefore costs approximately 23 percent more. Although NMFS logbook data do not include a measure of line lost, interviews with longline owners/operators suggest that approximately 4 percent of branchline may be lost per trip. Based on logbook data from 2006 to 2010, there is an average of 19 trips per longline vessel each year, suggesting that approximately 75 percent of branchline is lost annually. This indicates that approximately 68,000 feet of line per boat would need to be replaced annually. Increased annual cost to use 2.0 mm diameter line instead of 1.8 mm diameter line is therefore estimated at approximately $240 per boat, or $2,000 to $4,000 for those 10 to 15 boats currently using 1.8 mm line (Table 5.7).

### *MHI Longline Fishing Prohibited Area*

This section describes the cost to longline vessels of eliminating the seasonal boundary contraction from October to January of the longline fishing exclusion zone, and maintaining the larger closure (the February-September boundary) year-round. Elimination of the seasonal contraction in the longline fishing exclusion zone would mean longline fishing would no longer be allowed in the area formerly open between October-January, and would be expected to cause effort within this zone to be relocated elsewhere. Economic impacts to longline fishermen would depend on the location and degree of this effort redistribution and the number of existing fishing trips to this zone. This study estimates incremental cost to longline vessels of relocating trips from the area currently open only between October-January (estimated at 38 trips annually by the deep-set longline fishery and less than 1 trip annually by the shallow-set fishery) to waters just outside of the proposed year-round closure boundary. See below for explanation of the estimated number of trips to this zone annually.

The "seasonal contraction zone" where longline fishing is currently allowed only between October and January currently represents the closest available fishing to shore open to Hawaii longline fishermen. Assuming no decrease in fishing effort, eliminating the seasonal shoreward contraction of the boundary (i.e., maintaining the current February-September boundary year-round) would cause vessels to relocate their effort to areas farther from shore by 30 nautical miles (the average width of the contraction zone) for four months each year (i.e., October-January, when fishing was previously allowed in that area). Four primary types of potential costs relating to increased trip length are evaluated below: 1) increased fuel cost of traveling farther from shore, 2) increased travel time opportunity cost (reduced time available for fishing), 3) change in revenues due to differences in catch rate or size of fish in this zone compared to other areas between October-January, and 4) reduction in total effort. As summarized in Table 5.8, combined travel and fuel costs are estimated to range between $76,000 and $87,000, assuming maximum change in travel distance and no change in effort. No change in revenue due to catch rates or size of fish caught is expected, and the effect on total effort is uncertain.

**Table 5.8.** Estimated Cost of closure of MHI Longline Fishing Prohibited Area to Deep-Set Fishery.

| **MHI Longline Fishing Prohibited Area** | **Annual cost, all trips all vessels** | **Annual cost per trip** |
|---|---|---|
| Fuel Cost | $8,000 - $19,000 | $200 - $500 |
| Travel Time Cost | $68,000 | $1,800 |
| **Total** | $76,000 - $87,000 | $2,000 |

To estimate increased travel and fuel costs, the number of existing trips to the seasonal contraction zone is necessary. NMFS logbook data for longline fishing within the EEZ around Hawaii, plotted at a resolution of five degree squares (e.g., geographic areas such as the area bound by 150 to 155 degrees west and 15 to 20 degrees north), were used to estimate existing longline fishing effort (i.e. number of sets) and associated trips within the seasonal contraction zone. Using geographic information systems (GIS) analysis, we estimated the percent of area currently open to longline fishing in each five degree square that is located in the seasonal contraction zone. We assume that fishing effort (number of sets) is evenly distributed throughout each five degree square, and estimate the proportion of effort within the seasonal contraction zone as equivalent to the proportion of area within the seasonal contraction zone. For example, for the five degree square in our example above (150 to 155 degrees west and 15 to 20 degrees north), approximately six percent of area open to longline fishing is located in the seasonal contraction zone. We therefore assume 6% of all longline fishing effort in that five degree square occurs in the seasonal contraction zone. Because trips span multiple five degree squares while sets indicate precise fishing location, we convert the number of sets to number of trips based on the average number of sets per trip. Between October to January from 2006 to 2010, the average number of sets within the EEZ per deep-set trip was 7. The average number of annual deep-set sets in the seasonal contraction zone from 2006 to 2010 was 270, so we estimate 38 deep-set trips in this zone. From 2006 to 2010, there was little to no effort by the shallow-set fishery in this zone. Therefore, we estimate that there are 38 trips annually by the longline fleet to the seasonal contraction zone, all by the deep-set fishery.

Literature Review on Closure Areas

Area closures lead to relocation of fishing effort (Chakravorty and Nemoto, 2002), and anticipated economic impact to longline fishermen depends on the nature of this effort redistribution. Chaktravorty and Nemoto (2000) developed a model for evaluating the spatial redistribution of longline fishing effort, and economic impacts of area closures in Hawaii. Their study suggests that inshore area closure in Hawaii causes vessels to fish farther from shore, leading to a reduction in the number of total trips and an increase in trip length (the number of days on each). Because the total number of fishing days declines as a result of fewer trips taken and longer travel time, Chaktravorty and Nemoto (2000) identify a negative effect on fishing income.

A survey of Hawaiian longline fishermen conducted by Hamilton, Curtis and Travis (1996) identifies fishermen's primary concerns regarding fishery management and regulation in Hawaii. The survey finds that vessels targeting tuna were most affected by area closures within the fishery. Although cost associated with the MHI Longline Fishing Prohibited Area are not quantified within this survey, nearly all longline fishermen claimed an increase in operating costs (mainly in the form of fuel and food) due to increased trip length, and a subsequent decrease in revenue. Fishermen also noted that the closure of fishing areas close to shore leads to a higher economic risk of fishing, because higher operating expenses increase the losses incurred by a low catch trip. The same concerns were voiced by fishermen and vessel owners/operators interviewed for this analysis.

The response to area closures would likely include longline vessels seeking alternative fishing locations that would maximize profit. As suggested by Chaktravorty and Nemoto (2000), relocation of vessels would most likely occur to familiar, nearby waters, as well as waters with comparably high catch. The nature of effort relocation caused by area closures and subsequent effects on vessel earnings and local stock abundance are difficult to quantify. For example, Nguyen and Lueng (2009) identify that captains are likely to increase time spent at sea in order to meet specific revenue targets for a trip, thereby reducing time spent on shore, and possibly limiting the total number of trips taken. However, capacity constraints such as fuel and the need to preserve fish quality may limit the length of trips, especially for smaller vessels or vessels without ice makers on board. Thus, by increasing travel time, area closure near shore may reduce the number of fishing days available to vessels per trip, effects that would likely be accentuated for smaller vessels.

Another uncertainty exists in the effect of vessel relocation on local stock abundance of tuna within the EEZ around Hawaii. Catch Per Unit Effort (CPUE), the number of fish caught per hook set, is commonly used as an index of local abundance in fisheries (He and Boggs 1995, Chakravorty and Nemoto 2002). In a 30-year time series analysis of catch and CPUE in the EEZ around Hawaii, He and Boggs (1995) find no significant relationship between overall catch and CPUE of bigeye and yellowfin tuna, for either longline or troll fishermen. Although the study does identify a negative relationship between local catches and CPUE at a lag of two months, this relationship is considered inconclusive due to a multitude of factors. For example, local abundance of both bigeye and yellowfin tuna is thought to vary at a monthly scale because both species are highly mobile and widely distributed, and because fish are thought to migrate to certain areas on a seasonal basis, creating a strong seasonal effect in local abundance. Moreover, He and Boggs note that local catches likely have little effect on overall population abundance because only a fraction of stocks are thought to be available to Hawaii fisheries.

Additionally, based on conversations with fishermen, the perception and expectation of significant impacts on revenue, independent of actual impacts, may prompt some vessels to change their fishing behavior or exit the fishery. In their 2003 study, Pradhan and Lueng evaluate factors affecting exits from the Hawaiian longline fishery between 1991 and 1998. Pradham and Lueng observe that a number of factors, including earning potential, vessel size, crowding, resource abundance, and managerial factors directly affect whether fishermen choose to exit the fishery or stay. Multiple studies (Chakravorty and Nemoto 2002, Nguyen and Luen 2009) additionally emphasize that a perceived decrease in potential earnings and congestion caused by area closures may cause longline fishermen to stop fishing or exit the fishery. These studies emphasize that the decision to exit or remain in the fishery typically depends on a vessel owner's independent profit analysis, and would vary depending on a vessel's previous and projected revenue.

Fuel Cost

This section describes the methodology and estimated cost to the deep-set and shallow-set longline fisheries of increased fuel cost of eliminating the seasonal, shoreward contraction of the MHI Longline Fishing Prohibited Area boundary (i.e., maintaining the current February-September boundary year-round). As described below, if there is no reduction in the number of vessel trips, total fuel costs for all affected trips may rise by $8,000 to $19,000 annually (Table 5.8).

Fuel is estimated to represent the largest single variable cost to longline fishing, accounting for approximately 30% of daily variable costs according to a 1996 survey by Hamilton, Curtis & Travis. Moreover, conversations with longline owners/operators suggest that fuel costs vary substantially based on fuel prices and trip length, and may reach up to 80% of variable trip costs at times. The "seasonal contraction zone" averages 30 nautical miles in width, so we assume that eliminating the contraction of the Prohibited Area's boundary would force vessels currently traveling to fish in this area to travel 60 additional nautical miles round trip. This assumes that all longline fishing in the area starts immediately at the shoreside boundary (i.e., at the current October-January boundary). As some fishing trips to the seasonally open area may begin fishing effort farther from shore, this analysis estimates the maximum increase in fuel and travel time cost.

Interviews with longline owner/operators indicate that the average vessel uses approximately one to 2.5 gallons of fuel per nautical mile traveled, depending on vessel size. Assuming cost of $3.35 per gallon (NMFS cost model data), eliminating the seasonal, shoreward contraction of the MHI Longline Fishing Prohibited Area boundary and increasing nautical miles traveled by 60 nautical miles round trip is estimated to increase the cost of fuel per trip by approximately $200 to $500 total (Table 5.8).

Based on NMFS longline logbook data, an average of 38 trips are made each year within the "seasonal contraction zone," representing 2.2% of all trips (deep-set and shallow-set) made annually by the longline fisheries. Thus the total increased fuel cost would be expected to be a maximum of $8,000 to $19,000 annually for all vessels (Table 5.8).

Travel Time Cost

In addition to fuel cost, increases in travel time will decrease available time for fishing. This section describes the methodology and estimated cost to the deep-set longline fishery of increased travel time. As described below, assuming the same number of trips and the same trip length, total travel time costs for all 129 vessels are estimated to total as much as $68,000 annually (based on reduced catch revenue due to reduced time spent fishing) (Table 5.8).

Average vessel speed among longline vessels is estimated at 7.3 miles per hour (Nguyen and Lueng 2009), so travel time per trip may increase by approximately eight hours if vessels travel an additional 30 miles from shore, or an additional 60 miles round trip. It is expected that the cost of this increased travel time is a reduction in time spent fishing, and associated reduction in catch revenue. We estimate the average annual catch value per hour of fishing to assess the cost of increased travel time. Based on the fishery's total average annual revenue of $66.3 million from 2006 to 2010, 129 vessels, 143 sets per longline vessel per year, and one set per day, the average revenue per vessel day spent fishing is estimated at approximately $3,600 per day. Assuming eight additional hours of travel reduce time spent fishing by half of one day per trip (a typical set lasts 19 hours), the opportunity cost of additional travel time associated with the proposed modifications to the MHI Longline Fishing Prohibited Area is estimated to be a maximum of $1,800 per trip (half of a day's fishing revenue). Similar to the fuel cost analysis, this travel time cost analysis estimates the maximum increase in cost as it assumes that all existing trips in the "seasonal contraction zone" begin fishing effort immediately upon entering the area where longline fishing is allowed (and would therefore face the full 60 nautical mile round trip increased travel distance).

Based on NMFS longline logbook data, an average of 38 trips are made each year within the seasonal contraction zone, representing 2.2% of all trips (deep-set and shallow-set) made annually by the longline fisheries. Thus, the total effect of increased travel time is estimated to be as high as $68,000 annually.

Change in Catch Rates or Size of Fish Caught

Several owner/operators noted that the seasonal contraction of the boundary of the MHI Longline Fishing Prohibited Area was established because this area is not only closer to shore, but also provides access to large bigeye tuna that are migrating through this area during the winter months (October-January). As summarized in Table 5.9, logbook data suggest that between 2006 and 2010 there was no significant difference in the average size of bigeye tuna caught in this area. Moreover, logbook data indicate that the abundance of fish, characterized by CPUE, was 36% lower in the "seasonal contraction zone" between 2006 and 2010 than elsewhere within the fishery on average. As illustrated in Figure 5.3, this relationship also holds on a monthly basis: average weight of bigeye tuna caught is comparable between the "seasonal contraction zone," within the EEZ around Hawaii, and within the deep-set fishery as a whole. These statistics suggest that there is no catch weight or effort advantage to fishing within the "seasonal contraction zone" beyond the proximity to shore. This analysis indicates that the primary effects on cost of eliminating the seasonal, shoreward contraction of the MHI Longline Fishing Prohibited Area are the travel time and fuel cost savings discussed above.

**Table 5.9**. Catch Rates, Tuna Weight, and Size of Bigeye Kept, 2006 – 2010 Annual Averages.

| | Year | | | | | |
|---|---|---|---|---|---|---|
| **Logbook Variable** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006 – 2010 Average** |
| **Total Weight Kept** | | | | | | |
| **Tuna Weight (lbs) Kept in Seasonal Contraction Zone (January, October, November, December)** | 237,017 | 239,192 | 181,455 | 190,470 | 92,554* | 188,138 |
| **Tuna Weight (lbs) Kept Fishery Total (Annual)** | 126,023,61 | 15,277,418 | 15,992,835 | 11,953,561 | 14,357,695 | 14,036,774 |
| **Proportion Annual Tuna Weight Caught in Seasonal Contraction Zone** | 2% | 2% | 1% | 2% | 1% | 1% |
| **Size of Bigeye Kept** | | | | | | |
| **Average Weight of Bigeye Tuna Kept in Seasonal Contraction Zone (January, October, November, December)** | 82 | 76 | 83 | 89 | 80 | 82 |
| **Average Weight of Bigeye Tuna Kept Fishery Total (January, October, November, December)** | 81 | 75 | 80 | 84 | 83 | 81 |
| **Size of Bigeye in Seasonal Contraction Zone relative to Fishery Total (January, October, November, December)** | 100% | 100% | 103% | 105% | 96% | 101% |
| **Fishing Effort (Catch per Hook)** | | | | | | |
| **CPUE (all catch) in Seasonal Contraction Zone (January, October, November, December)** | 1.10% | 1.15% | 1.02% | 0.92% | 0.97% | 1.03% |
| **CPUE (all catch) Fishery Total (January, October, November, December)** | 1.43% | 1.86% | 1.70% | 1.44% | 1.57% | 1.60% |
| **CPUE (all catch) in Seasonal Contraction Zone relative to Fishery Total (January,** | 77% | 62% | 60% | 64% | 62% | 64% |

| | Year | | | | | |
|---|---|---|---|---|---|---|
| **Logbook Variable** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006 – 2010 Average** |
| **October, November, December)** | | | | | | |

*excludes catch data from the month of December

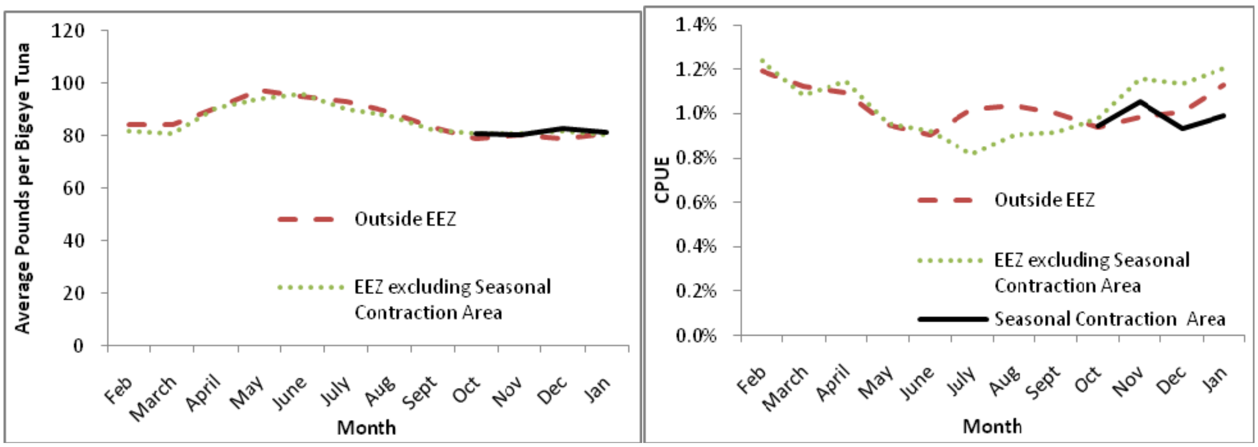


**Figure 5.3.** Comparison of Average Size of Bigeye Tuna Kept and average CPUE by Zone by Month, 2006 to 2010. Whereas the average weight per bigeye tuna caught co-varies throughout the fishery on a monthly basis, noticeable regional differences in CPUE are evident. Between October and December, during which time a seasonal contraction of the MHI Longline Fishing Prohibited Area occurs, CPUE is highest on average within areas of the EEZ outside of the seasonal contraction zone, and lowest on average within the seasonal contraction zone.

Reduction in Fishing Effort

Estimates discussed above of the cost to the fishery of increased fuel and travel costs assume no change in the number or length of fishing trips. However, it is possible that modifying the boundaries of the MHI Longline Fishing Prohibited Area to eliminate the seasonal, shoreward contraction would result in less fishing effort due to increased fuel and travel costs, as identified in the above literature review on effects of closure areas on fisheries.

However, due to annual catch limits on bigeye tuna, under existing conditions, effort may be curtailed at the end of the year when the area closer to shore is open to longline fishing. The bigeye catch limit imposed by the Western and Central Pacific Fisheries Convention Implementing Act for 2009 to 2011 (to be renegotiated for 2012 to 2014), caps total bigeye catch by the Hawaiian-based fleet west of 150 degrees longitude at 8,278,600 pounds. Once the catch limit is reached, then no additional longline landings of bigeye caught west of 150 degrees are allowed, though landings are allowed east of 150 degrees, farther from the Hawaiian Islands. In 2009, the bigeye fishery was closed on November 22, and in 2010 it was closed on December 29 due to reaching the catch limit. The effect of modifying the boundary of the MHI Longline Fishing Prohibited Area on fishing effort and catch may therefore be reduced as 1) the bigeye fishery may be closed during at least part of the time when the boundary currently contracts (October-January), and 2) catch limits may still be met if there is more effort potential in the fishery than catch limits allow (as indicated by closures in previous years).

## *Annual Certification for Operators / Owners*

This section discusses the cost to the longline fishery of enhancing existing Protected Species Workshop (PSW) trainings for owner/operators to include education on ways to minimize M&SI of marine mammals. The ongoing cost to all owner operators due to the additional time requirement is estimated at

$600 to $1,400 annually. The primary data source for this estimate is personal communication with NMFS. As all, or nearly all, longline boats participate in the deep-set fishery and would be required to attend these workshops as deep-set owner/operators, there are little to no expected additional costs of this requirement specific to the shallow-set fishery.

According to NMFS, this requirement may increase owner/operator time for PSW trainings by 15 minutes (web course workshop) to 20 minutes (classroom workshop). We assume that there are one to two operators/owners per vessel. However, permit data indicates that there are approximately 85 owners, due to some individuals owning/operating multiple vessels. We estimate that there are approximately 125 to 200 owner/operators that would be required to devote 15 to 20 minutes of time, for a total of 30 to 70 hours. Based on an estimated opportunity cost of $20 per hour, enhanced training would cost owner/operators approximately $600 to $1,400 annually.

### *Marine Mammal Handling / Release Placard*

This measure would require posting of a placard developed and distributed by NMFS. There are no expected costs to longline vessels of posting this placard and following its direction (confirmed in owner/operator interviews).

### *Captain Supervision of Marine Mammal Handling / Release*

This measure would require captains to supervise the handling and release of hooked or entangled marine mammals. Based on interviews with longline vessel operators, there are no expected costs to longline vessels of following this requirement.

### *Captain Notification Placard*

This measure would require posting of a placard developed and distributed by NMFS. There are no expected costs to the longline vessels of posting this placard and following its direction (confirmed in owner/operator interviews).

### *Southern Exclusion Zone*

This section describes the cost to deep-set longline vessels of establishing a Southern Exclusion Zone (SEZ). Similar to the closure of the MHI Longline Fishing Prohibited Area, closure of the SEZ is expected to cause effort within this zone to be relocated elsewhere, and economic impacts to longline fishermen would depend on the location and degree of this effort redistribution, and the number of existing fishing trips to this zone. This study estimates incremental cost to longline vessels currently fishing in this zone of relocating beyond the southern boundary of the SEZ (outside of the EEZ). As indicated in Table 5.10 below, total costs of this closure area, estimated based on increased fuel and travel costs, are estimated to be as high as $3.5 million annually (assuming the maximum increased travel distance due to effort relocation). Fishing effort could be relocated elsewhere, including to other, open areas within the EEZ around Hawaii. In that case, costs are expected to be lower.

Under this requirement, the Southern Exclusion Zone (SEZ) would be closed to deep-set longline fishing if observed false killer whale takes (determined to be mortalities or serious injuries) exceed a defined ‘trigger’(see section 2.3.2.8 for more details). Under the current PBR (2.5 take per year) and observer coverage levels (20 percent), the trigger would be established at two observed takes. Once there are two observed takes in one year, then the SEZ would be closed for the rest of the fishing (calendar) year and would re-open in January of the following year. One additional take in any of the following four years would result in a longer term closure; re-opening would occur at NMFS’ discretion, based on bycatch levels and other considerations.

Because the other proposed take reduction measures (e.g., weak circle hooks) aim to reduce take from current levels, using current rates of take is not an appropriate basis for estimating take rates that would occur under the Preferred Alternative. In the potential worst case scenario, triggers would be hit such that the SEZ would almost always be closed, while in the best case scenario the triggers would never be hit. As it is not known to what extent other measures would reduce take, this analysis estimates the monthly and annual cost of closing the SEZ.

Closing the SEZ to deep-set longline fishing would have the same types of effects as modifying the boundary of the MHI Longline Fishing Prohibited Area: 1) increased fuel cost of traveling further from shore, 2) increased travel time opportunity cost (reduced time available for fishing), 3) change in revenues due to catch rate or size of fish in this zone relative to other areas, and 4) potential reduction in fishing effort. To estimate these potential costs, data sources include interviews with Hawaii-based, deep-set longline owner/operators and NMFS logbook data.

It is assumed that vessels currently fishing in the SEZ would relocate to just outside the SEZ boundary, based on the assumption that vessels are inclined to fish in familiar locations (Chakravorty and Nemoto 2002). Similar to the analysis for the MHI Longline Fishing Prohibited Area, we assume that all fishing effort in the SEZ begins at the nearshore boundary of the SEZ (i.e., the edge of the EEZ). We therefore estimate an increase in travel distance due to relocation as the entire average width of the SEZ, which is a maximum increase in travel distance, as fishermen may choose to relocate to other areas that do not require as great an increase, if any, in travel distance. By assuming that all longline fishing in the SEZ currently starts immediately at the nearshore boundary of the zone, potential fuel and travel time costs may be overestimated depending on the actual distribution of where vessels start fishing within the SEZ.

As for the MHI Longline Fishing Prohibited Area, the analysis of existing longline fishing effort is based on NMFS logbook data for fishing within the EEZ around Hawaii, plotted at a resolution of five degree squares (e.g., geographic areas such as the area bound by 150 to 155 degrees west and 15 to 20 degrees north). Using GIS analysis, we estimated the percent of area currently open to longline fishing in each five degree square that is located in the SEZ, based on the assumption that fishing effort and number of trips is evenly distributed throughout each five degree square. Using logbook data from 2006 to 2010, we estimate that there are 360 deep-set longline trips in the SEZ each year.

**Table 5.10.** Estimated Cost of closure of Southern Exclusion Zone to Deep-Set Longline Fishery.

| Southern Exclusion Zone | Annual ongoing cost | Annual ongoing cost per trip |
|---|---|---|
| Fuel Cost | $362,000 - $904,000 | $1,000 - $2,500 |
| Travel Time Cost | $2,579,000 | $7,000 |
| **Total** | $2,941,000 - $3,483,000 | $8,000 - $10,000 |

Fuel Cost

Assuming no reduction in fishing effort, this section discusses the methodology and fuel cost estimate of relocating deep-set longline fishing from the SEZ to other areas (i.e., the worst-case scenario of all deep-set longline fishing moving to the high seas just beyond the southern boundary of the SEZ). Based on logbook data on location of fishing effort and data on fuel costs and efficiency, the total fuel cost to the longline fleet of closing the SEZ is estimated to range from $362,000 to $904,000 annually, assuming the maximum increased travel distance (Table 5.10).

The SEZ averages approximately 150 nautical miles in width (measured from the shoreside boundary to the EEZ boundary), so prohibiting deep-set longline fishing within the SEZ would require vessels currently fishing in this zone to travel at most 300 nautical miles more on a round trip. Interviews with longline owner/operators indicate that the average vessel uses approximately one to 2.5 gallons of fuel per nautical mile traveled. Assuming cost of $3.35 per gallon (NMFS cost model data) indicates that prohibiting deep-set longline fishing within the SEZ may increase the cost of fuel per trip (for those trips currently in the SEZ) by as much as $1,000 to $2,500 (Table 5.10).

NMFS logbook data indicate that there were an average of 360 deep-set trips annually within the SEZ between 2006 and 2010. Based on these numbers, if there is no change in fishing effort, then the maximum annual increased fuel cost of the SEZ for all vessels would be estimated to range from $362,000 to $904,000 (Table 5.10).

Travel Time Cost

Again, assuming no reduction in fishing effort, this section discusses the methodology and travel time cost estimate of relocating fishing from the SEZ to other areas. Based on logbook data on location of fishing effort, data on travel speed, and value of catch per fishing day, the total forgone fish catch revenue to the longline fleet of additional travel time is estimated at a maximum of $2,579,000 annually.

As longline vessel speed averages approximately 7.3 miles per hour, travel time may increase by as much as approximately 41 hours per trip due to the closure of the SEZ, or approximately 20 hours each on the outbound and inbound journeys. This analysis conservatively assumes that trip length remains constant, as it is assumed that this is necessary in order to maintain catch freshness and also because it is assumed that trip length is currently optimized in the fishery. If trip length remains constant, then it is expected that the cost of this increased travel time is a reduction in time spent fishing, and associated reduction in catch revenue. Based on the fishery’s total average annual revenue of $66.3 million from 2006 to 2010, 129 vessels, 143 sets per vessel per year, and one set per day, the average revenue per vessel per day fishing is estimated at $3,600. The opportunity cost of additional travel time of the SEZ is thus estimated at approximately $7,000 per trip, assuming the equivalent of two fishing days is spent travelling the additional distance. Based on an annual average of 360 deep-set trips in the SEZ between 2006 and 2010, total annual travel time cost for all vessels is estimated to be approximately $2,579,000, or an average of approximately $7,000 per trip.

Change in Catch Rates or Size of Fish Caught

If catch rates or size of fish caught in the SEZ is greater than other areas open to longline fishing, then revenue per hour of effort may decrease due to closure of the SEZ. However, NMFS logbook data suggests that the average size of bigeye tuna caught in the SEZ is approximately 4% smaller than the average bigeye caught throughout the whole fishery on average between 2006 and 2010 (Table 5.11). Additionally, the tuna catch rate, assessed through CPUE, is nearly identical between the SEZ and fishery as a whole. Although average size and catch rate of tuna is highly variable across the fishery, these yearly averages suggest that there would be minimal annual reduction in the size or quantity of fish caught per unit effort due to the closure of the SEZ. Furthermore, as this analysis assumes no change in trip length, only number of days fished, no change in quality or associated prices based on the time lapse from landing to market is anticipated.

**Table 5.11.** Catch Rates, Effort, and Size of Bigeye Kept.

| | Year | | | | | |
|---|---|---|---|---|---|---|
| **Logbook Variable** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006 – 2010 Average** |
| **Total Weight Kept** | | | | | | |
| **Tuna Weight (lbs) Kept in SEZ (Annual)** | 1,663,912 | 1,789,735 | 2,063,542 | 764,598 | 722,590 | 1,400,875 |
| **Tuna Weight (lbs) Kept Fishery Total (Annual)** | 12,602,361 | 15,277,419 | 15,992,835 | 11,953,561 | 14,357,696 | 14,036,774 |
| **Proportion Annual Tuna Weight Caught in SEZ (Annual)** | 13% | 12% | 13% | 6% | 5% | 10% |
| **Size of Bigeye Kept** | | | | | | |
| **Average Weight of Bigeye Tuna Kept in SEZ** | 82 | 79 | 78 | 87 | 85 | 82 |

| | Year | | | | | |
|---|---|---|---|---|---|---|
| **Logbook Variable** | **2006** | **2007** | **2008** | **2009** | **2010** | **2006 – 2010 Average** |
| **Average Weight of Bigeye Tuna Kept Fishery Total (Annual)** | 84 | 82 | 87 | 86 | 88 | 85 |
| **Size of Bigeye in SEZ Relative to Fishery Total (Annual)** | 97% | 97% | 90% | 101% | 97% | 96% |
| **Fishing Effort (Catch per Hook)** | | | | | | |
| **CPUE (all catch) in SEZ** | 1.11% | 1.72% | 1.86% | 1.24% | 1.25% | 1.44% |
| **CPUE (all catch) Fishery Total (Annual)** | 1.13% | 1.27% | 1.43% | 1.07% | 1.06% | 1.19% |
| **CPUE in SEZ Relative to Fishery Total (Annual)** | 99% | 136% | 130% | 115% | 117% | 120% |

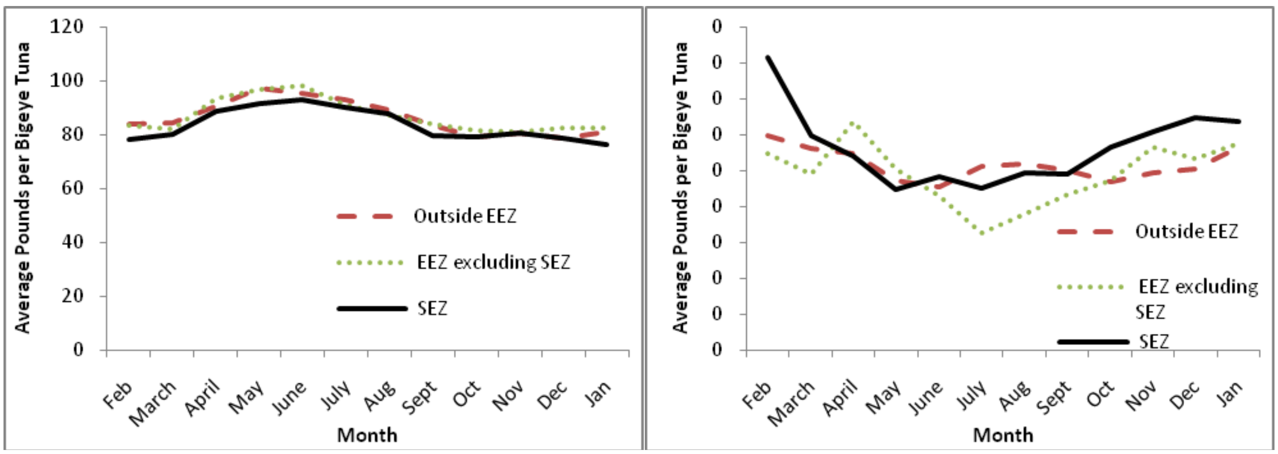


**Figure 5.4.** Comparison of Average Size of Bigeye Tuna Kept and average CPUE by Zone by Month, 2006 to 2010. Whereas the average weight per bigeye tuna caught co-varies throughout the fishery on a monthly basis, no distinct monthly trend is evident for CPUE between the SEZ, the rest of the EEZ, and areas outside the EEZ (i.e., high seas). The monthly and regional variability of CPUE nevertheless indicate that catch rates are variable over space and time.

<u>Reduction in Fishing Effort</u>

Estimates discussed above of the cost to the fishery of increased fuel and travel cost assume no change the number or length of fishing trips. The cost of changes in fishing effort due to increased travel time and associated reduced fishing effort are estimated as a travel time cost. Furthermore, fishing effort would not be expected to change as a result of potential differences in catch or CPUE in the SEZ compared to other areas because, as the data show, these differences are minimal. However, it is possible that the closure of the SEZ would result in further reductions in fishing effort because increased fuel and travel costs may lead to decreased profitability or potential exit of some vessels from the fishery, as identified in the above literature review on effects of closure areas on fisheries.

### *Non-Regulatory Measures*

These measures include administrative and other actions carried out by NMFS, and would not have any costs of the longline fisheries.

## Alternative 3: Close the EEZ around Hawaii to commercial longline

## fishing year-round

This section describes the cost to deep-set longline vessels of closing the entire EEZ around Hawaii to commercial longline fishing. Similar to the closure of the MHI Longline Fishing Prohibited Area and the SEZ, closure of the EEZ would be expected to cause effort within this zone to be relocated elsewhere. Economic impacts to longline fishermen would depend on the location and degree of this effort redistribution, as well as the number of fishing trips currently occurring in the EEZ. This study estimates the incremental cost to longline vessels currently fishing in the EEZ of relocating this effort to outside the EEZ.

This alternative would close the EEZ to all longline fishing, and would have the same types of effects as closing the MHI Longline Fishing Prohibited Area and the SEZ. There are four primary types of potential costs of this closure: 1) increased fuel cost of traveling further from shore, 2) increased travel time opportunity cost (reduced time available for fishing), 3) change in revenues due catch rate or size of fish in the EEZ compared to the high seas, and 4) change in effort due to increased costs. As summarized in Table 5.12, total costs of this closure area, estimated based on increased fuel and travel costs, are estimated to be as high as $8.6 to $10.2 million annually (assuming the maximum increased travel distance due to effort relocation). Nearly all of this cost (an estimated 94 percent) would be borne by the deep-set longline fishery.

This analysis focuses on the longline fishing trips currently in the EEZ, which are primarily deep-set trips. This analysis includes any trip that had at least one set in the EEZ. Between 2006 and 2010, there were approximately 1,014 trips annually by the deep-set longline fishery, while between 2007 and 2010 there were approximately 40 trips annually by the shallow-set longline fishery within the EEZ. Using a five-year average may overstate the number of trips that would occur within the EEZ in the future as trips within the EEZ have been recently declining (Figure 5.5). For example that in 2010, approximately 21 percent of deep-set longline sets occurred inside the EEZ, but in 2006 44 percent of sets occurred inside the EEZ.

To estimate these potential costs, data sources include interviews with Hawaii-based, deep-set longline owner/operators and NMFS logbook data.

**Table 5.12.** Estimated Cost of Closure of Economic Exclusion Zone, Deep-Set and Shallow-Set Fisheries.

| Economic Exclusion Zone | Annual ongoing cost | Annual ongoing cost per trip |
|---|---|---|
| Fuel Cost | $1,059,000 - $2,648,000 | $1,000 - $2,500 |
| Travel Time Cost | $7,553,000 | $7,000 |
| **Total** | $8,612,000 - $10,201,000 | $8,000 - $10,000 |

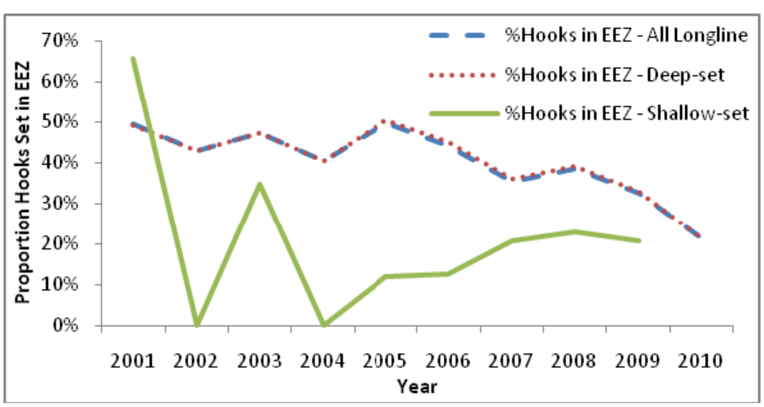

**Figure 5.5.** Proportion Hooks Set in EEZ by Shallow-Set and Deep-Set Longline Fisheries.

Fuel Cost

Once out of the existing MHI Longline Fishing Prohibited Area, there is a band of approximately 150 nautical miles within the EEZ that is open to longline fishing. Boats currently traveling to fish in the EEZ travel a maximum of 150 nautical miles less than if they were required to fish outside of the EEZ, or 300 miles round trip. Interviews with longline owner operators indicate that the average vessel uses approximately one to 2.5 gallons of fuel per nautical mile traveled. Assuming a cost of $3.35 per gallon (NMFS cost model data) closing the EEZ is estimated to increase the cost of fuel per trip by approximately $1,000 to $2,500. Assuming there are 1,054 deep-set and shallow-set trips within the EEZ annually, and that these trips are replaced by trips outside the EEZ, the increased fuel cost is estimated at approximately $1,059,000 to $2,648,000 annually (Table 5.12). This is the maximum increased fuel cost based on no change in the number of trips and the maximum difference in travel distance.

Travel Time Cost

Vessel speed averages 7.3 miles per hour, so travel time may increase by approximately 41 hours. It is expected that the cost of this increased travel time is a reduction in time spent fishing, and associated reduction in catch revenue. Based on the fishery's total average annual revenue per vessel of $66.3 million from 2006 to 2010, 129 vessels, 143 sets per vessel per year, and an assumption of one set per day, the average revenue per vessel per day fishing is estimated at $3,600. The opportunity cost of additional travel time of closing the EEZ is thus estimated at approximately $7,000 per trip, assuming the equivalent of two fishing days is spent travelling the additional distance (Table 5.12). Assuming that 1,054 EEZ trips are replaced by trips outside the EEZ, the increased travel time cost is estimated at approximately $7,553,000 annually. This is the maximum increased opportunity cost of travel time cost based on no change in the number of trips made and the maximum difference in travel distance.

Change in Catch Rates or Size of Fish Kept

Closing the EEZ may also affect catch rates or size of fish caught. Logbook data was used to identify if the EEZ has higher CPUE or larger size fish than other areas where the fishery operates. As shown in Table 5.13, the catch rate and size of fish kept is the same or higher in nearly all months of the year; therefore revenue per level of effort is not anticipated to be affected by closing the EEZ to commercial longline fishing.

A number of variables trend seasonally, including the spatial distribution of longline trips, price received at auction, and total quantity of fish caught and hooks set. Based on a five year average, the number of trips occurring within the EEZ spikes annually between the months of October and January, likely due to the contraction in the boundary of the MHI Longline Fishing Prohibited Area. During these months, the average number of deep-set trips occurring within the EEZ increased from less than 60 trips per month between April and September, to almost 160 trips per month at an annual peak in December.

Annually, bigeye tuna accounts for 82 percent of total pounds of tuna caught within the deep set longline fishery, and is the chief revenue source for deep-set longline fishermen overall. Whereas the percent bigeye of total tuna caught outside the EEZ is relatively constant year round at an average of 82.5 percent, bigeye catch as a percent of total tuna catch varies seasonally within the EEZ, dipping as low as 40 percent in July, and peaking above 85 percent between October and January.

However, as indicated in Table 5.13 and Figure 5.6 below, the data for the deep-set fishery do not suggest that fishing in any season in the EEZ is associated with increased CPUE (pounds of fish caught per hook set) or average size of fish caught. This observation suggests that seasonal benefits of fishing within the EEZ are mainly related to convenience and distance to shore, rather than increased catch weight per hook set.

**Table 5.13.** Comparison of Tuna Weight, Catch Rates and Size of Bigeye Kept In and Out of EEZ.

| | Year | | | | | |
|---|---|---|---|---|---|---|
| **Logbook Variable** | 2006 | 2007 | 2008 | 2009 | 2010 | 2006 – 2010 Average |
| **Total Weight Kept** | | | | | | |
| **Tuna Weight (lbs) Kept in EEZ** | 5,117,184 | 4,905,491 | 5,643,140 | 3,672,060 | 2,587,445 | 4,385,064 |
| **Tuna Weight (lbs) Kept Fishery Total** | 12,602,361 | 15,277,419 | 15,992,835 | 11,953,561 | 14,357,696 | 14,036,774 |
| **Proportion Tuna Weight Caught in EEZ** | 41% | 32% | 35% | 31% | 18% | 31% |
| **Size of Bigeye Kept** | | | | | | |
| **Average Weight of Bigeye Tuna Kept in EEZ** | 82 | 78 | 82 | 90 | 85 | 83 |
| **Average Weight of Bigeye Tuna Kept Fishery Total** | 84 | 82 | 87 | 86 | 88 | 85 |
| **Size of Bigeye from EEZ Relative to Fishery Total** | 97% | 95% | 94% | 104% | 96% | 97% |
| **Fishing Effort (Catch per Hook)** | | | | | | |
| **CPUE (All Catch) EEZ** | 0.93% | 1.11% | 1.32% | 0.90% | 0.92% | 1.04% |
| **CPUE (All Catch) Fishery Total** | 1.13% | 1.27% | 1.43% | 1.07% | 1.06% | 1.19% |
| **CPUE (All Catch) in EEZ Relative to Fishery Total** | 83% | 88% | 92% | 84% | 86% | 87% |

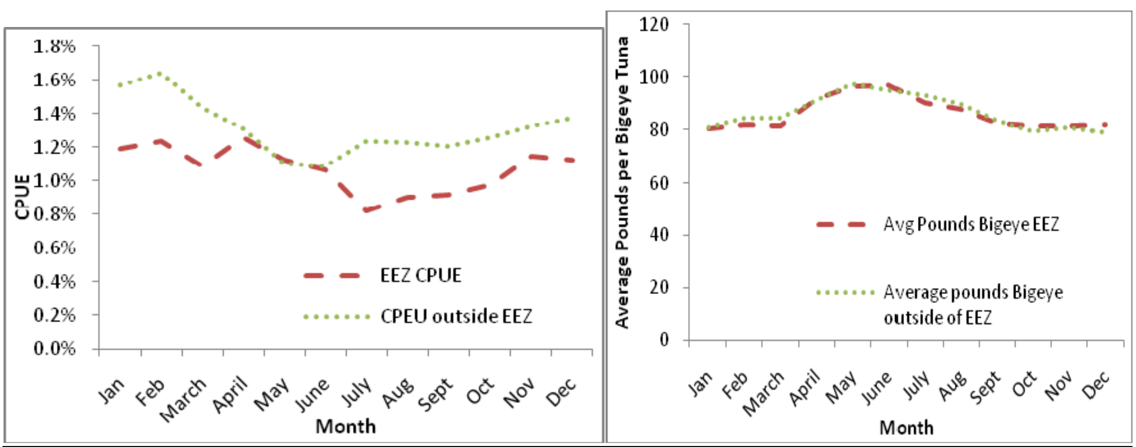


**Figure 5.6.** Catch per Unit Effort and average pounds per bigeye tuna caught inside the EEZ versus outside EEZ by Month, 2006-2010.

Change in Effort

A year-round closure of the EEZ around Hawaii to longline fishing would reduce the fishing area available for the Hawaii-based longline fleet. Fishing effort would likely continue on the high seas, and some effort from the EEZ would likely be displaced to the high seas, but the increased operating costs of fishing exclusively on the high seas could potentially force fishermen to leave the fishery or switch to other fisheries. Overall, those fishermen that would fish exclusively outside the EEZ may have reduced landings or a reduced profit margin if a significant percentage of their current effort is currently within the EEZ. Interviews with owner/operators indicate that closure of the EEZ may disproportionately affect small boats, which are broadly characterized as having a lower travel distance range and smaller number of hooks. According to interviewed owner/operators, in addition to having lower mileage range than other longline boats, small boats are often not equipped to withstand the volatile weather and rough conditions in the high seas and, unlike bigger boats, may fish almost exclusively within the EEZ. Several owner/operators expressed concern that proposed exclusion zones would either result in exit of these boats from the fishery or result in a safety hazard to small boats if they begin fishing in unsafe conditions farther from shore. Logbook data, however, indicate that of the 124 longline vessels active in 2010, 123 vessels fished at least once during the year outside of the EEZ. These trips may have been in close proximity to the EEZ, but illustrate that all or nearly all vessels in the longline fleet currently fish at least part of the time outside the EEZ.

## 5.7.2 Hawaii-Based Fishing Gear Suppliers

### *5.7.2.1 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team*

The Hawaii-based fishing gear suppliers may be adversely affected by the equipment requirements in the Preferred Alternative if gear currently in stock becomes obsolete and is not sellable to other fisheries. In particular, fishing gear suppliers may be affected by the requirement to use small circle hooks with a maximum wire diameter of 4.0 mm. This section describes the methodology and estimated cost to the gear suppliers of the one-time hook inventory cost, estimated at approximately $0 to $13,600.

Commercial fishing gear suppliers may not be able to sell their existing inventory of circle hooks with 4.5 mm diameter wire and tuna hooks in the event that small circle hooks with 4.0 mm diameter wire are required throughout the deep-set longline fishery. Assuming that gear suppliers on average have approximately six months of 4.5 mm wire diameter circle hook and tuna hook inventory in stock to replace lost hooks in the longline fishery, we estimate that there may be approximately 17,500 hooks in supplier inventory at any one time. Depending on whether these hooks can be sold to other fisheries, the one-time cost to suppliers due to inventory lost is estimated at $0 to $13,600 (based on 35,000 hooks needing replacement due to loss annually or 17,500 over a 6-month period if the new hook requirement is phased in over 6 months, and $0.81 weighted average hook price). According to owner/operator interviews, there are three Hawaii-based gear suppliers that supply the majority of Hawaii-based longline vessels. The one-time cost to individual suppliers of this inventory therefore ranges from $0 to $4,500. Using a three percent discount rate over 20 years, the total annualized equipment inventory cost of hooks to the three suppliers is estimated at $0 to $900, or up to $300 for individual suppliers. This cost may be an underestimate, however, as interviews with gear suppliers suggest that the cost of unsellable inventory may exceed $10,000 per supplier.

If fishing effort declines under the Preferred Alternative due to any of the proposed measures, and if this results in reduced demand for fishing gear, then suppliers may face ongoing reduced revenue and therefore reduced income.

### *5.7.2.2 Alternative 3: Close the EEZ around Hawaii to commercial longline fishing year-round*

There are no equipment change requirements under Alternative 3 that would affect the ability of gear suppliers to sell existing inventory. However, similar to the Preferred Alternative, if fishing effort declines under this alternative due to the closure of the EEZ to longline fishing, and if this results in reduced demand for fishing gear, then suppliers may face ongoing reduced revenue and therefore reduced income.

## 5.7.3 Seafood Consumers

No measureable effect on Hawaii seafood consumer prices would be expected due to the implementation of either of the Action Alternatives. Although the Action Alternatives may result in potential catch reduction, very little to no impact is expected on price due to the global nature of seafood supply and demand, and the small fraction of total supply provided by the Hawaii longline fishery. It is anticipated that any reduction in Hawaii-based longline catch would be compensated by increased imports to Hawaii or by reduced exports to the mainland or Asia. Hawaii imports up to two-thirds of its seafood from the U.S. mainland and foreign sources. In 2006, 19.7 million pounds of seafood from foreign sources was imported, while 1.5 million pounds were exported to foreign countries (NMFS, 2006). As the Hawaii longline fishery is known for the quality of fish it harvests, reduction in catch may affect the quality of tuna and swordfish available in the local Hawaii market, with potential effect on consumer surplus associated with locally-caught seafood.

## 5.7.4 Federal Agencies

This section summarizes the costs of proposed measures to NMFS. As only the Preferred Alternative has proposed requirements that would affect NMFS, costs would only be incurred in this Alternative, and not in Alternative 3.

### *5.7.4.1 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team*

This section summarizes the costs of proposed FKWTRP measures to NMFS. The Preferred Alternative includes three measures aimed at providing more information to fishermen on ways to minimize serious injury to marine mammals and reduce incidental takes of false killer whales, including an annual certification for vessel operators and owners, posting of a marine mammal handling/release placard on all longline vessels, and posting captain notification placards. As summarized in Table 5.14 the total estimated one time cost to NMFS incurred through the labor and materials involved with these measures is estimated at approximately $25,000, and the annualized cost over 20 years is estimated to be less than $2,000.

**Table 5.14.** Summary of Estimated Costs to NMFS

| Proposed Measure | One- time cost | Annualized Cost |
|---|---|---|
| Annual Certification for Operators/Owners | $15,000 - $16,000 | $1,000 |
| Marine Mammal Handling/Release Placard | $6,000 | $400 |
| Captain Notification Placard | $3,000 | $200 |
| **Total** | $25,000 | $1,700 |

### *Annual Certification for Operators / Owners*

This section discusses the cost of enhancing the existing Protected Species Workshop (PSW) trainings to include more information and training on ways to minimize mortality and serious injury of marine mammals. This would be a one-time cost to NMFS of staff time and materials to develop workshop materials. The primary data source for this estimate is personal communication with NMFS.

NMFS estimates that the one-time staff labor cost to develop additional workshop material would be approximately $5,000 to $5,500, while the one-time material cost is estimated at $15,000. Using a three percent discount rate over 20 years, the total annualized cost to NMFS of developing the annual certification training and expanding workshop content is estimated at approximately $1,000 (Table 5.14).

### *Marine Mammal Handling / Release Placard*

This measure would require posting of a placard developed by NMFS. The only cost estimates for this requirement is the one-time cost to NMFS of staff time and materials to develop the placard, which is estimated at $6,300. Using a three percent discount rate over 20 years, the total annualized cost to NMFS of developing the placard is approximately $400. The primary data source for this estimate is personal communication with NMFS (Table 5.14).

### *Captain Notification Placard*

This measure would require posting of a placard developed by NMFS. There are no expected costs to the longline vessels of posting this placard and following its direction (confirmed in owner/operator interviews), the only cost estimates for this requirement would be the one-time cost to NMFS of staff time and materials to develop the placard, estimated at $1,000 for labor and $2,250 for materials. Using a three percent discount rate over 20 years, the total annualized cost to NMFS of developing the placard is estimated at $200 (Table 5.14). The primary data source for this estimate is personal communication with NMFS.

### *Non-Regulatory Measures*

According to NMFS, none of these measures would increase costs to the agency.

## 5.8 Expected Net Benefit to the Nation of the Alternatives

As discussed above, it is not possible to provide *quantitative* estimates of all costs that may be attributable to the FKWTRP, and no quantitative estimates of benefits have been provided. However, it appears that if these could be quantified, the anticipated benefits of proposed FKWTRP as outlined in the Preferred Alternative and Alternative 3 would outweigh anticipated costs. As per the requirement of E.O. 12866, all effort is made in this RIR to comprehensively identify (and, wherever possible, quantify) benefits and costs associated with the FKWTRP. NMFS believes that the proposed FKWTRP would be expected to result in a net benefit to the Nation.

This assessment is based on the relatively small population of adversely affected groups (Hawaii longline fishery and equipment suppliers) versus the population in positively affected groups (potential benefits to all citizens of Hawaii and the Nation). As indicated through our national laws such as the Marine Mammal Protection Act that require conservation and protection of marine mammals, we as a nation have demonstrated the value we place on the conservation of marine mammals such as the false killer whale.

Both the Preferred Alternative and closure of the U.S. EEZ around the Hawaiian Islands to commercial longline fishing (Alternative 3) are expected to meet the goal of reducing take of false killer whales to below the PBR, and would therefore have similar benefits. However, as costs of the Preferred Alternative ($3.0 million to $8.0 million) are significantly lower than for Alternative 3 ($8.6 million to $10.2 million), the net benefits to the nation of the Preferred Alternative would exceed net benefits of Alternative 3.

# 6.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS

## 6.1 Introduction

The Regulatory Flexibility Act (RFA), first enacted in 1980, requires agencies to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a Federal regulation. Major goals of the RFA are: (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require that agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting impacts on small entities as a group, distinct from other entities, and on the consideration of alternatives that may minimize the burden on small entities while still achieving the stated objective of the action.

On March 29, 1996, President Clinton signed the Small Business Regulatory Enforcement Fairness Act. Among other things, the new law amended the RFA to allow judicial review of an agency's compliance with the RFA. The 1996 amendments also updated the requirements for a final regulatory flexibility analysis, including a description of the steps an agency must take to minimize the significant economic impact on small entities. Finally, the 1996 amendments expanded the authority of the Chief Counsel for Advocacy of the Small Business Administration (SBA) to file amicus briefs in court proceedings involving an agency's violation of the RFA.

In determining the scope, or 'universe', of the entities to be considered in an Initial Regulatory Flexibility Analysis (IRFA), NMFS generally includes only those entities, both large and small, that can reasonably be expected to be directly regulated by the proposed action. If the effects of the rule fall primarily on a distinct segment, or portion thereof, of the industry (e.g., user group, gear type, geographic area), that segment would be considered the universe for the purpose of this analysis. NMFS interprets the intent of the RFA to address negative economic impacts, not beneficial impacts, and thus such a focus exists in analyses that are designed to address RFA compliance.

Data on cost structure, affiliation, and operational procedures and strategies in the sectors potentially subject to the proposed regulatory action are insufficient, at present, to permit preparation of a "factual basis" upon which to certify that the preferred alternative does not have the potential to result in "significant adverse impacts on a substantial number of small entities" (as those terms are defined under RFA). Because, based on all available information, it is not possible to 'certify' this outcome, should the proposed action be adopted, a formal IRFA, focusing on the complete range of available alternatives (including the designated "preferred" alternative), has been prepared and is included in this package for review.

The purpose of this IRFA is to evaluate the economic, socioeconomic, and other costs and benefits of implementing the FKWTRP on small entities, including small businesses and small governments.

## 6.2 Requirements of IRFA[2]

Under 5 U.S.C., Section 603(b) and (c) of the RFA, each IRFA is required to contain:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and legal basis for, the proposed rule;

[2] For a detailed treatment of the requirements of economic analyses in support of RIR and RFAA requirements, see, "Conducting Economic Impact Analyses," Lewis E. Queirolo, Ph.D. NMFS Alaska Region, Juneau, Alaska. July 29, 2005.

- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply;
- A description of the projected reporting, recordkeeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap or conflict with the proposed rule;
- A description of any significant alternatives to the proposed rule which accomplish the stated objectives (of the proposed action), consistent with applicable statutes, and which would minimize any significant economic impact of the proposed rule on small entities.

Consistent with the stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as:

- The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
- The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
- The use of performance rather than design standards; and
- An exemption from coverage of the rule, or any part thereof, for such small entities.

## 6.3 Definition of a Small Entity

The RFA recognizes and defines three kinds of small entities: (1) small businesses, (2) small non-profit organizations, and (3) and small government jurisdictions.

Small businesses. Section 601(3) of the RFA defines a ‘small business’ as having the same meaning as ‘small business concern,’ which is defined under Section 3 of the Small Business Act. ‘Small business’ or ‘small business concern’ includes any firm that is independently owned and operated and which is not dominant in its field of operation. The SBA has further defined a “small business concern” as one “organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor. A (small) business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the firm is a joint venture there can be no more than 49 percent participation by foreign business entities in the joint venture.”

The SBA has established size criteria for all major industry sectors in the United States, and publishes those on its website. The sector pertinent for this analysis is finfish fishing (NAICS Industrial Code: 114111), which includes the longline fishing vessels based in the MHI. Table 6.1 includes this category, as defined by SBA, as well as the specific criterion to be used, for RFA purposes. The SBA defines a marine fishing business as a small business if it is independently owned and operated, not dominant in its field of operation, and has average annual receipts of $4 million dollars or less, including all its affiliated operations worldwide. Receipts means “total income” (or in the case of a sole proprietorship, “gross income”) plus “cost of goods sold” as these terms are defined and reported on Internal Revenue Service tax return forms.

While it is acknowledged that the fishing industry has strong linkages to the economy of Hawaii, and any regulations affecting fishing vessels would potentially affect other related businesses, such as fishing equipment suppliers and distributors and fish wholesalers, IRFA generally only includes those entities that are anticipated to be "directly regulated" by an action.

**Table 6.1.** Small Business Size Standards Matched to North American Industry Classification System

| NAICS Code | NAICS U.S. Industry Title | SBA Small Business Threshold Criteria |
|---|---|---|
| **Sector 11 – Agriculture, Forestry, Fishing, and Hunting** | | |
| **Subsector 114 – Fishing, Hunting, and Trapping** | | |
| 114111 | Finfish Fishing | $4.0 million in receipts |

Source: U.S. Small Business Administration. Effective November 5, 2010. Table of Small Business Size Standards Matched to North American Industry Classification System Codes."

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question. The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern's size.

Affiliation may be based on stock ownership when (1) a person is an affiliate of a concern if the person owns or controls, or has the power to control 50 percent or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock; or (2) if two or more persons each owns, controls or has the power to control less than 50 percent of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers, directors, or general partners control the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint ventures if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

Small organizations. The RFA defines "small organizations" as any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

Small governmental jurisdictions. The RFA defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of less than 50,000.

## 6.4 Reasons for Considering the Action

The Hawaii pelagic stock has been designated as strategic because the average annual mortality and serious injury (M&SI) of false killer whales incidental to the Category I Hawaii-based deep-set longline fishery (7.3 animals per year) exceeds the stock's PBR level (2.5 animals per year) (Carretta et al. 2011). NMFS is proposing to implement a FKWTRP to reduce incidental M&SI of Hawaii pelagic false killer whales in the Hawaii-based deep-set and shallow-set longline fisheries to below the stock's PBR level within 6 months of implementation, and incidental M&SI of Hawaii pelagic, Hawaii insular, and Palmyra Atoll false killer whales to insignificant levels approaching a zero rate within 5 years of implementation. This action is being proposed to meet the requirements of the MMPA.

# 6.5 Objectives of, and Legal Basis for, the Proposed Rule

The proposed action being addressed is the implementation of the proposed FKWTRP, pursuant to section 118(f) of the MMPA, to reduce incidental M&SI of three stocks of false killer whales in the Category I Hawaii-based deep-set longline fishery and the Category II Hawaii-based shallow-set longline fishery. This action is needed because incidental M&SI levels for these stocks in these fisheries exceed the thresholds established under the MMPA. These levels are, therefore, inconsistent with the mandates of the MMPA, and must be reduced.

The objective of this action is to utilize the best available scientific information to characterize and, as appropriate, implement the FKWTRP for this species. This action is proposed under the authority of the MMPA.

# 6.6 Number and Description of Any Small Entities Directly Regulated Under Alternative 2 (Preferred Alternative)

This section summarizes what is known about the potential adverse impacts of implementation of the FKWTRP on directly regulated small entities. The NMFS database of longline permit holders identifies 126 active vessel operations in Hawaii's longline fleet. As presented in Figure 3.5, between 2006 and 2010, there were 124 to 129 vessels in the longline fleet, with two years (2007 and 2008) with 129 vessels. Given that the maximum number of active vessels in the past five years is 129, it is assumed that the fleet consists of 129 vessels. Further, in 2007, 129 vessels were active in the deep-set longline fishery, so it is assumed that all longline vessels participate at times in the deep-set fishery.

As discussed above, while it is assumed that the longline fleet in Hawaii consists of 129 vessels, the NMFS database of longline permit holders only provides ownership information for the 126 currently active vessels. Based on this database, these 126 vessels are owned by 85 individuals. For the sake of this analysis, it is assumed that the remaining three vessels in the fleet are owned by individuals who own only one vessel. Therefore, it is assumed that the fleet is made up of 88 independently-owned businesses.

The second step was to estimate the annual average revenue to these businesses. The longline fisheries' average annual ex-vessel revenue is over $66.3 million dollars and there are 129 vessels in the fleet. The average annual revenue per vessel is, therefore, estimated at approximately $514,209. This implies that in order to not be considered a small business, an individual business would need to be made up of eight or more vessels. Based on the list of permittees, there is only one business with 14 vessels that may not meet the criteria of a small business. Therefore, the analysis identifies 87 small businesses that are anticipated to be directly regulated by the Action Alternatives. Of these small businesses identified, 68 businesses own 1 vessel each, 15 businesses own 2 vessels each, 2 businesses own 3 vessels each, 1 business owns 5 vessels, and 1 business owns 6 vessels. For the purpose of this analysis, it is assumed that all these small business are associated with the deep-set longline fishery.

The Preferred Alternative is not expected to generate benefits to the small businesses in the longline fishery, as the alternative would further restrict the location of longline fishing and require the use of specific gear, additional training, and response to marine mammal interaction. Table 6.2 presents the costs to small businesses identified above of implementing the Preferred Alternative. Costs associated with the Preferred Alternative stem from labor and material costs of replacing hooks and monofilament branchline to meet the proposed requirements; potential lost revenue due to potential effects of weak circle hooks on the total weight of tuna caught and revenue generated; additional travel cost (fuel and time) of fishing outside the MHI Longline Fishing Prohibited Area during the time when it is currently open to longline fishing, as well as cost of fishing outside the SEZ (if triggered); and annual cost of Protected Species Workshop certification of operators and owners (see Section 5.7.1 for more details).

**Table 6.2.** Cost of implementing the Preferred Alternative to Potentially Affected Small Businesses

| | Initial, One-Time Cost | | Annual Ongoing Cost | |
|---|---|---|---|---|
| **Size of Business based on No. of Vessels** | **Low Range** | **High Range** | **Low Range** | **High Range** |
| Cost per Business for 68 Businesses Owning 1 Vessel Each | $2,000 | $5,000 | $23,000 | $62,000 |
| Cost per Business for 15 Businesses Owning 2 Vessels Each | $5,000 | $11,000 | $47,000 | $123,000 |
| Cost per Business for 2 Businesses Owning 3 Vessels Each | $7,000 | $16,000 | $70,000 | $185,000 |
| Cost per Business for 1 Business Owning 5 Vessels | $12,000 | $27,000 | $116,000 | $308,000 |
| Cost per Business for 1 Business Owning 6 Vessels | $14,000 | $33,000 | $140,000 | $370,000 |

## 6.7 Reporting, Record-Keeping, and Other Compliance Requirements

No additional reporting, record-keeping, and other compliance requirement are anticipated for small businesses in addition to those already in place and those mentioned in Section 5.7.

## 6.8 Identification of all Relevant Federal Rules which May Duplicate, Overlap, or Conflict with the Action Alternatives

NMFS has identified no such Federal rules.

## 6.9 Description and Analysis of Significant Alternatives to the Action Alternatives

After careful examination of the best available scientific data on false killer whales, NMFS determines that only the two Action Alternatives (Preferred Alternative and Alternative 3) have the potential to accomplish the stated objectives and legal mandates associated with the conservation of this species.

Retention of the “No Action” alternative is not a viable choice for several reasons. Retention of the status quo would not be consistent with the objectives identified by the agency for this action (see the “Purpose and Need” discussion in the EA and RIR). In addition, adoption of the No Action alternative would be contrary to the agency’s obligations under the MMPA.

The complete closure of the EEZ to longline fishing under Alternative 3 is expected to incur more significant overall annual costs to small businesses compared with the preferred alternative, although no one-time capital costs are anticipated. These costs are associated with the opportunity cost of increased travel time to fishing areas outside the EEZ (see Section 5.7.1 for more details).

Similar to the Preferred Alternative, Alternative 3 is not expected to generate benefits to the small businesses in the longline fishery, as it would further restrict the location of longline fishing due to the complete closure of EEZ to longline fishing. Table 6.3 presents the costs to small businesses identified above of implementing Alternative 3. Costs associated with Alternative 3 primarily stem from additional travel cost (fuel and time) of fishing outside the EEZ (see Section 5.7.1 for more details).

**Table 6.3.** Cost of implementing the Alternative 3 to Potentially Affected Small Businesses

| Size of Business based on No. of Vessels | Annual Ongoing Cost | |
|---|---|---|
| | **Low Range** | **High Range** |
| Cost per Business for 68 Businesses Owning 1 Vessel Each | $67,000 | $79,000 |
| Cost per Business for 15 Businesses Owning 2 Vessels Each | $134,000 | $158,000 |
| Cost per Business for 2 Businesses Owning 3 Vessels Each | $200,000 | $237,000 |
| Cost per Business for 1 Business Owning 5 Vessels | $334,000 | $395,000 |
| Cost per Business for 1 Business Owning 6 Vessels | $401,000 | $474,000 |

Both of the Action Alternatives (Alternatives 2 and 3) would meet the objectives of the proposed rule. Alternative 3 was not selected because it would likely result in substantially greater economic impacts to small entities than the Preferred Alternative, without a greater likelihood of achieving the objectives of the proposed rule.

# 7.0 OTHER APPLICABLE LAW

## 7.1 Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions do not jeopardize the continued existence of any species listed as threatened or endangered or result in the destruction or adverse modification of the CH of listed species. The ESA requires the "action" agency to consult with an "expert" agency to evaluate the effects a proposed agency action may have on a listed species. If the action agency determines through preparation of a biological assessment or informal consultation that the Preferred Alternative is "not likely to adversely affect" listed species or CH, formal consultation is not required so long as the expert agency concurs.

A section 7 consultation was not necessary for this action. On October 4, 2005, NMFS completed a Biological Opinion on the continued operation of the Hawaii-based deep-set longline fishery under the Pelagics FMP, and completed Biological Opinions on the Hawaii-based shallow-set longline fishery on February 23, 2004, and October 15, 2008. NMFS analyzed the need for re-initiation of section 7 consultation. It was determined that re-initiation of consultation on the action (i.e., the continued prosecution of the Hawaii-based deep-set and shallow-set longline fisheries under the PFEP and the proposed rule to implement the FKWTRP) is not necessary; none of the criteria 50 CFR 402.16 have been met.

## 7.2 Marine Mammal Protection Act

The primary management objective of the Marine Mammal Protection Act (MMPA) is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. Section 118 of the MMPA specifies that NMFS develop and implement TRPs to assist in the recovery or prevent the depletion of strategic marine mammal stocks that interact with Category I and Category II fisheries, which are fisheries with frequent (Category I) or occasional (Category II) serious injuries and mortalities of marine mammals. The goal is to reduce takes incidental to fishing activities to levels below the PBR level, defined as the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. Alternative 2 (Preferred) would establish regulatory and non-regulatory measures that are expected to reduce serious injury and mortality of false killer whales due to incidental interactions with Hawaii-based commercial longline fishing gear to levels below PBR, accomplishing the requirements of MMPA section 118. A discussion of the marine mammals found within the affected environment can be found in section 3.2.1.1, and the expected impacts of the alternatives to marine mammals can be found in section 4.2.

# 7.3 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to minimize the paperwork burden for individuals, small businesses, educational and nonprofit institutions, and other persons resulting from the collection of information by or for the Federal government. The preferred alternative includes no new collection of information and further analysis is not required. The preferred alternative would require no additional reporting burdens by longline fishermen.

# 7.4 Magnuson-Stevens Fishery Conservation and Management Act, including Essential Fish Habitat

The EFH provisions of the MSA require NMFS to provide recommendations to Federal and state agencies for conserving and enhancing EFH if a determination is made that an action may adversely impact EFH. NMFS policy regarding the preparation of NEPA documents recommends incorporating EFH assessments into NEPA analyses; therefore, this Draft EA will also serve as an EFH assessment.

Pursuant to these requirements, section 2 of this document provides a description of the alternatives considered for the proposed FKWTRP. Section 3 provides a description of the affected environment, including the identification of areas designated as EFH and HAPC and an analysis of the impacts of fishing gear on that environment (section 3.1.2). EFH and associated benthic species and life stages are not likely to be affected by the Hawaii-based deep-set and shallow-set longline fisheries, as this gear is set in the pelagic environment. None of the proposed measures presented in section 2 (Description of the Action and Alternatives) of this Draft EA/RIR/IRFA are likely to modify fishing practices in a manner that would adversely affect EFH or HAPC. Therefore, and EFH consultation on the proposed action is not necessary.

# 7.5 Data Quality Act (Section 515)

Section 515 of Public Law 106-554 (the Data Quality Act) directs that all information products released to the public must first undergo a Pre-Dissemination Review to ensure and maximize the quality, objectivity, utility, and integrity of the information (including statistical information) disseminated by or for federal agencies.

The propose rule package has undergone a pre-dissemination review by the Protected Resources Division of the Pacific Islands Regional Office, completed on June 7, 2011, which determined this information product complies with applicable information quality guidelines implementing the Data Quality Act.

# 7.6 Administrative Procedure Act

The Federal Administrative Procedure Act (APA) establishes procedural requirements applicable to rulemaking by Federal agencies. The purpose of the APA is to ensure public access to the Federal rulemaking process and to give the public notice and an opportunity to comment before the agency promulgates new regulations. NMFS is not requesting a waiver from the requirements of the APA for notice and comment on this rulemaking.

## 7.7 Coastal Zone Management Act

Section 307(c)(1) of the Federal Coastal Zone Management Act (CZMA) of 1972 requires that all Federal activities that affect any land or water use or natural resource of the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. A copy of this document and the proposed rule will be submitted to the appropriate state government agency in Hawaii for review and concurrence with the preliminary determination that the preferred alternative (the proposed action) is consistent, to the maximum extent possible, with its coastal zone management program.

## 7.8 Executive Order 13132 (Federalism)

Executive Order (EO) 13132, otherwise known as the Federalism EO, was signed by President Clinton on August 4, 1999, and published in the *Federal Register* on August 10, 1999 (64 FR 43255). This EO is intended to guide Federal agencies in the formulation and implementation of "policies that have federal implications." Such policies include regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. EO 13132 requires federal agencies to have a process to ensure meaningful and timely input by state and local officials in the development of regulatory policies that have federalism implications. A Federal summary impact statement is also required for rules that have federalism implications.

NMFS believes this proposed action does not contain policies with federalism implications under EO 13132. All of the proposed actions would occur in the Exclusive Economic Zone beyond state jurisdiction. However, the Assistant Secretary for Legislative and Intergovernmental Affairs will provide notice of the proposed action and request for comments to the appropriate official(s) of the state affected by the proposed action.

## 7.9 Executive Order 12898 (Environmental Justice)

EO 12898 requires that federal actions address environmental justice in decision-making process. In particular, the human health or environmental effects of the actions should not have a disproportionately high and adverse effect on minority and low-income communities. Hawaii has members of environmental justice populations (low-income and/or minority groups) that participate in fisheries or live in communities that participate in fisheries. There are currently no known high and adverse environmental impacts of ongoing fishery management in the western Pacific that are affecting any community members including members of environmental justice populations. These low-income and/or minority populations may be more vulnerable to the management measures considered in this document; however, the impact analyses performed for the Draft EA suggest that there will likely not be significant cost impacts relative to annual revenues.

## 7.10 Executive Order 12866 (Regulatory Planning and Review)

The purpose of EO 12866, otherwise known as Regulatory Planning and Review, is to enhance planning and coordination with respect to new and existing regulations. This EO requires the Office of Management and Budget to review regulatory programs that are considered to be "significant." Section 5 of this Draft EA/RIR/IRFA includes the RIR, which includes an assessment of the costs and benefits of the Proposed Action, in accordance with the guidelines established by EO 12866. The analysis included in the RIR shows that this action is not a "significant regulatory action" because it will not affect in a material way the economy or a sector of the economy. This proposed rule has been determined to be not significant for the purposes of E.O. 12866.

## 7.11 Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) was enacted in 1980 to place the burden on the Federal government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA emphasizes predicting significant adverse impacts on small entities as a group distinct from other entities and on the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action. When an agency publishes a proposed rule, unless it can provide a factual basis upon which to certify that no such adverse effects will accrue, it must prepare and make available for public review an IRFA that describes the impact of the proposed rule on small entities. An IRFA for this action is provided in section 6 of this document.

## 7.12 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) requires Federal agencies to assess the effects of major Federal actions upon the human environment in the form of an environmental impact statement or EA. The analysis describes the level of significance of the impacts expected to result from the proposed Federal action. NMFS prepared this Draft EA in accordance with NEPA.

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# APPENDIX I

## Alternative Methods for SEZ Trigger Calculation and Closure Implementation

NMFS carefully considered the FKWTRT's recommendation regarding the SEZ trigger and closure, and also looked at several other methods before selecting the Preferred Alternative for further analysis. These alternate methods are described here and below in Tables A-1 and A-3-5. The SEZ specifications in the Preferred Alternative are also briefly described below and in Table A-2 to allow for direct comparison.

NMFS identified two general conceptual approaches to the SEZ trigger and closure. The first would be to allow a "generous" initial trigger in which the annual M&SI exceeds PBR, but a severe "consequence" (i.e., likely a multi-year closure of the SEZ) to maintain the 5-year average M&SI level below PBR.

The second approach would be to set a more precautionary (lower) trigger to maintain annual M&SI below PBR. In this case, the lower trigger would be more likely to be reached (and the SEZ closed) in a given year; however, the SEZ could potentially be reopened at the beginning of each year. Thus, in concept, a stricter trigger could avoid a lengthy, multi-year closure of the SEZ.

Further, NMFS considered alternatives in which the calculation of a trigger was adaptive, whereby an initial trigger would be calculated and later adjusted upward or downward based on the number of animals that could be taken without exceeding the 5-year average PBR. In these adaptive scenarios, all false killer whale takes that occur inside the EEZ (including those that occur inside the EEZ after the SEZ is closed) would be taken into account when adjusting the trigger.

NMFS examined the following 5 options:

| | |
|---|---|
| Option 1 | Take Reduction Team recommendation |
| Option 2 | Preferred Alternative |
| Option 3 | Generous trigger, scaled back consequence at higher PBR. |
| Option 4 | Restrictive trigger, multiple chances |
| Option 5 | Restrictive trigger, multiple chances, until 5-year average exceeds PBR |

Each of these options is further detailed on the following pages – both in narrative and table format. Options 3, 4 and 5 (comprising different triggers, PBRs, and take scenarios) are provided as illustrative examples.

*1. The FKWTRT's recommendation*

Trigger: The FKWTRT, in the Draft FKWTRP, recommended a trigger of 2 or "the number of observed M&SI interactions with false killer whales within the HI EEZ that, when extrapolated based on the percentage observer coverage for that year, are greater than the applicable false killer whale HI EEZ PBR." The trigger of 2 was based on the rough extrapolation of observed takes at the current 20% observer coverage, to keep the 5-year average M&SI level below the current PBR of 2.5.

Generalizing this concept to allow for changes in observer coverage and PBR, this translates to: trigger = PBR * 5 * observer coverage. This is the same as the trigger described in the Preferred Alternative.

Closure Implementation: The FKWTRT recommended that if the trigger were met in one year, the SEZ would be closed until the end of the year. The SEZ would be reopened and the trigger "reset" at the beginning of the next year. If the trigger were again met in the second year, then the SEZ would be closed until the FKWTRT reconvened to discuss other measures, or if other reopening criteria were met. NMFS would then reopen the SEZ, and the trigger would again be "reset."

Example Scenarios: In scenarios 1A and 1B in Table A-1, the trigger is met in years 1 and 2; even with 0 observed takes in years 3-5, the 5-year average take level exceeds PBR. This exceedance of the 5-year average would be even greater if takes approached, but did not meet the trigger in multiple years, as in scenario 1C.

Outcome: The only way for this trigger and consequence to keep the 5-year average M&SI below PBR would be, if the trigger is met in one year, there were no observed takes in the other 4 years of the 5-year average. Additionally, takes that occur within the US EEZ around Hawaii after the SEZ is closed are not accounted for when managing the SEZ, so the actual total M&SI level would still likely exceed PBR.

**Table A-1**. Alternative methods for SEZ trigger calculation and closure implementation – option 1.

1. FWKTRT's recommendation: When FKW takes meet trigger in one year, SEZ will close. The SEZ will reopen the next year and the trigger will reset. If the trigger is met in the following year, the SEZ will close until the FKWTRT can reconvene or other reopening criteria are met, and NMFS reopens the SEZ.

Trigger = PBR * 5 * Observer coverage (rounded down)

Assume that after trigger is met 2 years in a row, the SEZ is closed until new measures are adopted or other reopening criteria are met. Assume no other takes in the EEZ after trigger is met.

| Scenario 1A | | | Scenario 1B | | | Scenario 1C | | |
|---|---|---|---|---|---|---|---|---|
| **PBR** | | 2.5 | **PBR** | | 10 | **PBR** | | 10 |
| **Annual Observer Coverage** | | 20% | **Annual Observer Coverage** | | 20% | **Annual Observer Coverage** | | 20% |
| **Trigger** | | 2 | **Trigger** | | 10 | **Trigger** | | 10 |
| **Year** | **Takes** | **Extrapolated M&SI** | **Year** | **Takes** | **Extrapolated M&SI** | **Year** | **Takes** | **Extrapolated M&SI** |
| 1 | 2 | 10 | 1 | 10 | 50 | 1 | 8 | 40 |
| 2 | 2 | 10 | 2 | 10 | 50 | 2 | 8 | 40 |
| 3 | 0 | 0 | 3 | 0 | 0 | 3 | 8 | 40 |
| 4 | 0 | 0 | 4 | 0 | 0 | 4 | 8 | 40 |
| 5 | 0 | 0 | 5 | 0 | 0 | 5 | 8 | 40 |
| **5-Year Average Take:** | | **4** | **5-Year Average Take:** | | **20** | **5-Year Average Take:** | | **40** |

Outcome: Meeting the trigger in the 1st and 2nd years, even if no takes in the following 3 years, would put the 5-year average above PBR. The 5-year average >> PBR if annual takes approach but do not exceed trigger. The 5-year average would only remain below PBR if there were no takes in the other 4 years of the 5-year average.

2. *Preferred Alternative: "Generous" initial trigger, steeper consequence*

Trigger: Under the Preferred Alternative, there would be a generous (high) initial trigger (which exceeds PBR in a single year), consistent with the FKWTRT's recommended trigger, but a low subsequent trigger (1) in years 2-5.

Closure Implementation: If the trigger were met in a given year, the SEZ would be closed until the end of the year, and reopened at the beginning of the following year. If there were **1** take in any of the following 4 years, the SEZ would be closed until the FKWTRT reconvened to discuss other measures, or until other reopening criteria were met. NMFS would then reopen the SEZ, and the trigger would again be "reset."

Example Scenarios: In scenario 2A in Table A-2, the initial trigger (2) is met in year 1, and the subsequent trigger (1) is met in year 2. The SEZ would then likely be closed for the remaining 3 years. Similarly in scenario 2B, the initial trigger (10) is met in year 1, and the subsequent trigger (1) is met in year 4. The SEZ would then likely be closed until the end of year 5. In both of these cases, the 5-year average take level is slightly above PBR.

In scenario 2C, the take level is below the trigger in years 1 and 2. The trigger (2) is met in year 3, and the subsequent trigger (1) is met in year 4. The SEZ would likely be closed at least until the end of year 5, possibly until the 5-year average drops below PBR or until other reopening criteria are met. As with scenario 1C, this sub-trigger level of take would cause takes to exceed the 5-year average, though to a much lesser extent than under the FKWTRT's recommended option.

Outcome: The 5-year average would only remain below PBR, if the trigger is met in one year, there were no takes in the other 4 years of the 5-year average. Under this option, the fishery is allowed a single observed take after it hits the initial trigger; this would bring the 5-year average above PBR. NMFS believes this tiered approach would better allow the fishery to adjust its practices or otherwise respond to the closure, rather than a long-term closure after hitting a single trigger in a single year, but would prevent PBR from being greatly exceeded, as would happen under the FKWTRT's recommended SEZ implementation.

In this and several other scenarios, takes that occur within the US EEZ around Hawaii after the SEZ is closed are not accounted for, so the actual total M&SI level would likely exceed PBR. This emphasizes that the SEZ management measures themselves are unlikely to sufficiently reduce takes to required levels; in the Preferred Alternative, there are additional measures that are expected to further reduce takes to meeting the goals of the MMPA.

**Table A-2**. Alternative methods for SEZ trigger calculation and closure implementation – option 2.

2. Preferred Alternative: "Generous" initial trigger, steeper consequence. Allow a high initial trigger, consistent with the FKWTRT's recommendation, but low subsequent trigger (1) in years 2-5 (and higher likelihood of multi-year SEZ closure) to keep the 5-year average below PBR

Trigger = PBR * 5 * Observer coverage (rounded down); subsequent trigger in years 2-5 = 1
Assume no other takes in the EEZ after the trigger is met.

| Scenario 2A | | | Scenario 2B | | | Scenario 2C | | |
|---|---|---|---|---|---|---|---|---|
| **PBR** | | 2.5 | **PBR** | | 10 | **PBR** | | 2.5 |
| **Annual Observer Coverage** | | 20% | **Annual Observer Coverage** | | 20% | **Annual Observer Coverage** | | 20% |
| **Trigger** | | 2 | **Trigger** | | 10 | **Trigger** | | 2 |
| **Year** | **Takes** | **Extrapolated M&SI** | **Year** | **Takes** | **Extrapolated M&SI** | **Year** | **Takes** | **Extrapolated M&SI** |
| 1 | 2 | 10 | 1 | 10 | 50 | 1 | 1 | 5 |
| 2 | 1 | 5 | 2 | 0 | 0 | 2 | 1 | 5 |
| 3 | 0 | 0 | 3 | 0 | 0 | 3 | 2 | 10 |
| 4 | 0 | 0 | 4 | 1 | 5 | 4 | 1 | 5 |
| 5 | 0 | 0 | 5 | 0 | 0 | 5 | 0 | 0 |
| **5-Year Average Take:** | | **3** | **5-Year Average Take:** | | **11** | **5-Year Average Take:** | | **5** |

Outcome: 5-year average would only remain below PBR if no takes in the other 4 years of the 5-year average.

3. *Generous trigger, scaled back consequence at higher PBR.*

Trigger: Same trigger and closure implementation as Preferred Alternative when PBR < 4. At higher PBRs, the trigger would be reduced by half to accommodate and allow for takes in multiple years (rather than having a greater initial trigger and assuming/allowing only zero or one take in years 2-5). This reduced trigger is still "generous," in that extrapolated takes would still exceed PBR in a given year. It would also allow NMFS to reopen the SEZ each year until the 5-year average M&SI level exceeds PBR.

Under this option, the trigger would also be dynamic and tied to the 5-year average M&SI level. NMFS would adjust the trigger each year based on the projection of the number of animals that could be taken without the 5-year average M&SI level exceeding PBR, but allowing a minimum of 1 take per year. Because the trigger would be adjusted each year based on takes in the previous year(s), it would take into account the takes that occurred inside the EEZ after the SEZ closed.

- When PBR < 4, the trigger = PBR * 5 * observer coverage (rounded down) [same as Preferred Alternative]
- When PBR ≥ 4, trigger = ½ * PBR * 5 * observer coverage

Four was selected as the cutoff because when the original trigger (PBR * 5 * observer coverage) is cut in half, the reduced trigger would still be greater than 1 animal/year.

Closure Implementation: The SEZ would be closed when the trigger was met, and reopened at the beginning of the next year. The SEZ would continue to be reopened each year, because the trigger would have a minimum of 1 take/year.

Example Scenarios: Scenario 3A is the same as scenario 2A, because PBR < 4. In scenario 3B, PBR > 4, so the second equation was used to calculate an initial trigger of 5. This trigger was met in year 1, and the SEZ was closed. There were no additional takes inside the EEZ after the SEZ was closed. The trigger would be recalculated as for year 2, assuming a minimum of 1 take per year in years 2-5. The trigger of 2, with 1 take each in years 3-5, would keep the 5-year average below PBR. The SEZ would be closed when the trigger of 2 was hit in year 2, and reopened at the beginning of year 3. It would be closed again when the trigger of 1 was hit, and reopened at the beginning of year 4, etc.

Scenario 3C shows the case where takes occurring in the EEZ after the SEZ closed count toward the readjusted trigger. In this scenario, the initial trigger of 5 was met in year 1, and the SEZ closed, but there were two additional takes in the EEZ that year. The SEZ was reopened in year 2 with an adjusted trigger: assuming a minimum of 1 take per year in years 2-5, the trigger for year 2 (and subsequent years) would be 1. As with scenario 3B, the SEZ would be closed each year when the trigger was hit, and reopened at the beginning of the following year. In this case, the three additional takes in the EEZ after the SEZ closed in year 5 put the 5-year average take above PBR.

Outcome: Despite a reduced (but still "generous") initial trigger that allows for takes in multiple years, PBR is still likely to be exceeded because the trigger is adjusted annually and accounts for takes in the EEZ after the SEZ closes. Additionally, the minimum of 1 take per year may cause the 5-year average to exceed PBR. This method also lacks the longer-term predictability that some of the earlier scenarios show because of the annually-adjusted trigger.

**Table A-3**. Alternative methods for SEZ trigger calculation and closure implementation – option 3.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3. "Generous" trigger, consequence scaled back at higher PBR. Same trigger and closure implementation as preferred alternative when PBR < 4; at higher PBRs, a reduced trigger to spread the takes out across multiple years. Trigger would be adjusted annually based on the number of animals that can be taken without the 5-year average exceeding PBR, with a minimum of 1/year allowed. | | | | | | | | | | |
| Trigger: When PBR < 4, Trigger = PBR * 5 * Observer coverage (rounded down)<br>When PBR >= 4, Trigger = 1/2 * PBR * 5 * Observer coverage; adjusted annually once trigger is hit to reflect number of animals that can be taken without the 5-year average exceeding PBR, assuming minimum of 1 take/year | | | | | | | | | | |
| **Scenario 3A** | | | | **Scenario 3B** | | | | **Scenario 3C** | | |
| **PBR** | | 2.5 | | **PBR** | | 10 | | **PBR** | | 10 |
| **Annual Observer Coverage** | | 20% | | **Annual Observer Coverage** | | 20% | | **Annual Observer Coverage** | | 20% |
| **Initial Trigger** | | 2 | | **Initial Trigger** | | 5 | | **Initial Trigger** | | 5 |
| **Year** | **Takes** | **Extrapolated M&SI** | | **Year** | **Takes** | **Extrapolated M&SI** | | **Year** | **Takes** | **Extrapolated M&SI** |
| 1 | 2 | 10 | | 1 | 5 | 25 | | 1 | 5 + 2 in EEZ after SEZ closed | 35 |
| 2 | 1 | 5 | | 2 | 2 | 10 | | 2 | 1 | 5 |
| 3 | 0 | 0 | | 3 | 1 | 5 | | 3 | 1 | 5 |
| 4 | 0 | 0 | | 4 | 1 | 5 | | 4 | 1 | 5 |
| 5 | 0 | 0 | | 5 | 1 | 5 | | 5 | 1 + 3 in EEZ after SEZ closed | 20 |
| **5-Year Average Take:** | | **3** | | **5-Year Average Take:** | | **10** | | **5-Year Average Take:** | | **14** |
| Outcome: Maintaining the 5-year average below PBR depends on the level of takes inside the EEZ after the SEZ closure. | | | | | | | | | | |

4. *Restrictive trigger, multiple chances*

Trigger: Very low trigger equal to (PBR * observer coverage), but no less than 1/year:

- When PBR * observer coverage < 2, trigger = 1

- When PBR * observer coverage >= 2, trigger = PBR * observer coverage (rounded down)

The goal is to prevent observed takes, when extrapolated, from exceeding PBR in a single year.

Closure Implementation: If the trigger were met in a given year, the SEZ would be closed until the end of the year, and reopened at the beginning of the following year.

Example Scenarios: In scenarios 4A and 4B in Table A-4, the trigger is met each year. NMFS would close the SEZ when the trigger was met, and reopened at the beginning of the next year. The SEZ would not be closed for more than a year at a time.

Scenario 4C illustrates the fact that it would require a relatively large change in PBR before the trigger changes. The difference in PBR between scenarios 4B and 4C is 1 animal/year in PBR, an the triggers differ by 1 animal/year. However, at 20% observer coverage, the 5-year average in scenario 4B is the same as PBR, while it is much lower than PBR in scenario 4C.

Outcome: The 5-year average would exceed PBR is PBR were less than 5 under current levels of observer coverage (20%), or if PBR is less than 4 at 25% observer coverage. NMFS is unlikely to increase overall observer coverage in the deep-set longline fishery, as described in the description of the Preferred Alternative (section 2.3.2.9). A large (and probably unrealistic) increase in PBR would be required to increase the trigger. However, there are scenarios where, at higher PBRs, the 5-year average take level would be below PBR, possibly significantly below PBR (as in scenario 4C).

In this and several other scenarios, takes that occur within the US EEZ around Hawaii after the SEZ is closed are not accounted for, so the actual total M&SI level may still exceed PBR.

**Table A-4**. Alternative methods for SEZ trigger calculation and closure implementation – option 4.

4. Restrictive trigger, multiple chances. Allow a very low trigger equal to (PBR * observer coverage), with no less than 1/year, but allow fishery to reopen every year.

Trigger: When PBR * observer coverage < 2, Trigger = 1
When PBR * observer coverage => 2, Trigger = PBR * observer coverage (rounded down)

Assume trigger met in all years. No other takes in the EEZ after the trigger is met.

| Scenario 4A | | | Scenario 4B | | | Scenario 4C | | |
|---|---|---|---|---|---|---|---|---|
| **PBR** | | 2.5 | **PBR** | | 10 | **PBR** | | 9 |
| **Annual Observer Coverage** | | 20% | **Annual Observer Coverage** | | 20% | **Annual Observer Coverage** | | 20% |
| **Trigger** | | 1 | **Trigger** | | 2 | **Trigger** | | 1 |
| **Year** | **Takes** | **Extrapolated M&SI** | **Year** | **Takes** | **Extrapolated M&SI** | **Year** | **Takes** | **Extrapolated M&SI** |
| 1 | 1 | 5 | 1 | 2 | 10 | 1 | 1 | 5 |
| 2 | 1 | 5 | 2 | 2 | 10 | 2 | 1 | 5 |
| 3 | 1 | 5 | 3 | 2 | 10 | 3 | 1 | 5 |
| 4 | 1 | 5 | 4 | 2 | 10 | 4 | 1 | 5 |
| 5 | 1 | 5 | 5 | 2 | 10 | 5 | 1 | 5 |
| **5-Year Average Take:** | | **5** | **5-Year Average Take:** | | **10** | **5-Year Average Take:** | | **5** |

Outcome: 5-year average will exceed PBR if PBR is less than 5 at 20% observer coverage, or less than 4 at 25% observer coverage. Requires a large change in PBR before trigger changes.

5. *Restrictive trigger, multiple chances, until 5-year average exceeds PBR*

Trigger: Very low "initial" trigger equal to (PBR * observer coverage), but no less than 1/year

- When PBR * observer coverage < 2, trigger = 1

- When PBR * observer coverage >= 2, trigger = PBR * observer coverage (rounded down)

The goal is to prevent observed takes, when extrapolated, from exceeding PBR in a single year. However, this method accounts for takes occurring in the EEZ after the SEZ closes; the SEZ would be closed when the total 5-year average MS&I level exceeded PBR.

Closure Implementation: The SEZ would be closed when the trigger was met, and reopened at the beginning of the next year. If/when the 5-year average take level exceeds PBR, the SEZ would remain closed until that take level were brought below PBR.

Example Scenarios: In scenario 5A, the trigger is 1 the trigger is met in years 1 and 2; the SEZ would be closed after the trigger was hit in each of those years, and reopened at the beginning of the next year. The trigger is again met in year 3; this take puts the 5-year average take above PBR, so the SEZ would be closed until the 5-year average was brought below PBR.

In scenario 5B, the trigger is met each year, and there are no takes in the EEZ after the SEZ closes, so the fishery reopens each year, and the 5-year average take does not exceed PBR.

In scenario 5C, the trigger (2) is met in year 1, and the SEZ closes for the remainder of the year; however, an additional 6 takes occur in the EEZ after the SEZ is closed. The trigger is again met in year 2. These takes cause the 5-year average to reach PBR, so the SEZ is closed for the remainder of the 5-year period. However, takes in the EEZ outside the SEZ in years 4 and 5 bring the 5-year average take level above PBR.

Outcome: Generally, the 5-year average takes are maintained below PBR, but takes occurring in the EEZ during a long-term closure of the SEZ might still bring the 5-year average take level above PBR.

**Table A-5**. Alternative methods for SEZ trigger calculation and closure implementation – option 5.

5. Restrictive trigger, multiple chances, to a point. Allow a very low trigger equal to (PBR * observer coverage), with no less than 1/yea), but allow fishery to reopen every year until takes exceed the 5-year average PBR

Trigger: When PBR * Observer coverage < 2, Trigger = 1
When PBR * Observer coverage >= 2, Trigger = PBR * observer coverage (rounded down)

Assume trigger met in several consecutive years. No other takes in the EEZ after the trigger is met.

| Scenario 5A | | | Scenario 5B | | | Scenario 5C | | |
|---|---|---|---|---|---|---|---|---|
| **PBR** | | 2.5 | **PBR** | | 15 | **PBR** | | 10 |
| **Annual Observer Coverage** | | 20% | **Annual Observer Coverage** | | 20% | **Annual Observer Coverage** | | 20% |
| **Trigger** | | 1 | **Trigger** | | 3 | **Trigger** | | 2 |
| **Year** | **Takes** | **Extrapolated M&SI** | **Year** | **Takes** | **Extrapolated M&SI** | **Year** | **Takes** | **Extrapolated M&SI** |
| 1 | 1 | 5 | 1 | 3 | 15 | 1 | 2 + 6 in EEZ after SEZ closed | 40 |
| 2 | 1 | 5 | 2 | 3 | 15 | 2 | 2 | 10 |
| 3 | 1 | 5 | 3 | 3 | 15 | 3 | 0 | 0 |
| 4 | 0 | 0 | 4 | 3 | 15 | 4 | 0 + 2 EEZ takes | 10 |
| 5 | 0 | 0 | 5 | 3 | 15 | 5 | 0 + 1 EEZ take | 5 |
| **5-Year Average Take:** | | **3** | **5-Year Average Take:** | | **15** | **5-Year Average Take:** | | **13** |

Outcome: Maintaining the 5-year average below PBR depends on the level of takes inside the EEZ after the SEZ closure.