United States
Department of
Commerce

National Oceanic
and Atmospheric
Administration

National Marine
Fisheries Service

November 2012

Final Environmental Assessment, Regulatory Impact Review, and Final Regulatory Flexibility Analysis

For the
False Killer Whale Take Reduction Plan

Pacific Islands Regional Office
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Finding of No Significant Impact for the Rule to Implement a False Killer Whale Take Reduction Plan

National Marine Fisheries Service

This Finding of No Significant Impact (FONSI) was prepared according to the guidelines established in National Marine Fisheries Service (NMFS) Instruction 30-124-1 (July 22, 2005) and the requirements of National Oceanic and Atmospheric Administration (NOAA) Administrative Order 216-6 (NAO 216-6, May 20, 1999), concerning compliance with the National Environmental Policy Act (NEPA, 42 U.S.C. § 4321, *et seq.*). This FONSI is supported by the Environmental Assessment (EA), Regulatory Impact Review, and Final Regulatory Flexibility Analysis prepared for the rule to implement a False Killer Whale Take Reduction Plan (Plan) (attached).

After considering a range of alternatives developed in coordination with the False Killer Whale Take Reduction Team and members of the public, NMFS will take the following action:

> This action implements a False Killer Whale Take Reduction Plan to reduce incidental mortalities and serious injuries of the Hawaii Pelagic and Hawaii Insular stocks of false killer whales in the Hawaii-based commercial longline fisheries. The Plan is intended to meet the requirements of the Marine Mammal Protection Act through regulatory and non-regulatory measures. Regulatory measures include gear requirements, longline prohibited areas, training and certification in marine mammal handling and release, captains' supervision of marine mammal handling and release, and posting of NMFS-approved placards on longline vessels. Non-regulatory measures include research and data collection recommendations.

Alternatives considered are included in the Final EA and include analysis of the no action alternative.

Significance Analysis

NAO 216-6 contains criteria for determining the significance of the impacts of a proposed action. In addition, the CEQ regulations at 40 C.F.R. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant in making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1. Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?

   > No, the action is not expected to jeopardize the sustainability of any target species that may be affected by the action. The action most directly affects the Hawaii-based deep-set longline fishery, which primarily targets bigeye and yellowfin tuna. In the Western and Central Pacific Ocean, management of bigeye and yellowfin tuna is quota-based, and any small changes in catch rates or catch efficiency due to the fleet-wide use of circle hooks would not affect the quota or the resource. Area closures, including the Southern Exclusion Zone, may provide a small benefit to target species in those areas. However,

the deep-set fishery would also be expected to utilize open areas to achieve their target quota. Bigeye and yellowfin tuna would continue to be harvested by the Hawaii-based deep-set longline fleet in accordance with international conservation and management measures for those stocks and any associated catch limits which help to ensure that the U.S. tuna fisheries are sustainable.

The gear requirements and Southern Exclusion Zone closure do not apply to the shallow-set fishery. The only measure within the action that could affect the shallow-set longline fishery's target swordfish catch is the revision to an existing closure around the Main Hawaiian Islands. However, from 2006 to 2010, there was little to no effort by the shallow-set fishery in the area that would be closed year-round under this action. Therefore, there is little to no impact to swordfish and the shallow-set swordfish fishery expected from this action.

Environmental consequences of the alternatives are discussed in section 4.0.

2. Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?

   No, the action is not expected to jeopardize the sustainability of any non-target species. The action's circle hook requirement for the deep-set fishery and the longline area closures may affect longline catches of non-target species, but the expected effect cannot be precisely determined. There may be increased conservation of non-target species within longline closed areas, but those effects would depend on the level of effort redistribution to other areas following a closure. Environmental consequences of the alternatives are discussed in section 4.0.

3. Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or EFH as defined under the Magnuson-Stevens Act (MSA) and identified in FMPs?

   No, the action is not expected to cause substantial damage to the ocean and coastal habitats and/or EFH as defined under the MSA and identified in Fishery Ecosystem Plans (FEPs). The area impacted by the action contains EFH and an abundance of life forms of commercial and non-commercial value. The characteristics of this area will not be significantly impacted by this action. Environmental consequences of the alternatives are discussed in section 4.0.

4. Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?

   No, public health and safety is not expected to be adversely affected by implementing management measures in the Hawaii-based longline fisheries included under the action. NMFS considers safety factors when implementing management measures. This action will not substantially change the way longline fishing is conducted. Longline fishermen participating on the FKWTRT helped develop the measures, and thus the action was developed with the longline fishermen's understanding of fishing practices and techniques and does not include any unsafe fishing practices.

5. Can the proposed action reasonably be expected to adversely affect endangered or threatened species, mammals, or critical habitat for these species?

No, the proposed action is not expected to adversely impact endangered or threatened species, marine mammals, or designated critical habitat. The 2005 and 2012 Biological Opinions (BiOps) for the deep-set and shallow-set fisheries considered potential stressors and impacts to listed species related to vessel collisions, hooking and entanglement with fishing gear, human disturbance, exposure to vessel waste, direct and indirect competition with foraging grounds and exposure to marine mammal deterrents. Based on these BiOps, NMFS determined that the deep and shallow set fisheries are not likely to jeopardize the continued existence of ESA listed-species, or destroy or adversely modify critical habitat.

The purpose of the action is to reduce the serious injury and mortality of false killer whales incidental to the commercial Hawaii-based longline fisheries. A suite of regulatory and non-regulatory measures, including gear specifications, vessel owner and captain training, and time/area closures, are included in the proposed action. In response to these measures, longline fishermen are expected to purchase and fish with the specified gear or otherwise modify gear as required, and relocate effort when areas are closed to longline fishing. Little overall reduction in longline fishing effort is anticipated, though there is potential that a small number of vessels may exit the fishery as a result of the action. Based on the findings of the biological opinions conducted on these fisheries, implementing the proposed action will not jeopardize or adversely affect any populations or habitats of species listed as endangered or threatened under the ESA in a manner not previously considered (see Section 3.2, Biological Environment, and Section 4.2, Biological Effects of the Alternatives), and may benefit those species through a reduction in the number or severity of incidental injuries in longline fisheries. No adverse effects to marine mammals or other non-target species are expected. Moreover, the management of the longline fishing will not change impacts to seabirds in either of the fisheries.

6. Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

   No, the action is not expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area. The action would implement management measures affecting pelagic longline fishing, and would not be expected to impact benthic communities. The action may benefit protected marine species in the area of operation of the Hawaii-based longline fisheries due to an expected reduction in the number and/or severity of interactions with false killer whales, other marine mammals, and other protected species from implementation from gear changes and handling/release procedures. There may also be benefits to target and non-target fish species within closed areas, but because longline vessels are expected to shift some or all of the fishing effort into adjacent waters, the benefits of the closures to target and non-target species may be limited. No changes are expected in the effects of longline fishing on biodiversity, ecosystem functions, or predator/prey relationships. Environmental consequences of the alternatives are discussed in section 4.

7. Are significant social or economic impacts interrelated with natural or physical environmental effects?

No, this EA documents no significant social or economic impacts associated with natural or physical effects resulting from implementation of the action. The action is designed to reduce the adverse effects of Hawaii-based longline fisheries on false killer whales. The potential social and economic impacts of the action are analyzed in Section 4.3 (Economic Impacts of the Alternatives) of this EA, as well as in the Regulatory Impact Review (Section 5) and Final Regulatory Flexibility Analysis (Section 6).

8. Are the effects on the quality of the human environment likely to be highly controversial?

   No, the effects on the quality of the human environment are not likely to be highly controversial. The imposition of additional regulations contributes to the regulatory burden on fishermen and the communities they support. However, the action is required to comply with the Marine Mammal Protection Act and its take reduction goals, and NMFS has undertaken to minimize impacts on fishing participants and communities where possible.

   The measures were developed and recommended by consensus of the multi-stakeholder False Killer Whale Take Reduction Team. Through public meetings and fishery participation on the Take Reduction Team, and opportunities for public and agency comment on the proposed rule, this action was coordinated with affected members of the public and other agencies, and no controversy regarding effects on the quality of the human environment were identified.

   In the proposed action, NMFS incorporated several administrative modifications to the Team's recommended measures, for practical purposes and in response to public comments received on the take reduction plan proposed rule. The take reduction measures, including limited area closures and gear modifications, do not result in controversial effects.

9. Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?

   The action would not impact park land, farmlands, wild and scenic rivers, or wetlands, as these areas are not in the vicinity of the area affected by the action. Compliance with the management measures would not likely result in the permanent loss or destruction of, or impact to, any historic or cultural resources or ecologically critical areas. As described in Section 3.2.1, the action would not modify fishing practices in a manner that would aversely affect EFH, HAPC, designated critical habitat of the Hawaiian monk seal, the habitat of false killer whales, or the habitat any other protected marine species.

10. Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

    The action is not expected to result in highly uncertain effects on the human environment or to involve unique or unknown risks. The management measures include gear specifications (type of hooks and lines), required training and posting of materials, and time/area closures; NMFS has previously implemented similar types of management measures in this and other fisheries, and they do not present unique or unknown risks. The fishery restrictions are clearly detailed, were developed through discussions with the

fishing community, and the analysis of potential impacts is based on a review of reliable information on fishery effort and landings.

11. Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

    The cumulative impacts of the management measures on ecosystem components found to be affected by this action, in conjunction with other past, present, and reasonably foreseeable future actions have been analyzed with regard to both context and intensity (section 4.4). The past, present, and reasonably foreseeable future actions considered were not found to result in significant cumulative impacts when analyzed together with the action.

12. Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?

    No, the action is not likely to affect objects listed in or eligible for listing in the National Register of Historic Places or cause significant impacts to scientific, cultural, or historical resources. There are no objects on the National Register of Historic Places within the area affected by the action, and none of the elements of the action would change fishing practices or fishing areas in a manner that would lead to the loss or destruction of significant scientific, cultural, or historical resources.

13. Can the proposed action reasonably be expected to result in the introduction or spread of a non-indigenous species?

    No, none of the elements of the action would result in the introduction or spread of non-indigenous species. The Hawaii-based longline fisheries operate both with the U.S. EEZ around the Hawaiian Islands, Palmyra Atoll, and Johnston Atoll, and on the high seas. The proposed action would not result in U.S. vessels moving to or fishing in areas that are not already utilized, nor would it result in foreign vessels operating in U.S. waters.

14. Is the proposed action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?

    No, the proposed action does not set a precedent for future actions with significant effects and is not a decision in principle about future considerations. Gear restrictions and time/area closures are routinely used for both protected species and fish management actions. The Southern Exclusion Zone closure area identified in the action implements a specific trigger/closure mechanism in response to false killer whale bycatch that is new to the Hawaii-based longline fisheries, but there are existing mechanisms for closing areas or the entire fishery upon reaching catch limits for some target and non-target species (e.g., the bigeye tuna catch limit in the Western and Central Pacific Ocean for the deep-set longline fishery, or the sea turtle catch limit in the shallow-set longline fishery). Additionally, a similar trigger-based management closure has been used by NMFS to control incidental mortalities and serious injuries of another marine mammal species in Atlantic gillnet fisheries, under the Harbor Porpoise Take Reduction Plan.

    The management measures in the proposed action address the specific issue of Hawaii-based longline fishery interactions with false killer whales in the Pacific Ocean. Thus, the FKWTRP is being implemented to achieve a specific, geographically-restricted,

species-specific objective, and is therefore not expected to establish a precedent for future actions.

15. Can the proposed action reasonably be expected to threaten a violation of Federal, state, or local law or requirements imposed for the protection of the environment?

    No, the action is not expected to violate Federal, State, or local environmental laws. Rather, the purpose of the action is to bring the Hawaii-based longline fisheries into compliance with MMPA requirements through implementation of a FKWTRP. The MMPA requires the implementation of measures, through a take reduction plan, to reduce the serious injury and mortality of marine mammals in U.S. commercial fisheries to levels that are below each stock's PBR level. Levels of false killer whale serious injury and mortality incidental to the Hawaii-based longline fisheries have exceeded the Hawaii pelagic stock's PBR level since 2000. The action is proposed to reduce the incidental take of false killer whales in the Hawaii-based longline fisheries to below PBR to allow the fisheries to operate without violating the requirements of the MMPA. Federal, State, and fishery management agency representatives participated on the FKWTRT, helping to ensure consistency with Federal, State and local laws. Additionally, NMFS forwarded the Draft EA (for the proposed action) to the Hawaii Coastal Zone Management Program to ensure compliance with State land, water use, and natural resource management programs.

16. Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

    No, the action cannot be reasonably expected to result in cumulative adverse affects that could have a substantial effect on any of the target or non-target species caught in Hawaii-based fisheries. The action would not be expected to lead to an increase in fishing effort or harvest levels; some measures may actually result in a reduction in effort. Shifts in fishing effort into waters adjacent to managed or closed areas are not likely to increase total harvest of target or non-target species, because harvest of target and non-target species is managed under the relevant FEPs and international fishery management organizations. The action would not affect quotas and other effort restrictions or limitations in the FEPs.

Climate Change Impacts

There are no specific studies about the impacts of ocean circulation pattern changes or climate change on tuna stocks of the western and Central Pacific region. In general, it has been shown that large scale climate cycles can impact winds, currents, ocean mixing, temperature regimes, nutrient recharge, ocean acidity, sea level, and affect the productivity of all trophic levels in the Pacific Ocean. These impacts can result in variability in fish stock size, recruitment, growth rates, or other factors affecting fish stocks. Pelagic fish stocks, as well as protected species that interact with the fisheries, are currently affected by these large-scale climate fluctuations and will continue to be affected in the same way whether or not FKWTRP is implemented. Climate change will not affect the environmental impact or effectiveness of implementing measures that will establish gear requirements and area closures, but will otherwise not change fishing intensity, location of fishing, or the number of participants. Because no large changes are

expected to occur in any of the fisheries, the proposed action will not result in a change to annual greenhouse gas emissions.

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment, Regulatory Impact Review, and Final Regulatory Flexibility Analysis prepared for the rule to implement a False Killer Whale Take Reduction Plan, it is hereby determined that the rule to implement a False Killer Whale Take Reduction Plan will not significantly impact the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an environmental impact statement for this action is not necessary.

11/9/12

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Date

Final Environmental Assessment, Regulatory Impact Review, and Final Regulatory Flexibility Analysis for the False Killer Whale Take Reduction Plan

November 2012

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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 issuing 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 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

The U.S. Marine Mammal Protection Act (MMPA) requires the development and implementation of take reduction plans to reduce the incidental mortalities and serious injuries (M&SI) of certain marine mammal stocks in commercial fisheries. Levels of incidental M&SI of false killer whales in the Hawaii-based longline fisheries exceed the thresholds established under the MMPA, and are therefore inconsistent with the mandates of the MMPA and must be reduced. Therefore, NOAA's National Marine Fisheries Service (NMFS) is, by this action, implementing a take reduction plan to meet the MMPA's take reduction requirements for false killer whales.

NMFS published a proposed rule to implement a False Killer Whale Take Reduction Plan (FWKTRP) in the Federal Register on July 18, 2011 (76 FR 42082). In the Federal Register notice, NMFS also announced the availability of a Draft Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) for the proposed FKWTRP. The proposed rule and Draft EA/RIR/IRFA were available for public comment for 90 days. A total of 86 public submissions were received, 68 of which were identical, or slightly modified form letters expressing support for the proposed rule, and 18 contained substantive comments on specific measures or components of the proposed rule. All comments specific to the content of the proposed rule are summarized and responded to in the final rule, which will be published in the Federal Register. Only 4 public submissions contained comments specific to the analysis in the Draft EA/RIR/IRFA. A summary of those public comments and our responses can be found in Appendix A of this document.

This Final Environmental Assessment/Regulatory Impact Review/Final Regulatory Flexibility Analysis (EA/RIR/FRFA) analyzes the effects on the quality of the human environment caused by the implementation of a final rule to implement a FKWTRP. 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.
- Alternative 2: Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team. The 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 circle hooks with a maximum wire diameter of 4.5 mm and other specific characteristics in the Hawaii-based deep-set longline fishery;

    (2) establish a minimum diameter for monofilament line and a minimum breaking strength for any other line material used in the construction of leaders and branch lines in the Hawaii-based deep-set longline fishery. A branch line typically includes a snap, monofilament line, weight, swivel, leader (monofilament or wire), and hook;

    (3) modify an existing longline exclusion area around the Main Hawaiian Islands (MHI) to prohibit longline fishing year-round in an area that is currently closed only seasonally;

    (4) expand existing annual certification requirements for longline vessel owners and operators to include marine mammal interaction mitigation techniques;

    (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 (SEZ) that would be 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 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 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.

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

The Preferred Alternative, as described above, was updated from the Preferred Alternative identified in the Draft EA/RIR/IRFA, based on new information and analysis, and in response to issues raised in public comments. Updates include a revised maximum wire diameter for circle hooks, removal of the maximum size specification for circle hooks, an administrative change in the approach to implementing the MHI longline fishing prohibited area, and revised procedures for calculating the trigger for and closing the SEZ. The analysis throughout this final EA/RIR/FRFA has been updated where necessary to reflect the changes to the Preferred Alternative.

The analysis in the document shows that 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 implementing the Preferred Alternative as the final False Killer Whale Take Reduction Plan (FKWTRP).

ACRONYMS

APA	Administrative Procedure Act
BCA	Benefit-Cost Analysis
CEQ	Council on Environmental Quality
CFCAA	Consolidated and Further Continuing Appropriations Act, 2012
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
EPO	Eastern Pacific Ocean
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FEP	Fishery Ecosystem Plan
FKWTRP	False Killer Whale Take Reduction Plan
FKWTRT	False Killer Whale Take Reduction Team
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
IRFA	Initial Regulatory Flexibility Act Analysis
LOF	List of Fisheries
M&SI	Mortality and Serious Injury
MBTA	Migratory Bird Treaty Act
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
PDO	Pacific Decadal Oscillation
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
SST	Sea Surface Temperature
TAC	Total Allowable Catch
USCG	United States Coast Guard

USFWS	United States Fish and Wildlife Service
VMS	Vessel Monitoring System
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean
WPRFMC	Western Pacific Regional Fishery Management Council
WTP	Willingness-to-Pay
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/Final Regulatory Flexibility Analysis (EA/RIR/FRFA). An EA/RIR/FRFA 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 FRFA). This EA/RIR/FRFA addresses the statutory requirements of the National Environmental Policy Act (NEPA), Presidential Executive Order 12866, and Regulatory Flexibility Act (RFA). This EA/RIR/FRFA 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 Code of Federal Regulations (CFR) 229.2 define categories of fisheries based on their level of incidental M&SI of marine mammals. A Category I fishery is a commercial fishery that has frequent incidental M&SI of marine mammals, meaning that, by itself, it is responsible for the annual removal of 50% or more of any stock's PBR level. Category II fishery is a commercial fishery that has occasional incidental M&SI of marine mammals, meaning that, collectively with other fisheries, it is responsible for the annual removal of more than 10% of any marine mammal stock's PBR level and is by itself responsible for the annual removal of between 1 and 50%, exclusive, or any stock's PBR level. A Category III fishery is a commercial fishery that has a remote likelihood of, or no known incidental M&SI of marine mammals, meaning that, collectively with other fisheries, it is responsible for the annual removal of 10% or less of any stock's PBR level, or more than 10% of any stock's PBR level but by itself is responsible for the annual removal of 1% or less of that stock's PBR level. "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 the relevant stock's 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 default insignificance threshold for ZMRG as 10% of PBR (69 FR 43338, July 20, 2004). See 50 CFR 229.2.

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 final action is to implement a take reduction plan, pursuant to the MMPA, to reduce incidental M&SI of two 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, consistent with the short-term and long-term goals of Section 118. This action is needed because total 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 Action

Two false killer whale stocks identified in the Draft 2012 U.S. Pacific Marine Mammal Stock Assessment Reports (SAR) (Carretta et al. 2012b) are addressed by the 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 (MHI). The Hawaii Pelagic stock has partially overlapping range with the Hawaii Insular and Northwestern Hawaiian Islands stocks of false killer whales. 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 (13.6 animals per year) and the Category II Hawaii-based shallow-set longline fishery (0.2 animals per year) exceeds the stock's PBR level (9.1 animals per year), as of the Draft 2012 SAR (Carretta et al. 2012b). Additionally, though the stock's PBR level is only calculated for the EEZ around Hawaii, there is an estimated average annual M&SI of 11.2 pelagic false killer whales per year in the deep-set longline fishery on the high seas (Carretta et al. 2012b).

(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 MHI. The Hawaii Insular stock has a partially overlapping range with the Hawaii Pelagic and Northwestern Hawaiian Islands stocks of false killer whales. If a false killer whale is taken within the Pelagic/Insular stock overlap zone and the stock identity cannot be confirmed by photographic or genetic evidence, the mortality or serious injury is prorated. There are no genetic samples or photographs available to establish the stock identity for the false killer whales seriously injured or killed within the Pelagic/Insular overlap zone; thus they have been prorated. The prorated level of M&SI of the Hawaii Insular stock incidental to the Hawaii-based deep-set longline fishery (0.5 animals per year) exceeds the stock's PBR level (0.3 animals per year) (Carretta et al. 2012b). The Hawaii Insular stock has been designated as strategic. NMFS proposed to list Hawaiian insular false killer whales as an endangered distinct population segment under the ESA (75 FR 70169, November 17, 2010).

1.3.2 Marine Mammal Stocks Not Addressed by the Final Action

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

(2) False killer whale, Northwestern Hawaiian Islands (NWHI) stock. This stock was newly defined for the2012 Draft SAR and includes false killer whales found within 93 km (50 nm) of the NWHI and Kauai (Carretta et al. 2012b). This stock was not included in the scope of the Team's discussions or in the proposed action because survey information was not yet available and the stock had not yet been defined. It is not included in the final action because, although the rate of mortality and serious injury to false killer whales within the NWHI is unknown, it may be approaching zero if the stock remains entirely within Monument waters and the longline exclusion zone near Kauai, as its range is currently defined.

(3) False killer whale, Palmyra Atoll stock. This stock includes false killer whales found within the U.S. 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. 2012a).

MMPA Section 118(f)(1) provides that NMFS may develop take reduction plans for non-strategic marine mammal stocks interacting with a Category I fishery if NMFS determines, after notice and opportunity for public comment, that the fishery has a high level of M&SI across a number of such marine mammal stocks. The MMPA does not further define the term "high level". However, evaluation of the fishery's M&SI compared to PBR for the non-strategic marine mammals taken in the fishery, as presented in the final 2011 SARs (Carretta et al. 2012a; assessments for these stocks were not updated in the draft 2012 SARs), indicate levels of M&SI (i.e., levels between 0% and 4.7% of PBR) across seven stocks that meet the insignificance threshold set forth in 50 CFR 2292 (see (4) below for information on these other non-strategic stocks). Accordingly, this level of M&SI across non-strategic marine mammal stocks cannot be considered a "high level" for purposes of including these stocks in a take reduction plan. Therefore, NMFS is not including any non-strategic marine mammal stocks, such as the Palmyra Atoll stock of false killer whales, in the scope of the final Plan.

(4) Other marine mammal stocks in the Pacific Islands Region**.** The 2012 MMPA List of Fisheries (LOF) (76 FR 73912, November 29, 2011) 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; Carretta et al. 2012a), and were therefore not addressed by the

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 FKWTRP also does not address M&SI of humpback whales.

1.3.3 Commercial Fisheries Addressed by the Final Action

The action addresses the following two fisheries, as identified on the MMPA LOF:

(1) Hawaii-based deep-set longline fishery. The Category I Hawaii-based deep-set longline fishery operates both within and outside of the EEZ around Hawaii (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. Average annual M&SI estimates from 2006-2010 were 13.6 animals per year inside the EEZ around Hawaii and 11.2 animals per year on the high seas from the strategic Hawaii Pelagic stock of false killer whales, and 0.5 animals per year from the strategic Hawaii Insular stock (Carretta et al. 2012b). 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 and Hawaii Insular stocks.

(2) Hawaii-based shallow-set longline fishery. The Category II Hawaii-based shallow-set longline fishery operates both within and outside of the EEZ around Hawaii (defined on the MMPA LOF as the "HI shallow-set (swordfish target) longline/set line" and "Western Pacific Pelagic (Shallow-set component" fisheries). The Draft 2012 reports average annual M&SI from 2006-2010 were 0.2 animals per year inside the EEZ around Hawaii and 0.1 animal per year on the high seas from the strategic Hawaii Pelagic stock of false killer whales (Carretta et al. 2012b). The fishery was originally addressed by the proposed action due to the concern over the increase in the number of false killer whale takes that occurred in the deep-set longline fishery (i.e., from an estimated 3 animals in 2005 to a high of 17 in 2008; Carretta et al. 2011) , and the shallow-set fishery's recent interactions with false killer whales. However, the shallow-set fishery now also meets the MMPA requirement for the development of a Take Reduction Plan because of its incidental M&SI of the strategic Hawaii Pelagic false killer whale stock.

1.3.4 Commercial Fisheries Not Addressed by the Final Action

The following fisheries, as identified on the MMPA LOF, were considered, but were not addressed in the proposed action and are not addressed in the final 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 was less than 10% since a mandatory observer program began in 2006, but increased to 25% in 2010 and 33.3% in 2011. As stated above, while there is information on the level of interactions with false killer whales, there is little information on 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), none were killed or seriously injured in 2009-2010, and three were preliminarily determined to be seriously injured in 2011. Additionally, one blackfish (i.e., either false killer whale or short-finned pilot whale) was observed hooked, but its preliminary injury severity could not be determined (NMFS Observer Program reports and unpublished data). It is unknown whether this level is unsustainable because an abundance estimate and calculation of PBR for the 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 this final action. NMFS will continue to evaluate incidental interaction rates in the American Samoa longline fishery, and will consider additional conservation and management measures if warranted by the information developed.

(2) Hawaii shortline fishery and other pelagic 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) was considering management of the fishery, but no longer has immediate plans to do so. 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. However, this would not preclude management by those who are able to see and work with those data to make appropriate management decisions.

In addition to the shortline fishery, there are other near-shore state-managed pelagic 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 final 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 regulating these fisheries at this time. These and other nearshore pelagic 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 Final Action

The specific short-term and long-term goals of the action are defined to meet the bycatch reduction requirements of MMPA section 118(f). M&SI of the Hawaii pelagic and Hawaii insular stocks of false killer whales that occurs incidental to the Hawaii-based longline fisheries is known to exceed the stocks' PBR levels. The short-term goal of the FKWTRP, therefore, is to reduce, within six months of its implementation, incidental M&SI of the Hawaii pelagic and Hawaii insular stocks of false killer whales in the Hawaii-based longline fisheries, within the EEZ around Hawaii, to less than the stocks' PBR level (9.1 false killer whales per year for the Hawaii pelagic stock and 0.3 false killer whales per year for the Hawaii insular stock, as of the Draft 2012 SAR, Carretta et al. 2012b).

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 better understand the impacts of false killer whales incidental takes on the high seas. However, these information gaps 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, a goal of the FKWTRP is that incidental M&SI of the high seas component of the Hawaii Pelagic stock does not increase above current levels (i.e., 11.2 false killer whales per year, as of the Draft 2012 SAR, Carretta et al. 2012b).

The long-term goal of the FKWTRP is to reduce, within five years of its implementation, the M&SI of the Hawaii pelagic and Hawaii insular stocks of false killer whales to insignificant levels approaching a

zero mortality and serious injury rate (i.e., less than 10% of their respective PBR levels), as determined under 50 CFR 229.2.

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 issued a proposed rule, based on the FKWTRT's recommendations, to implement a proposed FKWTRP. NMFS also held a FKWTRT meeting in July 2011 during the public comment period for the proposed rule. In this final action, NMFS is issuing a final rule to implement the 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 FRFA, 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 action (section 1.3 of this document), alternatives (section 2), the environmental impacts of the 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 Final 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 rule;
3. A description of and, where feasible, an estimate of the number of small entities to which the rule will apply;
4. A description of the projected reporting, recordkeeping and other compliance requirements of the 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 rule; and
6. A description of any significant alternatives to the rule which accomplish the stated objectives (of the action), consistent with applicable statutes, and which would minimize any significant adverse economic impact of the rule on directly regulated small entities.

1.6 Changes from the Draft EA/RIR/IRFA

On July 18, 2011, NMFS published a proposed FKWTRP in the Federal Register and made the Draft EA/RIR/IRFA available for public comment. This Final EA/RIR/FRFA includes changes made in response to public comments as well as modifications based on additional analysis, as described in Table 1.1. A summary of public comments received on the Draft EA/RIR/IRFA and NMFS's responses can be found in Appendix A.

Table 1.1. Summary of changes from the Draft EA/RIR/IRFA to the Final EA/RIR/FRFA.

Section of the Document	Change from Draft Document
1.2 Statutory Requirements for Marine Mammal Take Reduction	Added clarifying text on definitions of Category I and II fisheries
1.3 Purpose and Need for Action	Updated information on marine mammal stocks and fisheries, based on the most recent stock assessment reports (Draft 2012 SARs), and updated discussion on marine mammal stocks included or not included in the scope of the final FKWTRP
1.6 Changes from the Draft EA/RIR/IRFA	Added new section to describe changes from the Draft EA/RIR/IRFA
2.3.2 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team (Description of Alternative 2)	Revised descriptions of the measures in the Preferred Alternative, including: - Hook requirements – removed the size requirement; revised the maximum wire diameter requirement; changed language for clarity - Branch line requirements – changed language for clarity - MHI Longline Fishing Prohibited Area – revised description of the technical implementation of the measure, but substance of the measure is unchanged - Protected Species Workshop – changed language for clarity - Southern Exclusion Zone – described a revised trigger/closure mechanism based on issues raised in public comments and NMFS's further analysis; area boundary and the concept of 2-step trigger/closure remain the same
2.4 Alternatives Considered but Not Analyzed Further	Revised text to reflect other options considered; deleted reference to an appendix containing details of alternative Southern Exclusion Zone measures (appendix is deleted from this document)
3.2 Biological Environment	Streamlined and condensed the descriptions; updated information as available; and made factual corrections
3.3 Social and Economic Environment	Updated with new data or information; revised and streamlined the description of the longline fisheries for clarity; made factual corrections; supplemented with new information in response to public comments

Section of the Document	Change from Draft Document
4.2.2 Alternative 2. Preferred Alternative: Implement regulatory and non-regulatory measures based on recommendations from the False Killer Whale Take Reduction Team (Environmental Consequences of Alternative 2)	Updated analysis to reflect impacts of revised measures
4.3 Economic Impacts of the Alternatives	Updated analysis to reflect impacts of revised measures and in response to public comments
4.4 Cumulative Effects Analysis	Updated analysis to include recent management measures and information in response to public comments
4.5 Comparison of the Alternatives	Updated to reflect impacts of revised measures (from Sections 4.2-4.3)
5.0 Regulatory Impact Review	Updated with new data or information; updated to reflect impacts of revised measures; supplemented analyses in response to public comments
6.0 Final Regulatory Flexibility Analysis	Updated with new data or information; updated to reflect impacts of revised measures; supplemented analyses in response to public and Small Business Administration comments
7.0 Other Applicable Law	Updated where applicable (e.g., dates that new memos were signed, concurrence letters received)
9.0 References	Updated, reorganized for clarity and completeness
Appendix A - Public Comments on the Draft EA/RIR/IRFA and Responses	Added new appendix that summarizes public comments received on the Draft EA/RIR/IRFA and provides responses
Appendix B – Draft EA/RIR/IRFA for the Proposed False Killer Whale Take Reduction Plan	Added new appendix that contains the Draft EA/RIR/IRFA in its entirety, to facilitate readers' understanding of the evolution of the Preferred Alternative and impacts analysis
Appendix I - Alternative Methods for SEZ Trigger Calculation and Closure Implementation	Removed appendix that described several alternatives considered for the proposed SEZ management measures

2.0 DESCRIPTION OF THE ACTION AND ALTERNATIVES

2.1 Objective of the Action and Alternatives

NMFS is implementing a FKWTRP to reduce incidental M&SI of Hawaii pelagic and Hawaii insular false killer whales in the Hawaii-based deep-set and shallow-set longline fisheries to below the stocks' PBR levels within 6 months of implementation, and to insignificant levels approaching a zero rate within 5 years of implementation. This section describes the 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, and Palmyra Atoll. 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).

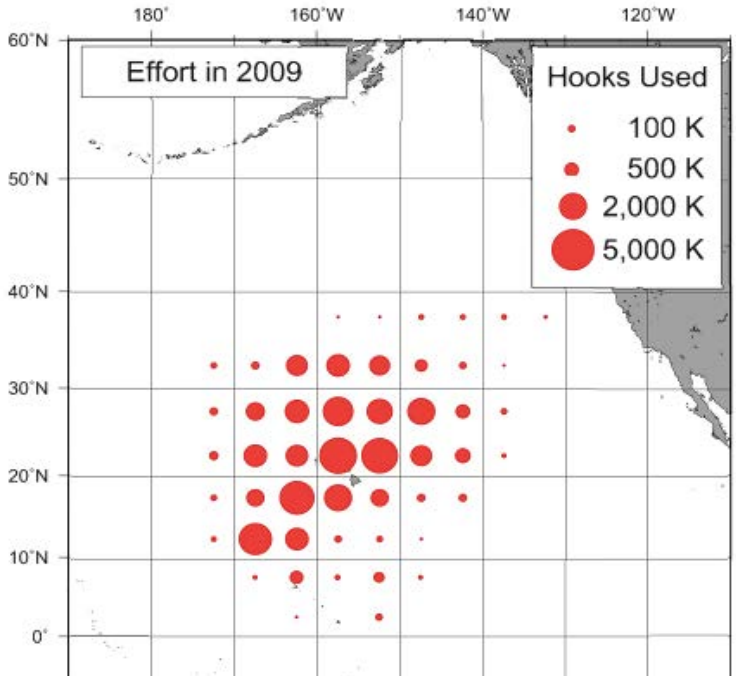

Figure 2.1. Spatial distribution of reported logbook fishing effort by the U.S. longline fleet, in thousands (K) of hooks, in 2009. Effort in some areas is not shown in order to preserve data confidentiality (NMFS 2010a).

2.3 Alternatives Considered

This section describes the action and two alternatives considered for the 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 circle hooks with 4.5 mm maximum wire diameter and other specific characteristics in the Hawaii-based deep-set longline fishery

Shape

Under this Alternative, NMFS would require that vessels on declared deep-set trips must use only circle hooks, as recommended by the FKWTRT. Analysis of observer data and predictive simulations indicate that the exclusive use of circle hooks 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 following interactions (FKWTRT 2010, Forney et al. 2011). 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 circle hooks may further reduce the number of incidental M&SI of false killer whales in the deep-set longline fishery.

Wire Diameter

NMFS proposed the required use of “weak” circle hooks in the deep-set fishery. “Weak” 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, hooks are expected to be strong enough to retain target bigeye tuna catch, but should bend and straighten under the pull strain of a hooked false killer whale, allowing the animal to release itself and thereby reduce the severity of the animal’s injury.

Wire diameter is one characteristic of a hook that contributes to its strength. During the development of the Draft and proposed FKWTRPs, NMFS and the FKWTRT understood that the “standard” wire diameter of circle hooks used in the deep-set fishery was 4.5 mm (0.177 in), based on the information available at that time. Based on this understanding, the FKWTRT concluded that the use of circle hooks of 4.0 mm or 4.2 mm would provide even greater conservation benefits. The Team recommended the required use of circle hooks with a maximum wire diameter of 4.0 mm (0.157 in), if a new research study was conducted and showed that the weaker hooks had no significant negative impacts on the retention of target species catch. If the analysis demonstrated that the use of 4.0 mm hooks will have a substantial

impact on tuna catch rates, the Team recommended additional trials to test whether 4.2 mm hooks would have a substantial impact on tuna catch rates. 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 4.0 mm wire diameter 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 collaboration with the Hawaii-based deep-set longline fishery and independent researchers, conducted a study to quantify the effects of hook wire diameter on bigeye tuna catch, comparing 15/0 circle hooks with 4.5 mm versus 4.0 mm wire diameter. 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 and found no significant negative impact to target catch of size 15/0 circle hooks with wire diameter of 4.0 mm compared to 4.5 mm (Bigelow et al. 2011). The hooks with 4.0 mm wire diameter had a statistically significant higher rate of straightening, though the rate of straightening was relatively low (0.462 per 1,000 4.0 mm wire diameter hooks, and 0.291 with no catch), and lower than studies of weak hooks in other fisheries (Bigelow et al. 2011). NMFS did not conduct trials with 4.2 mm hooks.

The FKWTRT's recommendations and the results of the study (Bigelow et al. 2011) formed the basis of NMFS's proposed requirement that the wire diameter of circle hooks in the deep-set longline fishery must not exceed 4.0 mm.

Two significant issues regarding the wire diameter requirement were raised during the public comment period. First, commenters and FKWTRT members emphasized that the Bigelow et al. (2011) study was not adequate to determine the potential effects of the weak hooks in the deep-set fishery. Specifically, commenters noted that the study was not conducted during the time of year when the largest bigeye tuna are historically caught, and the fish caught during the study period were substantially smaller than fish caught during that same time frame in previous years. Thus, they argued, the study was not able to confirm that larger bigeye tuna could be retained on the 4.0 mm wire diameter hooks. Follow-up analysis by Bigelow (2012) confirmed the seasonality effect of size and value of bigeye tuna in the fishery. Based on these findings, NMFS does not have sufficient data to determine whether the proposed weak hooks would have a significant impact on target catch throughout the year.

Second, NMFS received new information during the public comment period that indicates the use of 4.5 mm (0.177 in) wire diameter circle hooks in the deep-set fishery is not as widespread as was first believed during the development of the FKWTRT's recommendations and NMFS's proposed FKWTRP, and is therefore not representative of an industry "standard." NMFS confirmed this information by contacting major hook suppliers for the deep-set fishery. Information was obtained for approximately 80% of the vessels in the deep-set fishery. Only an estimated 20% of those vessels are believed to be using size 15/0 or smaller circle hooks with wire diameter of 4.5 mm or less; the remaining 80% are believed to be using circle hooks with a larger wire diameter (e.g., size 16/0 circle hooks with 4.7 mm or 5.0 mm wire diameter), or are using tuna or J hooks. Therefore, the majority of hooks currently in use are of larger wire diameter, and are therefore likely stronger, than what was believed to be the "standard" wire diameter for circle hooks in the deep-set fishery.

Team's consensus recommendation was that while "standard" circle hooks (14/0, 15/0, 16/0; 4.5mm wire diameter) alone will likely help reduce M&SI compared to tuna and J hooks, weaker than standard circle hooks (i.e., those with a smaller wire diameter, such as 4.0 mm or 4.2mm) would provide even greater conservation benefits (FKWTRT 2010). We agree. However, as indicated above, the Team's recommendation was based on the erroneous assumption that the standard diameter in use by the industry was 4.5 mm, rather than the more commonly used 4.7 mm or 5.0 mm. Accordingly, while we agree with the Team's findings, under this Alternative, NMFS would require a fleet-wide shift to ≤4.5 mm wire

diameter for circle hooks, so as to achieve a comparable reduction in hook wire diameter based on the corrected information.

In summary, NMFS has insufficient information to support the required use of circle hooks with 4.0 mm wire diameter at this time. In response to information received or obtained during the public comment period, under this Alternative, NMFS would revise the regulations to specify a maximum wire diameter of 4.5 mm.

Other Specifications

To aid in enforcement of the hook's wire diameter provision, NMFS would require that the hook shank contain round (non-flattened) wire that can be measured with a caliper or other appropriate gauge. Additionally, hook offset must not exceed 10 degrees.

Hook Requirement Summary

Under this alternative, NMFS would require that deep-setting vessels use circle hooks with a wire diameter not to exceed 4.5 mm (0.177 in). Hooks must contain round (non-flattened) wire that can be measured with a caliper or other appropriate gauge, and have a 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. The "stowed and unavailable for use" requirement for hooks not meeting the requirements is intended to foster effective enforcement yet enable vessels that engage in both the deep-set and shallow-set fisheries to carry gear for both fisheries.

2.3.2.2 Establish a minimum diameter for monofilament leaders and branch lines 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 branch line 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 branch lines, via a minimum diameter requirement.

In the final action, NMFS is establishing a minimum diameter of 2.0 mm for monofilament used to construct any part of branch lines, and a minimum breaking strength of 400 pounds for any material used to construct a branch line other than the hook in the Hawaii-based deep-set longline fishery. The intent of this measure is that the gear be assembled and maintained such that the hook is the weakest component of the terminal tackle.

2.3.2.3 Modification to the existing Main Hawaiian Islands Longline Fishing Prohibited Area

An existing longline exclusion zone prohibits commercial longline fishing year-round around the MHI (MHI) (50 CFR 665.806(c)). The exclusion zone was created in 1992 to reduce conflict between longline fisheries and pelagic troll/handline fisheries (57 FR 7661, March 2, 1992). The outer extent of the boundary changes seasonally to allow longline fishing to occur closer to the windward shores of the MHI between October and January (WPRFMC 2009a). From February-September, the longline exclusion zone covers 263,775 km^2 (76,904 nm^2). From October through January, the exclusion zone shrinks to 192,390 km^2 (56,092 nm^2). Thus, the seasonally open area covers 71,385 km^2 (20,813 nm^2).

The entire "core" range of the Hawaii insular stock of false killer whales falls within existing the year-round closure (i.e., inside the October-January boundary). However, the seasonally open area of the exclusion zone (i.e., the area between the October-January boundary and the February-September

boundary) is within the area of overlap between the Hawaii insular and pelagic stocks of false killer whales as defined in the Draft 2012 SAR (Carretta et al. 2012b). 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) in the longline fisheries has been documented in that seasonally open area.

Under this Alternative, NMFS would establish a Main Hawaiian Islands Longline Fishing Prohibited Area in FKWTRP regulations at 50 CFR part 229, bounded by the same coordinates as the existing February-September longline exclusion zone (Figure 2.2). Longline fishing within this area would be prohibited year-round. Such an exclusion would, in effect, maintain the current boundary of the February-September longline exclusion zone prohibitions throughout the entire year.

This regulation would make it clear that the entire area around the MHI, not just the seasonally open area to the north of the MHI, is important for false killer whale conservation. 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 be prohibited from the Hawaii Insular stock's entire "core" range and a very large portion of the stock's "extended" range. It would also likely reduce M&SI of the Hawaii pelagic false killer whale stock in that area.

The MHI Longline Fishing Prohibited Area would still be defined in 50 CFR 665.806(a). As authorized under MSA section 305(d), NMFS would revise the existing regulations in 50 CFR 665.806(a)(2) for the MHI Longline Fishing Prohibited Area to eliminate the seasonal boundary change. This action would be necessary to ensure the fisheries management regulations remain consistent with all applicable laws and regulations, including MMPA and the FKWTRP regulations.

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

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 believes more 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 also recommended that NMFS develop an additional voluntary component of the training to teach marine mammal photo-identification techniques to vessel owners and operators interested in participating in 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 expanded the content of the workshops in consultation with the FKWTRT to meet the needs of the FKWTRP and has presented the revised content since late 2010. To ensure the marine mammal component is maintained by regulation as part of the workshops, NMFS is also adding the requirement for certification to the take reduction plan regulations, under MMPA authority. NMFS has not yet begun to develop voluntary photo-identification training for fishermen.

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

Under this alternative, NMFS would 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 requirement would facilitate the careful handling and release of marine mammals incidentally hooked or entangled during longline fishing, including false killer whales, other small cetaceans, and large whales.

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 2.3.2.4 above), NMFS would 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 would 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, so long as the captain at all times maintains effective communications with and oversight of the crew.

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

NMFS would 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, as would be required under this Alternative (see 2.3.2.6 above).

2.3.2.8 Establish a Southern Exclusion Zone and specific triggers for closure

The action includes a series of contingency measures, including an area closure, to protect false killer whales should the other 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 would 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° 30' W. longitude, on the west at 165° 00' W. longitude, on the north by the MHI Longline Fishing Prohibited Area (boundary defined at 50 CFR 806(a)(2))and the Papahanaumokuakea Marine National Monument (PMNM, boundary defined at 50 CFR 404.2)), and on the south by the boundary of the EEZ around Hawaii (Figure 2.2). The SEZ would cover 386,122 km^2 (112,575 nm^2), that if closed, would reduce the area available to longline fishing within the EEZ around Hawaii by approximately 17%.

Within the EEZ, much of the deep-set longline fishing effort is currently concentrated around the MHI (compared to the NWHI), so it may be more illustrative to understand how much of the EEZ the SEZ would cover relative to the MHI, defined as the area to the east of 161° W. longitude (50 CFR 665.12). The SEZ and the existing MHI Longline Fishing Prohibited Area both extend into waters west of the 161° W. longitude boundary, but *for the portion of the area east of 161° W. longitude*, the SEZ would comprise approximately 35% of the area available to longline fishing within the EEZ (i.e., the EEZ east of 161° W.

longitude minus MHI Longline Fishing Prohibited Area that would be closed year-round under this Alternative; or 239,465 km^2 [69,816 nm^2] of the available 682,958 km^2 [193,572 nm^2]).

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 closure must be sufficiently large to prevent false killer whales from simply following boats and gear to areas outside of the closure. The SEZ defined by the FKWTRT and NMFS, at 386,122 km^2, is slightly larger than the state of Montana (380,838 km^2). 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 would 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 FKWTRP would not be counted retroactively against the trigger.

The following paragraphs describe the steps NMFS would take when determining whether to prohibit deep-set longline fishing in the SEZ. There are different procedures depending on whether there was a closure of the SEZ in the previous year. These steps closely approximate those outlined by the FKWTRT in the Draft FKWTRP.

(a) Defining the trigger.

The trigger would be defined as the larger of these two values:

(i) Two observed M&SI of false killer whales by the deep-set fishery within the EEZ around Hawaii; or

(ii) The smallest number of observed M&SI of false killer whales by the deep-set fishery within the EEZ around Hawaii that, when extrapolated based on the percentage observer coverage for that year, exceeds PBR.

This trigger accounts for possible changes in observer coverage and PBR in future years under the FKWTRP. Therefore, under the first threshold, the minimum trigger is two. For the second threshold to be applicable (i.e., a trigger larger than two), PBR would need to be 10 or greater, given current levels of observer coverage in the deep-set fishery (20%). If PBR were less than 10, two observed M&SI, when roughly extrapolated to the entire fishery based on 20% observer coverage (10 animals), would exceed PBR. Since M&SI cannot exceed PBR, under this example, the trigger would remain at two under the first threshold. If, on the other hand, PBR was determined to be 10 or greater, 2 observed M&SI, when roughly extrapolated to the entire fishery based on 20% observer coverage (10 animals), would be less than or equal to PBR, so the trigger could be increased until M&SI exceeds PBR.

NMFS would specify the trigger definition in the FKWTRP regulations and establish the trigger value for the first year of FKWTRP implementation as **two** observed false killer whales, given the current PBR for the Hawaii Pelagic stock and the deep-set fishery observer coverage level. The trigger value would remain valid until NMFS published a new trigger in the *Federal Register*. For example, if observer coverage in the deep-set fishery or PBR for the Hawaii Pelagic stock changed substantially enough to change the trigger value, NMFS would publish a new trigger.

There are three important considerations regarding the trigger calculations. First, the extrapolated estimates of false killer whale M&SI described in this section would be calculated for purposes of implementing the SEZ only, and would not represent the official bycatch estimates for false killer whales 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, prorations to species/stock for blackfish takes, 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.

Second, as the FKWTRT recommended, the trigger would apply only to the Hawaii pelagic stock of false killer whales, given the stock's strategic status and the location of the closure. Although the Hawaii Insular stock is also strategic, closure of the SEZ would have very little effect on the stock because the SEZ would be almost entirely outside the Insular stock's range. For the purposes of implementing the SEZ measures, any false killer whale incidentally 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. This is true even of false killer whales taken in the Pelagic/Insular stock overlap zone. Those animals would be prorated for assignment to the stocks in the official bycatch estimates, but for purposes of implementing the SEZ, those animals cannot be prorated.

Third, consistent with MMPA section 118, only observed serious injuries or mortalities would be counted when determining whether the trigger was met, while injuries determined to be non-serious would not. NMFS would expedite the process of making serious injury determinations for these animals, to allow for the timely implementation of the SEZ measures (see "Other Measures" below).

(b) <u>Procedures when no SEZ closure in previous year</u>.

For the first year of FKWTRP implementation, and in years in which the SEZ was not closed in the previous year, the following three steps (i-iii) would be applied for the current year:

(i) M&SI below the trigger.

After 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. Following the last mortality or serious injury before the trigger is met, NMFS would also convene the FKWTRT by teleconference to discuss the circumstances of the event. For example, if the trigger were three, NMFS would notify the FKWTRT of the first mortality or serious injury, and would convene the FKWTRT by teleconference after the second observed mortality or serious injury.

(ii) M&SI that meets the trigger.

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 fishing year, NMFS would close the SEZ until the end of that fishing year, and then would convene the FKWTRT for a meeting. NMFS would reopen the SEZ at the beginning of the next calendar year. The availability of funding may limit NMFS's ability to convene the FKWTRT for an in-person meeting; NMFS may convene the FKWTRT by teleconference or other efficient means until funding becomes available for an in-person meeting. Regardless of whether NMFS has convened an in-person FKWTRT meeting, NMFS would reopen the SEZ at the beginning of the next year.

If a closure of the SEZ were triggered, NMFS would notify the fishery and close the area for the specified time period (the rest of the fishing 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.

(iii) M&SI after the SEZ is closed.

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 fishing year following closure of the SEZ, there were 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.

(c) Procedures when SEZ was closed during the previous year.

If the SEZ was closed for any part of the previous year as per step (b), the following procedures (i-ii) would apply for the current year:

(i) M&SI below the trigger.

Consistent with the procedures described in step (b)(i) above, after each false killer whale 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. Following the last mortality or serious injury before the trigger was met, NMFS would also convene the FKWTRT by teleconference to discuss the circumstances of the event. For example, if the trigger were three, NMFS would notify the FKWTRT of the first mortality or serious injury, and would convene the FKWTRT by teleconference after the second observed mortality or serious injury.

(ii) M&SI that meets the trigger.

If there were an observed false killer whale mortality or serious injury in the deep-set longline fishery inside the EEZ around Hawaii that met the established trigger for a given fishing year, NMFS would close the SEZ, and then convene the FKWTRT for a meeting. NMFS would reopen the SEZ if specific criteria were met (see step (d) below). The availability of funding may limit NMFS's ability to convene the FKWTRT for an in-person meeting; NMFS may convene the FKWTRT by teleconference or other efficient means until funding becomes available for an in-person meeting.

If a closure of the SEZ were triggered, NMFS would 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 reopen the SEZ.

(d) Reopening the SEZ.

If the SEZ were closed as per step (c), NMFS reopen the SEZ if one or more of the follow criteria were met:

(i) NMFS determines, after considering the FKWTRT's recommendations and all relevant circumstances, that continued closure of the SEZ is not warranted, or otherwise does not serve the objectives of the FKWTRP. Such circumstances might include: the mortality or serious injury was a result of non-compliance with gear requirements, rather than an indication that the existing FKWTRP measures were ineffective; evidence of increased M&SI on the high seas or in areas outside the SEZ; evidence of increased interactions with other protected species outside the SEZ; etc.;

(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 total rate of false killer whale M&SI (including the EEZ around Hawaii, the high seas, and the EEZ around Johnston Atoll (but not Palmyra Atoll)) in an amount equal or greater than the rate required to reduce false killer whale M&SI within the EEZ around Hawaii. This requirement helps ensure that conservation and management measures are proving effective, and that fishing effort is not merely being displaced to other areas (e.g., if the PBR for the Hawaii pelagic stock inside the EEZ around Hawaii was 9.1 at the time of the closure and average annual false killer whale M&SI in the deep-set fishery inside the EEZ around Hawaii was 13.6, an approximately 33% 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 within the remaining open areas of 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 would include these criteria in regulations. Once NMFS determined that one or more of the criteria were met, NFMS would reopen the SEZ through a *Federal Register* notice. Once the SEZ were reopened, the procedures in step (b) would be followed.

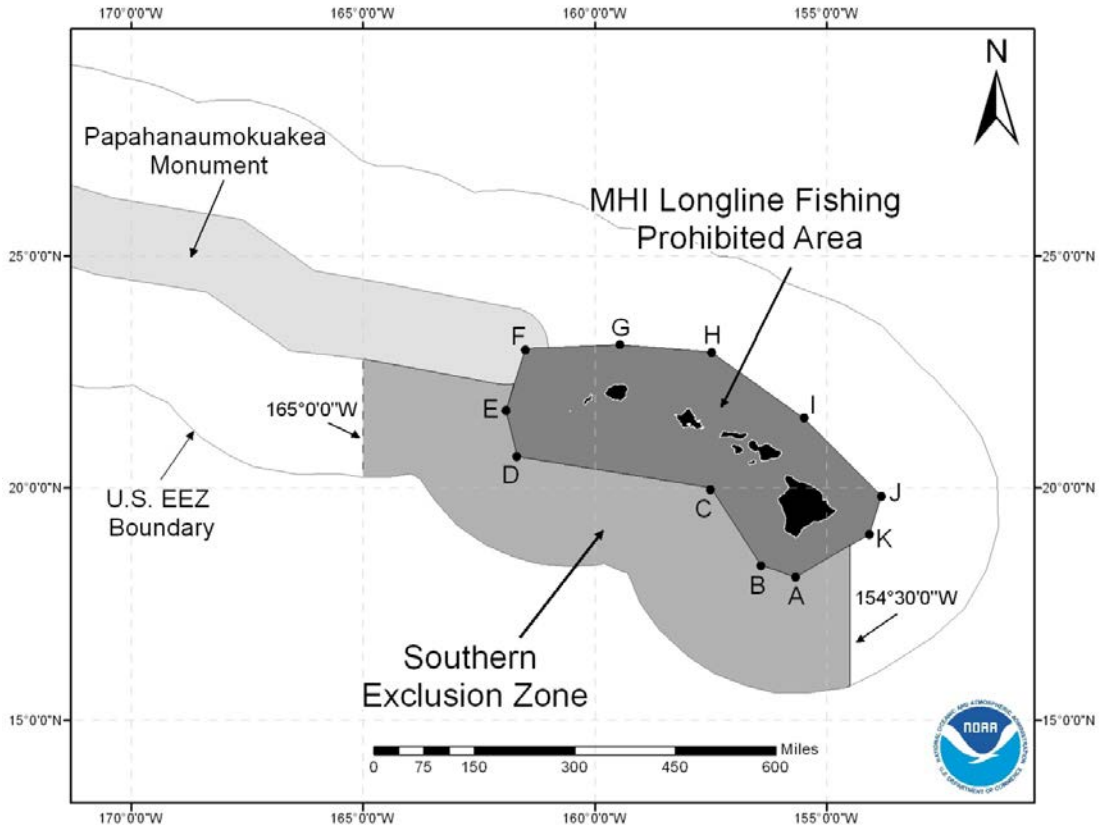

Figure 2.2. Revised MHI Longline Fishing Prohibited Area and Southern Exclusion Zone, shown with boundaries of the U.S. EEZ around Hawaii and the Papahanaumokuakea Marine National Monument.

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, provided the increase is funded by the Federal government. Following the submission of the FKWTRT's recommendations, NMFS conducted an analysis to determine the potential benefit of such an overall increase in observer coverage, in terms of how that coverage increase would increase the precision (i.e., decrease the error) of the bycatch estimate in the fishery. The analysis also evaluated the benefit of that error reduction compared to the cost of the observer coverage increase (McCracken and Boggs 2010). The analysis found diminishing improvement in the precision of the bycatch estimate when moving from 20 to 25% overall coverage. NMFS does not believe any incremental improvement in data precision justifies an increase to 25% coverage, given limitations on personnel and resources. Therefore, NMFS would not increase overall observer coverage in the fishery.

However, NMFS would implement an increase in <u>systematic</u> observer coverage in the deep-set longline fishery. This is based on the findings that ensuring 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% (McCracken and Boggs 2010). 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 branch lines/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.

Under this Alternative, NMFS would 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., branch line, 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 action also includes the following four non-regulatory measures:

- NMFS would 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 would 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 would 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[1]; and
- NMFS would 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.

[1] NMFS provided the FKWTRT with line-transect abundance estimates resulting from HICEAS II (Bradford et al. 2012) by email on June 5, 2012.

These measures are part of the 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 Draft 2012 SAR applies only to animals within the EEZ around Hawaii. Additionally, incidental M&SI of the strategic Hawaii insular stock of false killer whales (which resides entirely within the EEZ around Hawaii) in the longline fisheries would be reduced to below its PBR level (and below 10% of its PBR level). Incidental M&SI of the Hawaii pelagic stock of false killer whales occurring outside of the EEZ around Hawaii may still occur.

A large portion of the fishing effort already occurs outside of the EEZ around Hawaii: in 2010, 75% of hooks set by the Hawaii-based longline fisheries were outside the EEZ, while 16% of hooks were inside the EEZ around the MHI, 6% inside the EEZ around the Northwestern Hawaiian Islands (NWHI), and 3% in the EEZ around Pacific Remote Island Areas (WPRFMC 2012). 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. More information on the FKWTRT's development of these strategies can be found in the FKWTRT Meeting summaries (the Key Outcomes Memoranda), available online at: http://www.nmfs.noaa.gov/pr/interactions/trt/falsekillerwhale.htm

NEPA regulations generally require that an agency consider a reasonable range of alternatives, including those that are practical or feasible from the technical and economic standpoint, using common sense (40 CFR 1502.14). In addition, an agency need only evaluate alternatives that are reasonably related to the purposes of the project, as described in the purpose and need statement. NMFS and the FKWTRT did not further consider the measures in Table 2.1 because of: (1) a lack of data to suggest that they would reduce M&SI of marine mammals, (2) the existence of past research results that indicate they would not accomplish the desired objectives, or (3) they were impractical or infeasible from a technical or economic standpoint, and therefore not reasonable. 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) - Use of oceanographic buoys (NMFS, naval, other) to foster location and avoidance of false killer whales - Real-time fleet communication, possibly including VMS, to foster avoidance of whales - Use of hydrophones from longlines to identify presence of and/or depredation by false killer whales - Annual haul-out to reduce vessel noise profile (change rudder, cutlass bearing, etc.) - Degaussing of steel boats (demagnetize) - Direct current through vessel hull to eliminate electric profile - Diminish hydraulic profile (pumps, hoses, reel, steering) to background levels - Decoy buoys - Spotters (air or vessel-based) - Line changes (e.g., color, coating, diameter, snaps) - 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 - Streamers deployed alongside hook to change acoustic target profile of bait/catch - Different leaders to change acoustic target profile - Use of nails/metal tabs in bait tail to change acoustic target profile - Revised rules to allow fishermen to retain gills/guts on board - Bait/discard/offal retention, or offal processed on-board into an on-vessel commodity - Limits on line length and/or soak time - Noise deterrents - Taste deterrents
Strategies to minimize serious injuries and mortalities	- Use of barbless hooks - 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 (FKWTRT 2010). NMFS considered variations of the circle hook requirements for the deep-set fishery (e.g., size limits, different wire diameters), options for implementing the MHI Longline Fishing Prohibited Area, and other ways to implement the trigger and closure of the SEZ. Several of these variations were included in the Preferred Alternative of the Draft EA. Specifically, the Draft EA's Preferred Alternative included a requirement for the deep-set fishery to use circle hooks size 16/0 or smaller, with 4.0 mm maximum wire diameter, 10 degree offset or less, and a shank composed of round wire. The Draft EA's Preferred Alternative also included a Southern Exclusion Zone management area that would be closed to deep-set longline fishing for the remainder of the year if the

fishery reached a specified number of observed false killer whale serious injuries or mortalities in a given year, and then closed for a longer time period if there was a single additional observed false killer whale serious injury or mortality in any of the subsequent four years. The Draft EA, which is included as Appendix B to this Final EA, describes the draft Preferred Alternative's measures and their impacts in more detail.

The measures in the Preferred Alternative were revised for this Final EA to address issues that were raised during public comment and NMFS's further analysis (see Section 1.6 for a description of changes from the Draft EA to the Final EA). However, the measures in the Draft EA's Preferred Alternative were substantially similar to those analyzed in this Final EA. Their impacts were considered and found to be similar to those of the Preferred Alternative of this Final EA.

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 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 (FPEIS) 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

The global mean temperature has risen 0.76° C over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (IPCC 2007a). Ample evidence now exists supporting the wide-ranging ecological impacts of global climate change (Walther et al. 2002). There is a high confidence, based on substantial new evidence, that observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation. These changes include shifts in ranges and changes in algal, plankton, and fish abundance (IPCC 2007b).

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 and 69 FR 8336). 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.

FMP	EFH (Juveniles and Adults)	EFH (Eggs and Larvae)	HAPC
Bottomfish and Seamount Groundfish (Sections 6.2 and 6.3, Hawaii FEP)	**Bottomfish**: Water column and bottom habitat down to 400 meters **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 **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 **Seamount Groundfish**: Not identified
Coral Reef Ecosystem (Sections 6.2 and 6.3, Hawaii FEP)	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

FMP	EFH (Juveniles and Adults)	EFH (Eggs and Larvae)	HAPC
Crustaceans (Sections 6.2 and 6.3, Hawaii FEP)	**Lobsters**: Bottom habitat from shoreline to a depth of 100 meters **Deepwater shrimp**: The outer reef slopes at depths between 300-700 m	**Lobsters**: Water column down to 150 meters **Deepwater shrimp**: Water column and associated outer reef slopes between 550 and 700 m	**Lobsters**: All banks with summits less than 30 meters **Deepwater shrimp**: Not designated
Precious Corals (Sections 6.2 and 6.3, Hawaii FEP)	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 (Sections 6.2 and 6.3, Pelagics FEP)	Water column down to 1,000 meters	Water column down to 200 meters	Water column from surface to 1,000 m above all seamounts and banks with summits shallower than 2,000 m within the EEZ

Sources: WPRFMC and NMFS 2009a; WPRFMC 2009a and 2009b.

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 2005). 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, 2012a).

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 measures presented in section 2 of this EA/RIR/IRFA are likely to modify fishing practices in a manner that would adversely 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

There are many protected species – marine mammals, sea turtles, and seabirds – that occur in the Pacific where the Hawaii-based longline fisheries operate. The following sections discuss those species that have been observed, or may occur, in the action area.

3.2.1.1 Marine Mammals

Marine mammals that have been observed, or may occur, in the action area include:

Table 3.2. Marine mammal species within the geographic range of the Hawaii-based longline fisheries.

Common Name	Scientific Name	ESA Listed?
Blainville's beaked whale	*Mesoplodon densirostris*	No
Blue whale	*Balaenoptera musculus*	Yes
Bottlenose dolphin	*Tursiops truncatus*	No
Bryde's whale	*Balaenoptera eden)*	No
Common dolphin	*Delphinus delphis*	No
Cuvier's beaked whale	*Ziphius cavirostris*	No
Dwarf sperm whale	*Kogia sima*	No
False killer whale	*Pseudorca crassidens*	No – Insular stock proposed endangered
Fin whale	*Balaenoptera physalus*	Yes
Fraser's dolphin	*Lagenodelphis hosei*	No
Humpback whale	*Megaptera novaeangliae*	No
Hawaiian monk seal	*Monachus schauinslandi*	Yes
Killer whale	*Orcinus orca*	No
Longman's beaked whale	*Indopacetus pacificus*	No
Melon-headed whale	*Peponocephala electra*	No
Minke whale	*Balaenoptera acutorostrata*	No
North Pacific right whale	*Eubalaena japonica*	Yes
Northern elephant seal	*Mirounga angustirostris*	No
Pantropical spotted dolphin	*Stenella attenuata*	No
Pygmy killer whale	*Feresa attenuata*	No
Pygmy sperm whale	*Kogia breviceps*	No
Risso's dolphin	*Grampus griseus*	No
Rough-toothed dolphin	*Steno bredanensis*	No
Sei whale	*Balaenoptera borealis*	Yes
Short-finned pilot whale	*Globicephala macrorhynchus*	No
Sperm whale	*Physeter macrocephalus*	Yes
Spinner dolphin	*Stenella longirostris*	No
Striped dolphin	*Stenella coeruleoalba*	No

Detailed information on these species' geographic ranges, abundance, bycatch estimates, and status can be found in the most recent SARs, available online at: http://www.nmfs.noaa.gov/pr/sars/. This information is incorporated by reference.

Climate Change and Marine Mammals

Global climate change may be affecting marine mammals. Highly mobile species, such as marine mammals, can respond more rapidly to effects of climate change than their terrestrial counterparts

(Harwood 2001). No significant climate change-related impacts to marine mammal populations have been reported to date, but the most likely impact of climate change on cetaceans will be changes in range related to migration, expansion, or contraction of the geographic thermal niche populations currently occupy or the distribution of prey species with particular thermal requirements. The ranges of 88% of cetaceans may be affected by changes in water temperature resulting from global climate change, though humpback and other large whales are cosmopolitan species ranging throughout the world's oceans, and thermal and prey limitations related to climate change are unlikely to impact their ranges (McLeod 2009). While oceanic cetaceans are unlikely to be directly affected by rises in sea levels, important habitats for coastal species and species that require coastal bays and lagoons for breeding, such as humpback whales, could be adversely affected in the future (Simmonds and Elliot 2009). Large whales that feed in polar regions may also encounter reduced prey.

Current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of these species. Due to a lack of scientific data, specific effects climate change will have on this species in the future are not predictable or quantifiable to any degree such as would allow for more detailed analysis in this document (Hawkes et al. 2009).

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. These species protected under the ESA as follows:

Table 3.3. Sea turtle species within the geographic range of the Hawaii-based longline fisheries.

Common Name	Scientific Name	ESA Listing Status
Olive ridley turtle	*Lepidochelys olivacea*	Endangered – Mexico nesting population Threatened – All other stocks
Leatherback turtle	*Dermochelys coriacea*	Endangered
Loggerhead turtle	*Caretta caretta*	Endangered – North Pacific Ocean Distinct Population Segment (DPS)
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Green turtle	*Chelonia mydas*	Endangered – Pacific coast of Mexico breeding populations Threatened – All other stocks

A thorough review of the life history, status and trends, threats, and conservation efforts for sea turtles is available in section 5 of the January 30, 2012 Biological Opinion on the Hawaii-based shallow-set longline fishery (NMFS 2012a); 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:

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
Hawksbill: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_hawksbill_pacific.pdf
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

(Websites accessed June 2012)

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 are contingent upon trip type (i.e., shallow- or deep-set trip). Some of the required 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. 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 (Gilman et al. 2007).

Climate Change and Sea Turtles

Climate change is likely beginning to affect sea turtles found in the action area through the impacts of rising sand temperatures, rising sea level, increased typhoon frequency, and changes in ocean temperature and chemistry. These baseline effects are described below for five sea turtle species identified above.

Green Turtles

Although green turtles are probably already being affected by impacts associated with anthropogenic climate change in several ways, no significant climate change-related impacts to green turtle populations have been observed to date. However, such impacts will likely influence biological trajectories in the future over the long-term, on a century scale (Paremsan and Yohe 2003). For example, increasing temperatures at nesting beaches may impact sex ratios of hatchlings (many rookeries already exhibit strong female bias [Binckley et al. 1998; Chan and Liew 1995; Godfrey et al. 1996; Godfrey et al. 1999; Godley et al. 2001; Kaska et al. 2006; Marcovaldi et al. 1997; Oz et al. 2004]) and/or increase embryonic mortality (Matsuzawa et al. 2002). Increased nest mortality has also been linked to erosion due to increased typhoon frequency (VanHoutan and Bass 2007) and intensity, a predicted consequence of climate change (Webster et al. 2005). Seagrasses are a major food source for green turtles worldwide. Seagrass habitats may suffer from decreased productivity and/or increased stress due to sea level rise and salinity and temperature changes (Short and Neckles 1999; Duarte 2002). Climate change induced shifts in ocean productivity linked to temperature changes (Harwood 2001; Edwards & Richardson 2004; Hays et al. 2005) may affect foraging strategies and therefore reproductive capacity for green turtles (Solow et al. 2002), similar to what has been observed during El Nino events in the western Pacific (Limpus and Nicholls 1994; Chaloupka 2001).

While there are some available data on past trends, these data are limited, and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of this species. Due to a lack of scientific data, specific effects climate change will have on this species in the future are not predictable or quantifiable to any degree such as would allow for more detailed analysis in this document (Hawkes et al. 2009).

Hawksbill Turtles

Although hawksbill turtles are probably already being affected by impacts associated with anthropogenic climate change in several ways, no significant climate change-related impacts to hawksbill turtle populations have been observed to date. However, over the long-term, climate change-related impacts will likely influence biological trajectories in the future on a century scale (Paremsan and Yohe 2003). In the future, climate change-related increasing temperatures, sea level rise, changes in ocean productivity,

and increased frequency of storms events as a result of climate change are all potential threats to hawksbills for the same reasons described above for green turtles. Additionally, because hawksbills typically inhabit coral reef communities, they are vulnerable to changes that affect these communities including bleaching events, increased occurrence of disease, and weakening of coral skeletons as a result of global climate change (McWilliams et al. 2005; Langdon et al. 2000; Ohde and Hossain 2004).

As with green turtles, only limited data are available on past trends, and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of this species. Due to a lack of scientific data, the specific effects climate change will have on this species are not predictable or quantifiable to any degree that would allow for more detailed analysis in this document (Hawkes et al. 2009).

Olive Ridley Turtles

As with the other species discussed above, no significant climate change-related impacts to olive ridley turtle populations have been observed to date. However, over the long-term, climate change-related impacts will likely influence biological trajectories in the future on a century scale (Paremsan and Yohe 2003). Only limited data are available on past trends, and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of this species. Due to a lack of scientific data, the specific effects climate change will have on this species are not predictable or quantifiable to any degree that would allow for more detailed analysis in this document (Hawkes et al. 2009).

Leatherback Turtles

Although leatherbacks are probably already being affected by impacts associated with anthropogenic climate change in several ways, no significant climate change-related impacts to leatherback turtle populations have been observed to date. However, over the long-term, climate change-related impacts will likely influence biological trajectories in the future on a century scale (Paremsan and Yohe 2003). In the future, climate change-related increasing temperatures, sea level rise, changes in ocean productivity, and increased frequency of storm events as a result of climate change are all potential threats for leatherbacks for the same reasons described above for green and hawksbill turtles. Additional potential effects of climate change on leatherbacks include range expansion and changes in migration routes as increasing ocean temperatures shift range-limiting isotherms north (Robinson et al. 2009). Additionally, increases in their primary prey source, jellyfish due to ocean warming and other factors (Brodeur et al. 1999; Attrill et al. 2007; Richardson et al. 2009) may occur which may or may not impact leatherbacks as there is no evidence that any leatherback populations are currently food-limited.

As with greens and hawksbills, only limited data are available on past trends, and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of this species. Due to a lack of scientific data, the specific effects climate change will have on this species are not predictable or quantifiable to any degree that would allow for more detailed analysis in this document (Hawkes et al. 2009).

Loggerhead Turtles

As with the other species discussed above, no significant climate change-related impacts to loggerhead turtle populations have been observed to date. However, over the long-term, climate change-related impacts will likely influence biological trajectories in the future on a century scale (Paremsan and Yohe 2003). In the future, climate change-related increasing temperatures, sea level rise, changes in ocean productivity, and increased frequency of storm events as a result of climate change are all potential threats for loggerheads for the same reasons described above for other species. Juvenile loggerheads in the North Pacific in particular tend to concentrate along temperature fronts (Polovina et al. 2001, Polovina et al. 2006). Nesting abundance for two Pacific stocks is negatively correlated with sea surface temperature (SST), indicating warming may reduce ocean productivity and impact reproductive capacity unless these

stocks adapt by shifting to cooler foraging habitats (Chaloupka et al. 2008). Sea walls and beach armoring are common along coastal Japan, where north Pacific loggerheads predominantly nest, as precautions against tsunamis and sea level rise. Beach hardening structures limit access for nesting females and reduce the potential for natural beach migration with future sea level rise. Loggerhead nest temperatures appear to be within survival thresholds according to monitoring since 2000 (Matsuzawa 2005, Matsuzawa 2010, Matsuzawa et al. 2002) and the North Pacific population is estimated to have a 1:1 male to female ratio (NMFS and USFWS 2007). Therefore, this population may be less vulnerable to increases in sand temperature than those already highly skewed toward female or at the high end of thermal tolerance.

Only limited data are available on past trends, and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of this species. Due to a lack of scientific data, the specific effects climate change will have on this species are not predictable or quantifiable to any degree that would allow for more detailed analysis in this document (Hawkes et al. 2009).

A final factor when considering the effects of future anthropogenic climate change is the role the Pacific Decadal Oscillation (PDO) plays in influencing turtle populations. Recent studies combined two factors of climate variability mentioned above, changes in ocean circulation and sea surface temperatures (SST) on two different life stages of loggerhead sea turtles, (neonates and adult females) to see how they influence population trends (Van Houtan and Halley 2011). This study found that changes in loggerhead nesting over at least the last several decades are strongly correlated with ocean oscillations due to environmental influences on juvenile recruitment (Van Houtan and Halley 2011). Juvenile recruitment appears to be strongly correlated with the PDO in the Kuroshio Bifurcation Extension Region where juveniles congregate (Polovina et al. 2006) as they are most susceptible to oceanographic variability given their limited ability to exploit their environment for food (Van Houtan and Halley 2011). SST in the months preceding nesting has been demonstrated to influence whether females nest due to the need for sufficient nutrients for yolk production (Van Houtan and Halley 2011). Using this same type of information, forecasts were then made into the future for several populations. For loggerheads in the north Pacific, nesting trend data were combined with current PDO data and future winter SST temperature, which were based on the IPCC A2 projections, to project the population trend out to 25 years, which is the maximum lag time for the PDO. The PDO cannot be predicted beyond what information we have now. Twenty-five years is the calculated age to first reproduction for loggerheads, which means that we are predicting how many adult females there will be based on the number of juveniles that recruit today, which is influenced by current ocean conditions. Future winter SSTs influence adult breeding remigrations, which is the second component of the study. In this study the model contributions of each climate factor plus the error were calculated and for the North Pacific DPS, the PDO accounted for 37% of the results and the winter SST accounted for 26% (Van Houtan and Halley 2011). In the next 25 years, the model predicts that the North Pacific loggerhead nesting population will decline below a Quasi Extinction Threshold set at 50% of the current population size (Figure 6a; Van Houtan 2011). Beyond 25 years we do not have information to predict what the population will do. Additional studies that simulated changes in physical ocean properties in northern hemisphere westerlies in response to various future carbon dioxide emission scenarios predict that the area and primary production of the temperate oceanic biome in the north Pacific is anticipated to decrease by 34% over the next century (Polovina et al. 2011). The extent of the impact on species in the region, such as loggerheads, is unknown because we do not know how species may or may not adapt to changes over the long-term (Chaloupka et al. 2009).

3.2.1.3 Seabirds

Migratory seabirds and shorebirds are subject to the protections of the Migratory Bird Treaty Act (MBTA) under jurisdiction of USFWS. Several species are further protected under the ESA. The short-tailed albatross (*Phoebastria albatrus)*, Hawaiian dark-rumped petrel (*Pterodroma sandwichensis)*, and Newell's shearwater (*Puffinus newelli*) are listed as either endangered or threatened under the ESA and have ranges that overlap the fishing grounds of the Hawaii deep-set and shallow-set longline fisheries. A

comprehensive description of the species' distribution, population status, threats, and recovery strategy can be found in the species' recovery plans (available online at: http://ecos.fws.gov/tess_public/TESSWebpageRecovery?sort=1); this information is incorporated by reference. Since the NMFS observer program was initiated in 1994, there have been no observed interactions between these three listed seabird species and the Hawaii deep-set or shallow-set longline fleet.

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

The following seabird species have been observed hooked or entangled in the fisheries since 1994, when observers began recording interactions: Laysan (*Phoebastria immutabilis*) and black-footed albatrosses (*P. nigripes*), sooty shearwater, (*Puffinus griseus*), other shearwaters not identified to the species level, brown boobies (*Sula leucogaster*), red-footed boobies (*S. sula*), and Northern fulmar (*Fulmarus glacialis*) (NMFS 2011a). None of these species is listed under the ESA. The Laysan albatross population is estimated at about 1.2 million adults. Midway and Laysan Islands in the NWHI have the world's largest colonies, and together support more than 90% of the global breeding population (ACAP 2010). The global breeding population of black-footed albatross is estimated to be 122,614, with 95% breeding in the NWHI (USFWS unpublished data in Naughton et al. 2008). The estimated worldwide population of Northern Fulmars is 10-12 million individuals, and the North American breeding population is estimated at 2.1 million individuals. The red-footed booby winters on tropical islands in most oceans, ands its total population is estimated at 1,000,000 birds (Birdlife 2011a). The brown booby is found throughout the pan-tropical oceans, with a population is estimated at 200,000 adults (Birdlife 2011b). The total world population of sooty shearwaters is estimated at more than 20 million mature individuals. These birds nest only in Australia, New Zealand, and southern South America (Birdlife 2011c).

NMFS published seabird regulations for the longline fisheries in the *Federal Register* on December 19, 2005 (70 FR 75075). Fishery operations that are deep-set fishing north of 23º N latitude or shallow-set fishing anywhere, are required to comply with seabird mitigation regulations that are intended to reduce interactions between seabirds and Hawaii-based longline fishing vessels (50 CFR parts 600 and 665). The regulations require that vessel owners and captains employ a suite of mitigation measures that are specific to deploying gear from the side or stern of the vessel and may include using thawed and blue-dyed bait, weighted branch lines, strategic offal discards, a line shooter, and using a bird curtain during the set, among others. These measures help deter birds from becoming hooked or entangled in fishing gear and stealing bait. For a complete description of the requirements please see 50 CFR 665.815.

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 (NMFS 2011a). In 2010, there were 79 incidental interactions with seabirds in the shallow-set longline fishery and an estimated 220 incidental interactions with seabirds in the deep-set longline fishery, none of which are ESA-listed species (NMFS 2011a).

Climate Change and Seabirds

Climate change may be affecting seabirds. In a 2012 Biological Opinion on the impacts of the Hawaii-based longline fisheries on ESA-listed seabird species (USFWS 2012), the USFWS notes two major studies documenting climate change effects to seabirds (ACIA 2004, Bates et al. 2008). The authors of those studies suggest that climatic change in the Arctic would shift the range of short-tailed albatross prey

items northward, increasing energetic costs to foraging birds. Additionally, they suggest climate change would likely cause shifts in vegetation on the main breeding colony at Torishima Island, Japan.

Only limited data are available on past trends, and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of seabirds. Due to a lack of scientific data, the specific effects climate change will have on seabirds are not predictable or quantifiable to any degree that would allow for more detailed analysis in this document.

3.2.2 Target and Non-target Fish Species

A suite of pelagic management unit species (PMUS) are managed under the Pelagics FMP[2]. 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. Bycatch species are those that are normally discarded, either due to low commercial value or by regulations regarding retention. Information on these species, including life history, distribution, and stock structure can be found in the FSEIS for Amendment 18 to the Pelagics FMP (WPRFMC and NFMS 2009b), the Pelagics FEP (WPRFMC 2009a), and the 2001 FEIS for the Pelagics FMP (WPRFMC and NMFS 2001). Information on commercial fisheries' landings of these species is provided in section 3.3.3 below.

Climate Change and Target and Non-target Fish Species

The seasonal north-south movements of many large pelagics fish species in the North Pacific Transition Zone (NPTZ) appear to track the similar peak migration of primary productivity. Using remotely-sensed chlorophyll concentrations from satellite observations, Polovina et al. (2008) have found that over the past decade primary productivity in the subtropical and transition zone has declined an average of 1.5% per year with about a 3% per year decline occurring at the southern limit of the NPTZ. The expansion of the low chlorophyll waters is consistent with global warming scenarios based on increased vertical stratification in the mid-latitudes. Expanding oligotrophic portions of the subtropical gyres in the world's oceans in time will lead to a reduction in chlorophyll density and carrying capacity in the larger subtropical gyres, thus impacting the abundance of target and non-target species. For example, a recent scientific study using a spatial ecosystem and population dynamics model (SEAPODYM) suggests that by the end of this century, ocean temperatures in the Western and Central Pacific Ocean (WCPO) will increase to levels that will not support bigeye spawning in the WCPO (Lehodey et al. 2010). An international program called CLIOTOP (Climate Impacts on Oceanic Top Predators) is currently gathering information on climate change and its effects on pelagic ecosystems. Within this group, the SEAPODYM model is being applied to investigate the future management of tuna stocks and other highly migratory species in the context of climate and ecosystem variability, as well as to investigate potential changes due to greenhouse warming.

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 (WPRFMC and 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

[2] As of February 16, 2010 (75 FR 2198), all of the species-based fishery management plans were re-organized into place-based fishery ecosystem plans (FEP).

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 over 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 3.4, 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 3.4. 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, 2000, and 1990.

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 820,549 jobs in November 2010 (BEA 2012) (see Table 3.5). About 77% 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, retail trade, and then federal military. 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 3.5 presents employment by industry in 2010 for the State of Hawaii and the City and County of Honolulu.

Table 3.5. Employment by industry in 2010**.**

	City and County of Honolulu		State of Hawaii	
	Employees	**% of Total Employment**	**Employees**	**% of Total Employment**
Total employment	603,060	100%	832,721	100%
Farm employment	2,462	0%	12,172	1%
Nonfarm employment	600,598	100%	820,549	99%
Private employment	449,534	75%	639,555	77%
Forestry, fishing, and related activities	1,105	0%	3,616	0%
Mining	480	0%	1,049	0%
Utilities	2,131	0%	3,428	0%
Construction	27,415	5%	40,058	5%
Manufacturing	12,740	2%	16,938	2%
Wholesale trade	16,792	3%	21,570	3%
Retail trade	56,606	9%	83,189	10%
Transportation and warehousing	20,453	3%	27,110	3%
Information	9,505	2%	11,868	1%
Finance and insurance	25,078	4%	30,574	4%
Real estate and rental and leasing	24,006	4%	37,102	4%
Professional, scientific, and technical services	34,529	6%	43,957	5%
Management of companies and enterprises	6,139	1%	7,006	1%
Administrative and waste services	39,295	7%	55,535	7%
Educational services	15,522	3%	19,246	2%
Health care and social assistance	54,983	9%	72,668	9%
Arts, entertainment, and recreation	11,729	2%	20,812	2%
Accommodation and food services	56,912	9%	94,703	11%
Other services, except public administration	34,114	6%	49,126	6%
Government and government enterprises	151,064	25%	180,994	22%
Federal, civilian	31,820	5%	34,870	4%
Military	53,124	9%	56,267	7%
State and local	66,120	11%	89,857	11%
State government	53,736	9%	70,840	9%
Local government	12,384	2%	19,017	2%

Source: BEA 2012.

Between 2001 and 2010, employment in Hawaii increased by 9%, while that in the City and County of Honolulu increased by about 8% (see Table 3.6). The highest gains for both the state and the county are in the mining industry at almost 42% and 90%, respectively, followed by construction. Jobs in the tourism-related sectors of accommodation and food services and arts, entertainment, and recreation increased by over 3% and over 5% in the State of Hawaii, respectively. In the City and County of Honolulu, employment in accommodation and food services increased by 6%, whereas employment in arts, entertainment, and recreation decreased by 4%. Sectors that experienced job losses at both the state and

county level during this period include farm employment; forestry, fishing, and related activities; information; transportation and warehousing; retail trade; and manufacturing.

Table 3.6. Industry employment growth, 2001-2010 (% change).

	City and County of Honolulu	State of Hawaii
Total employment	8%	9%
Farm employment	-14%	-1%
Nonfarm employment	8%	9%
Private employment	8%	9%
Forestry, fishing, and related activities	-39%	-10%
Mining	42%	90%
Utilities	26%	26%
Construction	26%	19%
Manufacturing	-14%	-14%
Wholesale trade	3%	5%
Retail trade	-4%	-2%
Transportation and warehousing	-10%	-6%
Information	-16%	-14%
Finance and insurance	23%	27%
Real estate and rental and leasing	19%	18%
Professional, scientific, and technical services	14%	14%
Management of companies and enterprises	12%	13%
Administrative and waste services	13%	19%
Educational services	23%	30%
Health care and social assistance	20%	21%
Arts, entertainment, and recreation	-4%	5%
Accommodation and food services	6%	3%
Other services, except public administration	8%	11%
Government and government enterprises	7%	8%
Federal, civilian	16%	19%
Military	6%	5%
State and local	5%	6%
State government	5%	6%
Local government	4%	9%

Source: BEA 2012.

3.3.2.2 Income

As of 2010, Hawaii had a slightly lower per capita personal income compared to the nation, at $41,550, with the annualized growth rate of 4% between 2001 and 2010 (BEA 2012) (see Table 3.7). The City and County of Honolulu has a per capita personal income in 2010 of $45,216, which is the highest among all Hawaii counties. See Table 3.7 for a summary of personal income in the U.S., Hawaii, and the City and County of Honolulu.

Table 3.7. Personal income in 2001 and 2010.

Area	Per Capita Personal Income		
	2001	2010	Annualized Rate of Change (%)
State of Hawaii	$29,313	$41,550	4.0%
City and County of Honolulu	$31,106	$45,216	4.2%
U.S.A.	$39,944	$41,678	0.5%

Source: BEA 2012.

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. In 2011, the unemployment rate in Hawaii was 6.7%, up from 4.1% 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.

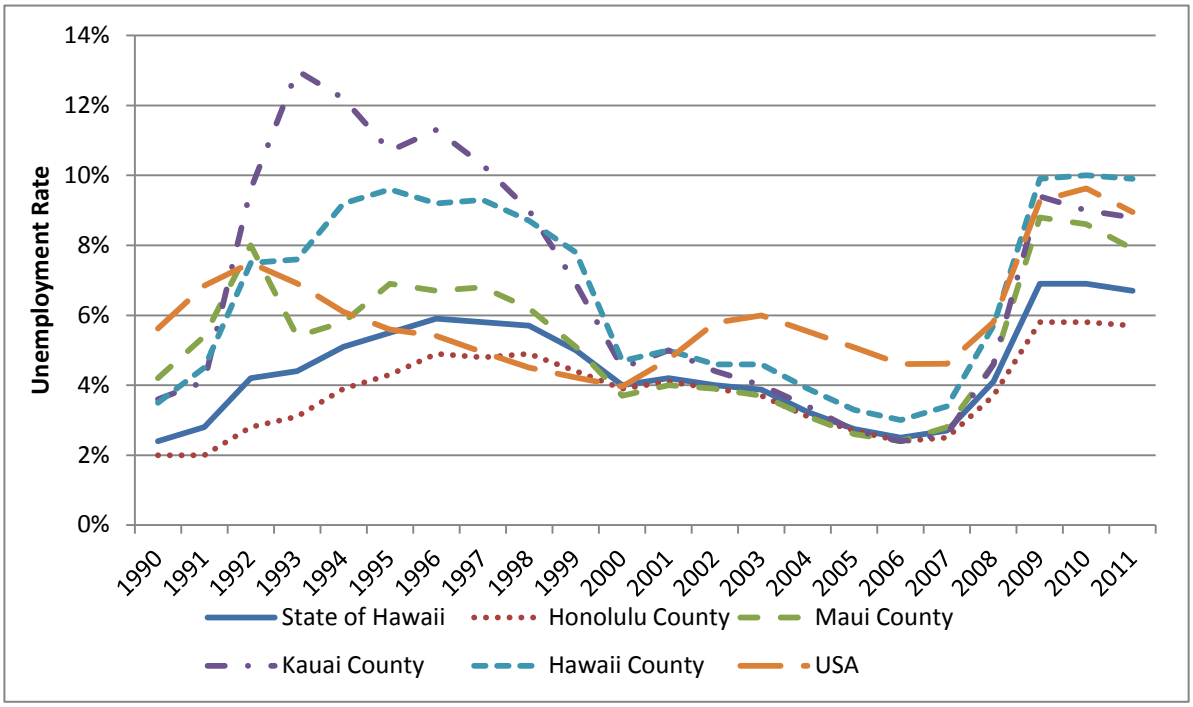

Figure 3.1. Historic unemployment rates in the counties in Hawaii, the State of Hawaii, and the United States.

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 (DAR and WPacFin 2010). In addition, Federal permits are required for Federally managed fishing in Federal waters (3-200 nm) around Hawaii. As of May 3, 2012, there are 153 Federal permits issued by the NMFS Pacific Islands Regional Office for commercial and non-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 permit holders are required to fish in other areas of the Pacific.

In 2010, about 28 million pounds of fish were caught for commercial purposes in the state, worth over $83.5 million (WPacFIN 2012) (see Table 3.8), while more than 29 million pounds of fish were caught in 2011, valued at above $91.5 million (WPacFIN 2012). 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 2011 exceeds $68 million (WPacFIN 2012). The overall average price per pound (based on amount paid to commercial fishermen by dealers) for all commercial fish in 2011 was approximately $3.12. Key fishery categories include pelagic, coral reef, bottomfish, precious corals, and crustaceans.

Table 3.8. Quantity, value, and price per pound of commercial landings in Hawaii, 1990-2011.

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
2010	27.93	$83.54	$2.99
2011	29.29	$91.51	$3.12

Source: WPacFIN 2012.

Pelagic Fisheries

Among the various categories of fisheries, the pelagic fishing industry is the largest and most valuable one, accounting for over 96% of commercial landings with 28.3 million pounds of pelagic fish caught commercially in 2011 (see Table 3.9). Pelagic fisheries primarily use longline gear, but also includes the MHI troll and handline, offshore handline, and the aku boat (pole and line) fisheries (WPRFMC and NMFS 2009a). 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 (WPRFMC and NMFS 2009a).

Coral Reef Fisheries

Coral reef fish made up about 1% of commercial landings in 2011 (see Table 3.9). With presently no active commercial coral reef fisheries in the NWHI, the commercial catch primarily comes from nearshore reef areas around the MHI (WPRFMC and NMFS 2009a). However, there has been a notable decline in nearshore coral reef fishery resources in recent decades because of overfishing (WPRFMC and NMFS 2009a). Coral reef fish species popular for commercial purposes include akule (which dominates nearshore commercial landings), soldierfishes, surgeonfishes, goatfishes, squirrelfishes, unicornfishes, and parrotfishes (WPRFMC 2010a). 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 1% of commercial landings in 2011 (see Table 3.9). Target species include snappers, jacks, and a single species of grouper that is concentrated at depths of 30 to 150 fathoms (fm) (WPRFMC 2010a). The most desirable species are seven deepwater species known as the Deep 7 (opakapaka, onaga, hapuupuu, ehu, kalekale, gindai, and lehi), which made up 54% of the commercial bottomfish catch in 2008 (WPRFMC 2010b).

After the establishment of the NWHI Marine National Monument in 2006 (later renamed Papahānaumokuākea Marine National Monument), commercial bottomfishing was scheduled to end in the Monument in 2011 (WPRFMC 2010a). However, this fishery was closed in 2009 when permit holders surrendered their permits under a permit compensation program 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 2010a). While bottomfishing around the MHI is conducted both commercially and by recreational fishermen, fishing in the NWHI was solely for commercial purposes (WPRFMC and NMFS 2009a). Methods and gear used in these fisheries are highly selective for desired species and sizes. For the current fishing season from September 1, 2012 through August 31, 2013, NMFS has specified a quota (annual catch target, ACT) of 325,000 lb of Deep 7 bottomfish in the MHI, based on an annual catch limit (ACL) of 346,000 lb. (77 FR 56791, September 14, 2012).

Precious Coral Fisheries

The discovery of two species of commercially valuable black coral in 1958, including Auʻau, 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 2010a). Over the past 30 years, almost all of the black coral has been harvested from state waters and from a bed located in the Auʻau Channel (WPRFMC 2010a). The domestic fishery for pink, gold, and bamboo precious coral resumed in 1999 (WPRFMC and NMFS 2009a), but gold coral has been subject to a 5-year harvest moratorium since 2008 (73 FR 47098, August 13, 2008). Harvest of precious corals is only allowed by selective gear with submersibles or by hand (NMFS 2009a).

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 2010a). In the MHI, commercial catch of spiny lobsters dropped by 75% to 85% by the early 1950s (WPRFMC and NMFS 2009a). 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 (WPRFMC and NMFS 2009a).

Table 3.9. Hawaii annual reported commercial landings (millions of pounds) for pelagic, bottom, reef, and other fisheries categories, 2000 to 2011.

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
2010	26.62	0.39	0.36	0.57
2011	28.27	0.31	0.30	0.42

Source: WPacFIN 2012.

3.3.3.1 Hawaii Fishing Community

Section 3.5.2 of the FSEIS 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 FKWTRP. 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 (WPRFMC and 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 the WPRFMC and NMFS' 2001 FEIS and 2004 FSEIS (WPRFMC and 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, the downturn in the global economy as well as recent increases in fuel prices are raising both operating and consumer costs are impacting global tourism markets.

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

3.3.3.2 Hawaii-based Longline Fisheries

The FKWTRP would affect the Hawaii-based deep-set and shallow-set longline fisheries. The domestic pelagic longline fleet also operates 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 2010, the longline represented 84% of the total commercial pelagic landings and 88% of the ex-vessel revenue (WPRFMC 2012).

3.3.3.2.1 Description of the Hawaii-based Longline Fisheries

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

The Hawaii-based longline fishery is a limited entry fishery with an upper limit of 164 longline permits. The fishery has two components, a larger deep-set fishery (roughly 130 vessels) that targets bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacores*) around the Hawaiian Islands and a smaller shallow-set fishery (roughly 30 vessels) that targets swordfish (*Xiphias gladius*) to the north of the Hawaiian Islands. In addition to other regulations, permit holders or designated agents for a vessel

registered for use under Hawaii longline limited access permits must provide notification of the trip type (either deep-setting or shallow-setting), and may not switch after the trip is underway.

Federal fishery managers officially defined deep- and shallow-set gear to separate the two fisheries in December 2004 (69 FR 17329, April 2, 2004). Specifically, a deep-set must have: all float lines on the vessel at least 20 m in length, a minimum of 15 branch lines between any two floats, no light sticks may be used, and a maximum of 10 swordfish may be retained or landed by the vessel (though NMFS recently proposed to revise this swordfish limit on deep-set trips north of the Equator; 77 FR 34331, June 11, 2012). If any one of these criteria is not met, the vessel is considered to be shallow-setting. There are additional differences between the fisheries. The general characteristics of the two gear types are provided in Table 3.10 and Figure 3.2, illustrating the differences and similarities between them.

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)).

Table 3.10. Characteristics of the Hawaii shallow- and deep-set longline fisheries.

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

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

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

results in the line being set relatively shallow in the water column where swordfish tend to congregate at night.

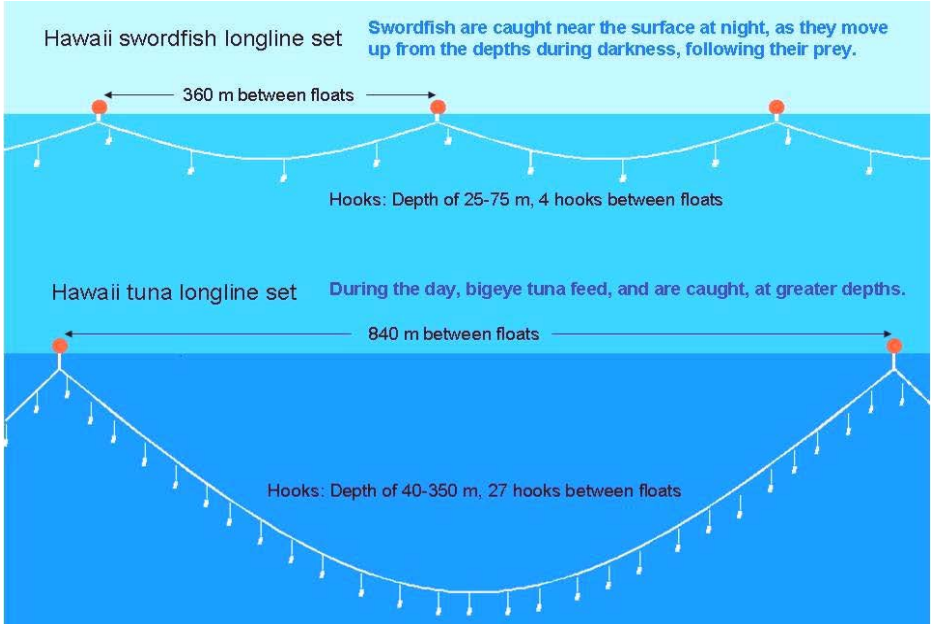

Figure 3.2. Generalized depiction of the configuration of shallow-set (swordfish target) and deep-set (tuna target) longline gear (NMFS 2010b).

Circle hooks are required in the shallow-set fishery and are used in the deep-set fishery by some operations. They are generally circular or oval in shape and have a point curving inward perpendicular to the shank. The point is less exposed in comparison to the J-hook (straight shank) and Japan tuna style hook (tuna hook) where the axis of the point runs parallel to the shank (Figure 3.3). Circle hooks are designed to reduce turtle mortality by decreasing the incidence of hook ingestion or reduce capture rates (Gilman et al. 2006). If sea turtles or other large animals are hooked, circle hooks are more likely to catch on the jaw rather than be ingested; this helps to avoid internal soft-tissue injuries. If an animal hooked in this manner falls off or is brought on board to have the hook removed and released, the resulting injuries are likely to be less severe than J-hook or tuna hook injuries. The use of circle hooks and mackerel-type bait by the Hawaii-based shallow-set fishery has contributed to reducing the sea turtle interaction rate by approximately 90% for loggerheads, 85% for leatherbacks, and 89% for combined species, compared to the period (1994-2001) when the fishery was operating without such gear (Gilman et al. 2007).

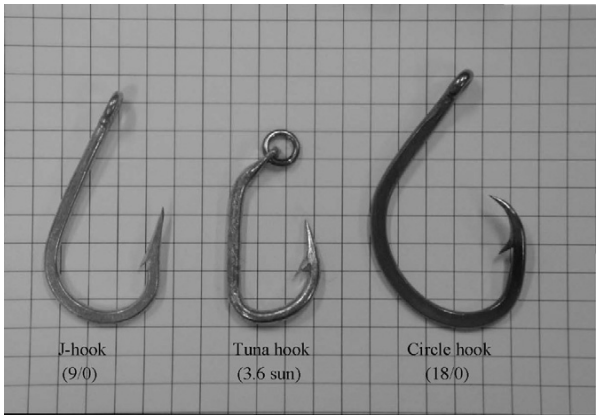

Figure 3.3. Lateral view of 9/0 J-hook, 3.6 sun Japanese tuna and 18/0 circle hooks (Curran and Bigelow 2010).

In the deep-set fishery, observer data indicate that the most predominant hook types used are tuna hooks (3.6 and 3.8 sun) and circle hooks (15/0 and 16/0, and less commonly, 14/0) (FKWTRT 2010, Bigelow et al. 2011). Since 2004, the deep-set fishery has shifted away from using mostly tuna hooks to either all circle hooks or a mix of hooks (Table 3.11). As of 2010, 43% of the deep-set fleet use only circle hooks while 25% use only tuna hooks.

Table 3.11. Annual composition of hooks used in the Hawaii deep-set fishery based on NMFS observer data.

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

Source: Bigelow et al. 2011.

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 shallow-set 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. Within the last several years, the fishery has operated seasonally, with effort highest in winter and spring months and dropping off substantially during the rest of the year.

Tuna vessels may currently range out to 1,000 nm but generally make trips within 500 nm 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. This fishery operates year-round, although vessel activity increases during the fall and is greatest during the winter and spring months.

3.3.3.2.2 History and Regulatory Baseline of Hawaii-Based Longline Fisheries

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

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 nm radius of the NWHI to prevent interactions with the endangered Hawaiian monk seal (Figure 3.4) (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 3.5). 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 3.12.

The Western and Central Pacific Fisheries Commission (WCPFC) adopted "Conservation and Management Measure for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean" (CMM 2008-01) in December 2008. CMM 2008-01 had the stated objective of reducing, over the period 2009-2011, the fishing mortality rate for bigeye tuna in the WCPO by at least 30% from the annual average during the period 2001-2004 or 2004 and ensuring that there was no increase in fishing mortality for yellowfin tuna beyond the annual average during the period 2001-2004 or 2004. In March 2012, the Commission adopted "Conservation and Management Measure for Temporary Extension of CMM 2008-01" (CMM 2011-01), which extends the majority of the provisions of CMM 2008-01 until February 28, 2013. The Commission is scheduled to discuss a follow-on measure to CMM 2008-01 at its next regular session in December 2012. NMFS promulgated regulations to implement specific provisions of CMM 2008-01 for U.S. fleets operating in the WCPO, which expired at the end of 2011 (see 74 FR 38544; 74 FR 63999). The regulations included bigeye tuna catch limits for U.S. longline fisheries and five specific requirements for the U.S. purse seine fleet operating in the WCPO: (1) fishing effort limits; (2) prohibition periods for the use of fish aggregating devices (FADs); (3) catch retention requirements; (4) observer requirements; and (5) closure of certain areas of the high seas to fishing. The regulations implementing the provisions of CMM 2008-01 for the U.S. purse seine fleet operating in the WCPO were extended to December 31, 2012 by an interim final rule (see 76 FR 82180). At the time of the writing of this document, NMFS was in the process of implementing the bigeye tuna catch limits for U.S. longline fisheries for 2012.

Under the provisions of the regulations that were in effect in 2009, 2010, and 2011, the U.S. longline fleets operating in the WCPFC Area were subject to a 3,763 mt annual catch limit. The limit did not apply to bigeye tuna that were landed in the U.S. Participating Territories to the WCPFC (American Samoa, Guam, or the Commonwealth of the Northern Mariana Islands) or to bigeye tuna caught by a vessel registered for use under a valid American Samoa Longline Limited Access Permit, provided that the bigeye tuna were not caught in the portion of the U.S. EEZ surrounding the Hawaiian Archipelago and the bigeye tuna were landed by a fishing vessel operated in compliance with a valid permit issued under 50 CFR 660.707 or 50 CFR 665.21 (now 50 CFR 665.801). Once the limit was reached, the retention, transshipping, and landing of bigeye tuna subject to the limit was prohibited in the WCPFC Area, with certain exceptions, until January 1 of the next calendar year.

For calendar year 2009, the catch limit was projected to be reached on December 29, 2009, so the prohibitions were put into effect from December 29, 2009 through end of the 2009 calendar year. In 2010, the catch limit was projected to be reached on November 22, 2010, so the prohibitions were put into effect from November 22, 2010, through the end of the 2010 calendar year. Based on the findings of a study of the 2010 bigeye tuna fishery closure (Richmond et al. 2012), some vessel operators continued to fish in the EPO during the period of time when the prohibitions were put into effect in 2010, while other vessel operators decided to stay in port. The size of the vessel may have been a determining factor, with the operators of smaller vessels tending more to choose to stay in port, so as not to have to travel longer distances to the EPO during the relatively rough fall/winter months. However, NMFS has implemented the longline bigeye tuna catch limit in the Inter-American Tropical Tuna Commission's (IATTC) Resolution C-11-01, "Resolution on a Multiannual Program for the Conservation of Tuna in the Eastern Pacific Ocean in 2011-2013." This catch limit is set at 500 mt for U.S. longline vessels over 24 m in overall length operating in the EPO (i.e., the IATTC's area of competence), so larger vessels fishing in the EPO during the period of time the prohibitions are in effect would be subject to that limit.

For the 2011 calendar year, the catch limit was originally projected to be reached on November 27, 2011, but as a result of the enactment of Section 113 of the Consolidated and Further Continuing Appropriations Act, 2012 (CFCAA; Pub. L. 112-55, 125 Stat. 552 et seq.) on November 18, 2011 (discussed in more detail in Section 4.4.2.4), and an arrangement between the Hawaii Longline Association (HLA) and American Samoa, NMFS began attributing catches to American Samoa that would otherwise have contributed to the catch limit. Thus, the deep-set longline fishery in Hawaii was not closed in 2011.

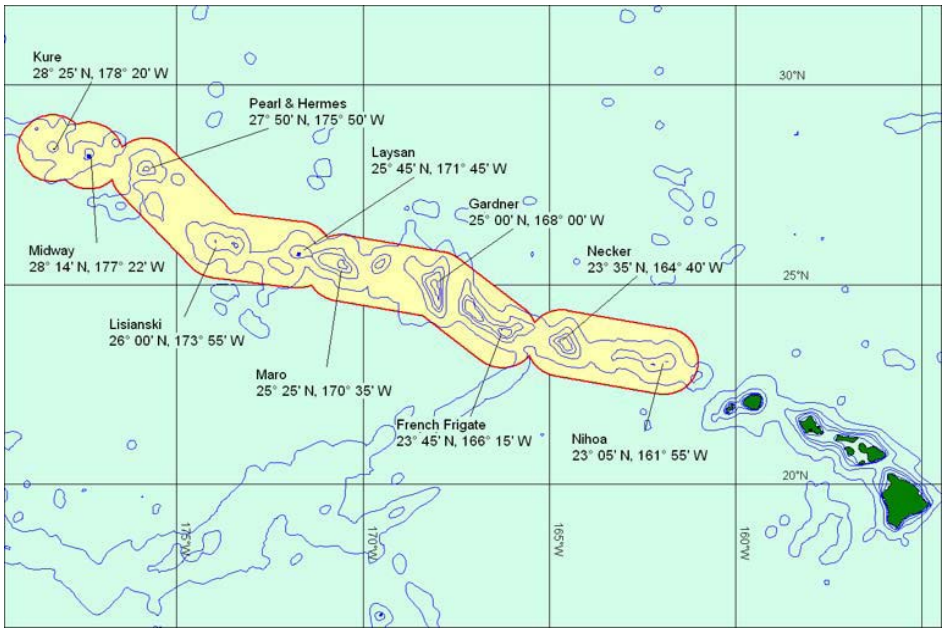

Figure 3.4. Boundary of Northwest Hawaiian Islands Longline Protected Species Zone.

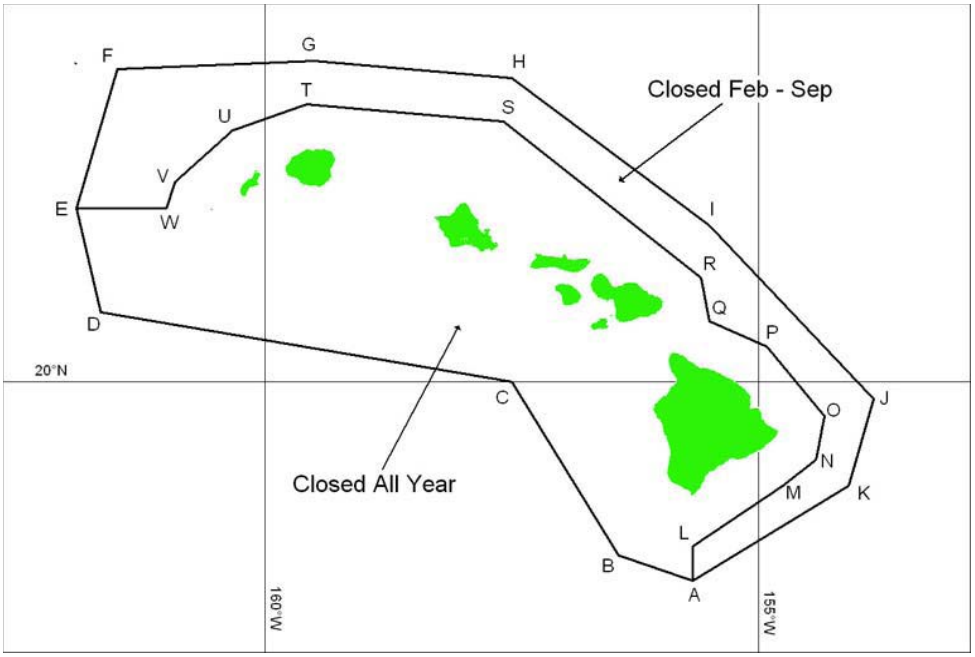

Figure 3.5. Boundary of MHI Longline Fishing Prohibited Area.

Table 3.12. 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 nm) 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 nm) to reduce conflict with near-shore fisheries
1994 Jun	Final rule, 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 (17) and leatherback (16) turtle takes, and 100% observer coverage.

Year/Month (Effective Date)	Action	Regulatory or monitoring changes
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 nm” 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 changed to 46.
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 (17 loggerhead and 16 leatherback) in accordance with settlement agreement approved by U.S. District Court for the District of Hawaii.
2012 Jul	Final rule 77 FR 43721, July 26, 2012	Revised swordfish trip limits in the Hawaii deep-set longline fishery on trips north of the equator to reduce regulatory discards. Swordfish retention limit increased from 10 to 25 if using circle hooks, or unlimited with observer embarked.
2012 Oct	Final rule 77 FR 60627, October 4, 2012	Revised limits on sea turtle interactions in the Hawaii shallow-set longline fishery to 34 North Pacific loggerhead and 26 leatherback.

3.3.3.2.3 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. Between 2006 and 2012, there were between 123 and 129 vessels in the longline fleet, with two years (2007 and 2012) with 129 vessels. Given that the number of active vessels in 2012 is 129, it is assumed that the fleet consists of 129 vessels. Further, in 2007, all 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.

Table 3.13 Number of active longline vessels based in Hawaii by year.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of Longline Vessels	101	100	110	125	124	127	129	128	127	123	128	129

Sources: NMFS 2012b, 2012c.

Longline effort increased rapidly from 37 vessels in 1987 to 138 vessels in 1990 (Ito and Machado 2001). 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, with the average size at 72 ft. Based on June 2012 NMFS data, of a total of 128 vessels in the fleet for which size information was available, 57 were 74 ft. long or longer (large), 57 ranged between 56 and 74 ft. (medium), and 14 were shorter than 56 ft. (small) (NMFS 2012c) (Table 3.14). 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 3.14. Size of active vessels in the Hawaii-based longline fleet in June 2012 and ethnicity of deep-set longline vessel owners by vessel size in 2000.

Vessel Size	**Number of Active Vessels (2012)***	**Ethnicity of Vessel Owner (2000)****		
		Caucasian	**Korean-American**	**Vietnamese-American**
Small (< 56 feet)	14	31%	64%	6%
Medium (56 – 74 feet)	57	31%	64%	6%
Large (> 74 feet)	57	72%	22%	6%
Total	**128**	**41%**	**53%**	**6%**

* Size information only available for 128 of 129 active vessels in 2012

** Percentages are based on a sample size of 50 longline vessels

Sources: NMFS 2012c, O'Malley and Pooley 2003.

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 must be a U.S. citizen or national, and 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). 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). Table 3.14 presents the ethnicity of

deep-set longline vessel owners by vessel size in 2000, highlighting that although Korean-Americans owned the majority of small (<56 ft) and medium-sized (56 – 74 ft) vessels in 2000, the majority of large longline vessels (> 74 ft) were owned by Caucasians at this time. Vietnamese-Americans, by contrast, represented a minority of deep-set vessel owners in 2000, as they targeted primarily swordfish at this time. Although the distribution of Caucasian and Korean-American vessel ownership is not expected to have changed significantly since 2000, the proportion of Vietnamese-American deep-set fishers likely increased after the closure of the Hawaiian swordfish fishery in 2001, which caused Vietnamese-American vessel owners to transition into deep-set tuna fishing, or relocate to California (Allen and Gough 2006). 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.

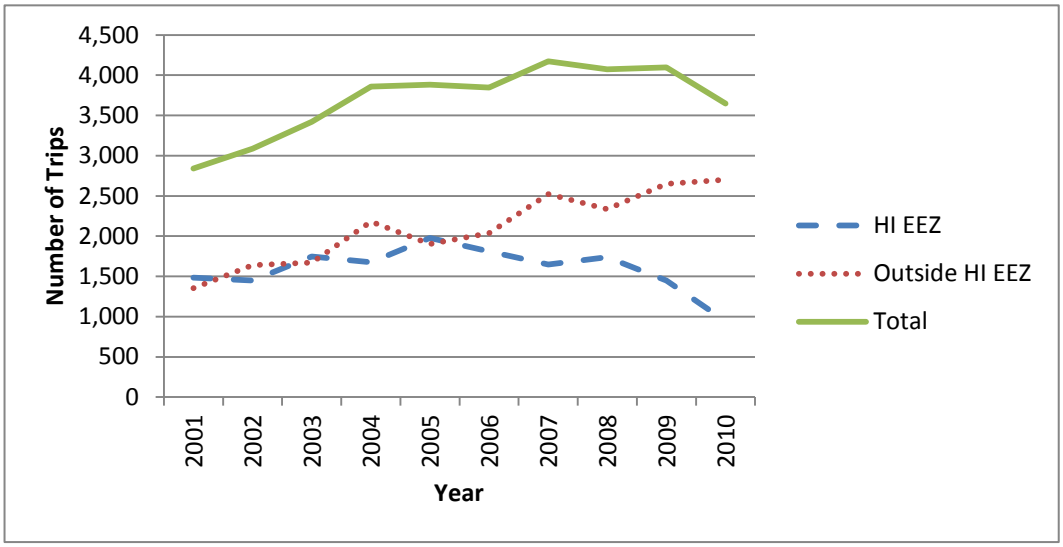

Figure 3.6(a). Number of trips by Hawai'i-based deep-set longline fishery by year and fishing area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to aggregation to preserve confidentiality, some data points might be missing).

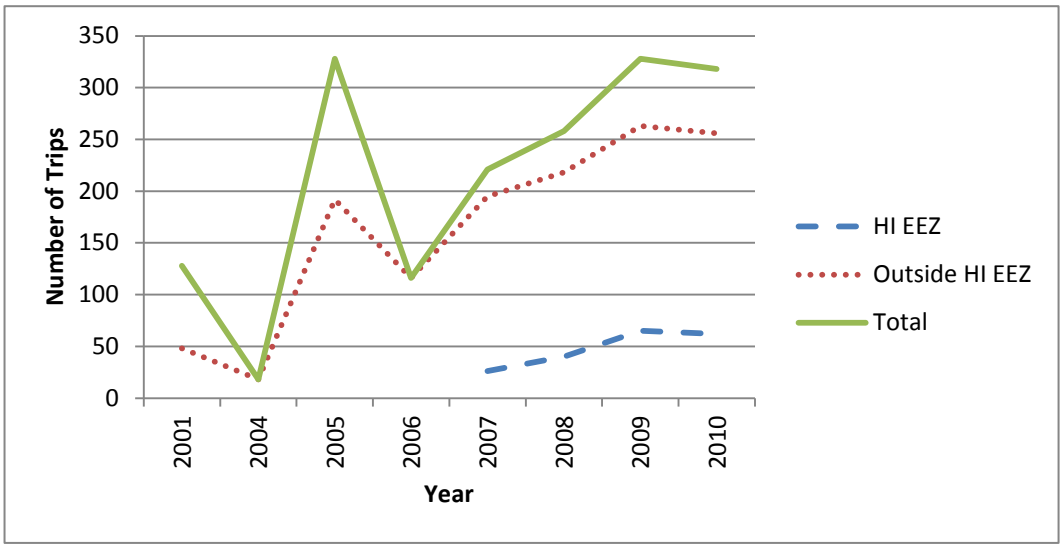

Figure 3.6(b). Number of trips by Hawai'i-based shallow-set longline fishery by year and fishing area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to aggregation to preserve confidentiality, some data points might be missing).

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)).

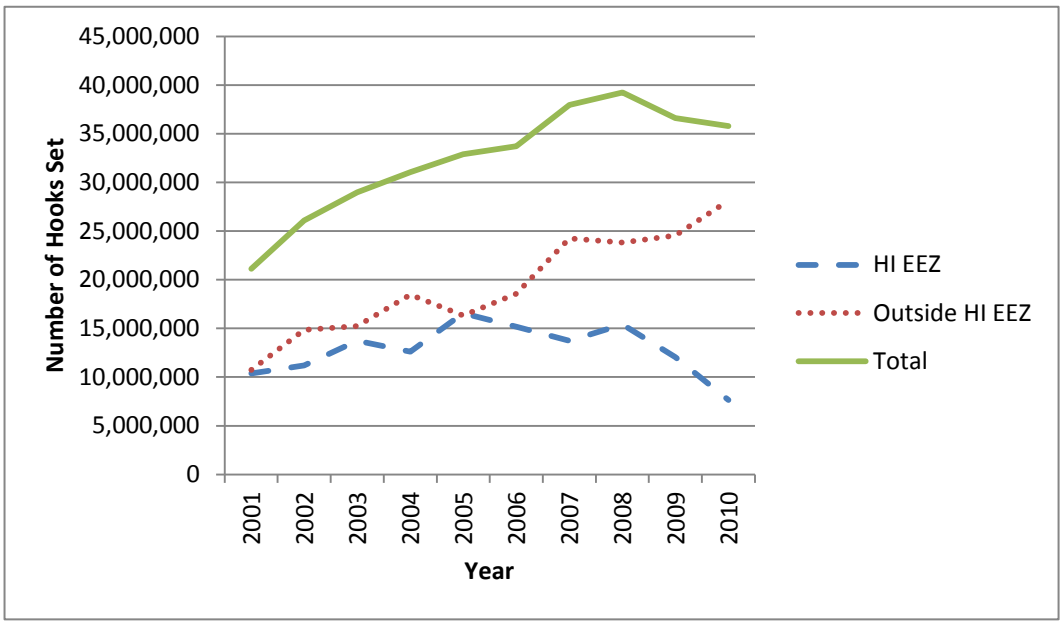

Figure 3.7(a). Number of hooks set by Hawai'i-based deep-set longline fishery by year and fishing area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to aggregation to preserve confidentiality, some data points might be missing).

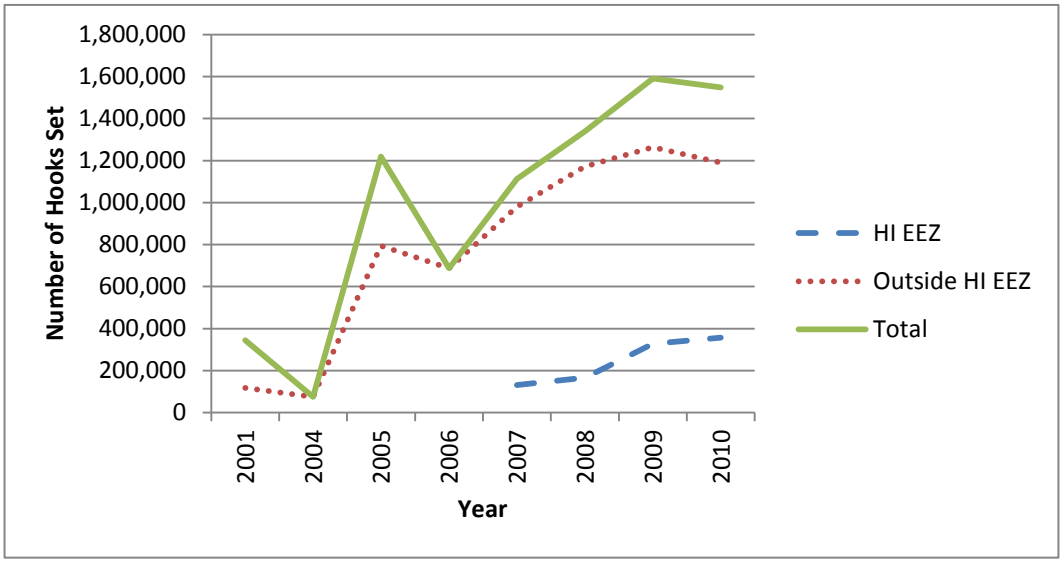

Figure 3.7(b). Number of hooks set by Hawai'i-based shallow-set longline fishery by year and fishing area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to aggregation to preserve confidentiality, some data points might be missing).

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.

3.3.3.2.4 Market and Value of Hawaii-Based Longline Fisheries

Almost all of the Hawaii-based longline catch is sold at either the United Fishing Agency auction in Honolulu, or the Suisan Fish Auction in Hilo. A small percentage of the longline catch is not sold at auction, and is directly marketed to retailers or exported by the fishermen. Wholesalers and retailers who buy their fish from the auction distribute to restaurants and other vendors (HIPA 2009). Additionally, approximately 3% of Hawaii's commercial tuna landings are exported annually, primarily to Japan and Europe (Geslani et al. 2012). 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).

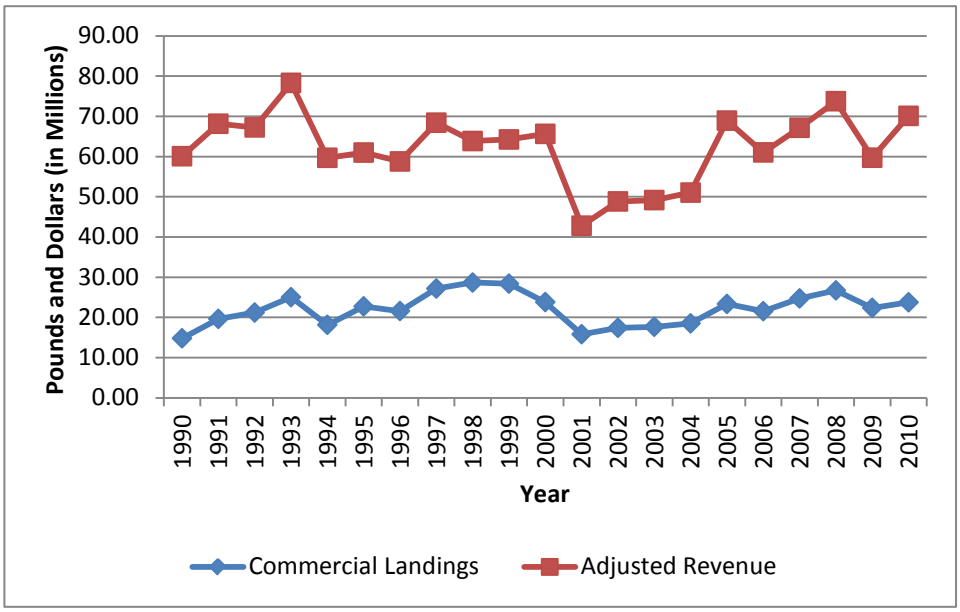

Figure 3.8. Commercial landings (in millions of pounds) and revenues (in millions of dollars) for Hawaii-based longline fisheries, 1990-2010 (WPacFIN 2012).

Table 3.15 presents recent annual commercial landings 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 (WPacFIN 2012). 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.

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 3.15. 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 13% of jobs in the state were in industries directly involved with tourism, with many other jobs were indirectly associated with the industry (see Table 3.5). 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 3.16). 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 3.16. 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: HTA and DBEDT 2010.

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 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 2008). 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 2012d). 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 2008).

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 and produce improved estimates of, marine recreational catch and effort. The MRIP is anticipated to replace the HMRFS (MRIP 2012). 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 2012d). 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 2012d). Additionally, 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 2012d). Direct annual expenditures on recreational fishing are estimated to be about $450 million (NMFS 2012d).

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 and Hawaii Audubon Society 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 (Hospital 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 (Hospital 2011).

3.3.6 Seafood Consumption in Hawaii

Annual fish consumption in Hawaii from commercial sources was estimated to average about 29 pounds per capita over the 10 year period between 2000 and 2009, just less than twice the national average (Geslani 2012). 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 1995).

Almost all of the Hawaii-based longline catch is sold at either the United Fishing Agency auction in Honolulu, or the Suisan Fish Auction in Hilo. Bidding is open at the auction and all levels of seafood market are represented, including private consumers (HIPA 2009). A small percentage of the longline catch is not sold at auction, and is directly marketed to retailers or exported by the fishermen. Wholesalers and retailers who buy their fish from the auction distribute to restaurants and other vendors (HIPA 2009). Additionally, approximately 3% of Hawaii's commercial tuna landings are exported annually, primarily to Japan and Europe (Geslani et al. 2012). 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. 2005). 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 of 96.5% directly sold for final consumption) (Cai et al. 2005).

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 (Maly 2001). 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 (Maly 2001). 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 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 circle hooks with 4.5 mm maximum wire diameter and other specific characteristics in the Hawaii-based deep-set longline fishery

The required use of circle hooks with a maximum wire diameter of 4.5 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).

<u>Reducing the severity of injury to marine mammals</u>

The predominant hook types used in the deep-set longline fishery are tuna hooks (3.6 sun and 3.8 sun) and circle hooks (15/0 and 16/0, and less commonly, 14/0) (FKWTRT 2010, Bigelow et al. 2011). 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 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.

	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%

Source: FKWTRT 2010.

Circle hooks that would meet the requirements of the Preferred Alternative (maximum wire diameter of 4.5 mm) that are currently used in the deep-set fishery and available to Hawaii-based suppliers are size 15/0 and 14/0 (though some manufacturers make size 16/0 circle hooks with a wire diameter of 4.5 mm or less). In a strength test conducted to support the FKWTRT's deliberations, circle hooks were tested using a Dyna-Link MSI7200 digital hook/line tester to gauge their "fail" point, or the point where the hook had opened up enough where it was determined a fish or whale could escape. The fail point for the 15/0 circle hooks tested that had wire diameter of 4.5 mm ranged from 290-310 pounds, compared to 450-600 pounds for 3.6 sun and 3.8 sun Japanese ringed tuna hooks (Funderburg et al. unpublished data 2010). The circle hooks are weaker than tuna hooks, and are weaker than the breaking strength of the monofilament branch lines (400 pounds) required under this Alternative (so the hook is the weakest component of the terminal tackle). The bending strength that would be necessary for a false killer whale to straighten a hook is unknown, but there is information that, at least in certain cases, a false killer whale could straighten a 15/0 circle hook with 4.5 mm wire diameter, as was observed by Bigelow et al. (2011). NMFS expects that the use of circle hooks with 4.5 mm wire diameter would release some hooked false killer whales, resulting in fewer serious injuries or mortalities.

Reducing the total number of injuries to marine mammals

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. Bootstrapping was a way to randomly sub-sample longline sets from observer data, with replacement, to simulate fishing under various scenarios and evaluate the impacts of those fishing scenarios on false killer

whale M&SI. 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 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 circle hooks 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).

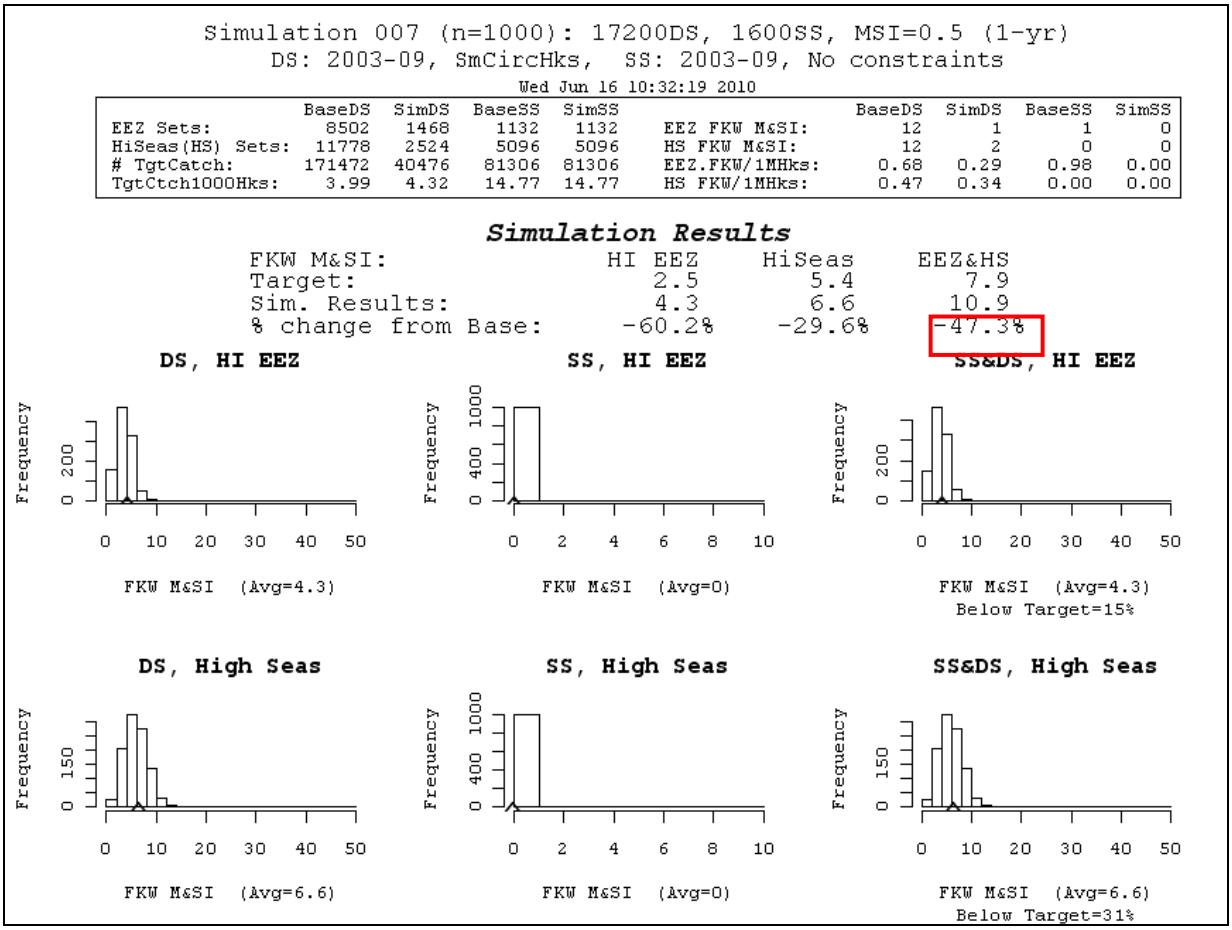

Figure 4.1. Sample simulation output for 17,200 deep sets per year, 1,600 shallow sets per year, a reduced M&SI rate of 50%, and the mandatory use of circle hooks in the deep-set longline fishery. In this case, the simulation forecasts that M&SI of false killer whales would decrease by about 47.3% (see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

<u>Other species</u>

Sea Turtles

The Preferred Alternative's hook requirements would be expected to provide some conservation benefit to sea turtles, though the magnitude of this benefit cannot be estimated. There are no existing requirements specific to hook type (e.g., size, shape, wire diameter) in the Hawaii-based deep-set longline fishery. As described in Table 3.11, the deep-set fishery currently uses both circle hooks (primarily sizes 15/0, 16/0, and less commonly 14/0) and tuna hooks (sizes 3.6 and 3.8 sun), though there are a small number of size 18/0 circle and J hooks in use. As of 2010, observer data indicate that 25% of vessels use only tuna hooks, 27% use a mix of circle and tuna hooks, and 43% use only circle hooks. The Preferred Alternative would require exclusive use of circle hooks in the deep-set fishery, thereby eliminating tuna and J hooks from use.

The Preferred Alternative sets a maximum wire diameter for circle hooks in the fishery, but there is no hook size requirement, so any size circle hook that meets the maximum wire diameter requirement would be allowed. Based on information NMFS obtained from two major gear distributors in Hawaii, circle hooks currently sold to the Hawaii-based deep-set fleet that would meet the Preferred Alternative's maximum wire diameter requirement (≤ 4.5 mm) are sizes 15/0 and 14/0; larger size circle hooks (e.g., 16/0 and 18/0) sold by these gear distributors have wire diameters >4.5 mm. The effect of the Preferred Alternative's hook requirement may be that fishermen currently using size 16/0 circle hooks (with wire

diameter > 4.5 mm) switch to size 15/0; however, if hook size is particularly important to fishermen, those fishermen may seek 16/0 hooks that meet the maximum wire diameter requirement. Some hook manufacturers do make size 16/0 circle hooks that meet the maximum wire diameter requirement and could be acquired by fishermen. The deep-set fishery generally does not use 18/0 circle hooks.

The effect of 15/0 circle hooks on sea turtle bycatch in the Hawaii-based deep-set longline fishery has not been tested experimentally, 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 has shown that, in some longline fisheries, circle hooks may reduce sea turtle interaction and mortality rates compared to J and tuna hooks (see reviews in Gilman et al. 2006 and Read 2007). Particularly for larger size circle hooks (e.g., 18/0), turtles are more likely to be hooked in the jaw than in the esophagus when compared with J hooks; these jaw-hooking may cause less injury and facilitate easier gear removal (Watson et al. 2005, Stokes et al. 2011). Even if swallowed, circle hooks may not embed, potentially improving the chance that a hook will pass through the gut or be removed with minimal injury (Stokes et al. 2011). The ability of large circle hooks to reduce sea turtle mortality is enhanced by use of finfish bait compared to squid bait (Watson et al. 2005, Stokes et al. 2011). There are no existing bait requirements for the Hawaii-based deep-set longline fishery, nor does the Preferred Alternative have a bait requirement. However, the deep-set fishery typically uses saury or sardine bait, both of which are finfish.

Circle hooks may also affect the rate of "foul hooking." Leatherback sea turtles are most often foul hooked, primarily in the flipper, shoulder, or armpit (Watson et al. 2004, NMFS 2005). 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. Researchers consider it likely that smaller circle hooks may be at least as effective in reducing foul hooking as larger circle hooks, or possibly more effective since the gap between the hook point and shank is smaller for smaller circle hooks (Watson et al. 2004).

It is unknown how or to what extent the results of the above research could be used to predict the impact of the Preferred Alternative. A likely result of the Preferred Alternative's maximum wire diameter requirement is a switch to 15/0 circle hooks, which are a smaller size than those examined in the above studies. Thus the benefits of large circle hooks of reducing sea turtle bycatch and mortality may not be realized. However, the most frequently hooked sea turtles in the Hawaii-based deep-set fishery are olive ridleys (NMFS 2005, NMFS observer data), which are generally smaller than loggerheads. These smaller turtles may benefit even from use of smaller size circle hooks compared to tuna or J hooks.

While the effect of the Preferred Alternative's hook requirement on sea turtles cannot be quantified, exclusive use of circle hooks is likely to provide some level of overall benefit relative to the status quo.

Seabirds

The expected effect of the 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 circle hooks in the fishery (see Table 3.11: approximately 43% of the fleet exclusively uses circle hooks and 27% uses a mix of circle and tuna, based on 2010 observer data; Bigelow et al. 2011), the required fleet-wide use of circle hooks is not anticipated to change current rates of seabird bycatch.

Target and Non-target Fish Species

The expected effect of this measure on target and non-target fish species is unknown. Numerous studies have been conducted in fisheries around the world to evaluate the impact of various sized circle hooks compared to J and tuna hooks on target and non-target species, and results have been mixed. There is some evidence that using circle hooks compared to tuna hooks in longline fisheries may increase or have no effect on the catch rates of target tuna species (e.g., Kim et al. 2007, Kerstetter and Graves 2006, Curran and Bigelow 2011), and as noted above, a large proportion of the Hawaii-based deep-set longline fishery already uses circle hooks (including some with specifications that would meet the requirements of this Alternative), so they are considered viable in the fishery. In the Western and Central Pacific Ocean, management of bigeye tuna in the longline fishery is based on catch limits, and changes in catch rates or catch efficiency due to the fleet-wide use of circle hooks would not affect the catch limit or the resource. Bigeye tuna would continue to be harvested by the Hawaii deep-set longline fleet in accordance with international conservation and management measures for bigeye and any associated catch limits which help to ensure that the U.S. tuna fisheries are sustainable.

The catch of non-target species may be affected by a change in hook type, to an unknown degree. Serafy et al. (2009) reviewed 11 empirical studies that reported circle versus J-hook fishing performance, and found that circle hooks appear to have little or no effects on catch rates of billfishes, but may result in lower mortality rates and lower rates of deep-hooking. Serafy et al. (2009) also report that impacts of circle hooks on elasmobranch catches in longline fisheries vary. They report that some studies found statistically insignificant catch rate differences of blue sharks between J and circle hook types, while others found higher blue shark catch rates on circle hooks. These findings are echoed by Gilman et al. (2008a), who discuss several studies showing that hook and bait type may affect shark catch per unit effort (CPUE). In the Hawaii-based deep-set longline fishery, an experiment comparing 18/0 circle hooks versus tuna and J hooks found that the catch rate of billfish, sharks, and a variety of non-target and bycatch species were reduced on circle hooks (Curran and Bigelow 2011). The authors note that this 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 for 18/0 circle hooks may not be transferrable to the smaller sized circle hooks already used by a portion of the deep-set fishery that would meet the requirements of this Alternative, but are an indication that catches of non-target species may be affected. The deep-set fishery generally does not use 18/0 circle hooks, and the 18/0 circle hooks currently available have a wire diameter greater than what would be allowed under this Alternative.

4.2.2.2 Establish a minimum diameter for monofilament leaders and branch lines in the Hawaii-based deep-set longline fishery

Branch lines typically include a snap, monofilament and/or other material, a weight, swivel, leader (monofilament or wire), and a hook. Each section in a branch line is held together by line crimps (usually four) rather than knots. Observer data indicate that monofilament branch lines 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 (NMFS Policy Directive PD 02-238). The FKWTRT believes that if the fishery used leaders and line in the branch lines that were strong relative to the hook strength, during a marine mammal hooking or entanglement, tension could be placed on the line (without the line breaking) to allow the hook to straighten, or the animal could be brought close to the vessel for disentanglement and/or dehooking attempts (FKWTRT 2010). If the animal were released from the gear without further injury, the injury would be much more likely to be considered a non-serious injury.

The intent of this measure is to make the hook the weakest part of the terminal tackle and prevent leaders and branch lines from breaking under the strain of a hooked or entangled marine mammal. The FKWTRT recommended a 2.0 mm minimum diameter for monofilament leaders and branch lines, 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 measure would also specify a minimum breaking strength of 400 pounds for any other line used in the construction of a branch line.

The required minimum diameter for monofilament leaders and branch lines, in combination with the required use of circle hooks, would be expected to reduce the M&SI rate of marine mammals by enabling attempts to straighten the hook and/or bringing the animal closer to the vessel (without the branch line breaking) for disentanglement or dehooking. The reduction cannot be quantified. The average observed branch line 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 branch line diameter from trip to trip, which might be explained by differences in measuring technique between observers, variability in observer-issued equipment, branch line 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 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, branch lines have been observed to break under the strain of a hooked marine mammal. Of 43 observed false killer whale and blackfish takes, the branch line broke in 7 interactions (5 false killer whales and 2 blackfish). The average reported branch line 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 sun tuna hooks, which are much stronger than most circle hooks used in the deep-set fishery (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 branch line diameter and the rate of line breaks during marine mammal interactions. However, while it is anticipated that line breaks would decrease under a 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.

Branch line breaks are not commonly reported during interactions with other protected species (e.g., seabirds and sea turtles), except rarely for leatherback sea turtles. This measure is therefore not likely to have an effect on these species. If the requirement does reduce the chance of the branch line 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 little to no expected effect on target or non-target fish species from this measure. Monofilament line that is less than 2.0 mm in diameter is typically 1.8 mm, which is 300 pound test. This is 100 pounds weaker than 2.0 mm monofilament line, which is 400 pound test. Therefore, switching to 400 pound test monofilament may mean that target and non-target fish species that would have broken 300 pound test monofilament may be retained on 400 pound test monofilament. However, a large majority of the fleet already uses monofilament in branch lines that would be compliant with the requirements of this Alternative, and any change in the catch rate of fish on branch lines with 2.0 mm monofilament compared to 1.8 mm monofilament is likely to be small and would not likely have a large negative effect n the status of the stocks.

Wire leaders, such as those used by the deep-set fishery, have been identified as a potential cause of shark bycatch (Gilman et al. 2008a). This Alternative would not require a change in the material used for leaders, but only specifies a minimum diameter for monofilament used in branchlines (including leaders) and a minimum breaking strength for any other line materials used in the branchline (including leaders). It is therefore unlikely that fishermen would change the materials used in leaders as a result of this measure, and therefore no change would be expected in shark bycatch.

4.2.2.3 Modification to the existing Main Hawaiian Islands Longline Fishing Prohibited Area

The existing MHI Longline Fishing Prohibited Area covers 263,775 km^2 (76,904 nm^2), including 192,390 km^2 (56,092 nm^2) that are closed to longline fishing year-round (50 CFR 665.806(c)(1)), and an additional 71,385 km^2 (20,813 nm^2) north of the MHI that are closed to longline fishing for eight months of the year (50 CFR 665.806(c)(2)). Under this Alternative, the entire area would be closed year-round. In effect, therefore, the only modification from the existing closure 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 current October-January boundary] or the PMNM).

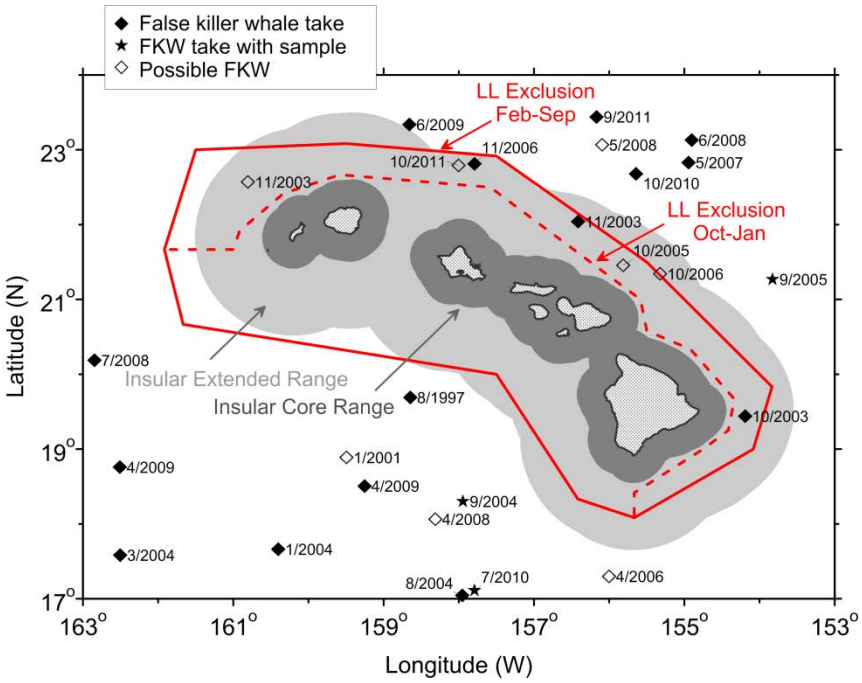

Figure 4.2. Core and extended ranges of the Hawaii insular stock of false killer whales, overlaid with the existing longline exclusion zone around the MHI. The modification to the year-round MHI Longline Fishing Prohibited Area would eliminate the seasonal change in the boundary of the exclusion zone, and would maintain the solid red line boundary at all times. Locations of observed takes of false killers and possible false killer whales (blackfish (pilot whale or false killer whale) and those that could have been a blackfish or some other dolphin) are noted, including those where a biopsy sample was obtained, since 1995.

The modification to the 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 in a large portion of the remaining extended range (Figure 4.2). The modification to the 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 modified closure would also offer protection to the Hawaii 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 modified 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 modified MHI Longline Fishing Prohibited Area would be 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 little to no expected effect on target or non-target fish species from this measure. As described in section 5.7.1 (in the RIR), the average number of annual deep-set sets in the seasonally open area from 2006 to 2010 was 270, which is approximately equivalent to 38 deep-set trips in the area (based on the average number of sets per trip). From 2006 to 2010, there was little to no effort by the shallow-set fishery in this area. It is expected that if the area were closed year-round, most of the longline fishing effort that previously occurred in this zone would be expected to relocate elsewhere, but could result in a reduction in fishing effort.

Prohibiting longline fishing year-round within the seasonally open area may provide a small benefit to the species in that area. However, the fish species are highly mobile and widely distributed, so if longline effort were redistributed to outside of the closed area, the same fish stocks would be impacted. From 2006-2010, the CPUE of bigeye tuna caught in the seasonally open area was 36% lower than elsewhere within the fishery on average, and the average weight of bigeye tuna caught is comparable between the seasonally open area, within the EEZ around Hawaii, and within the deep-set fishery as a whole. Therefore, there is likely little to no conservation benefit to 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. NMFS expanded the content of the workshops to meet the needs of the FKWTRP and has presented the revised content since late 2010.

The FKWTRT believes more 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 expanded training were carried out, this would potentially reduce the severity of injuries to marine mammals during these interactions (FKWTRT 2010).

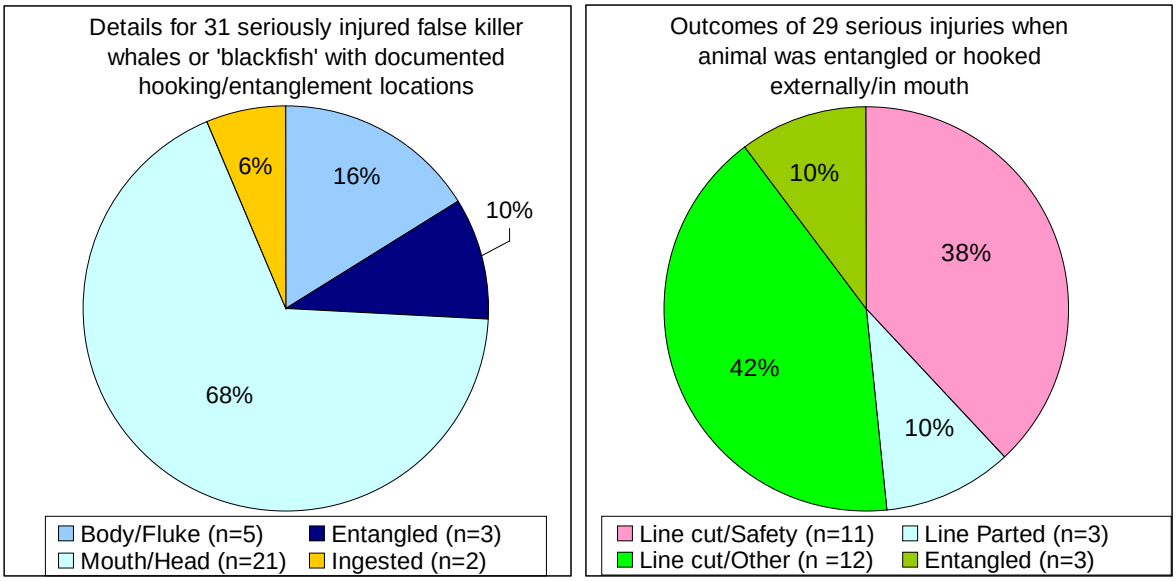

Figure 4.3. Information on seriously injured false killer whales reported by the observer program 1994-2009. Only interactions with sufficient detail to characterize where and how animals were hooked or entangled are show. Left panel shows nature of entanglement/hooking. Right panel shows outcome of 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 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 expanded training were carried out. Similar benefits would also be expected for other marine mammals that are hooked or entangled in the longline fisheries.

Because this 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 a requirement for vessel owners and operators to complete annual certification in marine mammal interaction mitigation techniques (described in section 4.2.2.4 above), is expected to facilitate improved handling and release of hooked or entangled marine mammals, potentially resulting in increased effort by fishermen to handle and release marine mammals to minimize further injury. Therefore, it is expected that fewer marine mammals would be 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 measures would be 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. The SEZ would cover 386,122 km^2 (112,575 nm^2), that if closed, would reduce the area available to longline fishing within the EEZ around Hawaii by approximately 17%.

As described in the description of the alternative (section 2.3.2.8), much of the deep-set longline fishing effort within the EEZ is currently concentrated around the MHI (compared to the NWHI), so it may be more illustrative to understand how much of the EEZ the SEZ would cover relative to the MHI, defined as the area to the east of 161° W. longitude (50 CFR 665.12). The SEZ and the existing MHI Longline Fishing Prohibited Area both extend into waters west of the 161° W. longitude boundary, but *for the portion of the area east of 161° W. longitude*, the SEZ would comprise approximately 35% of the area available to longline fishing within the EEZ (i.e., the EEZ east of 161° W. longitude minus MHI Longline Fishing Prohibited Area that would be closed year-round under this Alternative; or 239,465 km^2 [69,816 nm^2] of the available 682,958 km^2 [193,572 nm^2]).

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 pelagic stock's PBR and the level of observer coverage in the deep-set fishery. The PBR value for the Hawaii Pelagic stock was recently updated based on the most recent abundance estimates from a 2010 cetacean assessment survey (Carretta et al. 2012b). However, 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) as a way to bracket the potential (though unplausible) range of SEZ triggers. 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 9.1 (Carretta et al. 2012b), are <u>not</u> 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, the higher values 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
HICEAS II-outer EEZ (Bradford et al. 2012)	0.0007	0.66	1503	906	9.1
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 (15-25%) and PBRs (0.5-52) (Table 4.3). The resulting triggers ranged from 2 to 14. 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 a longer (multi-year) closure of the SEZ, if the trigger were met in two consecutive years.

Table 4.3. Potential triggers for closing the Southern Exclusion Zone, calculated using a range of PBR and observer coverage levels. The trigger is the larger of these two values: two (i.e., two is the minimum trigger); or the smallest number of observed animals that, when extrapolated based on observer coverage (i.e., the trigger divided by observer coverage), exceeds PBR. Trigger values must be whole numbers.

	Deep-set Fishery 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**
0.5	2	2	2	2	2	2	2	2	2	2	2
1	2	2	2	2	2	2	2	2	2	2	2
1.5	2	2	2	2	2	2	2	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2	2
2.5	2	2	2	2	2	2	2	2	2	2	2
3	2	2	2	2	2	2	2	2	2	2	2
9.1	2	2	2	2	2	2	2	3	3	3	3
10	2	2	2	2	2	3	3	3	3	3	3
10.1	2	2	2	2	2	3	3	3	3	3	3
10.5	2	2	2	2	2	3	3	3	3	3	3
11	2	2	2	2	3	3	3	3	3	3	3
12	2	2	3	3	3	3	3	3	3	3	4
13	2	3	3	3	3	3	3	3	3	4	4
14	3	3	3	3	3	3	3	4	4	4	4
15	3	3	3	3	3	4	4	4	4	4	4
20	4	4	4	4	4	5	5	5	5	5	5
25	4	5	5	5	5	6	6	6	6	7	7
30	5	5	6	6	6	7	7	7	7	8	8
35	6	6	6	7	7	8	8	8	9	9	9
40	7	7	7	8	8	9	9	9	10	10	11
45	7	8	8	9	9	10	10	10	11	11	12
50	8	9	9	10	10	11	11	12	12	13	13
52	8	9	9	10	10	11	11	12	12	13	14

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 for the remainder of the year. If the trigger were again met in the following year, the SEZ would be closed to deep-set longline fishing until reopening criteria were met, 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 of maintaining the 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 (since only the deep-set fishery would be closed), and would continue to interact with false killer whales at the current (low) 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. That incidental M&SI might be mitigated through implementation of other measures under this alternative (e.g., circle hooks, marine mammal handling/release training).

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 effect on target and non-target species. Any potential effects would depend on the level of effort redistribution following a closure. There may be potential conservation of the deep-set fishery's target and non-target species within the SEZ because there will be no deep-set longline fishing allowed within the SEZ when it is closed. However, management of this fishery's target species is based on catch limits, and the SEZ closure would not change the catch limit. The fishery would be expected to utilize open areas to achieve their target catch limit. Catch rates of non-target species would be expected to generally follow expected trends 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

Changes to observer training and observer data collection protocols would be expected to improve the quality of observer data on marine mammal interactions, and may 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 changes would be specific to marine mammals, and thus this component of the Alternative would not be expected to have an impact on other protected species or other biological resources.

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 (and below the insignificance threshold of 10% of 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, with the majority of hooks set on the high seas (75% of hooks set in 2010; WPRFMC 2012). A closure of the EEZ would likely further 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. Fishermen vary their fishing grounds throughout the year, and NMFS cannot predict where fishermen might move if effort is displaced to the high seas.

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 (i.e., increased bycatch of protected species on the high seas). Effects might be mitigated through implementation of other measures under this alternative (e.g., 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. However, NMFS cannot 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.

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 (though unquantifiable at this time), 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 considered 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 be expected to result from each alternative is contained within the Regulatory Impact Review (RIR) and Final Regulatory Flexibility Analysis (FRFA) (sections 5 and 6 of this document). As discussed in the RIR, the potentially affected groups analyzed for effects, and the type of impacts that could (but not necessarily would) occur, include:

- Hawaii-based longline fisheries. Directly regulated groups, 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 or monofilament line inventory and net revenue from selling different equipment.

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

- Seafood retailers/wholesalers. Indirectly affected group, with potential adverse impacts if the quantity or price of fish sold 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 longline 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, nor 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, since depredation is a learned behavior that may be passed down to successive generations of animals, and data indicate that depredation is increasing in Hawaii longline fisheries. Increased depredation could result 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 or to insignificant levels approaching a zero rate for the Hawaii pelagic and Hawaii insular 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 numbers of fishermen and fishing communities.

Increased false killer whale 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 may include Native and resident Hawaiians. The scientific community may be adversely affected by foregone opportunities to study and understand false killer whale biology and conservation. Finally, while unlikely due to limited false killer whale sightings, recreation and tourism groups engaging in wildlife viewing may be adversely affected by increased false killer whale M&SI if false killer whale populations decline.

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 longline 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 or fishing effort. Individual vessels may exit the fishery or be impacted to a greater degree by costs imposed by the Preferred Alternative. There may be adverse impacts on income and revenue of Hawaii-based fishing gear suppliers due to some longline gear inventory being barred from use (and therefore potentially unsellable) by the FKWTRP. There are little to no anticipated effects on seafood consumer prices, quality, or availability. However, such effects are possible if fishing effort and catch is reduced, resulting in minor impacts on well-being or quality of life.

Due to anticipated reductions in false killer whale M&SI, this alternative is expected to generate direct and indirect beneficial quality of life effects on groups that value the false killer whale, in particular, scientists and educators, and members of present and future generations of the general public concerned about marine mammal protection. Although unlikely, 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. While also unlikely, 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 would be 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 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 branch line 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 measures with projected impacts that affect the shallow-set fishery are the annual Protected Species Workshop certification for operators/owners and revisions to 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 seasonally open area of the MHI Longline Fishing Prohibited Area (i.e., less than one full trip each year).

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 3% 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 3% discount rate and a timeframe of 20 years. All costs are presented in 2011 dollars.

Table 4.4 summarizes total costs to the deep-set longline fishery associated with all measures in the Preferred Alternative (Alternative 2). Total initial, one-time capital costs are estimated to range from $359,000 to $603,000. The one-time labor cost and material cost associated with replacing hooks to meet the hook requirement is expected to be the most significant one-time cost under the Preferred Alternative, as this requirement is expected to require replacement of an estimated 81% of hooks currently in use. Annual ongoing costs in terms of gear changes, operating costs, and lost revenues incurred under the Preferred Alternative are, in turn, estimated to be between $86,300 and $4.1 million. Closure of the SEZ, if triggered, constitutes the majority of potential 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 $4.1 million annually for all vessels if the SEZ is closed all year (costs for this measure may be $0 if the closure is not triggered). These travel costs are estimated based on maximum increased travel distance;

costs would be lower if vessels relocated to other, less distant areas, or if the SEZ were closed for less than the full year.

As noted above, all (or nearly all) of the annual and one-time costs would be incurred by the deep-set fishery. The longline fishery may incur additional costs if the Preferred Alternative results in increased interactions with false killer whales due to false killer whale population increases. Potential costs to the fleet from interactions cannot be quantified due to the uncertainty in the net effect of the FKWTRP on the number of interactions between false killer whales and the longline fleet (potential increased population but requirements that seek to limit the number of interactions).

Table 4.4. Preferred Alternative: total expected income reduction to the deep-set longline fishery.[a]

Measure	Initial, One-Time Cost	Annual Ongoing Cost	Total Annualized Cost	Net Present Value Cost (2012 – 2031)
4.5 mm wire diameter circle hook requirement	$343,000 - $578,000	-$400 to -$500	$23,000 - $38,000	$336,000 - $571,000
2.0 mm diameter line requirement	$16,000 - $25,000	$2,000 - $4,000	$3,000 - $5,000	$49,000 – $77,000
MHI Longline Fishing Prohibited Area	$0	$84,000 – $97,000	$84,000 – $97,000	$1,245,000 -$1,437,000
Annual Certification for Operators/Owners	$0	$700 - $1,400	$700 - $1,400	$10,000 – $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	$0 - $3,978,000	$0 - $3,978,000	$0 -$59,190,000
Total Cost	**$359,000 - $603,000**	**$86,000 – $4,080,000**	**$111,000 -$4,119,000**	**$1,640,000 - $61,296,000**

a/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

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. Apart from limited reduced effort associated with increased travel time due to elimination of the MHI seasonal contraction zone (i.e., revision of the MHI Longline Fishing Prohibited Area to maintain the existing February-September boundary year-round), reduced effort effects may be low, as the vast majority of the expected costs of the Preferred Alternative are associated with the SEZ, which is only triggered in certain years (or portions of years) and which may result in much lower costs if vessels choose alternative fishing areas that do not require the high increased travel distances as assumed in this analysis. However, it is important to note

that any reduced effort or vessel exit from the fishery 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 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 (2.0 mm diameter or larger) monofilament leader/branch line as observer data indicate that all other vessels are currently using this type of line or stronger. Additionally, an estimated 104 vessels (81% of the fleet) are expected to incur costs associated with switching to the ≤ 4.5 mm diameter wire circle hook requirement (although the number of affected vessels may be higher if some vessels are using a mix of hook types, with some in compliance and some not in compliance with the hook requirement).

Furthermore, small vessels may be disproportionately affected in terms of profitability and potential exit of the fishery. According to a study of vessel profits in 2000, the profitability of the longline fleet varied by vessel size; excluding the three most profitable vessels in each size bracket, small longline tuna vessels (<56 ft) recorded net losses of $1,440, whereas medium sized vessels (56.1 ft – 73.9 ft) recorded average net revenues of $33,370, and large vessels (>74 ft) recorded net revenues of $19,190 (values in 2000 dollars). The three most profitable vessels in all size brackets each had annual net revenue exceeding $275,000, highlighting the profit variability within the fleet (O'Malley and Pooley 2003). These data from 2000 suggest that the owners of small vessels may already be marginally profitable, and could be most affected by the potential increased costs of the Preferred Alternative.

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 2000). 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 hook requirement. This section describes the methodology and estimated cost to the gear suppliers of the one-time hook inventory cost, estimated to range from approximately $0 to $12,300.

Commercial fishing gear suppliers may not be able to sell their existing inventory of circle hooks with wire diameter greater than 4.5 mm (including many size 16/0 circle hooks) and tuna and J hooks. Assuming that gear suppliers on average have approximately six months of hook inventory in stock to replace lost hooks in the longline fishery (estimated 33,696 hooks lost annually, divided by two), and an estimated 81% of the hooks currently sold to the deep-set fleet would not meet the FKWTRP's hook requirements, we estimate that there may be approximately 13,600 hooks in supplier inventory at any one

time that would not meet the FKWTRP's hook requirements for deep-setting. 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 $12,300 **(**based on 13,600 hooks becoming unsellable and $0.91 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 $4,100. Using a 3% discount rate over 20 years, the total annualized equipment inventory cost of hooks is estimated at $0 to $800, or up to approximately $275 for individual suppliers. Although not estimated as an expected cost, it is also possible that equipment suppliers may face a one-time cost related to the monofilament branch line requirement if they cannot sell their current inventory of 1.8 mm line to other fisheries.

If fishing effort declines under the Preferred Alternative due to any of the FKWTRP 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

Seafood consumers could be affected by the Preferred Alternative if the supply, price, or quality of seafood changes. Specifically, benefits to seafood consumers (also known as consumer surplus) decrease as prices rise (often due to decreased supply) or as quality declines. There are low *expected* effects of the Preferred Alternative on the supply of local, high quality tuna to Hawaiian consumers. However, the Preferred Alternative could affect the cost to fishermen of harvesting local catch, which could indirectly result in reduced supply of local catch (through reduced effort) or increased consumer price of local catch. Additionally, as discussed above, if the SEZ is triggered, then potentially longer travel time to fishing locations may reduce time available for fishing, thereby reducing fishing effort and catch. (The reduction in catch estimated to result from increased travel time due to revisions to the MHI Longline Fishing Prohibited Area is estimated to be very minor, at approximately 0.1% of fleet revenues).

Potential reductions in catch may result in reduced exports or increased imports. As the Hawaii longline fishery is known for the quality of fish it harvests, reduction in local catch (even if substituted with increased imports) may affect the quality of fish available in the local Hawaii market, with potential effects on consumer surplus associated with locally-caught seafood, as well as a potential effect on local seafood prices. A 2004 study of tuna prices in Hawaii found that there is a correlation between local supply of yellowfin, skipjack, and albacore tuna and price, with lower prices in periods of higher seasonal availability of local tuna (Pan and Pooley 2004). Findings relative to bigeye tuna suggest that price for bigeye is more closely connected to quality than local supply, though supply also influences price. The study also indicated that locally caught tuna is of higher quality than imported tuna.

While such adverse impacts on consumer surplus are possible, effects are expected to be limited for four reasons. First, as noted above, there are limited expected reductions in total local catch, as it is expected that the fleet will adapt to the gear requirements and will shift effort from exclusion zones to other areas. The vast majority of the expected costs of the Preferred Alternative and potential reduced fishing effort are associated with the SEZ, which is only triggered in certain years (or portions of years) and which, if it is closed to deep-set longline fishing, may result in much lower costs if vessels choose alternative fishing areas that do not require the high increased travel distances as assumed in this analysis.

Second, while increased costs associated with the Preferred Alternative may cause the exit of some vessels from the fishery (if prices do not rise accordingly), these effects are anticipated to be limited as the Preferred Alternative is expected to impose relatively low costs on many longline vessels (most potential costs estimated in this analysis are associated with the SEZ, which is only triggered in certain years or portions of years and outside of which many vessels currently fish). Effects on the cost and supply of locally caught fish are therefore anticipated to be limited. Third, in the event that the Preferred Alternative results in catch reduction or increased costs of local fish, impacts on local seafood prices are expected to be mitigated due to the global nature of seafood supply and demand (i.e., local prices are

affected virtually everywhere by global supply and demand because of the interconnected nature of global fisheries and markets.) It is anticipated that reductions in Hawaii-based longline catch would be compensated by increased imports to Hawaii or by reduced exports to the mainland or Asia, and that much of the potential increases in longline operating expenses due to increased travel time and fuel costs may not be passed onto consumers (due to competition from other supply sources). Finally, while locally caught tuna has a reputation for high quality, continuous advances in packing systems and air shipment increase the quality and availability of fresh pelagic fish in the Hawaii market from around the world, including from the Philippines, Indonesia, Micronesia, the Marshall Islands, Fiji, and Ecuador.

4.3.2.5 Seafood Wholesalers/Retailers

Similar to seafood consumers, seafood wholesalers/retailers would be adversely affected by the Preferred Alternative if the supply or quality of seafood were to decrease, causing a decrease in the volume sold. Wholesalers/retailers could also be adversely affected if the price of purchasing seafood rises, and they are not able to pass on this full price increase to consumers due to consumer price sensitivity. For the same reasons as discussed above regarding seafood consumers, these effects are not anticipated to result from the Preferred Alternative. In the event that the Preferred Alternative were to cause a decrease in local supply or increase in price, effects on wholesalers/retailers would be similarly mitigated due to the global nature of seafood supply and demand.

4.3.2.6 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 boating recreation and tourism in the Hawaiian Islands, including whale watching, is located within the existing longline exclusion zone of 25-75 nautical miles. 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.

Positive indirect effects of the Preferred Alternative on wildlife viewing recreation could also result if the FKWTRP contributes to increased abundance of false killer whales or other wildlife that may be viewed by recreationists or tourists. However, research on the Hawaii tour boat excursion and whale watching industry identified no whale watching boat trips that focus on false killer whale sightings. False killer whales are rarely currently sighted on such wildlife viewing trips, and the number of false killer whale sightings is unlikely to increase significantly as a result of the FKWTRP given the small size of the current population, limiting the benefits to wildlife viewers.

4.3.2.7 Recreational and Subsistence Fishing

There are two potential beneficial impacts of the Preferred Alternative to subsistence and recreational fishing, including charter 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 and recreational fishing in the Hawaiian Islands is located within the existing longline exclusion zone of 25-75 nautical miles. 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 subsistence fisheries and the commercial longline fisheries, there are no anticipated impacts related to congestion.

Likewise, although unexpected, 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 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 2000). Positive effects on the recreational and subsistence fishery are therefore likely limited.

4.3.2.8 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 (as no interaction with the species is required for passive use benefits, residents of other states that are interested in marine mammal conservation may also benefit).

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 false killer whale M&SI, this alternative is expected to generate direct and indirect beneficial quality of life effects on groups that value the false killer whales, particularly scientists and educators, and members of present and future generations of the general public that value marine mammal protection. Although unlikely, 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. While also unlikely, Alternative 3 may generate some positive effects for non-longline commercial fisheries or recreational/subsistence fisheries operating within the EEZ 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 longline fishing would be expected 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 $9.5 and $11.3 million dollars, of which an estimated $8.3 million are associated with the opportunity cost of increased travel time. Nearly all of this cost (an estimated 94%) 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.[a]

Closure of Economic Exclusion Zone	Annual Ongoing cost	Net Present Value 2012-2031
Fuel Cost	$1,197,000 - $2,992,000	$17,806,000 - $44,515,000
Travel Time Cost	$8,331,000	$123,942,000
Total	$9,528,000 - $11,323,000	$141,748,000 - $168,457,000

a/ All costs greater than $1,000 are rounded to the nearest thousand dollars

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, little to no measureable effects on Hawaii seafood consumer prices are expected due to Alternative 3. However, potentially greater effects on local catch may result from Alternative 3 than in Alternative 2. 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 effects on consumer surplus associated with locally-caught seafood. These effects are may still be limited due to the global market for fish and the potential for high quality imports

4.3.3.5 Seafood Wholesalers/Retailers

Similar to the discussion under Alternative 2, while prices are not expected to be affected, reduced local catch could affect the quality of fish on the Hawaiian market and associated consumer demand if imports are not the same high quality. While not expected, a reduction in consumer demand (related to reduced quality), would adversely affect the revenues and profits of seafood wholesalers and retailers.

4.3.3.6 Recreation and Tourism

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

4.3.3.7 Recreational and Subsistence Fishing

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

4.3.3.8 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. A cumulative impact is defined by the CEQ's regulations as "the impact on the environment which results from the incremental

impact of the action when added to the other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (540 CFR 1508.7). The regulations further specify that "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 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 2009a).

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.

NMFS proposed to revise critical habitat for the Hawaiian monk seal under the ESA. The revision would extend the current designation in the NWHI and designate new areas in the MHI (76 FR 32026, June 2, 2011). Longline fishing is already excluded from the current and proposed critical habitat areas. If NMFS lists the Hawaii insular false killer whale under the ESA, NMFS may designate critical habitat for population, but impact of longline fisheries, if any, on a future designation is unknown.

There are no reasonably foreseeable actions that would significantly affect the physical environment in the Pacific Islands 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 Program (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. NMFS has issued a permit that authorizes the Hawaii-based longline fisheries to incidentally take endangered Central North Pacific humpback whales (75 FR 29984, May 28, 2010).

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 NMFS 2009b); this section is incorporated by reference.

As noted in the Affected Environment section 3.2.1.1, climate change may affect marine mammals found in the action area. Global climate change is expected to continue and to therefore continue to impact marine mammals and their habitat. Although there is much speculation on the potential impacts of climate change to species and ecosystems, there are multiple layers of uncertainty associated with these analyses making it impossible to accurately predict the most likely scenario that will result and consequently what impacts species and ecosystems will face, particularly in Pacific Island countries (Barnett 2001). In addition to the uncertainty of the rate, magnitude, and distribution of future climate change and its associated impacts on temporal and spatial scales, the adaptability of species and ecosystems are also unknown. Parmesan and Yohe (2003) consider climate change a driver of small-magnitude but consistent impact that is important in that it systematically affects century-scale biological trajectories and ultimately the persistence of species. Based on this consideration and the uncertainties in predicting future impacts, the significance of climate change in the context of this analysis is low considering the limited temporal and spatial scale over which the action is likely to occur.

Through this Action (the Preferred Alternative), NMFS would 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 Plan would 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 if approved 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 determine whether the species' conservation status warrants a change in its listing status (endangered).

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 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. More recent management actions include expansion of critical habitat for leatherback sea turtles in areas off the U.S. West coast (77 FR 4170, January 26, 2012); definition of nine DPSs for loggerhead sea turtles and the endangered listing of the North Pacific Ocean DPS (76 FR 58868, September 22, 2011); completion of a NMFS Biological Opinion on the shallow-set longline fishery and a revised incidental take statement for sea turtles (NMFS 2012a); and revisions to the annual limit on incidental interactions between the Hawaii-based shallow-set longline fishery and leatherback and North Pacific loggerhead sea turtles (77 FR 60637, October 4, 2012), to be consistent with the Incidental Take Statement in the 2012 Biological Opinion (NMFS 2012a). Additionally, NMFS recently increased the swordfish retention limit in the Hawaii-based deep-set longline fishery for vessels using circle hooks from 10 to 25 (or unlimited with an observer aboard) (77 FR 43721, July 26, 2012). If this measure results in increased circle hook use, there may be benefits for reducing the number and severity of interactions with sea turtles.

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; and incidental capture in fisheries (trawl, gillnet and longline). 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.

As noted in the Affected Environment section 3.2.1.2, climate change is likely beginning to affect sea turtles found in the action area through impacts of rising sand temperatures, rising sea level, increased typhoon frequency, and changes in ocean temperatures and chemistry. Global climate change is expected to continue and to therefore continue to impact sea turtles and their habitat. Although there is much speculation on the potential impacts of climate change to species and ecosystems, there are multiple layers of uncertainty associated with these analyses making it impossible to accurately predict the most

likely scenario that will result and consequently what impacts species and ecosystems will face, particularly in Pacific Island countries (Barnett 2001). In addition to the uncertainty of the rate, magnitude, and distribution of future climate change and its associated impacts on temporal and spatial scales, the adaptability of species and ecosystems are also unknown. Parmesan and Yohe (2003) consider climate change a driver of small-magnitude but consistent impact that is important in that it systematically affects century-scale biological trajectories and ultimately the persistence of species. Based on this consideration and the uncertainties in predicting future impacts, the significance of climate change in the context of this analysis is low considering the limited temporal and spatial scale over which the action is likely to occur.

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; and continued outreach through NMFS's "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. Additional foreseeable future actions include; a status review and potential action to revise the ESA listing of the green sea turtle in Hawaii.

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

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. 2008b), and 96% on shallow-sets (WPRFMC and NMFS 2009b).

In addition, in August 2012 the USFWS issued a special purpose permit to NMFS under the authority of the Migratory Bird Treaty Act and 50 CFR 21.27. The 3-year permit authorizes the Hawaii-based shallow set longline fishery to incidentally interact with migratory seabirds, primarily Laysan and Black Footed Albatrosses. The permit continues the current management regime of the fishery, including the seabird deterrence regulations currently required by NMFS regulations and the USFWS Biological Opinion (USFWS 2012) referenced above, with no changes to the operation of the fishery during the permit period. Compliance with the terms of the permit would be considered in the decision to renew any future permit.

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; and efforts by Japan to require seabird interaction avoidance methods in its longline fisheries. 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.

As noted in the Affected Environment section 3.2.1.3, climate change may be affecting seabirds found in the action area. Global climate change is expected to continue and to therefore continue to impact seabirds and their habitat. Although there is much speculation on the potential impacts of climate change to species and ecosystems, there are multiple layers of uncertainty associated with these analyses making it impossible to accurately predict the most likely scenario that will result and consequently what impacts species and ecosystems will face, particularly in Pacific Island countries (Barnett 2001). In addition to the uncertainty of the rate, magnitude, and distribution of future climate change and its associated impacts on temporal and spatial scales, the adaptability of species and ecosystems are also unknown. Parmesan and Yohe (2003) consider climate change a driver of small-magnitude but consistent impact that is important in that it systematically affects century-scale biological trajectories and ultimately the persistence of species. Based on this consideration and the uncertainties in predicting future impacts, the significance of climate change in the context of this analysis is low considering the limited temporal and spatial scale over which the action is likely to occur.

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 above the authorized level of take (USFWS 2012), NMFS would reinitiate consultation to ensure the fishery considers the impacts to this listed species.

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 (RFMOs), including the Western and Central Pacific Fisheries Commission (WCPFC) 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.

Past actions include all of the fishery management actions and the actions of the fleets that have been taken in the affected environment to date, which together have resulted in the current management regime, current fishing patterns, and have affected the current status of the stocks. The effects of those actions are reflected in the baselines, as described in Chapter 3.

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, and marine debris. 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.

As noted in the Affected Environment section 3.2.1.4, climate change may be affecting target and non-target fish species caught in the Hawaii-based longline fisheries. Global climate change is expected to continue and to therefore continue to impact these fish and their habitat. Although there is much speculation on the potential impacts of climate change to species and ecosystems, there are multiple layers of uncertainty associated with these analyses making it impossible to accurately predict the most likely scenario that will result and consequently what impacts species and ecosystems will face, particularly in Pacific Island countries (Barnett 2001). In addition to the uncertainty of the rate, magnitude, and distribution of future climate change and its associated impacts on temporal and spatial scales, the adaptability of species and ecosystems are also unknown. Parmesan and Yohe (2003) consider climate change a driver of small-magnitude but consistent impact that is important in that it systematically affects century-scale biological trajectories and ultimately the persistence of species. Based on this consideration and the uncertainties in predicting future impacts, the significance of climate change in the context of this analysis is low considering the limited temporal and spatial scale over which the action is likely to occur.

Actions specifically affecting target species in the deep-set longline fishery include an increase in the swordfish retention limit if circle hooks are used and the elimination of the swordfish retention limit on deep-set trips with an observer (77 FR 43721, July 26, 2012). Additionally, on November 18, 2011, the President signed into law the Consolidated and Further Continuing Appropriations Act, 2012 (CFCAA). Section 113(a) of the CFCAA authorizes the U.S. Participating Territories to enter into arrangements with U.S. vessels that have permits issued under the Pelagics FEP for the assignment, allocation, and management of catch limits of highly migratory fish stocks established by the WCPFC. Under CMM 2008-01, and as extended by CMM 2011-01, Participating Territories are generally subject to an annual catch limit of 2,000 mt of bigeye (however, if these Participating Territories are undertaking responsible development of their domestic fisheries, the bigeye tuna catch limits do not apply). Under Section 113(a),

the Secretary of Commerce is to attribute to the U.S. Participating Territories those catches made by vessels operating under arrangements that are authorized under that section for the purposes of annual reporting to the WCPFC. Section 113(a) remains in effect until December 31, 2012, unless the WPFMC takes certain action – specified in Section 113(c) – regarding the management of catch and effort limits for the U.S. Participating Territories, and that action is implemented via regulations.

The WPFMC has recently – in June 2012 – recommended amending the Pelagics FEP to provide American Samoa, Guam, and CNMI the authority to use, assign, allocate, and manage catch limits of highly migratory fish stocks, or fishing effort limits, established by the WCPFC through arrangements with U.S. vessels permitted under the Pelagics FEP. Further, the authority provided in this Pelagics FEP amendment may be subject to maximum annual limits, and any other terms or conditions, as recommended by the WPFMC and approved by the Secretary of Commerce. The WPFMC also recommended that the U.S. Participating Territories may only assign up to 1,000 mt per year of their annual longline bigeye catch limits through arrangements with U.S. vessels permitted under the Pelagics FEP, and that that the WPFMC review this limit on an annual basis.

In addition to the amendment mention above, 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 catch limit 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.

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. These and other regulations affecting the Hawaii-based longline fisheries, as well as other commercial fisheries, contribute to the environmental baseline described in Chapter 3.

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, fishing communities, and related sectors (e.g., seafood consumers). 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 - Revised designation of critical habitat for leatherback sea turtles off the U.S. West Coast *Reasonably Foreseeable Management Actions* - Revision to designation of critical habitat for Hawaiian monk seals to include portions of main Hawaiian Islands - Designation of new critical habitat for Hawaii insular false killer whales
Biological Environment
Marine Mammals

Past and Present Management Actions
- Management of incidental take in commercial fisheries
  - MMPA section 118 incidental take authorization
  - Fisheries observer programs (domestic and international)
  - Protected Species Workshops for Hawaii-based longline owners and operators
  - Pacific Offshore Cetacean Take Reduction Plan
- MMPA and ESA permitting (if applicable)
- International and domestic regulations on marine debris and waste disposal
- Proposed ESA endangered listing of Main Hawaiian Island Insular false killer whale DPS
- 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
- Designation of new critical habitat for Hawaii insular false killer whales
- Proposed revision of monk seal critical habitat to include portions of main Hawaiian Islands

Sea Turtles
Past and Present Management Actions - ESA listing of all 5 species of sea turtles in U.S. - Establishment of 9 loggerhead DPSs and endangered listing for North Pacific Ocean DPS - Authorization of incidental take in fisheries, including recently revised limits for North Pacific loggerhead (34) and leatherback (26) takes in the shallow-set longline fishery consistent with the NMFS 2012 Biological Opinion - 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) - Status review in response to a petition to designate the green turtle population in Hawaii as a DPS for purposes of evaluating the conservation status under ESA

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 - USFWS 2012 Biological Opinion and take limits for short-tailed albatross in Hawaii's longline fisheries - USFWS 2012 MBTA permit authorizing incidental take of migratory seabirds under existing management measures *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, including longline catch limits for Highly Migratory Species (including bigeye, yellowfin, and skipjack tuna) in the WCPFC area - Section 113 of the CFCAA authorizing US Participating Territories to the WCPFC to enter into arrangements with qualifying US longline vessels for the purpose of assigning HMS quota - Increase in swordfish retention limit in Hawaii-based deep-set longline fishery to reduce regulatory discards, which may promote use of circle hooks in the fishery *Reasonably Foreseeable Management Actions* - Shift to ecosystem based management through place-based FEPs - RFMO management of Pacific swordfish and bigeye tuna stocks, with potential catch limit reductions or other restrictions through conservation and management measures - Pelagics FEP amendment to provide U.S. Territories with authority to use, assign, allocate, and manage catch limits of highly migratory fish stocks established by the WCPFC through arrangements between U.S. Participating Territories and U.S. vessels
Social and Economic Environment
Past and Present Management Actions - Fishery regulations through Fishery Ecosystem Plans (formerly 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 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 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, and the potential for that risk to increase due to the spread of or increase in depredation behavior. 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, in violation of requirements under MMPA section 118.

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.

Recent changes in the management of the longline fisheries may lead to increased longline fishing. These include regulations that increased the number of allowable sea turtle incidental takes in the shallow-set fishery, regulations that increased the swordfish retention limit in the deep-set fishery, and Congressional Act that allowed for Hawaii-based longline vessels to make arrangements with Territorial governments that allow those vessels to attribute their bigeye tuna catch to Territorial catch limits once the US bigeye tuna catch limit is reached. The increase in effort may be limited by fishing capacity (e.g., a limited number of available permits). However, increased longline effort may lead to increased number of interactions with false killer whales and other protected species. Thus, the no action alternative, in the context of the recent fishery management actions, may have a cumulatively negative impact on false killer whales and other protected species if actions are not implemented to reduce bycatch.

This alternative, when considered together with other past, present, and reasonably foreseeable activities, 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. As noted above, longline effort, and therefore catch of target and non-target fish stocks, may increase as a result of recent fishery management actions. However, the no action alternative would have no effect on the resources being impacted by those management actions.

There may be 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, though this could be balanced by the potential for increased income associated with recent changes in fishery management that may allow increased effort. If the level of M&SI of false killer whales continues to increase, or if the status of these false killer whale stocks worsens, 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 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 a positive effect on false killer whales and protected species. The anticipated benefits for false killer whales and other marine mammals of the take reduction 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, though the extent of these potential benefits cannot be quantified.

This alternative may be expected to benefit false killer whales and other protected species if other recent changes in longline fishery management lead to increased fishing effort by deep-set vessels. For example, recent changes to regulations allow deep-set vessels using circle hooks to retain up to 25 swordfish on any given trip, or unlimited swordfish if they have an observer onboard. The required gear changes and SEZ closure under this alternative may be expected to help ensure that false killer whales and other protected species are not adversely impacted by any increase in fishing effort as a result of the increased swordfish retention limit.

Under this alternative, neutral cumulative effects to target and non-target fish stocks would be expected. As described in sections 4.2.2 and 4.3.2, the measures under this alternative are not expected to substantially affect the longline fisheries' catch rate or value, though this may depend on the level of effort redistribution from closed areas to other open areas. While there may be some benefit to fish stocks within closed areas (the MHI Longline Fishing Prohibited Area and the SEZ), fishing effort would be expected to be largely displaced to areas outside of the closed areas, and thus catch of these species would likely be unaffected.

NMFS considered how the measures under this Alternative relate to, or are cumulative with, management of bigeye tuna in the WCPFC area. As described in section 3.3.3.2.2, the U.S. longline fleet operating in the WCPFC Area is subject to an annual catch limit of bigeye tuna, and once the limit is reached, the retention, transshipping, and landing of bigeye tuna subject to the limit is prohibited in the WCPFC area, with certain exceptions, until January 1 of the next calendar year. However, due to the enactment of Section 113 of the CFCAA, the catch limit was not reached in 2011, and it is likely that the catch limit will not be reached in 2012. If the WCPFC adopts similar catch limits in 2013 and beyond and the provisions of the CFCAA are extended, the bigeye tuna catch limit may not be reached in future years, as well. Even if catch limits were in place, which may lead to a reduction in fishing mortality on WCPO bigeye tuna (and a consequent positive impact to stock sizes), those impacts are likely to be negligible because: (1) the prohibitions after reaching the limit would be in effect for at the most only several months in 2012, if at all; (2) after the limit is reached, all of the affected longline vessels in the fleet could transfer their effort to other areas, such as the EPO, or to other species, mitigating any effect of the prohibition on fishing mortality rates (the stock structure of bigeye tuna in the Pacific Ocean is not well known, but there is some degree of mixing between the EPO and the WCPO, so any fishing mortality in the EPO would likely affect the status of the stock in the WCPO and fishing for other species in the Convention Area would result in at least some bigeye tuna being incidentally caught); (3) dual permit (Hawaii – American Samoa) vessels could continue fishing for bigeye tuna in the Convention Area outside of the U.S. EEZ around the Hawaiian Archipelago; and (4) vessels operating under arrangements

under the authorization of Section 113(a) of the CFCAA could continue fishing for bigeye tuna in the Convention Area regardless of where the fish are caught and landed. Moreover, based on recent catch statistics, the Hawaii-based longline fleet comprises only about 3% of the total catches of WCPO bigeye tuna, so its contribution to the stock's fishing mortality rate is relatively small (NMFS 2010; NMFS 2012; WCPFC 2011).

Cumulative effects on fishing-dependent communities resulting from measures in Alternative 2 would be 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 due to reduced catch and/or 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 Take Reduction Plan. However, there are benefits associated with passive use, environmental education, and scientific knowledge expected from reducing false killer whale incidental M&SI, and there may be potential benefits to wildlife viewing, 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 negative to those affected groups. However, we expect the FKWTRP to result in a net benefit to the Nation.

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 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 that have ranges that at least partially overlap with the longline fisheries. However, the extent of this benefit would depend on where and how much effort is displaced, and the possibility of transfer effects. For example, if imports of bigeye tuna are increased because the supply of bigeye tuna from the Hawaii-based longline fleet is substantially constrained as a result of closure of the EEZ, and those imports are from foreign fisheries that have less stringent environmental regulations or that function in an area that could cause more environmental impacts (e.g., more interactions with protected resources), adverse transferred effects, such as impacts to protected resources could result. These potential impacts would depend on the location and degree of effort redistribution by the U.S. longline fleet in response to closure of the SEZ. Changes in effort in the U.S. longline fleet resulting from this Alternative are uncertain but may be limited, as data indicate that all or nearly all vessels in the longline fleet currently fish at least part of the time outside the EEZ. However, as noted below, closure of the EEZ may lead to U.S. vessels exiting the fishery.

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. The majority of the effort in these fisheries (75% of hooks set in 2010; WPRFMC 2012) already occurs on the high seas. If a reduction in fishing effort led the U.S. not to reach its catch limit for target species, the market demand would likely be filled by another country. Fishing effort would likely be at least 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 the resources (i.e., target or non-target species). 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 greatly 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 likely 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 (though analysis in section 5.7.1.2 indicates revenue per level of effort is not anticipated to be affected by closing the EEZ) 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, particularly scientists and educators and members of the public that value marine mammal conservation), 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. The impacts, though, may be lessened if fishing effort and revenue increase as a result of recent fishery management actions that increased longline fishing

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 (Alternatives 2 and 3) would complement existing and forthcoming actions to reduce takes of other protected species. They would also lessen the potential negative impacts associated with the recent fishery management actions that could lead to increase in protected species interactions. Hence, the cumulative effect of the action alternatives, is expected to be 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 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 is likely negative. However, both Alternatives 2 and 3 are expected to result in direct and indirect benefits to other groups in the affected social and economic environment, particularly scientists and educators and members of the public that value marine mammal conservation.

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 ***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. • 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) ***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 (e.g., marine mammals, sea turtles, seabirds) due to: - Potential reductions in interactions and/or injury severity through required use of circle hooks, minimum line diameter, closed areas; - Increased precision of bycatch estimates better inform management and facilitate adapative management; and - 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. • 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. • Little to no effect on target and non-target species, given current spatial patterns of fishing, likelihood of fishing effort redistribution rather than effort reductions following area closures, highly migratory nature of the stocks, and existing fishery management measures (e.g., catch limits).	• Costs to regulated community associated with replacement of fishing gear, increased travel time and fuel costs, increased certification requirements, and potential reduced revenue due to reduced catch and/or fishing effort. • Potential reductions in revenue and income of fishing gear suppliers due to some gear inventory being unsellable to the Hawaii-based longline fisheries. • Direct and indirect beneficial quality of life effects on groups that value the false killer whale, particularly scientists and educators and members of the present and future generations of the general public that value marine mammal conservation, and potential benefits wildlife viewers. • Some potential positive effect on non-longline commercial fisheries or recreational/subsistence fisheries if local target fish population abundance rises.

	Physical Environment	Biological Environment	Social and Economic Environment
Alternative 3 ***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. • Potential negative effects due to: - Transfer effects if U.S. fishing effort decreases and less-protective nations increase their effort to fill the market void - 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 - Potential shift in effort to non-longline hook-and-line fisheries may cause increase in (unobserved) bycatch of protected species • Little to no effect no effect on target and non-target species, given current spatial patterns of fishing, likelihood of fishing effort redistribution rather than effort reductions following area closures, highly migratory nature of the stocks, and existing fishery management measures (e.g., catch limits).	• Greatest costs and reduced income for longline fishermen due to increased travel time and fuel costs, and potential reduced revenue due to fishing effort (i.e., if less than full redistribution of longline effort to the high seas). • Direct and indirect beneficial quality of life effects on groups that value the false killer whale, particularly scientists and educators and members of the present and future generations of the general public that value marine mammal conservation, and potential benefits wildlife viewers. • Some potential positive effect on non-longline commercial fisheries or recreational/subsistence fisheries if local 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, which was published in the Federal Register on July 18, 2011 (76 FR 42082) and available for public comment for 90 days. The measures in the final rule (the final action) have been revised to address new information and issues raised in 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 requires supporting analyses to assess the environmental impacts of the 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 Final Regulatory Flexibility Analysis, or FRFA). This is the RIR section of the integrated EA/RIR/FRFA, and provides the analytical background for decision-making.

5.2 Purpose of Regulatory Impact Review

The action being addressed in this RIR is the implementation of NMFS' FKWTRP, pursuant to section 118(f) of the MMPA, to reduce incidental M&SI of two 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 regulatory programs that are considered to be "significant regulatory action". The RIR serves as a basis to determine whether the FKWTRP 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 Action and Alternatives

This section summarizes the action and two alternatives considered for the FKWTRP. Details of the 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 circle hooks with 4.5 mm maximum wire diameter, sufficient round wire in the shank to be measured with a caliper, and 10 degree offset or less in the Hawaii-based deep-set longline fishery.
2. Establish a minimum 2.0 mm diameter for monofilament used in leaders or branch lines in the Hawaii-based deep-set longline fishery, and a minimum breaking strength of 400 pounds for any line used in the construction of a branch line if any other material is used.
3. Establish a year-round main Hawaiian Islands (MHI) longline fishing prohibited area in FKWTRP regulations, bounded by the same coordinates as the existing February-September boundary of the MHI longline exclusion zone. The net effect is to prohibit longline fishing year-round in the area north of the MHI that is currently closed to longlining only seasonally. NMFS is also revising existing Magnuson-Steven Act regulations defining the MHI longline exclusion zone, to eliminate the seasonal boundary change and make the current February-September boundary permanent year-round; this brings the MSA regulations into accordance with the FKWTRP regulations.
4. Require annual certification in marine mammal interaction mitigation techniques for longline vessel owners and operators.
5. Require posting of a marine mammal handling and release informational placard on longline vessels.
6. Require captains' supervision of marine mammal handling and release.
7. Require posting of a placard instructing crew to notify the captain of marine mammal interactions.
8. Establish a Southern Exclusion Zone (SEZ) and specific bycatch triggers for closure to the Hawaii-based deep-set longline fishery.

Non-regulatory Measures

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

Other Measures

The action also includes the following four measures:

- NMFS would 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 would 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 would 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 would 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 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 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 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.

Costs estimated in this document are approximate costs, based on the best available information. Note that in the tables, all costs (for values exceeding $1,000) are rounded to the nearest $1,000 to indicate that the values are approximate. In the text, further detail is provided on the values used to derive total costs. These costs in the text are typically rounded to the nearest one or ten digit number. Therefore, if readers use the values provided in the text to derive total costs, there may be some small discrepancy due to this rounding.

This analysis also addresses the distribution of costs and benefits associated with the implementation of the 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 FRFA). This information may be used by decision-makers to assess whether the costs and benefits of the implementation of the FKWTRP inequitably burden or benefit a particular group or economic sector. For example, while conservation efforts may have a relatively diffuse 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 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 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

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[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 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 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 FKWTRP. Net benefits are the benefits that remain after adjusting for the costs associated with the implementation of the FKWTRP. As will become apparent, implementation of the 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, and regional economic effects. It 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 FRFA)

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 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 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 FKWTRP and alternatives.

5.5.3 Contextual Information: Potentially Impacted Groups

This section identifies and describes the groups analyzed for potential effects by the FKWTRP. (Note that while each of these groups is analyzed, findings indicate that some groups are unlikely to incur impacts, as summarized above in Section 4.3). While the action will directly regulate and affect the Hawaii-based longline fishermen, the social and economic effects of the FKWTRP may 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. 2005). 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 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 (WPRFMC and NMFS 2001). The Hawaii-based longline fisheries are the largest of all the commercial pelagic fisheries in Hawaii. In 2010, the longline fishery represented 84% of the total commercial pelagic landings and 88% of the ex-vessel revenue (WPRFMC 2012). 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 (DAR and WPacFin 2010). In 2010, about 28 million pounds of fish were caught for commercial purposes in the state, worth over $83.5 million (WPacFIN 2012) (see Table 3.8), while more than 29 million pounds of fish were caught in 2011, valued at above $91.5 million (WPacFIN 2012). 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 or branch line 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 from commercial sources was estimated to average about 29 pounds per capita over the 10 year period between 2000 and 2009, just less than twice the national average (Geslani 2012). 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 1995).

- Seafood wholesalers/retailers. Indirectly affected group, with potential adverse impact if the price or quantity of fish sold in Hawaii changes. Almost all of the Hawaii-based longline catch is sold at either the United Fishing Agency auction in Honolulu, or the Suisan Fish Auction in Hilo. A small percentage of longline catch is not sold at auction, and is directly marketed to retailers or exported by the fishermen. Wholesalers and retailers who buy their fish from the auction distribute to restaurants and other vendors, and export swordfish and tuna to the US mainland, Japan, and to a lesser extent, Europe (HIPA 2009). The retail markets, such as supermarket chains and specialty seafood markets, present fish for sale to the public.

- Recreation and tourism. Indirectly affected group, with potential beneficial effects due to potential 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 2010, over 13% of jobs in the state were in industries directly involved with tourism, with many other jobs were indirectly associated with the industry (see Table 3.5). 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 2012d). 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 2012d). 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. 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 2012d). Direct annual expenditures on recreational fishing are estimated to be about $450 million (NMFS 2012d).

- 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 2012 (anticipated year of the implementation of the FKWTRP) through 2031 (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:

- U.S. Bureau of Economic Analysis (BEA)
- State of Hawaii 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
- NMFS Hawaii Longline Observer Program
- NMFS Longline Logbook Data
- NMFS, Pacific Islands Regional Office, Protected Resources Division
- NMFS, Pacific Islands Regional Office, Sustainable Fisheries Division
- Western Pacific Fisheries 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 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 primarily related to 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. It is possible that there are also benefits to wildlife viewing, subsistence and recreational fishing, and non-longline commercial fisheries, those these benefits are likely limited.

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 as a by-product of 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 5.1). 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.

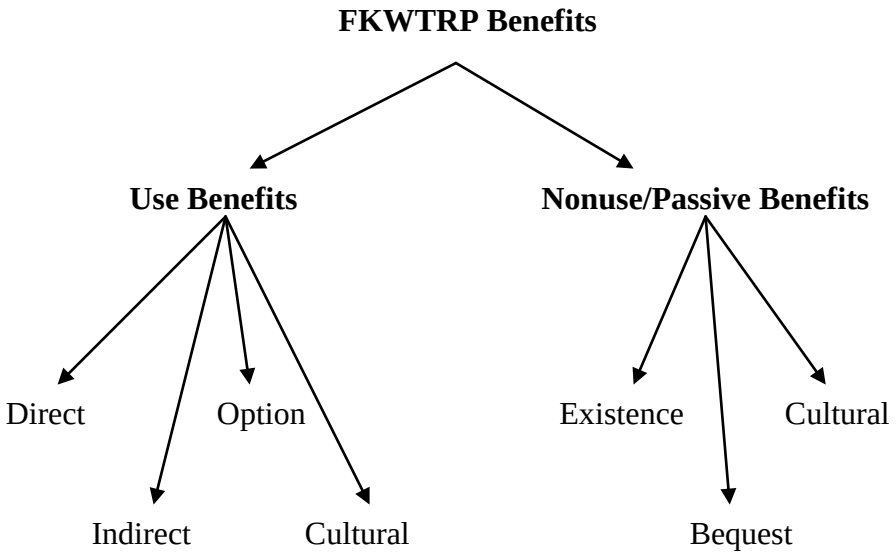

Figure 5.1. Benefits of FKWTRP

In addition to the categories shown in Figure 5.1 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 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). There are also potential non-consumptive use benefits related to whale watching or shoreline recreation. 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 or the FKWTRP, 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 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 protections offered by the FKWTRP could be expected to also elicit passive use values.

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 passive use, education and scientific knowledge, wildlife viewing, whale watching, recreational fishing, and subsistence activities. Using the Consumer Price Index, all values from the studies reviewed in this section were adjusted to 2011 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 Action and Alternatives. As discussed below, while possible, use benefits to recreation and fishing groups may be limited. The primary expected benefit of the Action Alternative is the benefit to the public of protecting marine mammals (likely realized through passive use values), established by Congress as federal policy through the MMPA.

5.6.4.1 Passive Use Benefits

The Action Alternatives are intended to fulfill NMFS's obligations under the MMPA, which was enacted in 1972 in response to increasing public concern regarding population declines in marine mammals caused by human activities. By passing the MMPA, Congress recognized the importance of marine

mammals and the marine ecosystem to the American public and, in response, established a comprehensive federal program to conserve and protect marine mammals. The primary benefit of the Action Alternatives is thus the value to the public of fulfilling the MMPA national policy of marine mammal protection.

Much of this value of marine mammal protection is expected to be in the form of 'passive use benefits'. With its expected reduction in M&SI of false killer whales, the Preferred Alternative would benefit people who value the conservation of marine mammals. 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 therefore accrue to many residents of Hawaii as well as the Nation (as no interaction with the species is required for benefits, residents of other states that are interested in marine mammal conservation may also benefit).

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. Richardson and Loomis (2009) update the estimates of Loomis and White (1996) 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 has not been quantified for false killer whales.

5.6.4.2 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 Dalrymple (2003) 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.

5.6.4.3 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.

Research on the Hawaii tour boat excursion and whale watching industry identified no whale watching boat trips that focus on false killer whale sightings. False killer whales are rarely currently sighted in such wildlife viewing trips, and the number of false killer whale sightings is unlikely to increase significantly as a result of the FKWTRP given the small size of the current population. However, with the potential for increased awareness of the false killer whale and increased population density due to the Action Alternatives, it is possible for sightings, and therefore benefit, to increase. Context for the potential magnitude of this possible benefit is provided through the studies presented 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 nation-wide 2006 review of studies on whale watching, Pendleton presents a range of consumer surplus values between $39 and $52 per trip.

Loomis, Yorizane, and Larson (2000) 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.

5.6.4.4 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 2000). Positive effects on the recreational and subsistence fishery are therefore expected to be limited. While benefits are likely limited, the studies outlined below provide general information on the value of recreational and subsistence fishing and potential benefits from enhancing this activity.

The economic benefits of recreational fishing have been estimated in many studies, creating a wide range of values. A 2study examining the importance of ulua species to Hawaii's subsistence and recreational fisheries, estimated 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 (DAR 2000).

Meyer Resources Inc. (1987) 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.

5.6.4.5 Commercial Fishing (Non-Longline)

There are two potential positive 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 2000). Positive effects on the other commercial fisheries may therefore be limited.

5.6.5 Summary

The preceding discussion outlines the types of economic benefits that may accrue to Hawaii residents and to citizens throughout the U.S. These primarily include benefits associated with passive use, environmental education, and scientific knowledge, with potential benefits also to recreational fishing, wildlife viewing, and subsistence fishing. 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 Action and Alternatives.

5.7 Expected Economic Costs

This section discusses the expected economic costs of the Action Alternatives, 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, 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 around 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 5.1. 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 3% 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 3% 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 5.1 and 5.2, respectively. Total one-time capital costs associated with all measures in the Preferred Alternative (Alternative 2) were estimated to range from $359,000 to $603,000. The one-time labor cost and material cost associated with replacing hooks to meet the new hook requirement is expected to be the most significant one-time cost under Alternative 2, as this requirement would affect 81% of the 129 active deep-set longline vessels estimated to be using other types of hooks. Annual ongoing costs incurred under Alternative 2 are, in turn, estimated at between $86,300 and $4.1 million. Closure of the SEZ, if triggered, constitutes the majority of potential annual costs, with increased travel costs (both time and fuel) due to full-year closure of this zone estimated to be as high as $4.0 million annually for all vessels; such costs would be lower if vessels relocated trips to other, less distant locations, and if closure were less than a full year.

Nearly all of the annual and one-time costs would be incurred by the deep-set fishery. The only measures with projected costs that affect the shallow-set fishery are the annual Protected Species Workshop certification for operators/owners and modification to the existing MHI Longline Fishing Prohibited Area (i.e., year-round closure of an area that was previously closed to longlining only seasonally). 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 seasonally-open area of the MHI Longline Fishing Prohibited Area (i.e., less than one full trip each year).

The longline fishery may incur additional costs if the Preferred Alternative leads to increases in false killer whale populations which then result in increased interactions with false killer. Potential costs to the fleet from interactions cannot be quantified due to the uncertainty in the net effect of the Preferred Alternative on the number of interactions between false killer whales and the longline fleet (potential increased population but requirements that seek to limit the number of interactions).

Table 5.1. Preferred Alternative: total expected cost to deep-set longline fisheries.[a]

Measure	Initial, One-Time Cost	Annual Ongoing Cost	Total Annualized Cost	Net Present Value Cost (2012 – 2031)
4.5 mm wire diameter circle hook requirement	$343,000 – $578,000	-$400 to -$500	$23,000 – $38,000	$336,000 – $571,000
2.0 mm monofilament line requirement	$16,000 – $25,000	$2,000 - $4,000	$3,000 – $5,000	$49,000 – $77,000
MHI Longline Fishing Prohibited Area	$0	$84,000 – $97,000	$84,000 – $97,000	$1,245,000 – $1,437,000
Annual Certification for Operators/Owners	$0	$700 – $1,400	$700 – $1,400	$10,000 – $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	$0 – $3,978,000	$0 – $3,978,000	$0 – $59,190,000
Total Cost	**$359,000 – $603,000**	**$86,000 – $4,080,000**	**$111,000 – $4,119,000**	**$1,640,000 – $61,296,000**

a/ Costs greater than $1,000 are rounded to the nearest thousand dollars.

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 5.2, expected annual costs of Alternative 3 are between $9.5 and $11.3 million dollars, of which an estimated $8.3 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 5.2. Alternative 3: cost to deep-set and shallow-set longline fisheries.[a]

Closure of Economic Exclusion Zone	Annual Ongoing cost	Net Present Value Cost (2012-2031)
Fuel Cost	$1,197,000 - $2,992,000	$17,806,000 - $44,515,000
Travel Time Cost	$8,331,000	$123,942,000
Total	$9,528,000 - $11,323,000	$141,748,000 - $168,457,000

a/ Costs greater than $1,000 are rounded to the nearest thousand dollars.

5.7.1.1 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 5.1. Costs are described for each 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 circle hooks with 4.5 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 circle hook with a maximum wire diameter of 4.5 mm, sufficient round wire in the shank to be measured with a caliper, and 10 degree offset or less. Based on data from fishery equipment suppliers, an estimated 81% of hooks currently sold to deep-set longline vessels are expected to be required to be replaced under the Preferred Alternative. Costs of hooks and the types the hooks currently in use were determined from estimates provided by local and national hook suppliers. Although each individual vessel may use a mix of hook types, to estimate costs on a per vessel basis, we assume that 81% of vessels (104 vessels) will need to replace 100% of their hooks. With this simplifying assumption, total costs to the fleet remain the same, but the costs per vessel may be lower if there are more affected vessels, each with fewer hooks requiring replacement.

We estimate three types of potential costs of replacing existing hooks with 4.5 mm diameter wire circle hooks: 1) one-time capital and labor cost of replacing existing hooks, 2) ongoing hook replacement cost, and 3) costs to suppliers of having inventory that is no longer in demand. As summarized in Table 5.3 below, the results indicate that the requirement for the Hawaii-based deep-set longline fishery to use 4.5 mm diameter circle hooks would cost approximately $343,000 to $578,000 in one-time capital and labor expenditures ($3,000 to $5,000 per affected vessel), with small reduced annual equipment costs (expected savings of less than $500 for all vessels). Annualized costs for equipment are thus estimated at $200 to $300 per affected vessel.

We do not expect reductions in fish catch or value for the estimated 81% of vessels that would be required to switch to ≤4.5 mm wire diameter circle hooks from other hook types. We are not able to estimate the difference, if any, that the choice of hook types has on catch or value, given the numerous other factors that affect species and size composition of catch and landings for each particular vessel. However, the current use of circle hooks with ≤4.5 mm wire diameter by an estimated 19% of vessels in the fishery suggests that circle hooks with ≤4.5 mm wire diameter are an economically viable option. As such, we expect that vessels switching to ≤4.5 mm wire diameter circle hooks from other hook types would have minor or no reductions in catch or catch value.

Table 5.3. Estimated hook replacement cost results to deep-set longline fishery.[b]

	All Vessel Costs		Per Vessel Costs	
Measure	**One-time capital cost**	**Annual ongoing cost**	**One-time cost per vessel[c]**	**Annualized cost per vessel[a]**
One-time replacement cost	$200,000 - $221,000	N/A	$2,000	$100
One-time replacement labor cost	$143,000 - $357,000	N/A	$1,000 - $3,000	$100- $200
Ongoing hook replacement cost	N/A	-$400 to -$500	N/A	-$5
Total	$343,000- $578,000	-$400 to -$500	$3,000 - $5,000	$200 - $300

a/ Includes one-time and annual ongoing costs, over 20 years assuming a 3% discount rate

b/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

c/ Costs per vessel may be lower if vessels use a mix of hook types and more vessels are affected, each with fewer hooks to replace.

Table 5.4 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 5.4. Hook replacement cost data.

Variable	Value Range	Sources
% of Fleet Using Circle Hooks with ≤4.5 mm wire diameter	19%	Gear suppliers, based on 98 vessel sample size
% of Fleet Using Circle Hooks with >4.5 mm wire diameter of Other Hooks	81%	Gear suppliers, based on 98 vessel sample
Cost of New Hooks (circle hooks with ≤ 4.5 mm wire diameter)	$0.84 - $0.89	Gear Suppliers, Owner/Operator Interviews. Weighted average price of 14/0 and 15/0 circle hooks with ≤ 4.5 mm wire diameter.
Cost of Old Hooks (> 4.5 mm wire diameter circle hooks or other hooks)	$0.86 - $0.91	Gear Suppliers, Owner/Operator Interviews. Weighted average price of 16/0 circle hooks and tuna hooks.
Number of Hooks Per Set (Deep-set fishery)	2,217	2006 – 2010 NMFS Hawaii Longline Logbook data: (Total Number of Hooks / Total Number of Sets)
Number of Hooks Lost Annually (Deep-set fishery)	33,696	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 two years (2007 and 2012) with 129 vessels. Based on 2006-2010 NMFS Hawaii Longline Logbook data, 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)	285,971	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)	1-6 months	NMFS
One-Time Labor Hours to Replace Hooks Per Vessel	60-160	Owner/Operator interviews
Opportunity Cost Per Labor Hour	$21	U.S. Bureau of Labor Statistics, average of fishing supervisor and average fishing occupation wage (U.S. Bureau of Labor Statistics 2011)

Table 5.5 presents a range of hook prices for hooks currently in use by the deep-set longline fleet. Based on data from equipment suppliers regarding the proportion of hooks currently sold to the deep-set longline fleet, we estimate a weighted average cost of hooks in use that meet the circle hook requirement (14/0 and 15/0 circle hooks with ≤ 4.5 mm wire diameter) of $0.84-0.89 per hook and a weighted average cost of hooks that do not meet the hook requirement (16/0 circle hooks and tuna hooks.) of $0.86 - $0.91 per hook (see Table 5.4).

Table 5.5. Hook use and cost.

Hook Size	Wire Diameter	Estimated Cost Per Hook (Low)	Estimated Cost Per Hook (High)
14/0	4.3 mm	$ 0.86	$ 0.90
14/0 ring	4.3 mm	$ 0.90	$ 0.95
15/0	4.3 mm	$ 0.95	$ 1.00
15/0 ring	4.3 mm	$ 0.81	$ 0.85
16/0	4.7 mm	$ 0.86	$ 0.90
16/0 ring	4.7 mm	$ 0.95	$ 1.00
3.6 tuna ring	3.6 mm	$ 0.83	$ 0.87

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 ≤ 4.5 mm wire diameter 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 $343,000 to $578,000 for the estimated 104 affected vessels.

As indicated in Table 5.4, 81% of vessels in the deep-set longline fleet are believed to be using circle hooks with > 4.5 mm wire diameter or other hook types (tuna or J), so approximately 19% of the fleet, or 104 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 2,217 hooks in use per fishing set, and assuming a three month supply of replacement hooks on each vessel, approximately 2,280 hooks would need to be replaced per vessel (2,217 hooks in use plus approximately 66 inventory hooks).

NMFS expects to allow a one- to six-month phase-in period for the hook requirement. Therefore, for this analysis, this phase-in period is assumed to potentially range from one to six months. The longer the phase-in period, the lower the cost. 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 ≤ 4.5 mm wire diameter circle hooks. If the phase-in period is six months, we estimate that vessels would replace hooks at the 12% annual average rate of loss, or approximately 130 hooks over the six-month period. 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 2,150 (6-month phase-in period) to 2,260 hooks (one-month phase-in period) 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 ≤ 4.5 mm wire diameter hooks is estimated at $0.84 to $0.89 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 $200,000 to $221,000, or an average of $2,000 per vessel (the product of 2,150 to 2,260 hooks per vessel and $0.89 to $0.94 cost per hook and crimp). Using a 3% discount rate over 20 years, the total annualized equipment cost of replacing hooks is estimated at $13,000 to $15,000, or an average of approximately $100 per affected vessel.

Labor cost to replace hooks is estimated using a labor rate of $21 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 $143,000 to $357,000 for the estimated 104 affected vessels, or an average of $1,000 to $3,000 per vessel. Using a 3% discount rate over 20 years, the total annualized labor cost of replacing hooks is estimated at $10,000 to $24,000, or an average of $100 to $200 per affected vessel.

Ongoing Hook Replacement Costs

This section describes the methodology and estimated cost to the deep-set longline fishery of the ongoing cost of purchasing ≤ 4.5 mm wire diameter circle hooks compared to the cost of purchasing hooks currently in use. The annual cost savings is estimated at approximately $400 - $500 for all affected vessels.

Once 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 circle hooks with ≤ 4.5 mm wire diameter. On average, the ≤ 4.5 mm wire diameter circle hooks are expected to cost

approximately $0.02 less than > 4.5 mm wire diameter circle hooks in current use based on the weighted average price of hooks sold to the fishery. Cost savings of $0.02 is the difference between the high weighted average costs ($0.91 and $0.89) as well as the difference between the low weighted average costs ($0.86 and $0.84). While this represents an expected cost savings across the fleet, individual vessel owners may experience either a cost savings or slight increase due to variability in hook prices between vendors.

Assuming loss of approximately 34,000 hooks annually across the longline fleet (see Table 5.4), the cost savings of using ≤ 4.5 mm wire diameter circle hooks is estimated at approximately $400 - $500 annually, or approximately $5 per affected vessel. 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. Actual cost savings estimated may be higher as the number of hooks replaced annually may be higher.

Monofilament Branch Line Diameter Requirement

This section describes the cost of implementing the requirement that all monofilament used in the construction of branch lines and leaders in the deep-set longline fishery be 2.0 mm or larger in diameter, or have a breaking strength of 400 pounds or greater if any other line material is used.

Based on interviews with longline owner/operators, all, or nearly all, deep-set longline vessels are believed to be using monofilament line in their branch lines. For the leader component of the branch line, NMFS observer data indicate that in recent years, all deep-setting vessels use wire leaders or, rarely, other materials (e.g., multi-strand monofilament) that are stronger than 2.0 mm diameter monofilament. Thus, leaders would not need to be replaced.

Boats that are using monofilament line in their branch lines that is not 2.0 mm or greater in diameter are believed to be using 1.8 mm, as this is the smallest monofilament branch line diameter commercially sold in Hawaii. The NMFS PIRO Hawaii Longline Observer Program collects data on the diameter of branch line/leaders on longline vessels. The data collected over time shows some inconsistency in observer measurement, as records for a given vessel sometimes indicate different branch line diameter. However, the data indicates that over 85% of monofilament branch lines 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 (but less than 2.0 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 branch line 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 branch line that is 1.8 mm diameter or smaller. Therefore, we estimate that there are 10 to 15 vessels that may have monofilament branch lines 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 monofilament branch line, 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 5.6, results indicate that the monofilament strength requirement for the Hawaii-based deep-set longline fishery is estimated to cost approximately $16,000 to $25,000 in one-time capital expenditures (approximately $1,600 per affected vessel, rounded to $2,000 in Table 5.6), with annual increased equipment costs of approximately $2,000 to $4,000 annually (approximately $200 - $300 per affected vessel). On an annualized basis, these equipment costs (one time and annual ongoing) are estimated to total $3,000 to $5,000 (approximately $300 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 is provided below.

Table 5.6: Estimated 2.0 mm monofilament replacement cost results to deep-set longline fleet.[b]

	Total Affected Vessel Costs		Per Vessel Costs	
Measure	**One-time capital cost**	**Annual ongoing cost**	**One-time cost per affected vessel**	**Annualized cost per affected vessel[a]**
Replacement cost	$16,000 - $25,000	$2,000 - $4,000	$2,000	$300

a/ Includes one-time and annual ongoing costs, over 20 years assuming a 3% discount rate

b/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

One-time line replacement cost

On average, approximately 40 feet of branch line is used for every hook set (POP catalog, personal communication with owner/operator), amounting to 88,600 feet of line per vessel (2,217 hooks multiplied by 40 feet). Monofilament line is sold in five-pound coils, with a price of approximately $38 - $40 per coil. As there are approximately 430 feet per pound for 2.0 mm monofilament, an estimated 206 pounds of monofilament, or 41 coils are required per boat. One-time equipment cost to replace branch line monofilament is thus estimated at approximately $1,600 per boat (rounded to $2,000 in Table 5.6), or approximately $16,000 to $25,000 for all 10 to 15 boats that may currently use weaker line. Using a 3% discount rate over 20 years, the total annualized equipment cost of replacing hooks on ten to fifteen boats is estimated at approximately $100 per boat. Based on conversations with owner/operators, labor time to replace hooks would cover the labor requirement to replace branch line/leaders.

Ongoing replacement cost

Boats that are not using 2.0 mm diameter monofilament line are expected to be using 1.8 mm as this is the smallest monofilament line diameter commercially sold in Hawaii. Monofilament that is 1.8 mm in diameter has 530 feet per pound, while monofilament that is 2.0 mm in diameter has 430 feet per pound. The stronger, 2.0 mm diameter line therefore costs approximately 23% more. Although NMFS logbook data do not include a measure of line lost, interviews with longline owners/operators suggest that approximately 4% of branch line 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 76% of branch line is lost annually. This indicates that approximately 67,000 feet of line per boat would need to be replaced annually (76% multiplied by 88,600 feet of line per vessel). Increased annual cost to use 2.0 mm diameter line instead of 1.8 mm diameter line is therefore estimated at approximately $200 - $300 per boat, or a total of $2,000 to $4,000 for those 10 to 15 boats currently using 1.8 mm line (Table 5.6).

MHI Longline Fishing Prohibited Area

This section describes the cost to longline vessels of the modifications to the existing longline exclusion zone around the MHI, which would eliminate the area's seasonal boundary change from October to January, and maintain the larger closure (the February-September boundary) year-round. The modifications 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 one trip annually by the shallow-set fishery) to waters just outside of the FKWTRP's year-round closure boundary (the existing February-September 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 5.7, combined travel and fuel costs are estimated to range between $84,000 and $97,000, 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 5.7. Estimated cost of closure of MHI Longline Fishing Prohibited Area to deep-set fishery.[a]

MHI Longline Fishing Prohibited Area	Annual cost, all affected trips	Cost per affected trip
Fuel Cost	$9,000 - $22,000	$200 - $600
Travel Time Cost	$75,000	$2,000
Total	$84,000 - $97,000	$2,000 - $3,000

a/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

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 6% 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 2000), 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 2000). 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 2000, Nguyen and Lueng 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 $8,600 to $21,600 annually (rounded to $9,000 - $22,000 in Table 5.7).

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, and 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 a cost of $3.78 per gallon (NMFSf 2012), 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 $227 to $568 total (rounded to $200 to $600 in Table 5.7).

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 $8,600 to $21,600 annually for all vessels (rounded to $9,000 - $22,000 Table 5.7).

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 the longline fisheries are estimated to total as much as $75,000 annually (based on reduced catch revenue due to reduced time spent fishing) (Table 5.7). To estimate travel time costs, we identify the average catch revenue per fishing hour for all longline trips, and assume that this is the average reduced revenue (cost) of each additional travel hour that will be required to substitute alternative locations for trips currently to the seasonal contraction zone.

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 (rather than increasing the length of the trip), and associated reduction in catch revenue. We estimate the average annual catch value per hour of longline fishing to assess the cost of increased travel time for trips currently to the seasonal contraction zone. Based on the fishery's total average annual revenue of $73.2 million from 2006 to 2011 (NMFS 2012f), 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 $3,950 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, WPRFMC 2010d), the opportunity cost of additional travel time associated with the FKWTRP's modifications to the MHI Longline Fishing Prohibited Area is estimated to be a maximum of $1,975 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 $75,000 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 5.8, 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 5.2, 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 5.8. 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, October, November, December)	77%	62%	60%	64%	62%	64%

*excludes catch data from the month of December

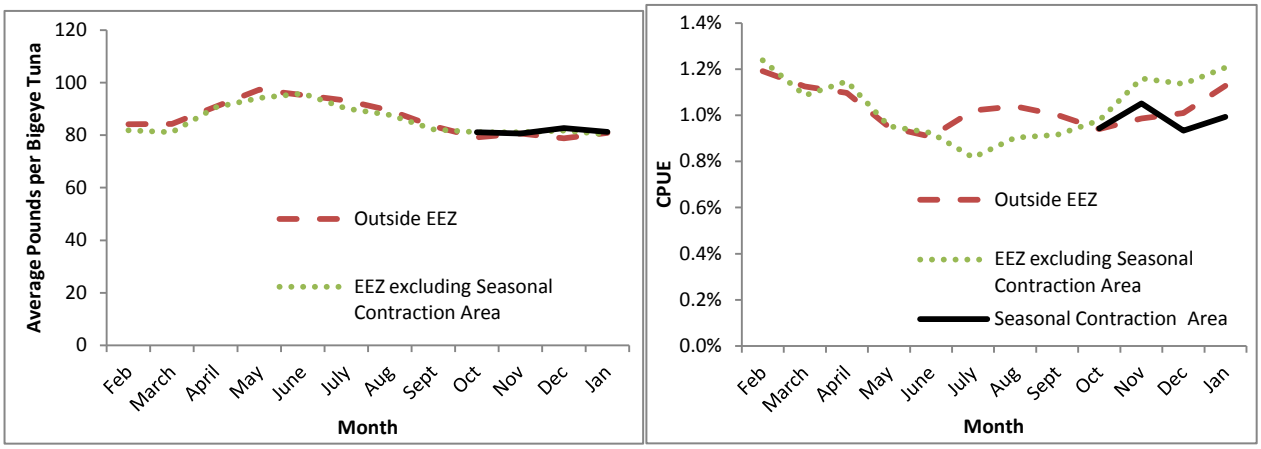

Figure 5.2. Comparison of average size of bigeye tuna kept and average CPUE by zone (outside EEZ, EEZ excluding MHI Longline Fishing Prohibited Area seasonal contraction area, and MHI Longline Fishing Prohibted Area seasonal contraction area) by month, 2006 to 2010. Whereas the average weight per bigeye 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. The length of time fishing was assumed to change, however, as more travel time could be required to reach fishing locations. The cost of travel time was estimated above in terms of reduced fishing effort, quantified as reduced revenue to the fleet of a maximum of approximately $75,000 annually (0.1% annually of longline fleet revenue). Additional impacts to fishing effort are possible if vessels change the number or length of trips in response to elimination of the seasonal contraction zone. The number of sets in the seasonal contraction zone accounts for approximately 1.5% of sets in the longline fishery. It is expected that this is the maximum level of fishing effort that could be affected by elimination of the seasonal contraction zone. However, it is possible that increased costs associated with the elimination of the seasonal contraction zone could result in exit of some vessels from the fishery, thereby potentially leading to larger reductions in fishing effort.

However, due to the annual longline catch limits on bigeye tuna (implemented via domestic regulations in 2009, 2010, and 2011, and in the process of being implemented in 2012 at the time of the writing of this document), under existing conditions, the fishing effort of the Hawaii-based longline fleet may be curtailed at the end of the year when the area closer to shore is open to longline fishing. As described in Section 3.3.3.2.2 of this document, once the 3,763 mt catch limit is reached, vessels subject to the limit cannot retain, transship, or land bigeye tuna caught in the WCPFC Area, except under certain conditions. For the calendar year 2009, the catch limit was projected to be reached on December 29, 2009, so the prohibitions were put into effect from December 29, 2009 through end of the 2009 calendar year. In 2010, the catch limit was projected to be reached on November 22, 2010, so the prohibitions were put into effect from November 22, 2010, through the end of the 2010 calendar year. If similar prohibitions are put into effect in 2012 and beyond, the effect of modifying the boundary of the MHI Longline Fishing Prohibited Area on fishing effort may be lessened, since fishing effort in the WCPFC Area may be curtailed during at least part of the time when the boundary currently contracts (October-January), due to vessels being affected by the prohibitions. However, due to the enactment of Section 113 of the CFCAA, the catch limit was not reached in 2011, and it is likely that the catch limit will not be reached in 2012. If the WCPFC

adopts similar catch limits in 2013 and beyond and the provisions of the CFCAA are extended, the bigeye tuna catch limit may not be reached in future years, as well.

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 approximately $700 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 an additional 15 to 20 minutes of time, for a total of 30 to 70 hours. Based on an estimated opportunity cost of $21 per hour, the enhanced training would cost approximately $700 - $1,400 annually across all owner/operators (Table 5.1).

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 5.9 below, total costs of this closure area, estimated based on increased fuel and travel costs, are estimated to be as high as $4.0 million annually (assuming a year-round closure and 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. Additionally, costs would be lower if the area is closed for less than the full year.

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 for the Hawaii pelagic stock (9.1 false killer whales per year, as of the Draft 2012 SAR) and observer coverage levels (20%), the trigger would be established at two observed mortalities or serious injuries. Once there are two observed false killer whale mortalities or serious injuries inside the EEZ around Hawaii in the deep-set fishery in one year, then: (a) the SEZ would be closed to deep-set fishing for the rest of the fishing (calendar) year, with re-opening in January of the following year; or (b) if the area were closed the previous year as per (a) and the trigger were met again the following year, then the SEZ would be closed for a longer period of time, until specific reopening criteria were met.

Because the other take reduction measures (e.g., 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 costs of both the worst (12 months of closure) and best case (0 months of closure) annual scenarios.

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 farther 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 2000). 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, and where they would relocate.

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 approximately 370 deep-set longline trips in the SEZ each year.

Table 5.9. Estimated cost of closure of Southern Exclusion Zone to deep-set longline fishery.[a]

Southern Exclusion Zone	Annual ongoing cost	Cost per affected trip
Fuel Cost	$0 - $1,051,000	$0 - $3,000
Travel Time Cost	$0 - $2,927,000	$0 - $8,000
Total	$0 - $3,978,000	$0 - $11,000

a/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

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 $0 - $1,051,000 annually, assuming the maximum increased travel distance (Table 5.9). There would be no costs ($0) if closure of the area was not triggered in a given year (i.e., 0 months of closure).

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 a cost of $3.78 per gallon (NMFS 2012e) indicates that the SEZ measure may increase the cost of fuel per trip (for those trips currently in the SEZ) by as much as $0 (if 0 months of closure) to over $2,800 (12 months of closure and assuming lowest vessel fuel efficiency, rounded to $3000 in Table 5.9).

NMFS logbook data indicate that there were an average of 370 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 $0 (0 months of closure) to $1,051,000 (12 months of closure and assuming lowest vessel fuel efficiency) (Table 5.9).

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 $2,927,000 annually in the event of year-round closure of the SEZ.

As longline vessel speed averages approximately 7.3 miles per hour, travel time may increase by as much as approximately 40 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 $73.2 million from 2006 to 2011 (NMFS 2012f), 129 vessels, 143 sets per vessel per year, and one set per day, the average revenue per vessel per day fishing is estimated at approximately $3,950. The opportunity cost of additional travel time of the SEZ is thus estimated at approximately $7,900 per trip, assuming the equivalent of two fishing days is spent travelling the additional distance. Based on an annual average of 370 deep-set trips in the SEZ between 2006 and 2010, total annual travel time cost for all vessels is estimated to be approximately $2.9 million.

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 5.10).

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 5.10. 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
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%

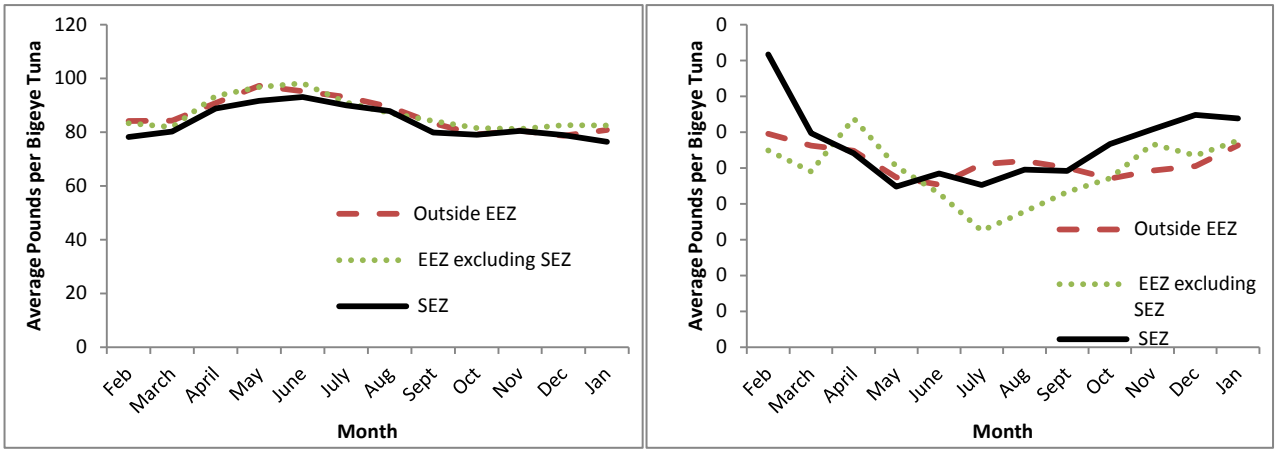

Figure 5.3. Comparison of average size of bigeye tuna kept and average CPUE by zone (outside EEZ, EEZ excluding SEZ, and SEZ) by month, 2006 to 2010. Whereas the average weight per bigeye tuna caught co-varies throughout the fishery on a monthly basis, no distinct monthly trend is evident for CPUE between 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.

Reduction in Fishing Effort

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 length of time fishing was assumed to change (be reduced), however, as more travel time could be required to reach fishing locations. The cost of changes in fishing effort due to increased travel time and associated reduced fishing effort are estimated as a travel time cost. As discussed above, we estimated the cost of travel time related to the closure of the SEZ in terms of reduced fishing effort, quantified as reduced revenue to the fleet of a maximum of approximately $2.9 million annually (approximately 4% of longline annual revenue). Additional impacts to fishing effort are possible if vessels change the number or length of trips in response to a SEZ closure. The number of sets in the SEZ account for approximately 10.8% of sets in the longline fishery. It is expected that this is the maximum level of fishing effort that could be affected if the SEZ were triggered and closed all year. However, it is possible that increased costs associated with triggering closure of the SEZ could result in exit of some vessels from the fishery, thereby potentially leading to larger reductions in fishing effort.

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.

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

This section describes the cost to deep-set and shallow-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 described in more detail below, no change in revenue due to catch rate or size of fish in the EEZ is expected, while changes in effort (other than those associated with increased travel time) are uncertain but may be limited, as data indicate that all or nearly all vessels in the longline fleet currently fish at least part of the time outside the EEZ. As summarized in Table 5.11, total costs of this closure area, estimated based on increased fuel and travel costs, are estimated to be as high as $9.5 to $11.3 million annually (assuming the maximum increased travel distance due to effort relocation). Nearly all of this cost (an estimated 94%) 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 1,010 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 5.4). For example, in 2010, approximately 21% of deep-set longline sets occurred inside the EEZ, which is a substantially lower proportion than in 2006 when 44% 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 5.11. Estimated cost of closure of Economic Exclusion Zone, deep-set and shallow-set fisheries.[a]

Economic Exclusion Zone	Annual ongoing cost	Annual ongoing cost per trip
Fuel Cost	$1,197,000 - $2,992,000	$1,000 - $3,000
Travel Time Cost	$8,331,000	$8,000
Total	$9,528,000 - $11,323,000	$9,000 - $11,000

a/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

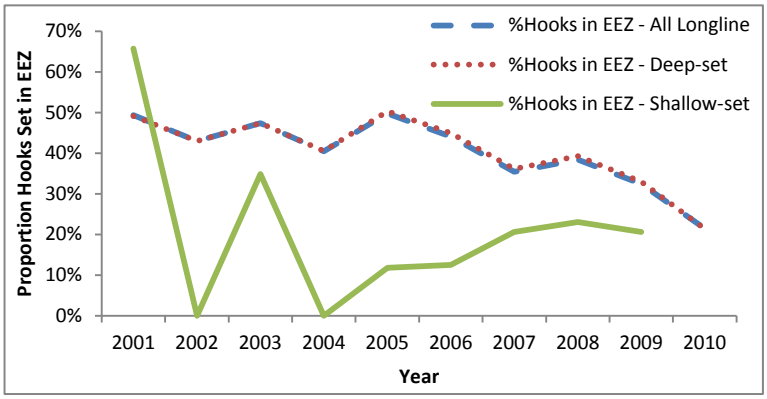

Figure 5.4. Proportion hooks set in EEZ by shallow-set and deep-set longline fisheries.

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 $3.78 per gallon (NMFS 2012e) closing the EEZ is estimated to increase the cost of fuel per trip by approximately $1,100 to $2,800 (rounded to $1,000 - $3,000 in Table 5.11). Assuming there are 1,050 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 $1.2 million - $3.0 million annually (Table 5.11). 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 round-trip 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

$73.2 million from 2006 to 2011 (NMFS 2012f), 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 $3,950. The opportunity cost of additional travel time of closing the EEZ is thus estimated at approximately $7,900 per trip, assuming the equivalent of two fishing days is spent travelling the additional distance (rounded to $8,000 in Table 5.11). Assuming that 1,054 EEZ trips are replaced by trips outside the EEZ, the increased travel time cost is estimated at approximately $8.3 million 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 5.12, the catch rate and size of fish kept is the same or higher outside the EEZ 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% 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 of all bigeye 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% in July, and peaking above 85% between October and January.

However, as indicated in Table 5.12 and Figure 5.5 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 5.12. 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%

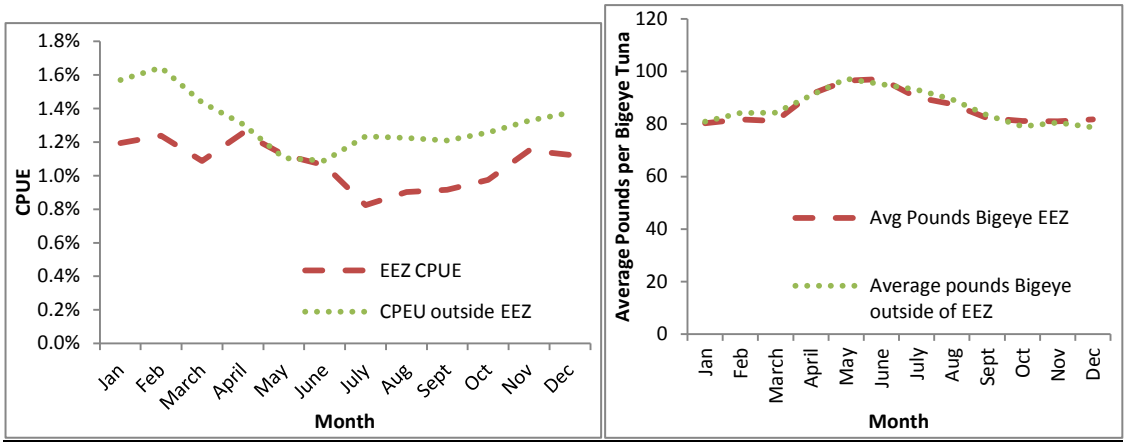

Figure 5.5. Catch per unit effort and average pounds per bigeye tuna caught inside the EEZ versus outside EEZ by month, 2006-2010.

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 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 circle hooks with a maximum wire diameter of 4.5 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 $12,300.

Commercial fishing gear suppliers may not be able to sell their existing inventory of circle hooks with > 4.5 mm diameter wire (including many size 16/0 circle hooks) and tuna or J hooks in the event that circle hooks with ≤ 4.5 mm diameter wire are required throughout the deep-set longline fishery. Assuming that gear suppliers on average have approximately six months of hook inventory in stock to replace lost hooks in the longline fishery (estimated 33,696 hooks lost annually, divided by two – see Table 5.4), and an estimated 81% of the hooks currently sold to the deep-set fleet would not meet the FKWTRP's hook requirements, we estimate that there may be approximately 13,600 hooks in supplier inventory at any one time that would not meet the FKWTRP's hook requirements for deep-setting. Depending on whether these hooks can be sold to other fisheries, the one-time cost to suppliers due to inventory lost is estimated at approximately $0 to $12,300 (based on approximately 13,600 hooks becoming unsellable and $0.91 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 $4,100. Using a 3% discount rate over 20 years, the total annualized equipment inventory cost of hooks to the three suppliers is estimated at approximately $0 to $800, or up to approximately $275 for individual suppliers. Although not estimated as an expected cost, it is also possible that equipment suppliers may face a one-time cost related to the monofilament branch line requirement if they cannot sell their current inventory of 1.8 mm line to other fisheries.

If fishing effort declines under the Preferred Alternative due to any of the 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

Seafood consumers could be affected by the Action Alternatives if the supply, price, or quality of seafood changes. Specifically, benefits to seafood consumers (also known as consumer surplus) decrease as prices rise (often due to decreased supply) or as quality declines. There are low *expected* effects of the Preferred Alternative on the supply of local, high quality tuna to Hawaiian consumers. However, the Preferred Alternative will affect the cost to fishermen of harvesting local catch, which could indirectly result in reduced supply of local catch (through reduced effort) or increased consumer price of local catch. Additionally, as discussed above, if the SEZ is triggered, then potentially longer travel time to fishing locations may reduce time available for fishing, thereby reducing fishing effort and catch. (The maximum reduction in catch estimated to result from increased travel time due to revisions to the MHI Longline Fishing Prohibited Area is estimated to be very minor, at approximately 0.1% of fleet revenues).

Potential reductions in catch may result in reduced exports or increased imports. As the Hawaii longline fishery is known for the quality of fish it harvests, reduction in local catch (even if substituted with increased imports) may affect the quality of fish available in the local Hawaii market, with potential effects on consumer surplus associated with locally-caught seafood, as well as a potential effect on local seafood prices. A 2004 study of tuna prices in Hawaii found that there is a correlation between local supply of yellowfin, skipjack, and albacore tuna and price, with lower prices in periods of higher seasonal availability of local tuna (Pan and Pooley 2004). Findings relative to bigeye tuna suggest that price for bigeye is more closely connected to quality than local supply, though supply also influences price. The study also indicated that locally caught tuna is of higher quality than imported tuna.

While such adverse impacts on consumer surplus are possible, effects are expected to be limited for four reasons. First, as noted above, there are limited expected reductions in total local catch, particularly in the Preferred Alternative, as it is expected that the fleet will adapt to the gear requirements and will shift effort from exclusion zones to other areas. The vast majority of the expected costs of the Preferred Alternative and potential reduced fishing effort is associated with the SEZ, which is only triggered in certain years (or portions of years) and which, if it is closed to deep-set longline fishing, may result in much lower costs if vessels choose alternative fishing areas that do not require the high increased travel distances as assumed in this analysis. Potential costs are greater in Alternative 3, with potential for greater reductions in total catch.

Second, while increased costs associated with the rule may cause the exit of some vessels from the fishery (if prices do not rise accordingly), these effects are anticipated to be limited as the rule is expected to impose relatively low costs on many longline vessels (most potential costs estimated in this analysis are associated with the SEZ, which is only triggered in certain years or portions of years and outside of which many vessels currently fish). Effects on the cost and supply of locally caught fish are therefore anticipated to be limited. Third, in the event that the Preferred Alternative results in catch reduction or increased costs of local fish, impacts on local seafood prices are expected to be mitigated due to the global nature of seafood supply and demand (i.e., local prices are affected virtually everywhere by global supply and demand because of the interconnected nature of global fisheries and markets). It is anticipated that reductions in Hawaii-based longline catch would be compensated by increased imports to Hawaii or by reduced exports to the mainland or Asia, and that much of the potential increases in longline operating expenses due to increased travel time and fuel costs may not be passed onto consumers (due to competition from other supply sources). Finally, while locally caught tuna has a reputation for high quality, continuous advances in packing systems and air shipment increase the quality and availability of fresh pelagic fish in the Hawaii market from around the world, including from the Philippines, Indonesia, Micronesia, the Marshall Islands, Fiji and Ecuador.

There is greater potential for adverse effects on consumers due to Alternative 3 as there are potentially higher drop in on catch of due to potentially greater reduced effort associated with closure of the EEZ. However, even in Alternative 3, effects on consumers may be partially offset by the global market for fish and the potential for high quality imports to substitute for locally caught fish.

5.7.4 Seafood Wholesalers/Retailers

Similar to seafood consumers, seafood wholesalers/retailers would be adversely affected by the Action Alternatives if the supply or quality of seafood were to decrease, causing a decrease in the volume sold. Wholesalers/retailers could also be adversely affected if the price of purchasing seafood rises, and they are not able to pass on this full price increase to consumers due to consumer price sensitivity. For the same reasons as discussed above regarding seafood consumers, these effects are not anticipated to result from the Action Alternatives. In the event that the Action Alternatives were to cause a decrease in local supply or increase in price, effects on wholesalers/retailers would be similarly mitigated due to the global nature of seafood supply and demand.

5.7.5 Federal Agencies

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

5.7.5.1 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 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 5.13 the total estimated one time cost to NMFS incurred through the labor and materials involved with these measures is estimated at approximately $29,000, and the annualized cost over 20 years is estimated to be approximately $2,000.

Table 5.13. Summary of estimated costs to NMFS.[a]

Measure	One- time cost	Annualized Cost
Annual Certification for Operators/Owners	$20,000	$1,000
Marine Mammal Handling/Release Placard	$6,000	$400
Captain Notification Placard	$3,000	$200
Total	$29,000	$2,000

a/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

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, while the one-time material cost is estimated at $15,000, for a total one-time cost of $20,000. Using a 3% 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 $1,400 (rounded to $1,000 in Table 5.13).

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 $6,000. Using a 3% 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 5.13).

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 $2,000 for materials, for a total one-time cost of $3,000.. Using a 3% discount rate over 20 years, the total annualized cost to NMFS of developing the placard is estimated at $200 (Table 5.13). 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 the 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 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 annualized costs of the Preferred Alternative ($111,000 to $4.1 million) are significantly lower than for Alternative 3 ($9.5 million to $11.3 million), the net benefits to the nation of the Preferred Alternative would exceed net benefits of Alternative 3.

6.0 FINAL 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 a Final Regulatory Flexibility Analysis (FRFA), NMFS generally includes only those entities, both large and small, that can reasonably be expected to be directly regulated by the 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 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 action be adopted, a formal FRFA, 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 FRFA 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 FRFA[2]

Under 5 U.S.C., Section 604 of the RFA, each FRFA is required to contain:

- A succinct statement of the need for, and objectives of, the 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 summary of the significant issues raised by the public comments in response to the initial regulatory flexibility analysis, a summary of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments
- A description of and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available;
- A description of the projected reporting, recordkeeping and other compliance requirements of the 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; and
- A description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected.

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% 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, this FRFA generally only includes those entities that are anticipated to be "directly regulated" by an action. Section 603(b) of the RFA limits its application to the "small entities *which will be subject to the proposed regulation* "-that is, those "small entities *to which the proposed rule will apply*." *Cement Kiln Recycling Coalition v EPA*, 255 F.3d 855, 869 (Fed. Cir. 2001) (*quoting*, *Mid-Tex Elec. Coop. v. FERC*, 773 F.2d 327, 342 (Fed. Cir. 1985)). Because longline equipment suppliers and distributors and fish wholesalers are not "subject to" the take reduction plan regulation, this analysis does not address the indirect economic effects of the action on those entities. However, impacts on indirectly regulated entities are considered in the Regulatory Impact Review.

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% 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% 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 Marine Mammal Protection Act (MMPA) requires that NMFS develop and implement take reduction plans for strategic marine mammal stocks that are incidentally killed or injured in Category I or II fisheries, as defined on the annual MMPA List of Fisheries. The MMPA specifies that the immediate goal of a take reduction plan is to reduce, within six months of its implementation, the incidental mortality or serious injury of marine mammal stocks to levels less than their potential biological removal (PBR)

levels. The long-term goal of a take reduction plan is to reduce, within five years of its implementation, the incidental mortality or serious injury of marine mammals to insignificant levels approaching a zero rate, taking into account the economics of the fishery, the availability of existing technology, and existing State or regional fishery management plans. The insignificance threshold has been defined in regulations as 10% of PBR (50 CFR 229.2)

The Hawaii pelagic and Hawaii insular stocks of false killer whales have been designated as strategic because the average annual mortality and serious injury (M&SI) of these false killer whales incidental to the Category I and Category II Hawaii-based deep-set and shallow-set longline fisheries (total of 13.6 Hawaii pelagic false killer whales per year inside the EEZ around Hawaii, and 0.5 Hawaii insular false killer whales per year) exceeds the stocks' PBR levels (9.1 Hawaii pelagic and 0.3 Hawaii insular false killer whales per year) (Carretta et al. 2012b). NMFS is required by section 118 of the MMPA to implement a FKWTRP that is calculated to reduce incidental M&SI of Hawaii pelagic and Hawaii insular false killer whales in the Hawaii-based deep-set and shallow-set longline fisheries to below the stocks' PBR levels within 6 months of Plan implementation (the short-term goal), and to insignificant levels approaching a zero rate within 5 years of Plan implementation (the long-term goal). This action is being taken to meet the requirements of the MMPA. The FKWTRP rule is based on the consensus recommendations of the False Killer Whale Take Reduction Team, which is a multi-stakeholder advisory group that includes representatives from the affected longline fisheries.

6.5 Objectives of, and Legal Basis for, the Rule

The action being addressed is the implementation of the FKWTRP, pursuant to section 118(f) of the MMPA, to reduce incidental M&SI of two 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 being taken under the authority of the MMPA.

The rule, identified as the Preferred Alternative in this combined Final Environmental Assessment, Regulatory Impact Review, and Final Regulatory Flexibility Analysis, would implement regulatory and non-regulatory measures based on consensus recommendations of the False Killer Whale Take Reduction Team. The regulatory measures include:

(1) require the use of circle hooks with a maximum wire diameter of 4.5 mm and other specific characteristics in the Hawaii-based deep-set longline fishery;

(2) establish a minimum diameter for monofilament line and a minimum breaking strength for any other line material used in the construction of leaders and branch lines in the Hawaii-based deep-set longline fishery. A branch line typically includes a snap, monofilament line, weight, swivel, leader (monofilament or wire), and hook;

(3) modify an existing longline exclusion area around the Main Hawaiian Islands (MHI) to prohibit longline fishing year-round in an area that is currently closed only seasonally;

(4) expand existing annual certification requirements for longline vessel owners and operators to include marine mammal interaction mitigation techniques;

(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 (SEZ) that would be 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 FKWTRP include: (1) increasing the precision of bycatch estimates in the Hawaii-based deep-set longline fishery; and (2) making specific changes to the observer training and data collection protocols. Four other non-regulatory measures are part of the 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 document.

As noted above, the rule is the product of the consensus recommendations of the False Killer Whale Take Reduction Team, which includes representatives of the Hawaii-based longline fisheries that would be directly regulated by the Plan.

6.6 Number and Description of Any Small Entities Directly Regulated by the Rule

This section summarizes what is known about the potential adverse impacts of implementation of the FKWTRP rule on directly regulated small entities. The NMFS database of longline permit holders identifies 129 active vessel operations in Hawaii's longline fleet in 2012. As presented in Table 3.13, between 2006 and 2012, there were 124 to 129 vessels in the longline fleet, with two years (2007 and 2012) 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.

The NMFS database of longline permit holders provides ownership information for the 126 vessels active in 2010 (more recent data were not available for this analysis). The database indicates that 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' annual ex-vessel revenue between 2006 and 2011 has averaged over $73.1 million dollars (in 2011 dollars). Based on 129 vessels in the fleet, the average annual revenue per vessel is, therefore, estimated at approximately $567,100. This implies that in order to not be considered a small business (average annual receipts of $4 million dollars or less), 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 rule. 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.

6.7 Estimated Impacts to Small Entities Directly Regulated by the Rule

The rule is not expected to generate benefits to the small businesses in the longline fishery, as the rule 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 rule. Costs associated with the rule stem from labor and material costs of replacing hooks and monofilament branch line to meet the FKWTRP regulatory requirements; 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 (but would be closed under the FKWTRP), as well as cost of fishing outside the SEZ (if the area is closed due to the deep-set fishery meeting the SEZ "trigger"); and annual cost of Protected Species Workshop certification of operators and owners (see Section 5.7.1 of the RIR for more details on the impacts and how they were estimated).

Averaging total costs to the longline fleet of the rule (from the RIR, Table 5.1) across all 129 active vessels, results in a per vessel one-time cost of $3,000 to $5,000, and an annual ongoing cost of $700 to $32,000 per vessel (Table 6.2). Average annual ongoing costs vary considerably depending on the duration of a potential SEZ closure, which may range from 0 months (i.e., no closure if the SEZ trigger is not reached in any given year) to 12 months (full-year closure, if the SEZ trigger is reached); the length of any SEZ closure will depend on the deep-set fishery's actual level of bycatch after the rule goes into effect. Individual business costs may be higher or lower than the range presented in Table 6.2 depending on several factors, particularly 1) location of current longline trips (if a vessel currently fishes in closure areas, costs will be higher for that vessel), and 2) current gear use (if a vessel would need to change hooks or branch line to meet the rule's gear requirements, costs will be higher for that vessel).

Table 6.2. Cost of implementing the rule to potentially affected small businesses.[a]

Size of Business based on No. of Vessels	Initial, One-Time Cost		Annual Ongoing Cost	
	Low Range	High Range	Low Range	High Range
Cost per Business for 68 Businesses Owning 1 Vessel Each	$3,000	$5,000	$700	$32,000
Cost per Business for 15 Businesses Owning 2 Vessels Each	$6,000	$9,000	$1,000	$63,000
Cost per Business for 2 Businesses Owning 3 Vessels Each	$8,000	$14,000	$2,000	$95,000
Cost per Business for 1 Business Owning 5 Vessels	$14,000	$23,000	$3,000	$158,000
Cost per Business for 1 Business Owning 6 Vessels	$17,000	$28,000	$4,000	$190,000

a/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

The effects of the FKWTRP on small businesses will depend on the profitability of these businesses, which is difficult to quantify due to uncertainty and volatility in revenue and cost structures over time, as well as uncertainty regarding the actual costs of the FKWTRP, particularly the costs if the SEZ area closure were triggered. In 2000, the average Hawaiian longline tuna vessel recorded net revenues at 11% of total revenue after accounting for fixed costs, variable costs, and labor. Although more recent profit data are not available, it is likely that the overall profitability of the fleet has decreased since 2000 due to rising operating costs. For instance, while average gross revenue has remained relatively unchanged since 2000, increasing from an average of $495,456 in 2000 to $530,000 in 2011, the price of fuel has more than doubled over this same period (NMFS 2012e, O'Malley and Pooley 2003).

The profitability of the fleet in 2000 varied by vessel size. O'Malley and Pooley (2003) found that among tuna vessels, small vessels (<56 ft) were the most profitable; they had higher gross revenues and, consequently, higher labor costs but lower fixed and variables costs compared to larger vessels. However, for 2000, after excluding the three most profitable vessels in each size bracket ("economic highliners"), small longline tuna vessels (<56 ft) recorded net losses of $1,440, whereas medium sized vessels (56.1 ft – 73.9 ft) recorded average net revenues of $33,370, and large vessels (>74 ft) recorded net revenues of $19,190 (values in 2000 dollars). The three most profitable vessels in all size brackets each had annual net revenue exceeding $275,000, highlighting the profit variability not only within the fleet, but within vessel sizes (O'Malley and Pooley 2003). Data from 2000 suggest that the owners of small vessels may already be marginally profitable, and could be most affected by the potential increased costs of the rule. Accordingly, because of the wide variability of profits within vessel classes, it is not possible to draw meaningful conclusions from an analysis of economic impacts based on vessel size.

6.8 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.

6.9 Identification of all Relevant Federal Rules which May Duplicate, Overlap, or Conflict with the Rule

NMFS has identified no such Federal rules.

6.10 Description and Analysis of Significant Alternatives to the Action

In addition to the rule (the Preferred Alternative), this EA/RIR/FRFA formally considers two other alternatives. Implementation of the "No Action" alternative is not a viable option because it would not be consistent with the objectives identified by the agency for this action (see Section 6.5, and the "Purpose and Need" discussion in the EA and RIR), and would be contrary to the agency's obligations under the MMPA, and therefore contrary to law.

Alternative 3 would close the U.S. EEZ around Hawaii to longline fishing year-round. This alternative was considered because it would satisfy the MMPA's take reduction goals by eliminating incidental mortalities and serious injuries of false killer whales in the longline fisheries within the U.S. EEZ. However, eliminating false killer whale M&SI in the U.S. EEZ by prohibiting all longline fishing would impose considerable economic costs on the fishery due to additional transiting time to fishing grounds on the high seas and lost fishing opportunities, while it would also go beyond the requirements of the MMPA (i.e., to reduce M&SI below PBR within 6 months, and to insignificant levels within five years). Longline fishermen still would be allowed to continue fishing on the high seas, where a high proportion of the fishing currently occurs (75% of hooks were set by the fleet on the high seas in 2010; WPRFMC 2012), but the EEZ closure would likely result in more substantial economic impacts due to longer transit time and the resulting lost fishing opportunities.

In response to comments from the Office of Advocacy at the Small Business Administration (Advocacy), NMFS also considered alternatives that would further minimize economic costs to the affected small businesses, while still achieving MMPA objectives. As described in Section 6.6 above, 87 of the 88 businesses owning Hawaii longline vessels are considered small businesses. Advocacy urged NMFS to consider alternatives that establish different requirements or timetables for different size vessels, in recognition that vessels' profitability (and thus the economic impact of new regulations) may vary by

vessel size. Using the vessel length brackets identified in O'Malley and Pooley (2003), as of October 2012 the Hawaii-based fleet comprises 15 small vessels (<56 ft), 57 medium vessels (56.1 ft – 73.9 ft), and 57 large vessels (>74 ft) (NMFS 2012c).

NMFS's considerations in response to Advocacy's comments focused on alternatives to, or variations of, the measures in the rule that have the largest potential cost to the longline industry: the weak circle hook requirement and the Southern Exclusion Zone.

Alternative Implementation of Circle Hook Requirements

The weak circle hook requirement included in the Take Reduction Team's consensus recommendation is a key component of the Take Reduction Plan, and is expected to both reduce the number of false killer whale interactions and reduce the severity of injuries if animals are hooked. That is, both the TRT and NMFS believe that a false killer whale is less likely to become ensnared on a circle hook, rather than on a conventional J hook or tuna hook. Further, a weak circle hook makes it more likely that the false killer whale will escape a hooking with minor or no injuries, which are not counted in the M&SI determination.

Because of the false killer whale's low PBR, only two observed M&SI occurring within the U.S. EEZ around Hawaii in any given year will exceed the reductions required under MMPA based on existing 20% observer coverage. With such low rates of allowable M&SI, NMFS did not consider it a viable alternative to limit the hook requirement to only certain classes of vessels within the fleet. However, NMFS did consider different implementation timetables for implementation of the requirement, either for all vessels or for vessels of different size classes. A longer phase-in period could lower the cost to the affected fishermen.

NMFS evaluated a range for implementation timelines for all affected vessels, from 30 days (the minimum period required by the Administrative Procedures Act) to six months. Based on this analysis, we estimated that the cost savings of a 6-month implementation timeframe compared to one-month would be only $100 per affected vessel (see section 5.7.1.1 of the RIR for details). We estimate that approximately 20% of vessels in the fleet are already using hooks that meet the TRP requirement, and would not have any cost associated with the measure assuming they satisfy the wire diameter requirements. Further, we do not have data on the percentage of vessels using circle hooks that already meet the TRP's maximum wire diameter requirement, within each vessel size category.

Although a six-month implementation timeline for the circle hook requirement, either for all longline vessels or for a particular size class of vessels, may allow a minimal cost savings for those vessels, NMFS also rejected this alternative. Under the MMPA's short-term take reduction goal, a plan must be calculated to achieve a significant reduction in incidental M&SI of false killer whales in the fisheries (that is, reduction below the stocks' PBR levels) within six months of the Plan's implementation. Delaying implementation of this take reduction measure for six months, even for only a portion of the fleet, would mean approval of a plan that likely could not achieve the 6-month take reduction goal.

Although we rejected a 6-month implementation timetable, NMFS decided upon an intermediate-length timetable of 90 days for all vessels to meet the requirement. A 90-day implementation period will allow gear suppliers to acquire a sufficient supply of hooks and fishermen to change over their gear, and still implement the measure in time to help achieve the MMPA's short-term take reduction goals. It may result in a small cost savings to fishermen compared to an immediate implementation of the requirement. Accordingly, NMFS concludes that the 90 day implementation period appropriately minimizes the rule's burden on small entities.

Alternative Implementation of Southern Exclusion Zone Provisions

The SEZ encompasses an area with a high concentration of the fishery's historical interactions with false killer whales. The boundary was recommended to NMFS by the False Killer Whale Take Reduction Team as the smallest area that could be closed that would still provide the necessary reductions in false

killer whale injuries and deaths. Under the rule, the area would be open until bycatch in the deep-set fishery exceeds a sustainable threshold (the trigger), and would then be closed to deep-set longline fishing until bycatch is reduced to sustainable levels. While the SEZ is closed, other areas of the EEZ around Hawaii will remain open subject to existing regulatory measures, as will the high seas, where a growing majority of effort has taken place in recent years. The SEZ closure would not affect or restrict shallow-set fishing, which primarily targets swordfish.

We considered, but rejected, alternative SEZ measures that would have separate triggers or closures for vessels of different size classes. The sustainable bycatch threshold (or PBR level) for the Hawaii Pelagic false killer whales is 9.1 mortalities and serious injuries per year (Carretta et al. 2012b). Because there is approximately 20% observer coverage in the deep-set longline fishery, every observed and reported false killer whale serious injury or mortality extrapolates to approximately five total mortalities and serious injuries. In other words, if the fishery has two observed false killer whale serious injuries or mortalities, NMFS would extrapolate the M&SI to 10 whales, which would exceed the PBR of 9.1 and violate MMPA requirements. Accordingly, two M&SI meet the trigger for closing the SEZ (see Section 2.3.2.8 for more details on the trigger). Based on this low trigger, it would be impracticable to further apportion the trigger among different sectors of the deep-set longline fleet, by vessel size or any other characteristic.

Similarly, NMFS cannot consider an exemption from the SEZ closure for small vessels. Given the very low thresholds for sustainable false killer whale bycatch, and the equal probability that a vessel of any size may incidentally injure or kill a false killer whale, we cannot exempt small vessels from the requirements.

Accordingly, NMFS rejected these alternative implementations of the SEZ measures.

Evaluation of Viable Alternatives

After careful examination of the best available scientific data on false killer whales, NMFS finds that only the Preferred Alternative (the final rule) and Alternative 3 have the potential to meet the stated objectives of the FKWTRP, consistent with MMPA requirements.

The complete closure of the U.S. EEZ to longline fishing under Alternative 3 is expected to incur more significant overall annual costs to small businesses compared with the rule, 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 of the RIR for more details on the analysis). The complete closure of the U.S. EEZ would eliminate all false killer whale M&SI from longline fishing within the U.S. EEZ while exceeding the requirements of MMPA, section 118. Although Alternative 3 may be most desirable from a conservation standpoint, NMFS believes that the Preferred Alternative will also meet the requirements of the MMPA, at lesser economic cost to the fishery.

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, based on average total costs to the fishery over all 129 active vessels (costs will vary by vessel and business depending on the number of trips currently taken within the EEZ). Costs associated with Alternative 3 primarily stem from additional travel cost (fuel and time) of fishing outside the EEZ (see Section 5.7.1.2 of the RIR for more details on the analysis).

Table 6.3. Cost of implementing the Alternative 3 to potentially affected small businesses.[a]

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	$74,000	$88,000

Cost per Business for 15 Businesses Owning 2 Vessels Each	$148,000	$176,000
Cost per Business for 2 Businesses Owning 3 Vessels Each	$222,000	$263,000
Cost per Business for 1 Business Owning 5 Vessels	$369,000	$439,000
Cost per Business for 1 Business Owning 6 Vessels	$443,000	$527,000

a/ All costs greater than $1,000 are rounded to the nearest thousand dollars.

Both the Preferred Alternative (the final rule) and Alternative 3 are expected to meet the objectives of the FKWTRP and the take reduction goals of the MMPA. Alternative 3 was not selected because it would impose substantially greater economic impacts to small entities than the Preferred Alternative, and is not necessary to achieve MMPA objectives. NMFS believes that implementation of the Preferred Alternative will achieve the requirements of the MMPA while minimizing economic impacts to small businesses to the extent practicable.

6.11 Significant Comments in Response to the IFRA

Four public submissions were received that contained comments specific to the analysis in the Draft EA/RIR/IRFA. These comments are summarized and responded to in Appendix A of this document. In response to these comments, NMFS updated and revised the FRFA analysis with respect to potential profitability impacts on the fleet, especially for those vessels already operating with thin profit margins, and to the potential for varying levels of impacts by vessel size class. See comments/responses 16-18 in Appendix A for more detail on these comments. In addition, NMFS received comments from Advocacy that have been addressed in Sections 6.3, 6.7, and 6.10 of this FRFA.

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 critical habitat 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 critical habitat, formal consultation is not required so long as the expert agency concurs.

NMFS has determined that reinitiation of consultation is 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, October 15, 2008, and January 30, 2012. NMFS analyzed the need for re-initiation of section 7 consultation, and determined that the continued operation of the Hawaii-based deep-set and shallow-set longline fisheries under the PFEP and the FKWTRP did not (1) give rise to new information the effects of which may affect listed species or critical habitat in a manner or to an extent not previously considered; or (2) modify the fishery in a manner that causes an

effect to the listed species or critical habitat that was not considered in the previous biological opinions. Accordingly, it is not necessary to reinitiate consultation under 50 CFR 402.16.

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 each affected stock's 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, and long-term to insignificant levels approach a zero M&SI rate (i.e., 10% of PBR)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, and long-term, to insignificant levels approaching a zero M&SI rate, thus 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, so 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 EA also serves as an EFH assessment.

Pursuant to these requirements, section 2 of this document provides a description of the alternatives considered for the 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 measures presented in section 2 (Description of the Action and Alternatives) of this EA/RIR/FRFA are likely to modify fishing practices in a manner that would adversely affect EFH or HAPC. Therefore, an EFH consultation on the 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 Pacific Islands Regional Office, completed on November 9, 2012, 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 did not requesting a waiver from the requirements of the APA for notice and comment on the proposed rulemaking. NMFS held a 90-day public comment period for the FKWTRP proposed rule.

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 was submitted to the appropriate state government agency in Hawaii for review and concurrence with the preliminary determination that the proposed action was consistent, to the maximum extent possible, with its coastal zone management program. A letter of concurrence was received by NMFS PIRO on September 14, 2011.

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 determined the action does not contain policies with federalism implications under EO 13132.

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 economic costs of the management measures considered in this document. As presented in Table 3.14 in the document, a disproportionate number of Korean-Americans own smaller vessels, which may be disproportionately affected by the rule if these vessels tend to fish closer to shore in the areas that would be closed in the Preferred Alternative. In cases where minority or low income

groups may be subject to disproportionate economic harm from an action, Executive Order 12898 typically requires NMFS, via NEPA, to analyze those impacts. However, NEPA requires such analysis only when economic effects are interrelated with a disproportionately high and adverse human health or environmental effect stemming from the action. A supposition of differential cost impacts across the Hawaii longline fleet is not a sufficient basis to examine environmental justice. The analysis presented in the Draft EA provides no basis for such a finding. Rather, the Agency believes this regulatory action is most likely to result in net positive benefits to the environment.

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 EA/RIR/FRFA includes the RIR, which includes an assessment of the costs and benefits of the 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 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 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 a Regulatory Flexibility Analysis that describes the impact of the rule on small entities. An Initial Regulatory Flexibility Act analysis was prepared for the proposed action and was made available for public review. A FRFA for this final 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 Federal action. NMFS prepared this EA in accordance with NEPA.

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APPENDIX A

Summary of Public Comments Received on the Draft EA/RIR/IRFA and Responses

NMFS published the False Killer Whale Take Reduction Plan (FWKTRP) proposed rule in the Federal Register on July 18, 2011 (76 FR 42082). In the Federal Register notice, NMFS also announced the availability of a Draft Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) for the proposed FKWTRP. The proposed rule and Draft EA/RIR/IRFA were available for public comment for 90 days. A total of 86 public submissions were received, 68 of which were identical, or slightly modified form letters expressing support for the proposed rule, and 18 contained substantive comments on specific measures or components of the proposed rule. All comments specific to the content of the proposed rule are summarized and responded to in the final rule, which will be published in the Federal Register.

Only 4 public submissions contained comments specific to the analysis in the Draft EA/RIR/IRFA. Below, we provide a summary of those public comments and our responses. In the responses, we note the sections of the document, if any, that were revised in response to the comment.

Requirements of NEPA

Comment 1: The effects of the proposed action will be significant, controversial, and uncertain, so NMFS should have prepared an Environmental Impact Statement, not an Environmental Assessment.

> **Response:** In accordance with NEPA, CEQ regulations (40 CFR Parts 1500 – 1508), and NOAA Administrative Order 216-6 (Environmental Review Procedures for Implementing the National Environmental Policy Act), NMFS prepared an EA to determine whether an Environmental Impact Statement (EIS) is required for this action. The EA analyzed the environmental impacts of the action and alternatives, and provided sufficient information to determine that there were no significant impacts associated with the Preferred Alternative. Accordingly, preparation of an EIS for this action is not required. See the Finding of No Significant Impact attached to this document. No further agency action is warranted in response to this comment.

Benefits

Non-use benefits

Comment 2: The Draft EA lacks evidence and specifics of the value of the existence of false killer whales, particularly how the Nation as a whole is benefited by the proposed action. The referenced existence values are not quantified in any way, even though these values make up most of the "benefits" evaluation.

> **Response:** Marine mammal protection is a national priority. Congress passed the MMPA (and other species protection legislation) in recognition of the benefits to the public of marine mammal and other species protection.
>
> Existence values refer to the individual utility or well-being derived from the knowledge of the existence of a natural resource without the expectation of any form of use. Section 5.6.4.1 defines existence values as cited in the comment, as well as provides example existence values that have been

found in previous studies. Additional language has been added to section 5.6.4.1 to explain that Americans throughout the Nation (i.e. residents of other states than Hawaii) can benefit from false killer whale conservation, as no interaction with the species is required for existence values to be realized. Similar language has also been added to section 4.3.2.8. Findings from previous economic studies indicate that many people value species conservation in other regions and not just their own region, suggesting that false killer whale conservation in Hawaii can provide benefits to people located throughout the United States.

Quantifying existence values is problematic for various reasons described in Section 5.6.3; furthermore, there are no available studies on existence values specific to false killer whales. Section 5.6.4.1 presents findings from previous studies of existence values (which do not include any studies of existence values specific to false killer whales) to provide context for possible existence values associated with false killer whales.

In summary, sections of the document describing existence value and benefits have been supplemented in response to this comment.

Comment 3: Regarding existence value, very few Americans, or even Hawaiians, are aware that false killer whales exist. This existence value is therefore limited to a very small percentage of the American public, thereby having a negligible effect. It is further complicated by the fact that a significant percentage of the people that are aware of their existence are fishermen who do not like them and place no value on their existence.

Response: As noted above in response to comment 2, Congress directed the protection of marine mammals through the MMPA, in recognition of the benefits to the public of marine mammal and other species protection. Specifically, MMPA section 118 requires that NMFS develop a take reduction plan and implementing regulations that will reduce to appropriate levels both the number and severity of interactions between the Hawaii deep-set and shallow-set fisheries and false killer whales. The Draft EA acknowledges that existence values for the false killer whale are not applicable to all Americans, but are most relevant for individuals who value protection of marine mammals. Regarding awareness of the false killer whale, in surveys, individuals often value general conservation and protection of endangered/threatened species (particularly mammals, fish, and birds), regardless of their prior knowledge of the species. Also, while there may be limited knowledge currently about the false killer whale, conservation activities such as those in the Action Alternatives raise awareness among the public.

No further agency action is warranted in response to this comment.

Comment 4: There is reference to the cultural value of preserving false killer whales in sections 4.3.1 and 5.6.2.1 for Native Hawaiians. While I have no direct knowledge of the traditional Hawaiian cultural value of false killer whales, the native Hawaiian fishermen that I know have a very low opinion of false killer whales. In fact, every ethnic fishing culture I have knowledge of dislikes false killer whales, and would see no benefit from their preservation. Japanese, Korean, Vietnamese, Portuguese, and Italian fishermen that I have worked with all express this attitude.

Response: The language in Sections 4.3.1 and 5.6.2.1 that Native Hawaiians could be especially affected by increased false killer whale M&SI due to cultural and spiritual reasons is based on information received from the Office of Hawaiian Affairs (OHA) regarding the importance in Hawaiian culture of caring for all living things and the belief in the interconnectivity of all living things, including land and marine species (personal communication with OHA, April 2011). However, in response to this comment, language is added to Sections 5.7.1 and 4.3.2.1 to acknowledge that false killer whales can increase costs to fishing communities through predation of fish or destruction of gear. Thus, sections of the document describing costs to the longline fisheries have been supplemented in response to this comment.

Comment 5: NMFS should consider direct and indirect reduced effect of quality of life on groups that participate in longline fishery for the lifestyle (i.e., smaller vessel participants as outlined above), general public who value Hawaii's fisheries, and seafood who value the availability of quality local fresh tuna. As written, NMFS' attribution of beneficial quality of life effects without considering similar negative effects has resulted in a biased and unbalanced analysis.

> **Response:** Potential adverse impacts on the longline fishery are analyzed through the social and economic cost analysis. In Section 4.3.2.1, the Draft EA recognizes that increased costs to the longline fishery may result in reduced effort and that quality of life may be impacted as "reduced effort would decrease longline fishing income and employment, and would potentially result in social or economic hardship for individual owner/operators or fishermen." Regarding the effects on quality of life to seafood consumers, additional language regarding the potential effects on seafood consumers has been added to sections 4.3.2.4 and 5.7.3. Thus, sections of the document describing potential effects to the social and economic environment, specifically to seafood consumers, have been supplemented and improved in response to this comment.

Comment 6: The report fails to include non-quantifiable "existence value" effects in the analysis of costs. These make up the whole of the "benefits' evaluation, but are ignored in the evaluation of the costs of the Action Alternatives.

> **Response:** Existence values refer to the individual utility or well-being derived from the knowledge of the existence of a natural resource without the expectation of any form of use or interaction. It is possible that some people are negatively affected by the existence of false killer whales, even if they do not expect to ever interact with them, but this seems unlikely. However, it is possible some groups such as fishermen may be negatively affected by the presence of false killer whales through interaction. These are not negative existence values, but are rather costs of interactions. Recognizing this, language has been added to Sections 4.3.2.1 and 5.7.1 to acknowledge that false killer whales can increase costs to fishing communities through predation of fish or destruction of gear. Thus, sections of the document describing costs to the longline fisheries have been supplemented in response to this comment.

Use benefits

Comment 7: There is no evidence to support benefits to tourists and whale watchers. Primary target species for marine wildlife viewing in Hawaii are humpback whales, spinner dolphins, and green sea turtles. False killer whales are not targeted for commercial wildlife watch tours given their relatively low density, and are unlikely to become a viable target for such activity within the timeframe considered for this analysis. More importantly, the primary false killer whale stock interacting with the deep-set longline fishery is the pelagic stock, which does not occur within the nearshore areas utilized by wildlife watch tour boats. It is therefore unlikely that any benefit to wildlife watching would be realized from the implementation of the TRP.

> **Response**: The Draft EA notes that tourists and whale watchers could benefit from increased false killer whale populations. Marine mammal sightings during wildlife viewing activities are opportunistic and may include viewing of false killer whales. Additional language has been provided in section 5.6.4, 5.6.4.3, and 4.3.2.6 of the report to recognize that many of the potential use benefits to groups such as tourists and whale watchers may be limited, and that the primary expected benefit of the Action Alternatives is the benefit to the public of protecting marine mammals. Thus, sections of the document regarding benefits of the proposed action have been supplemented and improved in response to this comment.

Comment 8: The Draft EA mentions a potential benefit to recreation and tourism from the decreased congestion from commercial fishing boats in section 5.5.3, but this is contradicted by section 4.3.2.5,

which states there are no anticipated impacts of the Action Alternatives related to congestion. There is no history of "congestion" from commercial fishing boats in the waters fished by the longline fleet.

Response: Sections 5.5.3 and 4.3.2.5 (now 4.3.2.6) serve different purposes. Section 5.5.3 (and section 4.3) serves to describe the groups that were analyzed for potential effects, while Section 4.3.2.6 (and Section 5.6.4) summarizes the findings of the analysis in terms of expected effects of the Preferred Alternative for each analyzed group. While this study identifies recreation and tourism as a potentially affected sector, the economic impact analysis (Sections 4.3.2.6 and 5.6.4) determines that this group will incur limited to no significant impacts as a result of the FKWTRP. Text has been added to Sections 5.5.3 and 4.3 to clarify that not all potentially affected groups summarized in Sections 5.5.3 and 4.3 are expected to experience costs or benefits as a result of the FKWTRP. Thus, sections of the document regarding potentially affected groups have been supplemented and improved in response to this comment.

General

Comment 9: Section 5.8 states that while it is not possible to quantify all of the costs, and it is not possible to quantify any benefits, the Action nonetheless "appears" to create a net benefit to the nation. I do not think this is justified by the information presented in the document, much less if one considers the costs mentioned above that were not included in the analysis. To me, as a fisherman and a U.S. citizen, I would be much more comfortable with a document honestly concluding that, while this action is going to have a lot of costs and no real tangible benefit, we, your government, are going to do it anyway because congress passed a law that says we have to.

Response: In passing the MMPA, Congress found that marine mammals are resources of great international significance, esthetic and recreational as well as economic, and they should be protected. *See* section 2(6). Under the MMPA, NMFS is required to take action to mitigate the problem of incidental mortalities and serious injuries of marine mammals in commercial fisheries. Comparing the benefits of species protection evident by these national laws, and the findings from the economic literature that species preservation has value to the relatively low expected costs of the rule, NMFS does determine that the Action appears to create a net benefit to the nation. No further agency action is warranted in response to this comment.

Costs

Comment 10: A non-quantifiable cost not addressed in the document is the ill will that will be generated between the fishermen and the government by the imposition of these proposed restrictions. It is difficult to justify the need to impose restrictions to increase false killer whale populations, when these same false killer whales destroy tens of thousands of dollars worth of catch from every boat each year. This discontent is further exacerbated by the rarity of hookings of these predators, and even when hooked, the whales are usually released alive. That their legitimate interests have been so subordinated to nebulous "existence value" of a creature that they consider a major pest will certainly add to the current atmosphere of distrust that exists between small business people and their government.

Response: We understand that the fishing industry is a highly regulated industry and individual fishermen may not support new fishery restrictions, but NMFS is required by the MMPA to implement bycatch reduction measures to reduce false killer whale serious injuries and mortalities to sustainable levels. The MMPA was enacted due to Congress's recognition of public interest in protecting marine mammal species; interest which can be expressed through the form of existence values as well as potential scientific and use values. Catching a false killer whale may be a rare event for individual fishermen and animals are usually released alive, but the animals' injuries are most

often considered to be “serious” (i.e., the animal is more likely than not to die of the injury), and the total fleet-wide number of these injuries exceeds allowable thresholds.

The MMPA's take reduction process is participatory, and is designed to foster stakeholder input in the development of bycatch reduction measures. The measures in the Take Reduction Plan are almost identical to the consensus recommendations of the multi-stakeholder Take Reduction Team, which included representatives from the longline fishing industry, state and federal fishery management agencies, scientists, and conservation organizations. The Team, and NMFS, made every effort to identify justifiable and realistic measures that would meet the MMPA-specified take reduction goals on the MMPA-specified timeline. The Plan focuses almost exclusively on bycatch reduction, rather than depredation mitigation, mainly because of a lack of existing technologies for mitigating depredation. Development of depredation mitigation strategies, technology, and techniques is a high priority for future research, and one that we expect would reduce the negative impacts of depredation behavior.

No further agency action is warranted in response to this comment.

Comment 11: Wholesalers and retailers are the critical link between the fishery and seafood consumers. The Draft EA/RIR/IRFA estimates that the Hawaii longline landings in 2008 were nearly 26.7 million pounds with revenue of $71.9 million, suggesting that revenue derived by wholesalers and retailers once the catch moves through the local and export markets would be much greater. However, the analysis does not consider these multiplier effects and thus may have underestimated the impacts of the preferred alternative.

Response: Seafood wholesalers/retailers would be adversely affected by the Action Alternatives if the supply or quality of seafood were to decrease, causing a decrease in the volume sold. Wholesalers/retailers could also be adversely affected if the price of purchasing seafood rises, and they are not able to pass on this full price increase to consumers due to consumer price sensitivity. Although not anticipated to result from the Action Alternatives, language regarding potential effects to wholesalers and retailers has been added to Sections 4.3.2.5 and 5.7.4. Thus, sections of this document describing potential social and economic impacts of the proposed action have been supplemented and improved in response to this comment.

Comment 12: Seafood consumers are the largest group of stakeholders in this process. The analysis of the costs to them presented in section 5.7.3 is misleading and incomplete. The Draft EA acknowledges that there is consumer surplus value associated with the high quality local longline fish, but it does not quantify that value. The document states that “[n]o measurable effect on Hawaii seafood consumer prices would be expected due to the implementation of either of the action alternatives,” but this assumes that any loss of local supply of fish would simply be replaced by increased imports, and that the price competition from imports would prevent increased production cost from being passed on to the consumer. There is also no acknowledgment that consumer value would be lost due to increased imports. There are no citations to any studies or other materials that discuss the value of locally produced food (specifically fish).

Response: Consumer surplus of a product such as seafood is equal to the difference between the value from the product derived by consumers less price paid. The consumer surplus associated with high quality local longline fish has not been quantified in previous studies, and is not known. However, recognizing the importance to Hawaiian consumers of high quality fish, sections 5.7.3 and 4.3.2.4 in the final EA/RIR/FRFA have been modified to provide additional information on potential effects on consumer surplus associated with locally caught longline fish if the supply, price, or quality of seafood in Hawaii were to be affected by the FKWTRP (though these effects are expected to be limited for the reasons discussed in the modified text). Thus, sections of this document describing potential social and economic impacts of the proposed action have been supplemented and improved in response to this comment.

Reduction in Catch, Trade Imbalance, and Transfer Effects

Comment 13: The value of having sustainable American fisheries that provide the highest quality products (in contrast to unregulated foreign fishing fleets) is discussed nowhere in the Draft EA.

> **Response:** The Draft EA identified potential effects on catch due to a 4.0 mm wire diameter small circle hook requirement, specifically the potential for reduced catch retention on these "weak" hooks that are not currently used in the fishery. The hook requirement has been modified to 4.5 mm wire diameter in the Final EA. Due to this modification, there are no expected effects on longline catch due to the Preferred Alternative, as described in the Final EA (section 5.7.1.1). However, as noted in the Final EA, it is possible that fishing effort (and associated local catch) may decline as an indirect result of increased costs associated with the Preferred Alternative, potentially resulting in increased imports. As locally caught longline fish is generally regarded as higher quality than imported fish, the analysis has included additional language on the potential effects to consumers regarding the price and availability of high quality fish in Sections 4.3.2.4 and 5.7.3. Thus, sections of this document describing potential social and economic impacts of the proposed action have been supplemented and improved in response to this comment.
>
> We agree that recent studies have identified a beneficial spillover effect to sea turtles where U.S. production from the Hawaii-based shallow-set longline fishery displaces the fishing activities of foreign fleets that have higher turtle bycatch rates in the same general area (Chan and Pan 2012, Rausser et al. 2009). For example, Chan and Pan (2012) concluded that the expansion of the shallow-set fishery to 5500 annual sets, with its historical contribution to the U.S. market, is likely to cause a reduction in imports from foreign swordfish fisheries, thereby decreasing the sea turtle bycatch associated with U.S. consumption of swordfish. A key finding of Chan and Pan (2012) is that, based on historic swordfish production data to supply U.S markets, U.S. production offsets non-U.S. production of swordfish in the central and north Pacific by nearly one-for-one. We are not aware of current studies that apply these findings to the deep-set fishery, which primarily targets tuna. We further note that, unlike the shallow-set fishery that is subject to closure when sea turtle hard caps are exceeded, the FKWTRP would not close the deep-set fishery, but rather allows for its continued operation after the SEZ trigger is reached. Accordingly, NMFS believes that this action allows for the sustainable participation of the Hawaii-based deep-set fishery.

Comment 14: The Draft EA fails to evaluate the transferred effects on the environment resulting from deep-set fishery closures or by the exodus of vessels from the fishery due to imposition of new gear requirements, which would cause increased imports of target species.

> **Response**: Transferred effects are indirect effects due to regulation (such as the Action Alternatives) leading to market production or environmental changes in other areas not subject to the regulation. For example, transferred effects could include potential increases in fishing in other regions of the world and increased imports to Hawaii. It is expected that transferred effects from the Action Alternatives would be minimal as there are expected to be limited effects on overall Hawaii longline catch and product price. However, if catch were to be reduced such that imports increase, then transferred effects could result in areas with increased production, such as the Asia-Pacific region. If these fisheries have less stringent environmental regulations, then adverse transferred effects to sensitive resources could result. As any increase in seafood imports due to the Action Alternatives is expected to be low (with associated low transferred effects), and the source of such potential imports is not known, no environmental or market transferred effects are quantified in the analysis. However, a general discussion of potential transferred effects has been added to sections 4.4.5 in response to this comment.

Comment 15: The Draft does not address the likely increase in the U.S. trade deficit in fish products if a closure of the local fishery occurs.

Response: The FKWTRP would not close a local fishery, but rather includes regulatory and non-regulatory measures to manage the Hawaii-based longline fisheries to reduce false killer whale mortalities and serious injuries. The FKWTRP's measures include 1) the use of specific gear (gear that is currently in use by portions of the fishery), 2) creation and/or extension of longline exclusion zones, and 3) marine mammal handling and release training and education. Regarding the exclusion zones, the analysis indicates that a maximum of 12.2% of current fishing effort could be re-located due to the proposed exclusion zones. Approximately 1.5% of all annual longline sets from 2006-2010 are estimated to be within the seasonally open area (October-January) of the existing MHI Longline Fishing Prohibited Area, while approximately 11% of all annual longline sets from 2006-2010 are estimated to be within the Southern Exclusion Zone. Closure of the Southern Exclusion Zone would only be triggered in some years, though the length of the closure (e.g., number of months) in any given year cannot be predicted. Analysis findings do not indicate that the FKWTRP would result in significant reductions in average annual longline catch. In the event that catch does decline as a result of the FKWTRP (due to increased travel time and associated reduced fishing effort, or as a potential indirect effect through increased operating costs), any associated increase in seafood imports would have an insignificant effect on the overall US trade deficit. No further agency action is warranted in response to this comment.

Impacts on Small Businesses and Small Vessels

Comment 16: The Draft EA fails to evaluate the actual costs of the Proposed Rule on fishermen, vessel owners, and small business owners. NMFS must provide a more detailed analysis of these and related economic impacts (in an EIS), particularly on small vessels within the Hawaii longline fleet. Economic data regarding the longline fleet are available and can and should be used by the agency.

Response: The Draft EA/RIR/IRFA evaluates the estimated costs of the FKWTRP on fishermen, vessel owners, and small businesses based on a reasonable range of foreseeable responses to the Proposed Rule, including increased vessel travel time and fuel, costs (related to the exclusion zones), gear costs (related to hook and line requirements), and time costs (related to training requirements). To prepare the analysis, economic data on the longline fleet regarding effort, catch weight, trip location, revenues, and fishing gear currently in use were gathered from NMFS's Hawaii Longline logbook data, the NMFS Pacific Islands Observer Program, existing economic studies of the longline fleet, local fishing equipment suppliers, and longline fishermen. Total economic effects on the fleet are uncertain, including effects on profitability of the fleet and potential effects on entry/exit of vessels due to the FKWTRP. In response to the comment, additional information has been added to Sections 4.3.2.1 and 6.7 of the EA/RIR/FRFA describing the profitability of the deep-set tuna fleet, including differential profitability by vessel size, as of 2000 (O'Malley and Pooley 2003). While this information provides more context for potential profitability impacts on the fleet, the effects on profitability by vessel size category is unknown as data by specific vessel were not available for this analysis.

In summary, sections of this document describing potential social and economic impacts of the proposed action have been supplemented and improved in response to this comment.

Comment 17: The analysis does not consider varying level of impacts by vessel class, and therefore underestimates the potential impacts to the longline fishery.

Response: NMFS's permit program for the Hawaii longline fishery does not distinguish "classes" in the fishery. We are interpreting this comment to mean vessel *size* classes, and are responding to this comment in terms of the size classes identified for purposes of the EA/RIR/FRFA (see Table 3.14).

The economic analysis estimates the total potential impacts to all vessels in the Hawaii longline fishery, and estimates the average costs on a per vessel basis to identify the magnitude of potential costs to individual boat owners/fishermen. As assessed in sections 6.6 and 6.7, nearly all vessels are expected to be small businesses, so nearly all costs in Table 6.2 would affect small businesses. Also, as discussed in section 4.3.2.1, economic costs to the longline fishery may not be distributed evenly across all vessels and communities in the fishery due to differences in current gear used, location of fishing trips, overall effort, and catch characteristics. Logbook data on these variables are not available by vessel size class, so the analysis cannot distinguish the proportion of costs borne by each vessel size class. Recognizing that effects may vary by vessel size class, additional language has been added to the Final EA/RIR/RFRA in Section 4.3.2.1 describing available information on profitability by vessel size class. Section 6.7 has also been supplemented with data describing the profitability of the longline fleet, including differential profitability by vessel size, as of 2000 (O'Malley and Pooley 2003). This data highlights that net revenue differs by vessel size across the fleet, and that small vessels may be particularly vulnerable to an increase in operating costs due to already thin profit margins.

In summary, sections of this document describing potential social and economic impacts of the proposed action have been supplemented and improved in response to this comment.

Comment 18: The Draft EA summarily (and incorrectly) concludes that "impact analyses performed for the Draft EA suggest that there will likely not be significant cost impacts relative to annual revenues." The Draft EA fails to analyze the effects of those economic costs presented in table 6.2 on the affected small businesses, including an explanation of what this would mean to the boat owners and fishermen. The quantified costs per vessel are very significant, and probably exceed the annual profit generated by a number of the boats. The additional costs associated with gear replacement and increased travel distance may therefore be detrimental to this element of the fleet, but such impacts are not sufficiently captured in the EA.

Response: The Draft EA and Final EA have attempted to address potential welfare effects on the Hawaii longline fishing community through quantification of costs that could be experienced by the longline fleet. The costs quantified in the Final EA are estimated to range from $700 to $31,700 per vessel. Cost estimates in the Final EA differ from the cost estimates in the Draft EA due to changes in the measures within the Preferred Alternative as well as minor adjustments related to using new data that has become available since the Draft EA was completed. As presented in the Final EA, the total annualized costs of the Preferred Alternative are estimated to range from $112,200 to $4.1 million, which is 0.15% to 5.7% of $73.2 million in average annual revenues in the longline fishery. Additional discussion has been provided in Sections 4.3.2.1 and 6.7 regarding the range of profitability of longline fishing vessels, and that some vessel owners may be vulnerable to small increases in operating costs as some may already operate with thin profit margins. Thus, sections of this document describing potential social and economic impacts of the proposed action have been supplemented and improved in response to this comment.

Comment 19: The cost impact numbers set forth in the Draft EA show there will be significant impacts to certain classes of permit holders. NEPA requires NMFS in such instances to perform a much more rigorous and detailed environmental justice analysis. Aside from failing to meet NEPA requirements, the cursory "environmental justice analysis" provided in the Draft EA also does not provide detail sufficient to allow for meaningful public comment.

Response: Executive Order 12898 and CEQ guidance instruct agencies to determine whether a proposed action is likely to have disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Indian tribes. Where such effects are identified as a result of the proposed action or any alternative, agencies should analyze how environmental and health effects are distributed within the affected community. The analysis

presented in the Draft EA does not provide a basis for concluding that the proposed action to implement a FKWTRP to protect false killer whale populations will result in disproportionately high and adverse human health or environmental effects on any population or group. To the contrary, this regulatory action is being undertaken to conserve the environment, and is expected to result in net positive benefits to the environment. Although the EA identifies differential cost impacts across the Hawaii longline fleet, this fact alone does not provide a sufficient basis to trigger further analysis under EO 12898. No further agency action is warranted in response to this comment.

Cumulative Effects

Comment 20: The Draft EA does not evaluate how the anticipated effects of Amendment 18 relate to, or are cumulative with, the effects caused by the Proposed Rule.

Response: The anticipated effects of Amendment 18 to the Pelagics FMP on the longline fisheries were analyzed in the documents that supported that action (e.g., WPRFMC and NMFS 2009c). The longline fisheries as they currently operate under the FMP (now FEP), as amended, are considered in the environmental baseline. The management measures contained within the amendment are also analyzed as part of the past and present actions affecting various resources. Amendment 18's measures apply to the shallow-set fishery that primarily targets swordfish. The primary effect of Amendment 18's measures was to remove regulatory restrictions that were inhibiting the achievement of optimum yield in the swordfish fishery, as required under National Standard 1 of the MSA. Amendment 18's measures included removal of the annual set limit, elimination of the set certificate program, and implementation of a loggerhead sea turtle hard cap of 46 annual interactions. However, the hard cap for loggerheads was subsequently vacated and remanded to the agency as a result of litigation. Following completion of a new biological opinion in January 2012, new interaction limits of 34 North Pacific loggerheads and 26 leatherbacks were implemented by rulemaking. Although the expected effect of Amendment 18 is to allow shallow-set fishing to return to higher pre-2000 levels, NMFS does not believe that this action, when considered together with Amendment 18 and other fishery management measures, will have cumulatively significant effects. The shallow-set fishery historically causes low false killer whale M&SI, and is identified as a Category II fishery in the LOF primarily because of the deep-set fishery's impact on false killer whale stocks (i.e., the shallow-set and deep-set fishery together have M&SI exceeding the Hawaii Pelagic false killer whale stock's PBR level, but M&SI in the shallow-set longline fishery alone, averaged across 2006-2010, is 2.2% of the stock's PBR level). Moreover, the FKWTRP's circle hook requirement for the deep-set fishery, like the existing circle hook requirement for the shallow-set fishery, is expected to have a positive effect on other protected species, including sea turtles. No further agency action is warranted in response to this comment.

Comment 21: The Draft EA does not analyze how fishery closures associated with bigeye tuna catch limits under the WCPFCIA relate to, and are cumulative with, the effects of the Proposed Rule, particularly with respect to changes in patterns of fishing effort, cumulative decreases in fishing effort, associated economic impacts, and transferred effects resulting from increases in imports from foreign fisheries.

Response: Existing fishery management requirements for the tuna longline fishery, including bigeye tuna catch limits and management measures for implementing the catch limit, are considered part of the environmental baseline and are part of the past and present management actions affecting the resources in the affected environment and the Hawaii-based deep-set longline fishery. The description of the environmental baseline in section 3.3.3.2.2 has been updated to reflect the most current information on bigeye tuna catch limits and management measures in the WCPFC Area.

In 2009 and 2010, the U.S. bigeye tuna catch limit was reached and prohibitions affecting the Hawaii-based deep-set longline fishery were put into effect. In 2009, the prohibitions implementing the bigeye tuna catch limit were put into place only days before the end of the year, but in 2010, the closure lasted forty days. Social and economic impacts of 2010 closure were investigated by Richmond et al. (2012). Examining the expectations of the Hawaii fishing community in advance of the closure, Richmond et al. (2012) found that the biggest fear among fishermen, buyers, and retailers was that the closure would lead to a dramatic decline in the supply and a compensatory increase in price of local bigeye tuna. The study found that the impacts of the closure on the supply of locally caught bigeye tuna were not as great as anticipated by many in the fishing community. Vessels in the Hawaii-based longline deep-set fishery to which the prohibitions did not apply (i.e., vessels longlining for bigeye tuna in the Eastern Pacific Ocean (EPO) and vessels with American Samoa Longline Limited Access Permits) increased their bigeye tuna production after the closure. Those vessels, along with vessels in the Hawaii troll and handline fisheries, provided a continuing supply of local bigeye tuna to the Hawaii market during the closure. The production of bigeye tuna, in numbers of fish, of the Hawaii longline fleet (including EPO-caught fish) during December 2010 was 23% less than the average production during the five previous Decembers. The average weight of the fish was 11% less than the average weight from the previous five Decembers (possibly linked to differing biological conditions in the EPO). Smaller bigeye tuna tend to be of lower value than larger fish, but the average price of longline-caught bigeye tuna during December 2010 was found to be 33% greater in December 2010 than the average from the previous five Decembers. Richmond et al. (2012) also found that most tuna buyers reported the average quality of tuna entering the auction to have declined significantly over the course of the closure, presumably due to the longer hold times involved in trips to the EPO. The study found indications that during the closure there was an increase in the amount of lower quality bigeye tuna (and lower prices for those grades) and a decrease in availability of high- and medium-grade bigeye tuna (and higher prices for those grades). Information gathered in the study suggested that impacts to consumers in Hawaii might have been greater (i.e., prices might have been greater) if it were not for the severe snowstorms on the U.S. east coast about the same time, which hindered shipments to the U.S. east coast, leaving a greater supply in the Hawaii market.

Reaching the U.S. bigeye tuna catch limit is less likely in 2012 because of the enactment of the section 113 of the Consolidated and Further Continuing Appropriations Act (CFCAA), 2012. Certain provisions of section 113 are only effective until December 31, 2012, and it is unclear whether it will be continued in future years. However, the WPFMC has taken action to approve an amendment to the Pelagics FEP that would effectively continue the provisions of section 113, and provide American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands the authority to use, assign, allocate, and manage catch limits of highly migratory fish stocks, or fishing effort limits, established by the WCPFC through arrangements with U.S. vessels permitted under the Pelagics FEP.

A discussion of the effects of reaching the bigeye tuna catch limit has been added to the cumulative effects section (sections 4.4.2.4 and 4.4.5.2) and the RIR (section 5.7.1). Given that the prohibitions after reaching the catch limit would be in place for only a few months in 2012, if at all, based on the provisions of Section 113 of the CFCAA, and that it is likely that provisions similar to Section 113 of the CFCAA would be in place in 2013 and beyond, should the WCPFC adopt similar catch limits for bigeye tuna, it is unlikely that the effects of implementation of these bigeye tuna catch limits, when considered together with the effects of the False Killer Whale Take Reduction Plan, would lead to significant cumulative impacts.

In summary, sections of this document describing the bigeye tuna catch limits and associated impacts have been supplemented and improved in response to this comment. Regarding potential transferred effects, please see the response to comments 14 and 15 above.

Other

Comment 22: The Draft EA does not address food safety and security issues [related to potential increases in imported fish].

> **Response:** The effect of the FKWTRP on food safety and security is expected to be insignificant, as the proposed alternatives are not expected to impact overall longline catch. However, in the event that catch does decline as a result of the FKWTRP (as a potential indirect effect through increased operating costs), any associated increase in imported seafood is expected to have minimal effects on food safety and security. As approximately two thirds of seafood consumed in Hawaii is currently imported, the potential increase resulting from any reduced local catch would represent a small percent change in total imports. No further agency action is warranted in response to this comment.

Comment 23: The "Data Quality Act (section 515)" section certifies that this document, which admits that major portions of the analysis are unquantifiable, and is very one sided in presenting benefits as opposed to costs, has been determined to be objective. This determination was made by the same agency that prepared the document. Is this a joke?

> **Response**: NMFS completed a pre-dissemination review of the proposed rule, Draft EA/RIR/IRFA to ensure the information meets NOAA's standards for quality, objectivity, utility, and integrity. The documents and the analyses contained within are based on the best available data and information, and were reviewed by technically qualified staff within NMFS and NOAA for scientific and factual accuracy, as well as consistency with published standards pertinent to NEPA and MMPA regulations. No further agency action is warranted in response to this comment.

APPENDIX B

Draft Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis for the Proposed False Killer Whale Take Reduction Plan

July 2011

United States
Department of
Commerce

National Oceanic
and Atmospheric
Administration

National Marine
Fisheries Service

July 2011

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

For the Proposed
False Killer Whale Take Reduction Plan

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Draft Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis for the Proposed False Killer Whale Take Reduction Plan

July 2011

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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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APPENDIX I A-1

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

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

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).

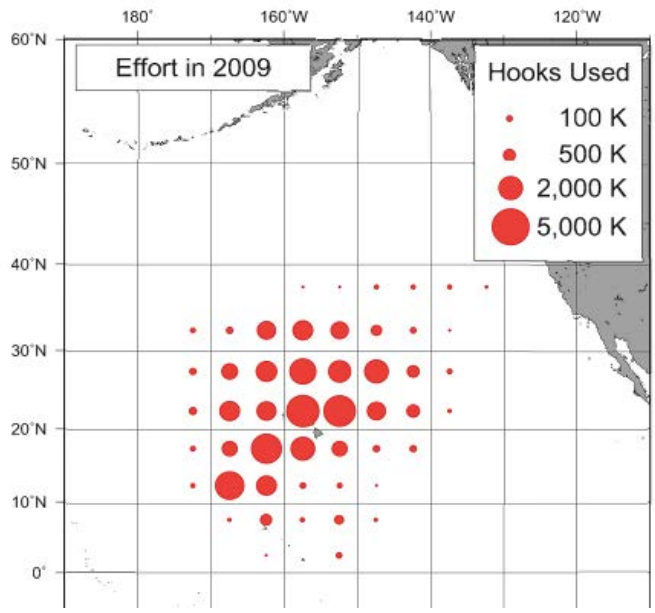

Figure 2.1. Spatial distribution of reported logbook fishing effort by the U.S. longline fleet, in thousands (K) of hooks, in 2009. Effort in some areas is not shown in order to preserve data confidentiality (NMFS 2010c).

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) <u>Defining the trigger</u>.

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) Observed M&SI below the trigger.

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) Observed mortality or serious injury that meets the trigger.

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 4th 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) Observed mortality or serious injury in the next consecutive year(s).

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.

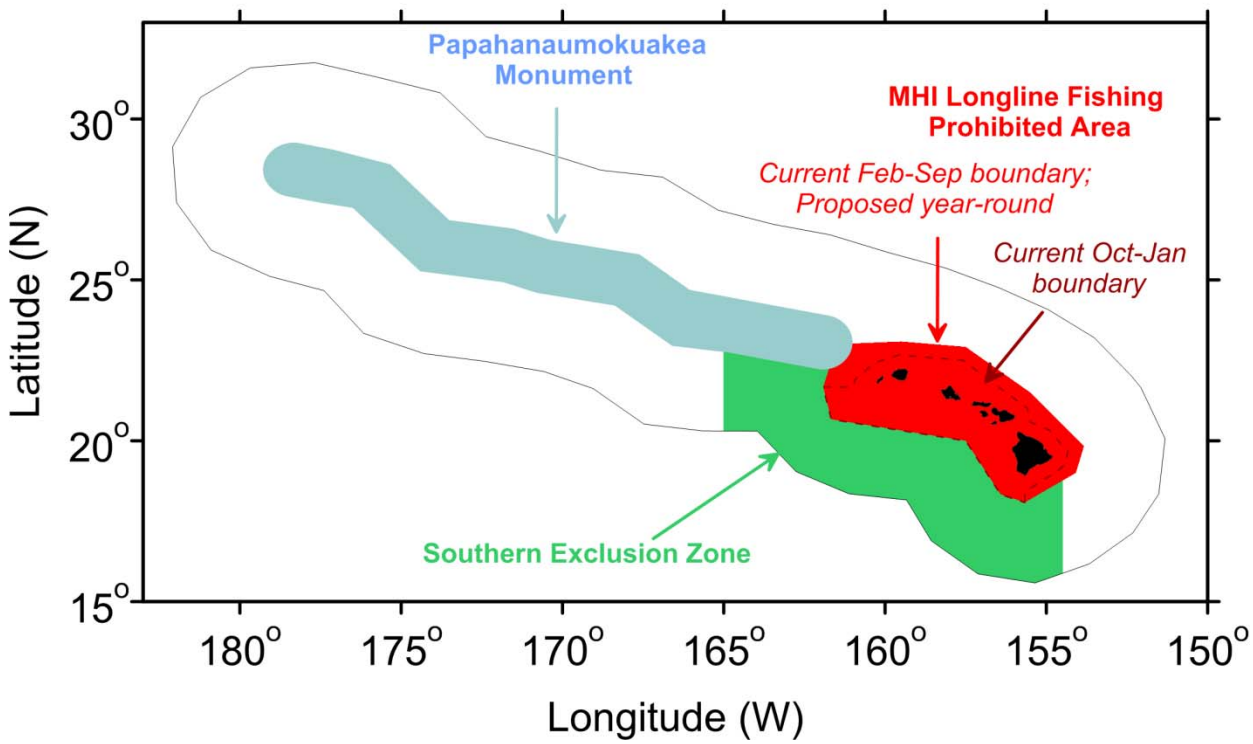

Figure 2.2. Proposed MHI Longline Fishing Prohibited Area and Southern Exclusion Zone, shown with boundaries of existing longline prohibited area and Papahanaumokuakea Marine National Monument.

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) - Use of oceanographic buoys (NMFS, naval, other) to foster location and avoidance of FKW - Real-time fleet communication, possibly including VMS, to foster avoidance of whales - Use of hydrophones from longlines to identify presence of and/or depredation by FKW - Annual haul-out to reduce vessel noise profile (change rudder, cutlass bearing, etc.) - Degaussing of steel boats (demagnetize) - Direct current through vessel hull to eliminate electric profile - Diminish hydraulic profile (pumps, hoses, reel, steering) to background levels - Decoy buoys - Spotters (air or vessel-based) - Line changes (e.g., color, coating, diameter, snaps) - 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 - Streamers deployed alongside hook to change acoustic target profile of bait/catch - Different leaders to change acoustic target profile - Use of nails/metal tabs in bait tail to change acoustic target profile - Revised rules to allow fishermen to retain gills/guts on board - Bait/discard/offal retention, or offal processed on-board into an on-vessel commodity - Limits on line length and/or soak time - Noise deterrents - Taste deterrents

Strategies to minimize serious injuries and mortalities	- Use of barbless hooks - 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 **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 **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 **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 **Deepwater shrimp**: The outer reef slopes at depths between 300-700 m	**Lobsters**: Water column down to 150 meters **Deepwater shrimp**: Water column and associated outer reef slopes between 550 and 700 m	**Lobsters**: All banks with summits less than 30 meters **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.

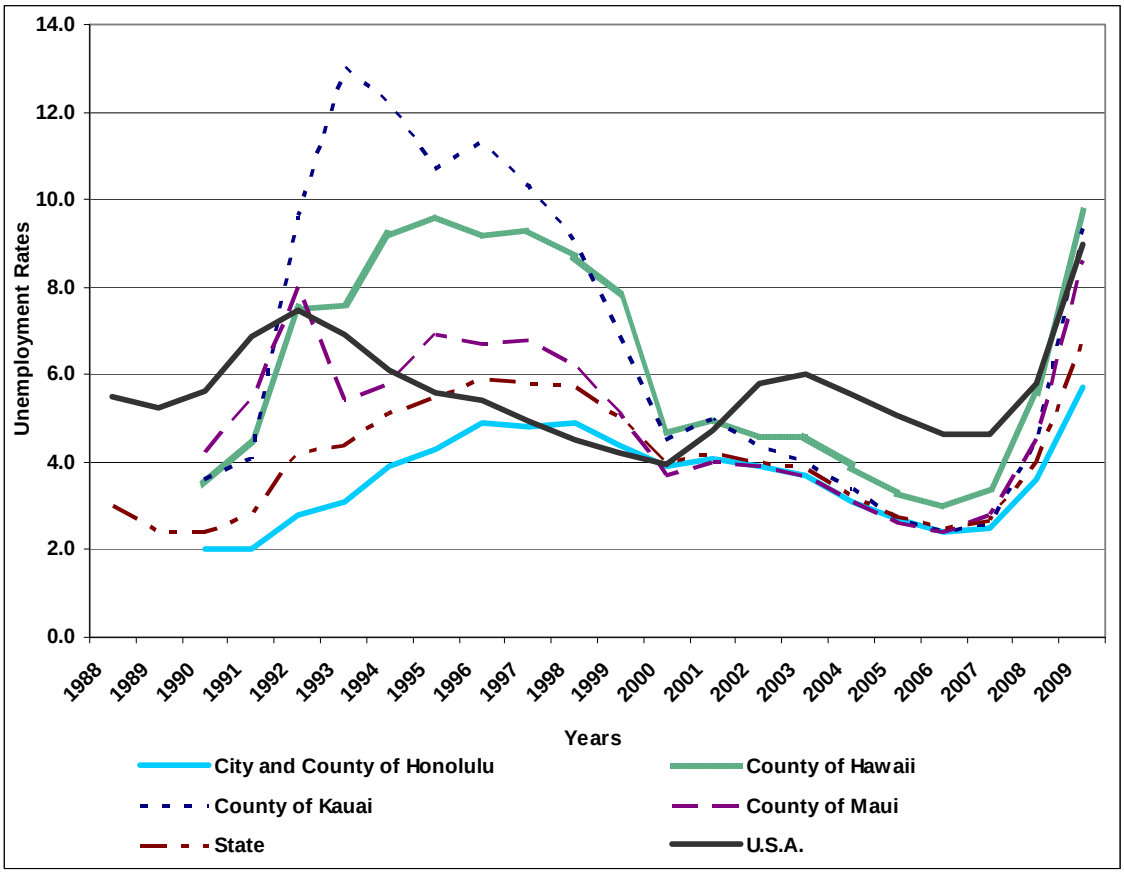

Figure 3.1. Historic Unemployment Rates in the Counties in Hawaii, the State of Hawaii, and the United States.

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 Auʻau, 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 Auʻau 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.

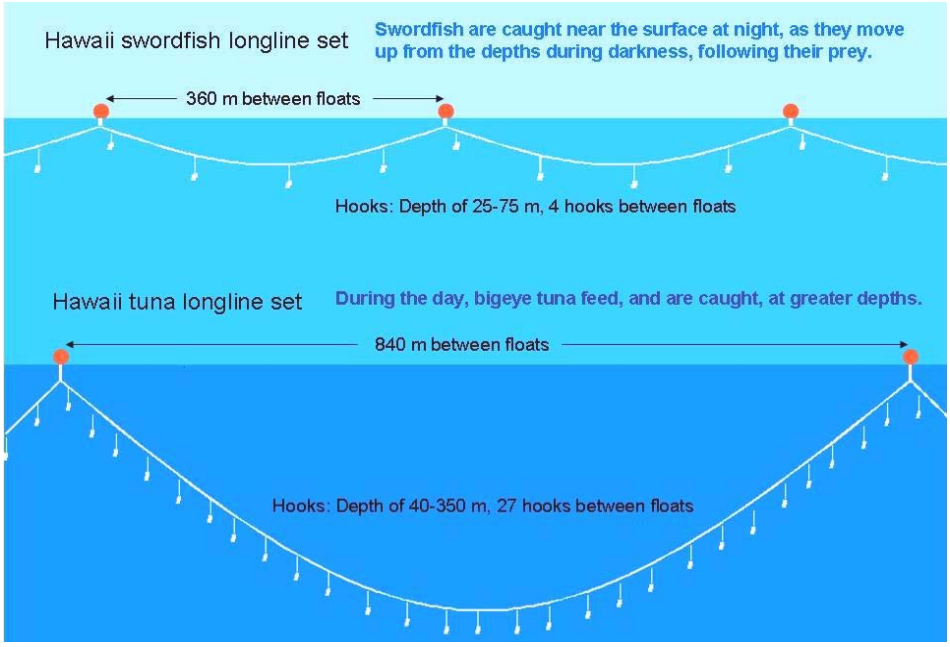

Figure 3.2. Configuration of shallow-set (swordfish target) and deep-set (tuna target) longline gear (NMFS 2009).

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

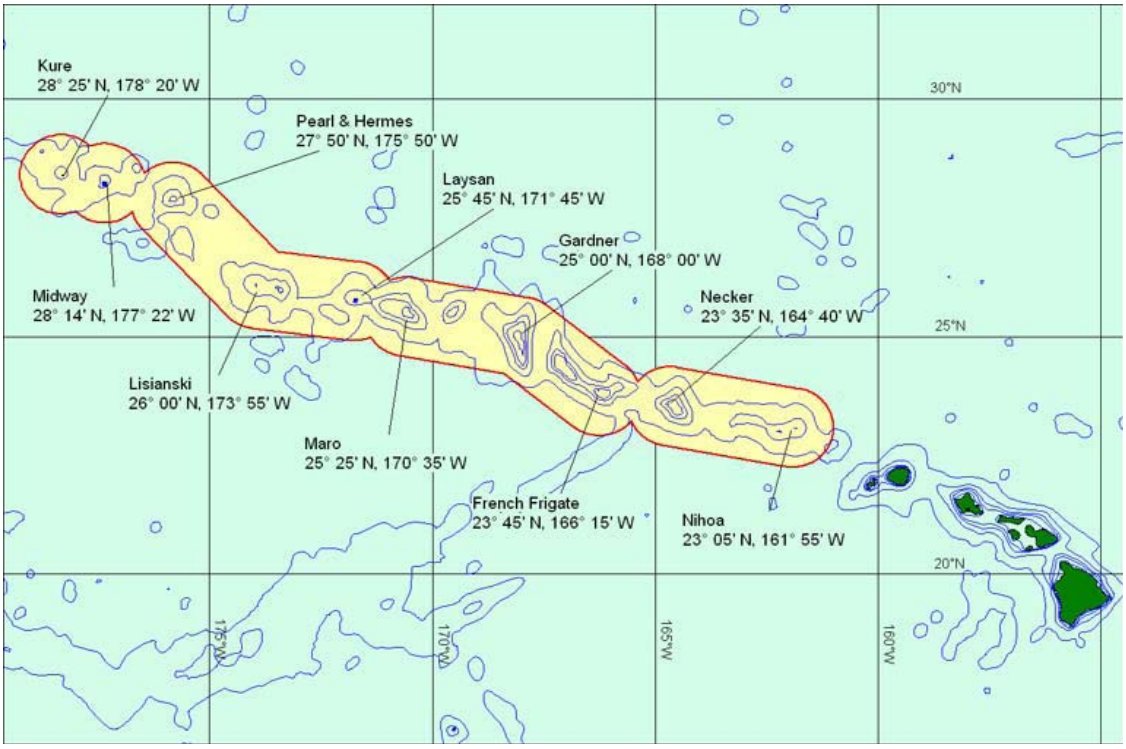

Figure 3.3. Boundary of Northwest Hawaiian Islands Longline Protected Species Zone.

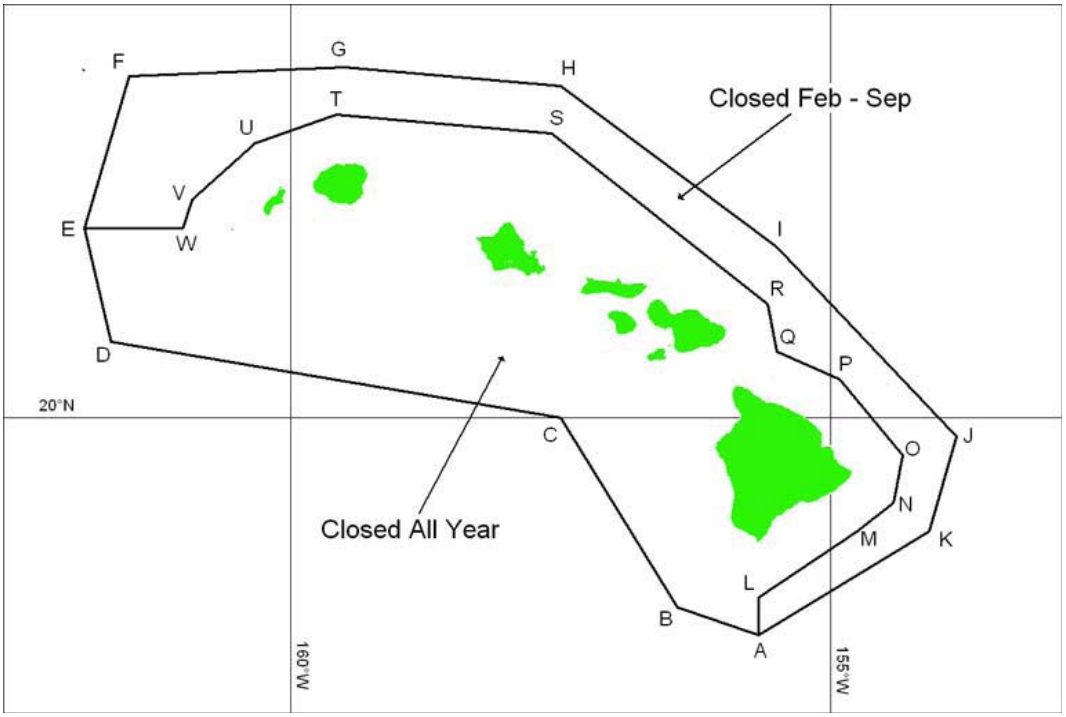

Figure 3.4. Boundary of MHI Longline Fishing Prohibited Area.

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.

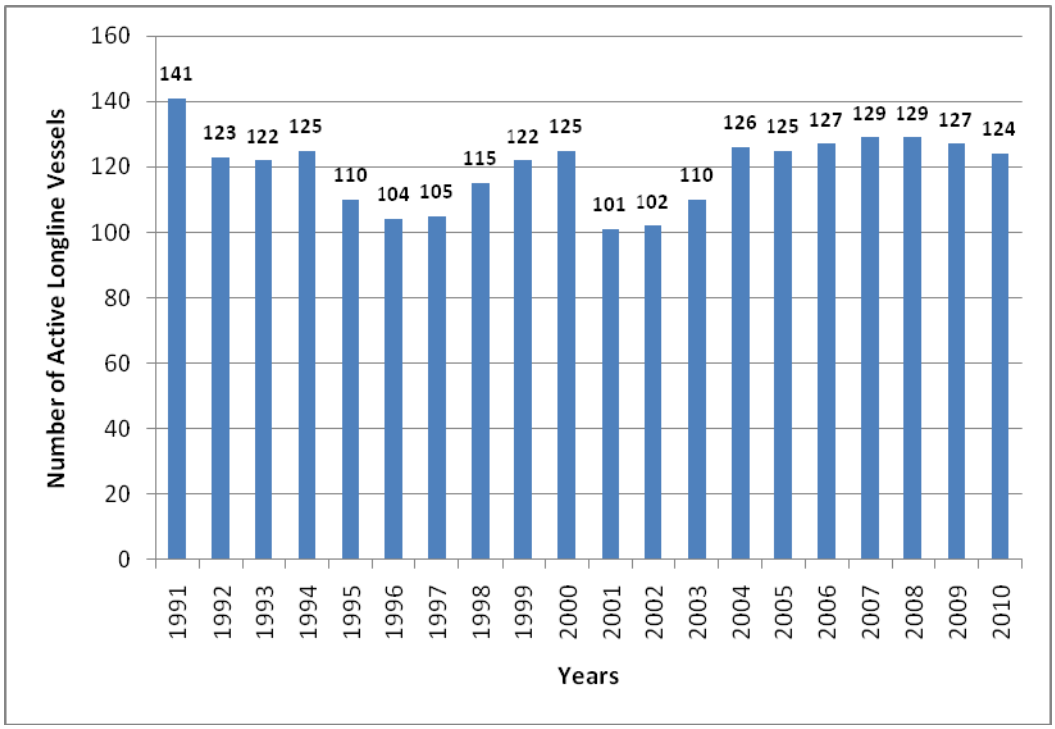

Figure 3.5. Number of Active Longline Vessels Based and Landing in Hawai'i by Year, 1991-2010 (NMFS 2001-2010 Longline Logbook Data)

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.

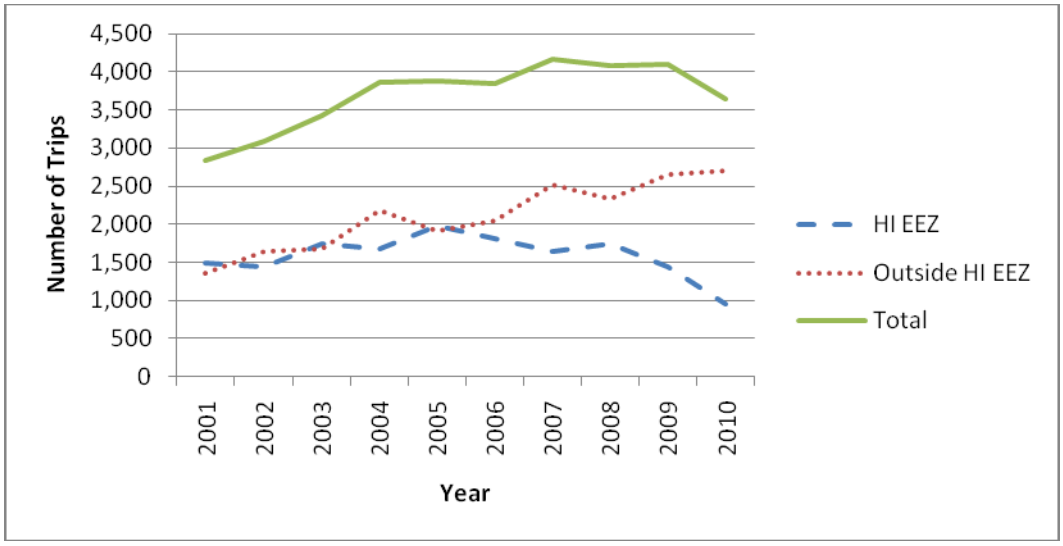

Figure 3.6(a). Number of Trips by Hawai'i-based Deep-set Longline Fishery by Year and Fishing Area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to the aggregated nature of the Logbook Data provided by NMFS for this analysis in order to preserve confidentiality, some data points might be missing).

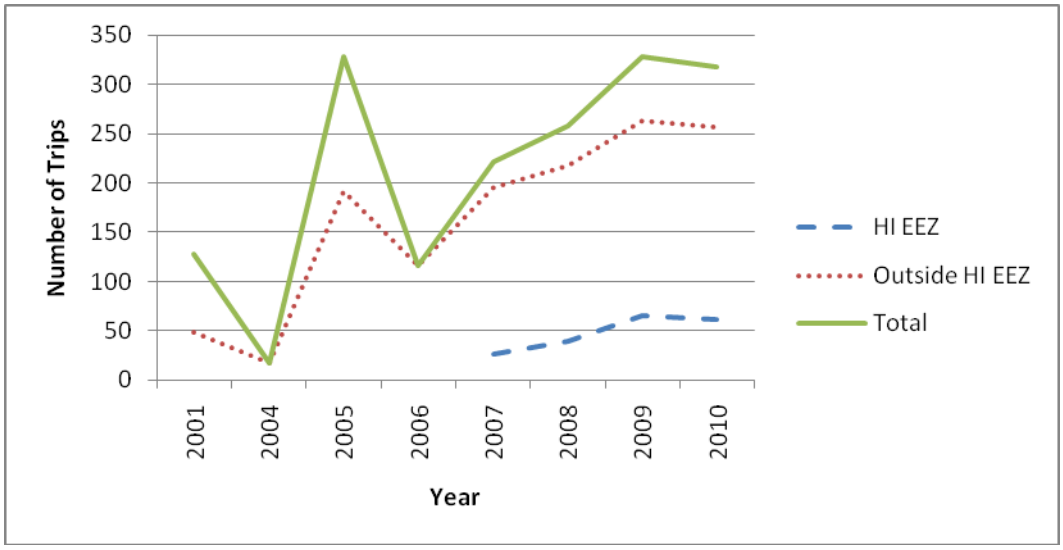

Figure 3.6(b). Number of Trips by Hawai'i-based Shallow-set Longline Fishery by Year and Fishing Area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to the aggregated nature of the Logbook Data provided by NMFS for this analysis in order to preserve confidentiality, some data points might be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

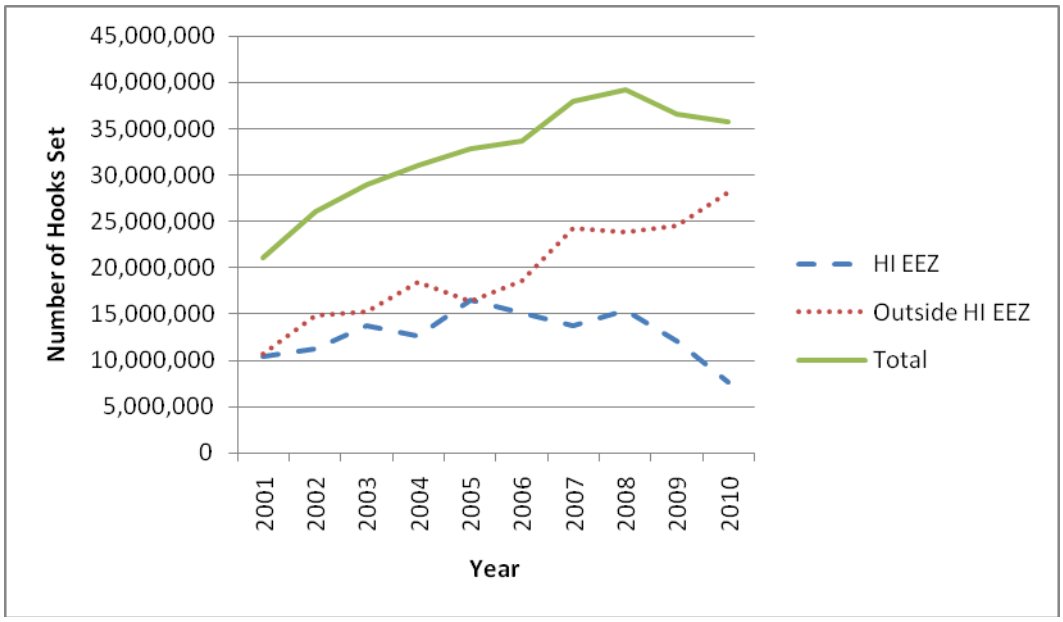

Figure 3.7(a). Number of Hooks Set by Hawai'i-based Deep-set Longline fishery by Year and Fishing Area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to the aggregated nature of the Logbook Data provided by NMFS for this analysis in order to preserve confidentiality, some data points might be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

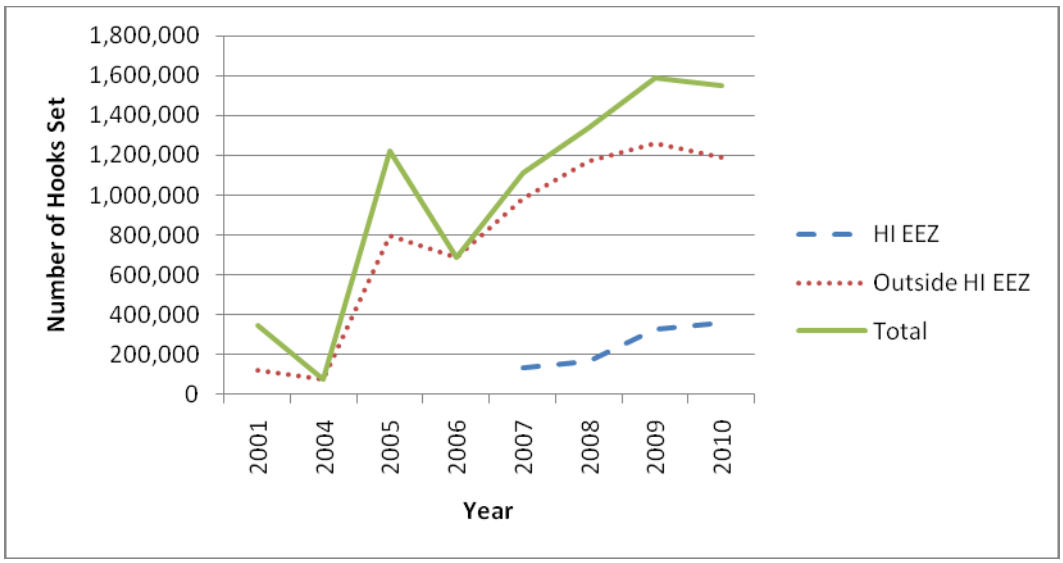

Figure 3.7(b). Number of Hooks Set by Hawai'i-based Shallow-set Longline fishery by Year and Fishing Area, 2001-2010 (NMFS 2001-2010 Longline Logbook Data – due to the aggregated nature of the Logbook Data provided by NMFS for this analysis in order to preserve confidentiality, some data points might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

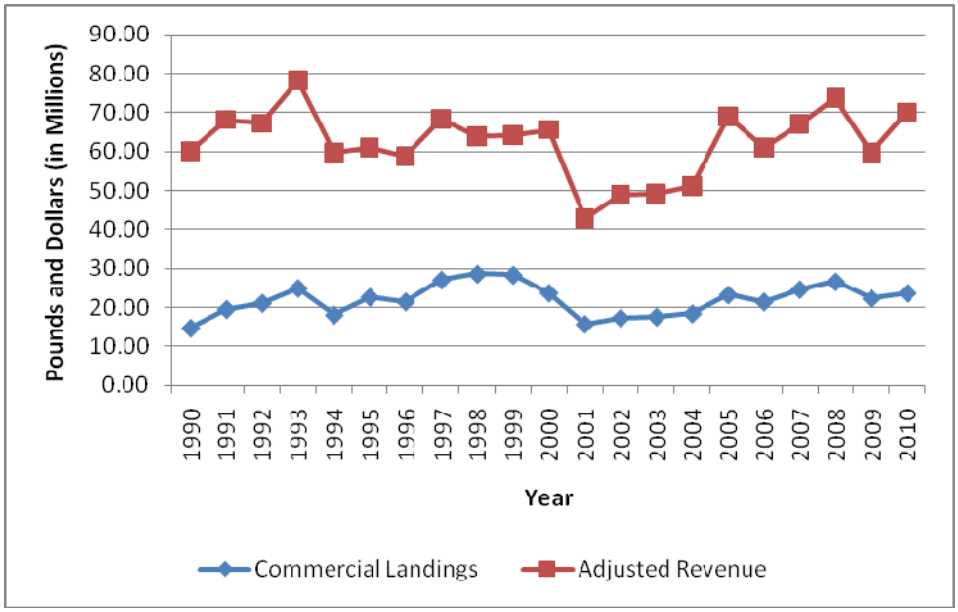

Figure 3.8. Commercial Landings (in Millions of Pounds) and Revenues (in Millions of Dollars) for Hawaii-based Longline Fisheries, 1990-2010 (WPacFIN 2010).

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).

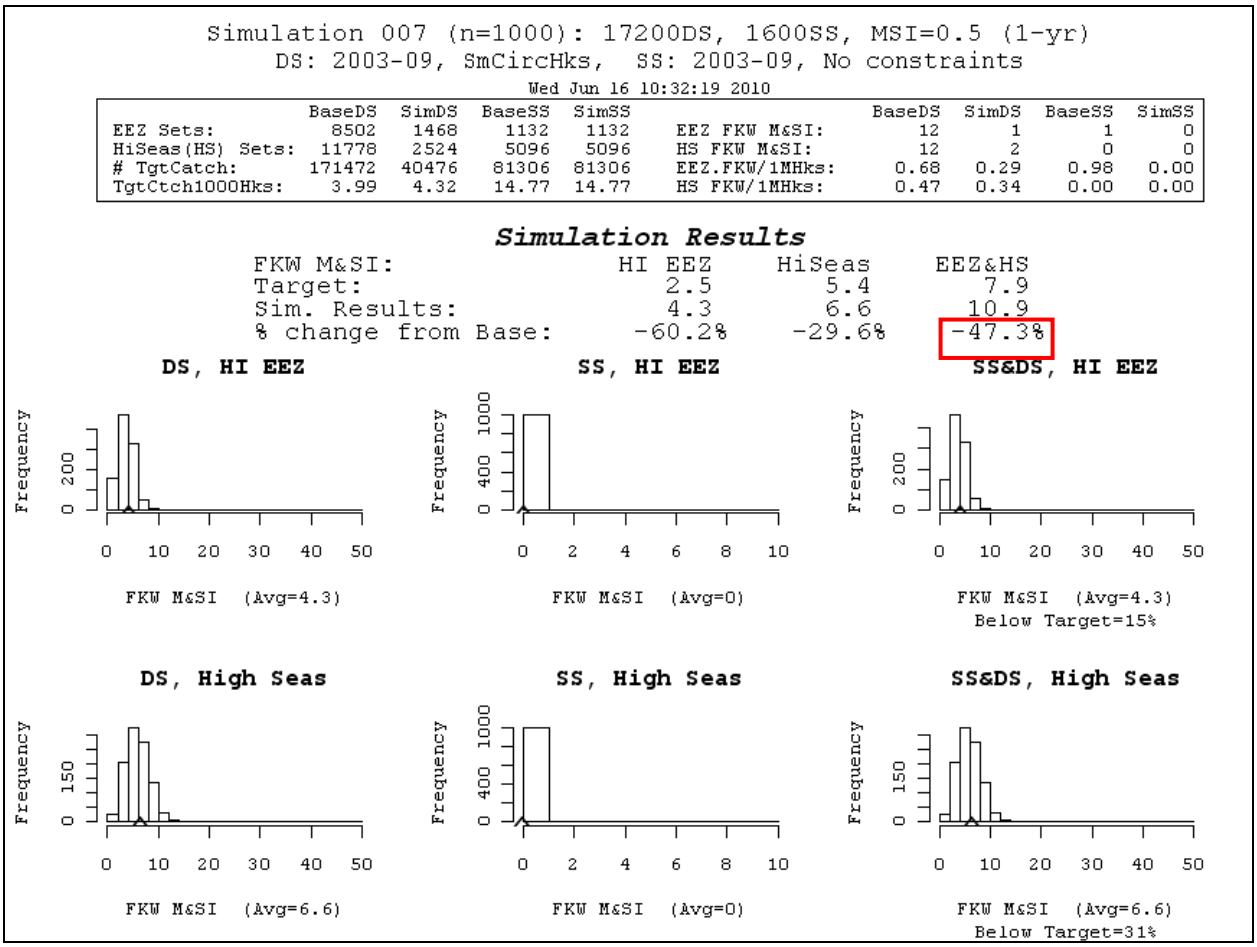

Figure 4.1. Sample simulation output for 17,200 deep sets per year, 1,600 shallow sets per year, a reduced M&SI rate of 50%, and the mandatory use of small circle hooks in the deep-set longline fishery. In this case, the simulation forecasts that M&SI of false killer whales would decrease by about 47.3%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

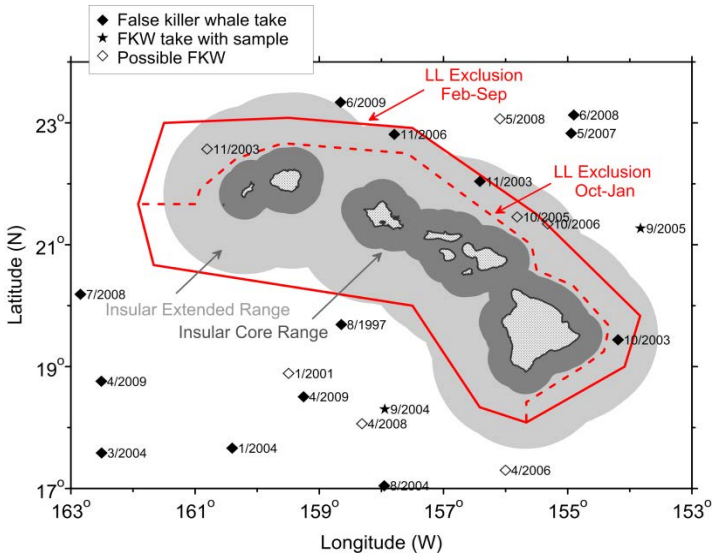

Figure 4.2. Core and extended ranges of the Hawaii insular stock of false killer whales, overlaid with the existing longline exclusion zone around the MHI. The proposed year-round MHI Longline Fishing Prohibited Area would eliminate the seasonal change in the boundary of the exclusion zone, and would 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).

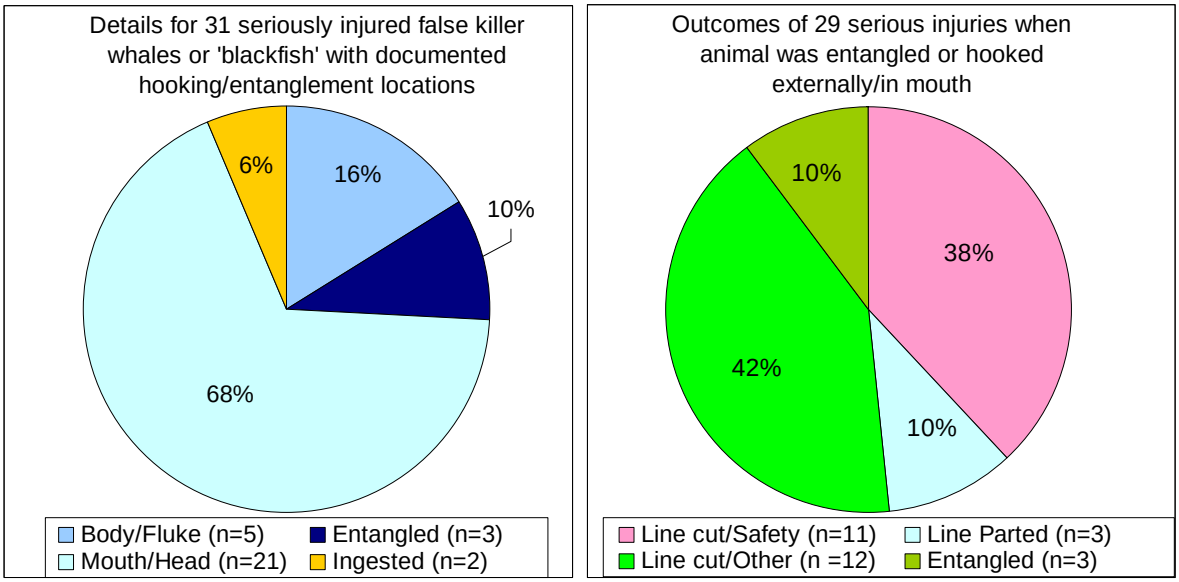

Figure 4.3. Information on seriously injured false killer whales reported by the observer program 1994-2009. Only interactions with sufficient detail to characterize where and how animals were hooked or entangled are show. Left panel shows nature of entanglement/hooking. Right panel shows outcome of 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 - MMPA section 118 incidental take authorization - Fisheries observer programs (domestic and international) - Protected Species Workshops for Hawaii-based longline owners and operators - 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 ***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. • 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) ***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: - Potential reductions in interactions and/or injury severity from use of weak circle hooks, minimum line diameter, and closed areas; - Increased precision of bycatch estimates better inform management and facilitate adapative management; and - 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. • 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. • 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. • Potential reductions in revenue and income of fishing gear suppliers due to some gear inventory being unsellable to the Hawaii-based longline fisheries. • 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. • Some positive effect on non-longline commercial fisheries or recreational/subsistence fisheries if target fish population abundance rises.

Alternative 3 ***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. • Potential negative effects due to: - Transfer effects if U.S. fishing effort decreases and less-protective nations increase their effort to fill the market void - 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 - Potential shift in effort to non-longline hook-and-line fisheries may cause increase in (unobserved) bycatch of protected species • 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. • 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. • 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.

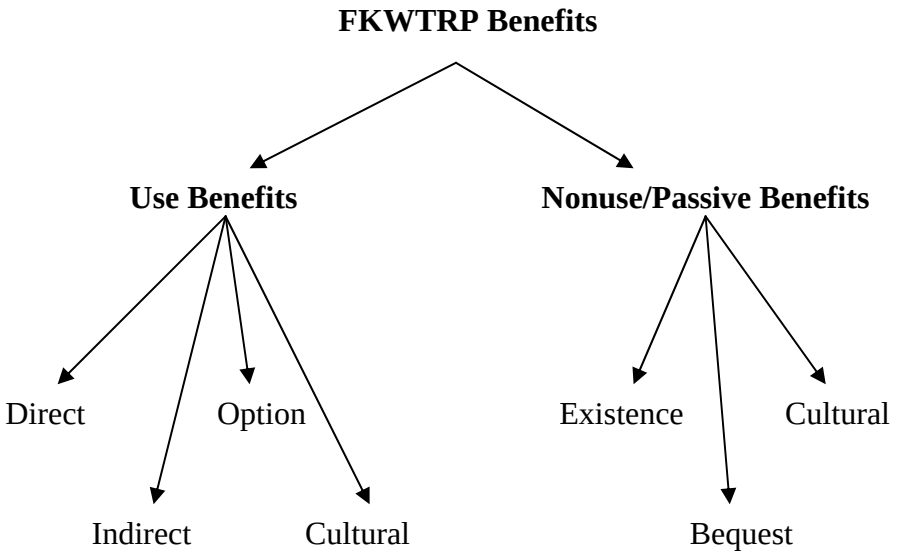

Figure 5.2. Benefits of FKWTRP

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.

<u>One-time Hook Replacement Cost</u>

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.

Ongoing Hook Replacement Costs

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.

Catch Reduction Costs

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

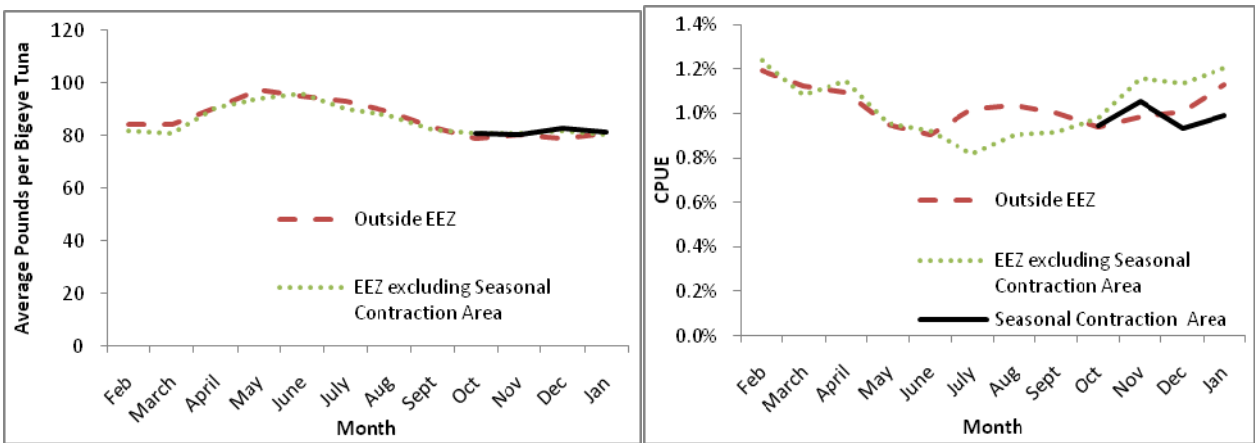

Figure 5.3. Comparison of Average Size of Bigeye Tuna Kept and average CPUE by Zone by Month, 2006 to 2010. Whereas the average weight per bigeye tuna caught co-varies throughout the fishery on a monthly basis, noticeable regional differences in CPUE are evident. Between October and December, during 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%

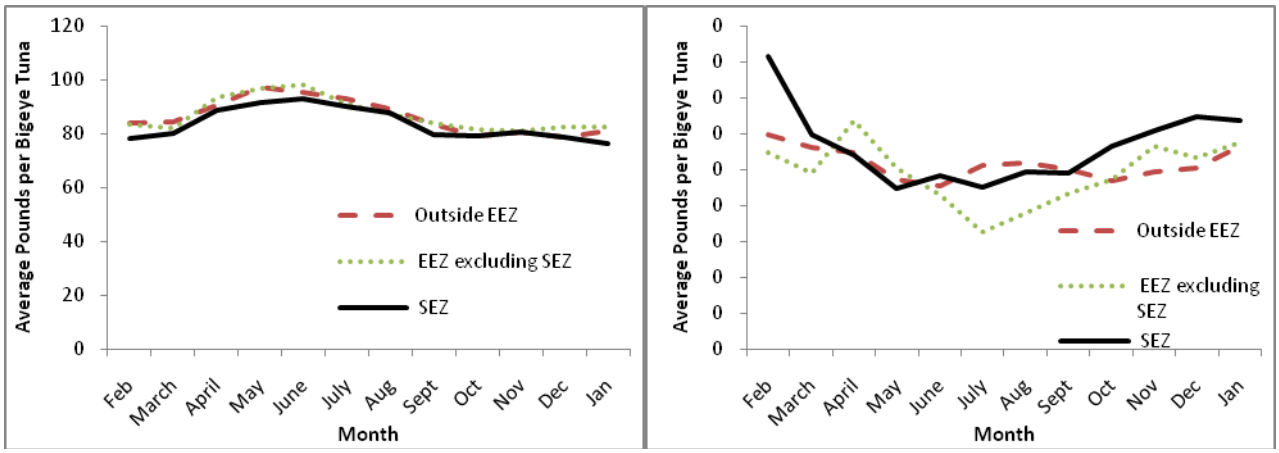

Figure 5.4. Comparison of Average Size of Bigeye Tuna Kept and average CPUE by Zone by Month, 2006 to 2010. Whereas the average weight per bigeye tuna caught co-varies throughout the fishery on a monthly basis, no distinct monthly trend is evident for CPUE between the SEZ, the rest of the EEZ, and areas 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.

Reduction in Fishing Effort

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

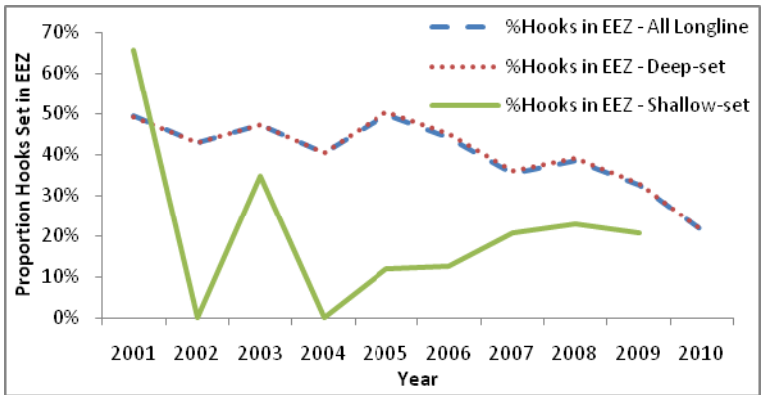

Figure 5.5. Proportion Hooks Set in EEZ by Shallow-Set and Deep-Set Longline Fisheries.

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%

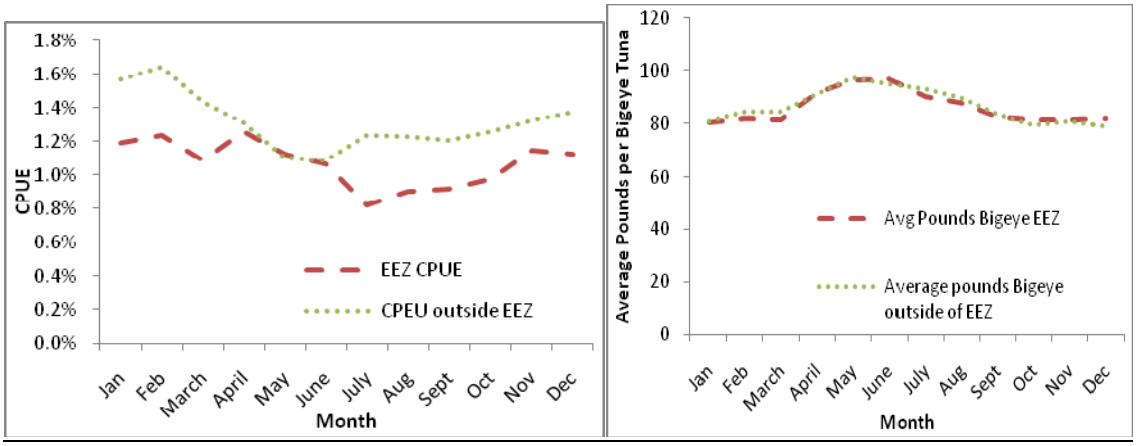

Figure 5.6. Catch per Unit Effort and average pounds per bigeye tuna caught inside the EEZ versus outside EEZ by Month, 2006-2010.

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		
PBR		2.5
Annual Observer Coverage		20%
Trigger		2
Year	**Takes**	**Extrapolated M&SI**
1	2	10
2	2	10
3	0	0
4	0	0
5	0	0
5-Year Average Take:		**4**

Scenario 1B		
PBR		10
Annual Observer Coverage		20%
Trigger		10
Year	**Takes**	**Extrapolated M&SI**
1	10	50
2	10	50
3	0	0
4	0	0
5	0	0
5-Year Average Take:		**20**

Scenario 1C		
PBR		10
Annual Observer Coverage		20%
Trigger		10
Year	**Takes**	**Extrapolated M&SI**
1	8	40
2	8	40
3	8	40
4	8	40
5	8	40
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		
PBR		2.5
Annual Observer Coverage		20%
Trigger		2
Year	**Takes**	**Extrapolated M&SI**
1	2	10
2	1	5
3	0	0
4	0	0
5	0	0
5-Year Average Take:		**3**

Scenario 2B		
PBR		10
Annual Observer Coverage		20%
Trigger		10
Year	**Takes**	**Extrapolated M&SI**
1	10	50
2	0	0
3	0	0
4	1	5
5	0	0
5-Year Average Take:		**11**

Scenario 2C		
PBR		2.5
Annual Observer Coverage		20%
Trigger		2
Year	**Takes**	**Extrapolated M&SI**
1	1	5
2	1	5
3	2	10
4	1	5
5	0	0
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)

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

PBR	2.5
Annual Observer Coverage	20%
Initial Trigger	2

Year	Takes	Extrapolated M&SI
1	2	10
2	1	5
3	0	0
4	0	0
5	0	0
5-Year Average Take:		**3**

Scenario 3B

PBR	10
Annual Observer Coverage	20%
Initial Trigger	5

Year	Takes	Extrapolated M&SI
1	5	25
2	2	10
3	1	5
4	1	5
5	1	5
5-Year Average Take:		**10**

Scenario 3C

PBR	10
Annual Observer Coverage	20%
Initial Trigger	5

Year	Takes	Extrapolated M&SI
1	5 + 2 in EEZ after SEZ closed	35
2	1	5
3	1	5
4	1	5
5	1 + 3 in EEZ after SEZ closed	20
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		
PBR		2.5
Annual Observer Coverage		20%
Trigger		1
Year	**Takes**	**Extrapolated M&SI**
1	1	5
2	1	5
3	1	5
4	1	5
5	1	5
5-Year Average Take:		**5**

Scenario 4B		
PBR		10
Annual Observer Coverage		20%
Trigger		2
Year	**Takes**	**Extrapolated M&SI**
1	2	10
2	2	10
3	2	10
4	2	10
5	2	10
5-Year Average Take:		**10**

Scenario 4C		
PBR		9
Annual Observer Coverage		20%
Trigger		1
Year	**Takes**	**Extrapolated M&SI**
1	1	5
2	1	5
3	1	5
4	1	5
5	1	5
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.