Amendment 5
to the
Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region

Measures to Reduce Interactions between the American Samoa Longline Fishery and Green Sea Turtles

Including an Environmental Assessment and Regulatory Impact Review

May 12, 2011

Western Pacific Regional Fishery Management Council
1164 Bishop St., Suite 1400
Honolulu, Hawaii 96813

Photo of longline vessels at port in Pago Pago, American Samoa
Courtesy of Western Pacific Fishery Management Council

Amendment 5
to the
Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region

Measures to Reduce Interactions between the American Samoa Longline Fishery and Green Sea Turtles

Including an Environmental Assessment and Regulatory Impact Review

Responsible Agency

Michael D. Tosatto
Regional Administrator
Pacific Islands Regional Office
National Marine Fisheries Service
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814
(808) 944-2200

Responsible Council

Kitty M. Simonds
Executive Director
Western Pacific Fishery
Management Council
1164 Bishop St., Suite 1400
Honolulu, HI 96813
(808) 522-8220

1.0 Abstract

Pelagic longline fishing in the U.S. EEZ around American Samoa is primarily conducted to target albacore tuna for canning in the local Pago Pago cannery. The fishery is managed under the Fishery Ecosystem Plan for Pelagic Fisheries in the Western Pacific Region (Pelagics FEP) that was developed by the Western Pacific Fishery Management Council (Council), approved by the Secretary of Commerce, and implemented by the National Marine Fisheries Service (NMFS) in 2009. The fishery is managed as a limited access fishery, with provisions for permits, logbooks, and observers, among others to reduce the number and severity of interactions with protected species. The American Samoa longline fishery has been observed to interact (hook or entangle) with green sea turtles (*Chelonia mydas*) which are listed as threatened under the Endangered Species Act (ESA). To address this issue, the Council has developed an amendment to the Pelagics FEP to provide for the long-term viability and sustainability of the economically important longline fishery, while at the same time providing for the long-term survival, recovery, and sustainability of sea turtles by reducing the number of sea turtle interactions with the American Samoa longline fishery.

To reduce interactions between the longline fishery and green sea turtles, the Council considered a range of alternatives that would modify gear used in the fishery. The preferred alternative requires that fishermen on vessels longer than 40 feet and with Class B, C, and D permits, set hooks to fish at least 100 meters deep by increasing the length of line between floats and the suspended horizontal mainline to 30 meters, increasing the distance between floats and adjacent branch lines with hooks to 70 meters, and providing that there be no less than 15 branch lines with hooks between all floats. The possession or landing of more than 10 swordfish would also

be prohibited to ensure that shallower longline fishing does not occur on a deep-set fishing trip. In addition to the no action alternative, other alternatives considered include the use of larger hooks with larger bait, and a combination of larger hooks and bait and deeper set depths.

The environmental assessment (EA) found that all of the alternatives would reduce interactions with sea turtles. The proposed gear modifications are not expected to change the conduct of the fishery in terms of the number of participants, area fished, and fish targeted. For this reason, none of the alternatives would likely result in adverse impacts on target and non-target species. Alternatives that require deeper fishing and/or larger hooks and bait are expected to result in a reduction in catch of surface-dwelling fish that are incidentally caught in the fishery, such as mahimahi and wahoo. Alternatives 2 and 4 may result in a small number of swordfish being discarded if the trip limit were reached. The trip limits would be an indirect means of preventing longline fishermen from deploying shallow sets and targeting swordfish. No large changes or impacts to seabirds, marine mammals, essential fish habitat, habitat areas of particular concern, marine protected areas, fishing communities, or safety at sea are likely.

This FEP amendment and EA are being made available to the public together with the proposed rule. Prior opportunities for public comment have also occurred at several council meetings, public meetings, and meetings of the council's advisory groups described in Section 5.0 of this document. NMFS is seeking public comments on the proposed rule that would implement the proposed action. Instructions on how to comment on the proposed rule as well instructions on how to obtain a copy of the EA can be found by searching on Regulatory Identifier Number 0648-AY27 at www.regulations.gov; or by contacting the Council or Agency official at the above addresses.

Finally, at its 148th meeting the Council recommended NMFS' Pacific Islands Regional Office (PIRO) conduct the necessary administrative action to revise the common and scientific species names of four pelagic management unit species (PMUS) in the regulations implementing the Pelagics FEP. These changes are summarized in Section 5 of this amendment document.

1.1 Document Overview and Preparers

This is a combined FEP Amendment and Environmental Assessment. The contents of this document comply with Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requirements for fishery management plan amendments, and with National Environmental Policy Act (NEPA) requirements. The document informs interested and affected parties about the Council's recommended fishery management measures, and serves as the basis for a determination by NMFS on whether or not to prepare an environmental impact statement. The document also informs NMFS in its development of regulations that would implement the selected action, if approved by the Secretary of Commerce.

Primary authors were Western Pacific Fishery Management Council staff:

Paul Dalzell, Chief Scientist
Kelly Finn, Fishery Analyst

Primary reviewers and contributors were NMFS PIRO Sustainable Fisheries Division staff:

Adam Bailey, Fishery Policy Analyst
Ethan Brown, NEPA Specialist
Phyllis Ha, NEPA Specialist
Brett Wiedoff, Fishery Policy Analyst

List of Acronyms/Abbreviations

ASG	American Samoa Government
CMM	Conservation and Management Measure
CNMI	Commonwealth of Northern Mariana Islands
CPUE	Catch per Unit of Effort
Council	Western Pacific Regional Fishery Management Council
DMWR	American Samoa's Department of Marine and Wildlife Resources
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EPO	Eastern Pacific Ocean
ESA	Endangered Species Act
F	Fishing Mortality
FAD	Fish Aggregating Device
FEP	Fishery Ecosystem Plan
FMP	Fishery Management Plan
FR	Federal Register
HAPC	Habitat Areas of Particular Concern
HBF	hooks between floats
IATTC	Inter-American Tropical Tuna Commission
ITS	Incidental Take Statement
lb	pound(s)
MMPA	Marine Mammal Protection Act
MSY	Maximum Sustainable Yield
mt	metric tons(s)
MUS	Management Unit Species
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Islands Regional Office
PMUS	Pelagic Management Unit Species
RFMO	Regional Fishery Management Organization
RFP	request for proposals
SSC	Scientific and Statistical Committee
SPC	Secretariat of the Pacific Community
TDR	temperature-depth recorder or time-depth recorder
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VMS	vessel monitoring system
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean
WPRFMC	Western Pacific Regional Fishery Management Council

2.0 Table of Contents

2.1 List of Figures

2.2 List of Tables

3.0 Background Information

U.S. pelagic longline fisheries in the western Pacific incidentally catch small numbers of sea turtles, all species of which are listed under the Endangered Species Act. The Endangered Species Act permits a limited take[1] of sea turtles through a Biological Opinion (BiOp) which is prepared by NMFS. The BiOp which includes the American Samoa pelagic longline fishery was published in 2004 and at the time there was very little data or information on the expected level of sea turtle interactions in the American Samoa longline fishery. The 2004 BiOp incidental take statement for the annual number of turtle interactions for the American Samoa longline fishery longline fishery, was six hard-shell turtles with one mortality; and take of one leatherback turtle with zero mortalities. The level of turtle interactions occurring solely in the American Samoa pelagic longline fishery since 2006 exceeded the incidental take statement in the 2004 BiOp and, therefore, NMFS Pacific Islands Region Office (PIRO) requested that the Council develop the proposed action to reduce interactions in this fishery. These measures are described and analyzed in this document. NMFS completed a BiOp for the American Samoa fishery in September 2010 (NMFS 2010c), which analyzes the Council's preferred alternative intended to reduce the potential for further interactions between longlines and sea turtles in the American Samoa fishery.

The American Samoa Observer Program began observing this fishery in April 2006. During the period from April 2006 through 2009, observer coverage rates averaged approximately 7.2 percent and during this time period observers reported eight sea turtle interactions, all juvenile green sea turtles and all resulting in mortalities, during longline operations in this fishery (Figure 1). In 2010, observer coverage began ramping up with the goal of reaching 40 percent coverage. Observer coverage in 2010 was 25.0 percent, with 41 percent coverage in the fourth quarter. There were six interactions with green sea turtles in 2010; five resulted in mortality and one was release injured, but alive.

The sea turtle interaction rate for all species in the American Samoa longline fishery from 2006-2010 ranged from 0.001-0.004 turtles per 1,000 hooks, with a mean of 0.002 turtles per 1,000 hooks. The Hawaii deep-set longline fishery, which fishes at the same and greater depths than the American Samoa fishery had turtle interaction rates for all species over the same period ranging from 0.0004-0.002 turtles per 1,000 hooks, with a mean of 0.001 turtles per 1,000 hooks or half the American Samoa average. The reasons for this difference in interaction rates are unknown but this is not critical in order to recommend the proposed management measures. Possible reasons for the difference include differing sea turtle populations and their densities in the tropical South Pacific Ocean versus the sub-tropical North Pacific Ocean, differing hook densities in areas where the two fisheries occur, or differences in the gear deployment. Although the reasons for the disparity in the rate of interactions are unknown, the fishery will now be conducted in accordance with the provisions of the 2010 BiOp and research will continue to provide insight into reducing interactions in both fisheries. Further, although the rate may be doubled, the overall rate is still quite low, compared to other regional, foreign fisheries (Bartram and Kaneko 2004).

[1] The Endangered Species Act permits a limited take of sea turtles through a Biological Opinion (BiOp) which is prepared by NMFS. The term ''take'' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

The U.S. longline fleet based out of Pago Pago targets albacore tuna (*Thunnus alalunga*) to supply the cannery in American Samoa. More than 10.5 million pounds of pelagic fish were landed by American Samoa vessels during 2009. Tunas accounted for more than 10 million pounds or approximately 96 percent of the total landings with the target stock, albacore, comprising more than 8.6 million lb (WPRFMC unpublished 2009 Pelagics Annual Report module). The majority of American Samoa's pelagic catch is caught by the large vessel longline fishery and marketed to the tuna cannery. Nearly 15 million hooks were set by American Samoa-based longline vessels during 2009, down from a high of 17.5 million set in 2007 (WPRFMC 2009b, Figure 5). There is some uncertainty about the long term continuity of the Pago Pago-based albacore tuna cannery business (TEC Inc. 2007), especially since the San Diego-based Chicken of the Sea International tuna cannery closed in September 2009. This facility has since been acquired in October 2010 by Tri-Marine, a company that supplies tuna and tuna relates services to leading tuna packers.

The American Samoa longline fishery is currently conducted in accordance with provisions in the Pelagics FEP and codified in the Code of Federal Regulations at 50 CFR Part 665. Current regulations in the American Samoa longline fishery include a prohibition on U.S. vessels 50 ft in length or longer overall from fishing for pelagic management unit species (PMUS) seaward of three nautical miles (nm) to approximately 50 nm around the islands of American Samoa, effective March 1, 2002. In 2005, a limited entry system was implemented with NMFS issuing a total of 60 longline limited access permits to qualified candidates with 22 permits issued in Class A (≤40 ft length), five in Class B (40.1-50 ft), 12 in Class C (50.1-70 ft), and 21 in Class D (>70 ft) (70 FR 29646, May 24, 2005).

Under the limited entry program, all vessel operators must submit Federal longline logbooks, class C and D vessels must carry VMS units and, if requested by NMFS, Class B, C, and D vessels must carry observers. Logbooks allow NMFS to monitor some catch, discard, effort, and protected species interactions. In addition, a regulatory amendment implemented in December 2005 requires owners and operators of vessels registered for use under longline general permits to annually attend NMFS's protected species workshops, carry and use dip nets, line clippers, and bolt cutters, and follow handling, resuscitation, and release requirements for incidentally hooked or entangled sea turtles (70 FR 69282, November 15, 2005).

Although there are existing regulations intended to reduce the severity of incidental sea turtle interactions, the Council recommended additional measures be implemented in the American Samoa longline fishery to further minimize the number of interactions with green sea turtles. Therefore, this amendment considers enhanced management of the albacore tuna fishery in order to ensure the long-term viability of the fishery, and the survival and recovery of green sea turtles by reducing the number of sea turtle interactions in the American Samoa longline fishery.

3.1 Magnuson-Stevens Fishery Conservation and Management Act

Enacted in 1976, and subsequently reauthorized in 1996 and 2006, the Magnuson-Stevens Act is the principal Federal statute regarding the management of U.S. marine fisheries. The purposes of the Magnuson-Stevens Act include the following: the conservation and management of the fishery resources of the United States; the protection of essential fish habitat (EFH); the establishment of regional fishery management councils; the preparation and implementation of fishery management plans (FMPs); the promotion of domestic, commercial, and recreational fishing; the support and encouragement of international fishery agreements; and the development of fisheries that are underutilized or not utilized.

The Magnuson-Stevens Act established both required and discretionary provisions of an FMP and created 10 National Standards to ensure that any FMP or FMP amendment is consistent with the Magnuson-Stevens Act. Each FMP and its amendments contain a suite of management measures that together characterize a fishery management regime.

The Magnuson-Stevens Act created eight regional fishery management councils to provide advice and recommendations to the Secretary of Commerce through the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), and National Marine Fisheries Service (NMFS). The fishery management councils are responsible for the preparation and transmittal to the Secretary of appropriate, science-based FMPs (and amendments to those plans) for fisheries under their jurisdiction. The Secretary may approve, disapprove, or partially approve each FMP or amendment and, if approved, implement them through Federal regulations which are enforced by the U.S. Coast Guard (USCG) and NMFS Office of Law Enforcement (OLE). NMFS OLE also provides funding to local government agencies through cooperative/joint enforcement agreements to enforce federal fisheries regulations.

3.1.1 Western Pacific Regional Fishery Management Council

Under the Magnuson-Stevens Act, the Western Pacific Regional Fishery Management Council has management responsibility for U.S. fisheries in the Pacific Ocean seaward of American Samoa, Commonwealth of Northern Mariana Islands (CNMI), Guam, Hawaii, and the Pacific Remote Island Areas (16 U.S.C. § 1852(a)(H)). The Council has 13 voting members, eight of whom are appointed by the Secretary, and five of whom are the principal Federal, and State, Territory or Commonwealth officials with fishery management responsibility. The Council also retains three non-voting members that include: U.S. Department of State, U.S. Fish and Wildlife Service, and U.S. Coast Guard. The Council’s office is located in Honolulu, Hawaii.

Domestic fisheries that operate within the U.S Exclusive Economic Zone (EEZ) waters and high seas in the western Pacific region are currently managed under five FEPs (which replaced the FMPs) including: the American Samoa Archipelago, Hawaii Islands Archipelago, Mariana Islands Archipelago, Pacific Remote Islands Area, and the Pacific Pelagic Fisheries.

4.0 Purpose and Need

The purpose of this proposed action is to reduce interactions between the American Samoa longline fishery and Pacific green sea turtles while enabling the American Samoa longline fishery to sustainably continue operations. The proposed action is needed to reduce the fishery’s adverse impacts on Pacific green sea turtles, an ESA-listed species, so as to allow for their long-term survival, recovery, and sustainability.

To meet the purpose and need, the Council developed and analyzed a suite of alternative management measures intended to reduce future sea turtle interactions in this fishery. The alternatives under consideration are described and their potential impacts analyzed in this amendment.

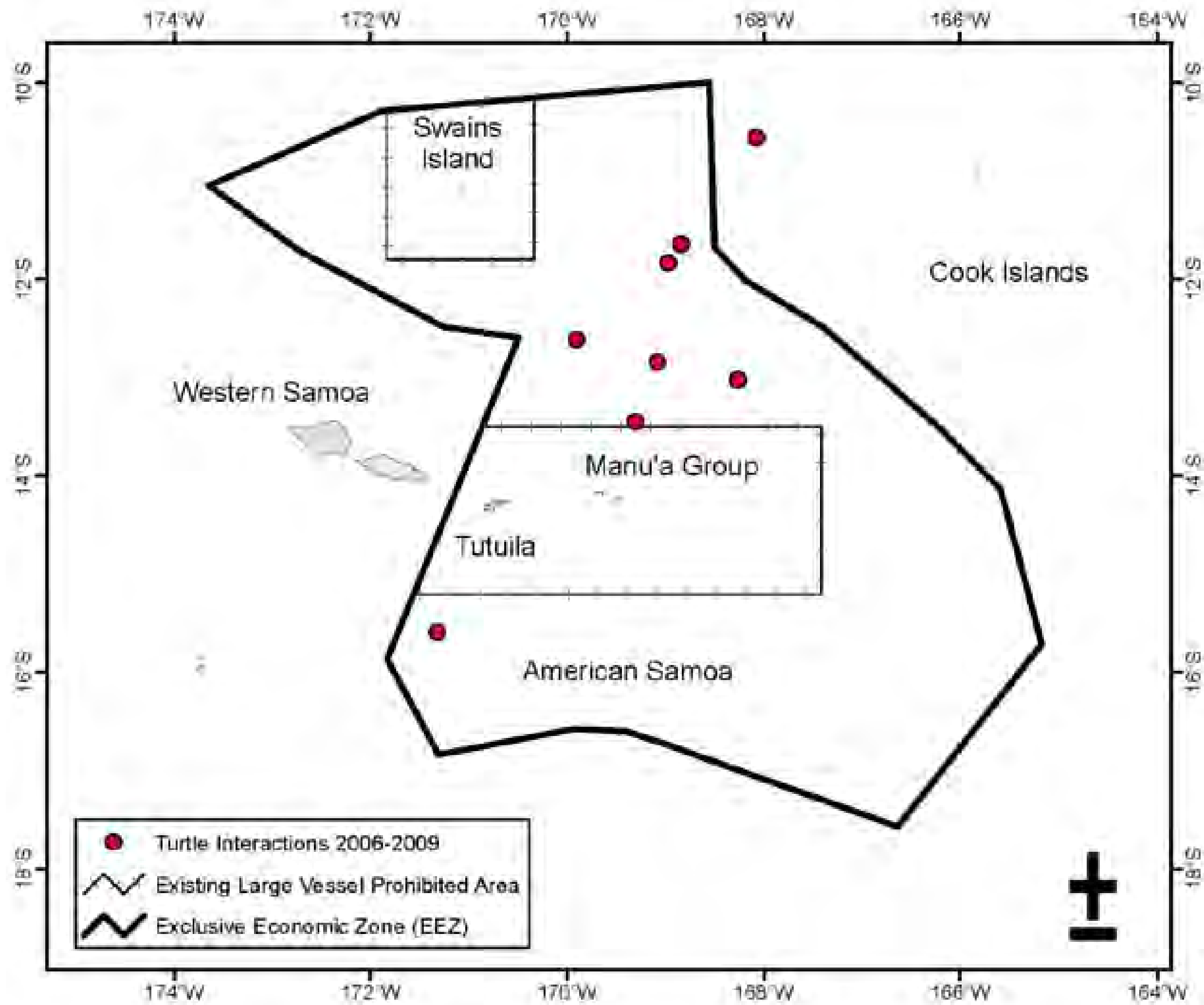

Figure 1: Approximate Locations of Observed Sea Turtle Interactions in the American Samoa Longline Fishery, 2006-2009.
Source: NMFS PIRO Observer Program.

5.0 Initial Actions

The Council has previously taken a series of management actions to avoid gear conflicts in waters close to island areas in the western Pacific region, to protect species or habitats, and to facilitate the continuation and emergence of small-scale localized fishing effort in the various island areas included in the Council's jurisdiction.

In 2002, Framework Measure 1 to the Pelagics FMP closed waters from 3-50 nm around American Samoa to pelagic fishing by large vessels greater than 50 ft in length (67 FR 4369;

January 30, 2002). This was done to prevent gear interactions and catch competition between small and large vessels and to maintain the potential for economically viable catches of pelagic fish in the small-scale fishery. Current regulations at 50 CFR 665.12 specify a large vessel as any vessel 50 ft or longer in overall length and includes most of the vessels participating in the Federal longline fishery.

Amendment 11, effective May 24, 2005 (70 FR 29646), implemented a limited entry program for the American Samoa-based longline fishery in order to constrain the potential expansion of the American Samoa-based longline fishery. Under the limited entry program, vessels can fish using longline gear, or land or transship fish caught using longline gear, inside EEZ waters around American Samoa, Guam, Northern Mariana Islands, and the Pacific remote island areas with a valid American Samoa longline permit. Longline vessels over 40 ft long are required to notify NMFS before each longline trip and carry an observer if requested by NMFS. In addition, longline fishing vessels over 50 ft long, fishing inside the EEZ around American Samoa, are required to carry a functioning vessel monitoring system (VMS). Furthermore, the large vessel prohibited areas regulation (50 CFR 665.817) prohibits vessels 50 ft or longer from fishing for pelagic fish in specific areas around Tutuila, Manua Islands, Rose Atoll, and Swains Island. There are 60 federal longline limited access permits available for issuance by NMFS. In 2007, approximately 23 small, alia-type vessels less than 50 ft in length and 26 vessels 50 ft and greater in length were permitted. In 2010, this mix of permitted vessels included 12 alia longliners (although only one of these actively fished in 2010), and 34 vessels 50 ft and longer, with about 25 of these large vessels actively fishing.

Sea turtle mitigation regulations became effective December 15, 2005 (November 15, 2005; 70 FR 69282). They require vessel owners and operators to complete a NMFS Protected Species Workshop every year and have a valid Protected Species Workshop certificate on board the vessel (50 CFR 665.814). They are also required to carry and use specific equipment for handling and releasing turtles and to follow specific procedures if a sea turtle is entangled or hooked (50 CFR 665.812). The fishery operates under a 2004 biological opinion issued by NMFS as described in Section 10.10.

Council Actions

At the 142nd Council meeting held in Honolulu, Hawaii, June 16-19, 2008, the Council reviewed available information about the American Samoa longline fishery and sea turtle interactions and took initial action by directing its staff to work with NMFS' Pacific Islands Regional Office (PIRO) and Pacific Islands Fishery Science Center (PIFSC) to develop and analyze for consideration by the Council at their next meeting, a range of alternatives for mitigating sea turtle interactions with the American Samoa longline fishery. The Council recommended the range of alternatives suggested by PIFSC to include the following requirements:

- hooks to be set at least 100 m deep;
- use of 45-g or heavier weights on branch lines within 1 meter from each hook;
- use of longer float lines;
- restricting hook deployment to an appropriate distance away from either side of floats;
- use of the largest practical whole fish bait with the hook point covered; and
- use of 16/0 or larger circle hooks with <10 degree offset.

The Council also directed its staff to hold public meetings with longline fishermen in American Samoa to discuss the issue and potential solutions. The Council requested NMFS immediately undertake cooperative research around American Samoa regarding potential measures to cost-effectively reduce longline-sea turtle interactions.

A public scoping meeting on sea turtle interactions with the American Samoa longline fishery was held on July 21, 2008, in Pago Pago, American Samoa, and participants were presented with information on the sea turtle interactions. Participating fishermen recommended that a trial program be implemented to test the feasibility of removing the first two or three hooks nearest to the float lines to reduce sea turtle interactions. Removing the first two or three hooks, it was reasoned, would cause the first hooks to be set below 100 meters (i.e., below the "turtle zone"; see Figure 2) where many sea turtle interactions occur (Beverly and Chapman 2007). Fishermen also recommended that a green sea turtle stock assessment be conducted[2] to ensure that a scientifically reliable incidental take statement is produced for the fishery. Also discussed were several sea turtles that had been found stranded and dead in American Samoa including five green sea turtles recently stranded in Pago Pago Harbor. Necropsies of the turtles by American Samoa's Department of Marine and Wildlife Resources (DMWR) staff found that the stranded turtles had ingested plastics (M. Sabater, DMWR, pers. comm.). Participants suggested in the meeting that much of this plastic waste is the result of people disposing of garbage into streams which empty into the harbor. Those at the meeting felt this information should be made known to the public that all mortality, including fishing mortality and pollution-caused mortality must be considered as baseline impacts to a species[3].

The goal of sea turtle bycatch reduction in the American Samoa fishery was discussed at the American Samoa Archipelago and the Pacific Pelagic Advisory Panel (AP) joint meeting held July 22, 2008, in Pago Pago, American Samoa. This meeting was attended by longline fishermen from the American Samoa fishery. The APs determined that requiring hooks to be set at 100 m or deeper is a viable option to minimize sea turtle interactions and that longline fishermen are willing to modify setting operations to keep hooks out of the upper 100 m "turtle zone".

At its 143rd meeting, held in October 2008, the Council recommended that research be done on the stock structure of green sea turtles in the Pacific Island area, particularly those that may interact with the American Samoa longline fishery. The Council sent a letter to NMFS PIRO regarding the Council's recommendation to obtain improved information about the status and stock structure of western and central Pacific Ocean (WCPO) green sea turtle populations. PIFSC

[2] NMFS recognizes the need to develop a scientifically sound basis for any incidental take statement. A stock assessment for green sea turtles in the entire Western and Central Pacific, including around American Samoa, is not possible. Most abundance estimates are based on nesting females, the data for which vary greatly in quality and continuity between locations, and is very limited for the Samoa Archipelago. Moreover, there is no way to accurately estimate the population size, population age structure, and demographic rates (mortality, recruitment, longevity) of the green sea turtles populations impacted by the American Samoa longline fishery. Research continues toward obtaining the necessary information to learn more about the stocks in the American Samoa archipelagic region (See Section 8.6.1.1). Therefore, NMFS's Protected Resources Division relied on the best available scientific information during the section 7 consultation.

[3] In accordance with the ESA, all known sources of mortality are considered prior to NMFS finalizing a biological opinion.

responded and described some work PIRO had been undertaking including the Western Pacific Green Turtle Genetic DNA Stock Composition project whereby genetic analysis of samples collected from Micronesian regional turtle projects will occur in two phases. The first step of the analysis was to work up samples to establish a baseline, and to look at foraging turtle samples to determine the haplotype frequencies in different Micronesian foraging areas (S. Pooley, PIFSC, letter received August 19, 2008). NMFS PIRO responded by describing several ongoing studies including a Micronesian green sea turtle genetics study which has collected more than 600 samples, a Central Pacific green turtle genetics and migration study whereby more than 100 samples have been collected for genetic analysis and approximately 1,000 turtles tagged in the Federated States of Micronesia, analysis of three green turtles caught in the American Samoa longline fishery, and various other turtle conservation projects (W. Robinson, PIRO, letter received November 20, 2008). This work, combined with other collaborative efforts at compiling existing data into usable formats will contribute to better understanding of the green sea turtle population dynamics in the region. As sea turtle genetic and population dynamic research continues, the Council and NMFS continue to seek reductions in the number and severity of interactions between the American Samoa-based longline fishery and green sea turtles, because at this time, avoiding interactions and reducing their severity are considered the best available solutions to the problem.

Also at its 143rd meeting, after reviewing available information and the alternatives described here, the Council recommended Alternative 2 (a minimum 100 m hook depth requirement) as a preliminarily preferred alternative, and directed staff to work with the NMFS, fishermen, and the U.S. Coast Guard to develop gear configurations that would be enforceable in the field. In addition, the Council recommended that NMFS examine observer data to determine the ecological and economic impacts of requiring the 100 m hook depth requirement in this fishery.

At the 144th meeting held in March 2009 in Pago Pago, American Samoa, the Council finalized their recommendation of Alternative 2 to reduce interactions between green sea turtles and the American Samoa longline fishery. The Council clarified that the proposed action should specify that the distance from each float to adjacent branch lines be at least 70 m, and 30 m float lines be used to ensure that all hooks are at least 100 m deep.

In addition, the Council reiterated their prior recommendation that research be undertaken on the effect of larger circle hooks on albacore catch rates and sea turtle interactions; and that an intensive year-long experiment with high observer coverage, at a minimum of 30 percent of trips (as recommended by the Council's Scientific and Statistical Committee (SSC)), be conducted to explore the variability in turtle interactions over time and space and with different gear configurations. The Council and PIFSC put forth a request for proposals (RFP) for research on the effect of larger circle hooks on albacore catch rates and sea turtle interactions and a project was chosen for funding. The study compared the effectiveness of 16/0 or larger circle hooks with the smaller (13/0 through 16/0) circle hooks normally used in the American Samoa longline fishery. The field work for the study was conducted between July and August 2010, and the final report received by the Council in February 2011 (Beverly et al. 2011). The study found that there was no significant difference in catch rates, the life status of fish on capture, or the size composition of the catch for the main target species in this fishery, albacore. Statistically significant differences were found in the catch rates of escolar, skipjack tuna, and wahoo with higher catch rates on the 14/0 hooks, and in the size composition of bigeye and yellowfin tuna with larger fish taken on the 16/0 hooks. The results suggest that the adoption of larger circle hooks in the fishery will not have an impact on albacore catch rates, but there will be some potential losses (reduced catch rates of skipjack tuna and wahoo) and some potential gains (larger bigeye and yellowfin tuna). Overall potential impacts on the fishery are undetermined, but initially presumed to be minimal.

The Council also expressed concern that there is a lack of information on Pacific green sea turtle stock structure and that additional genetic samples may be needed to determine whether the rare interactions the American Samoa longline fishery experiences are having a population-wide impact to green sea turtle stocks. In addition, the Council expressed that identification of the genetic stock of the turtles which interact with the American Samoa longline fishery is essential to interpret the population effects of interactions.

Finally, the Council reiterated its commitment to work with the U.S. delegation to the Western and Central Pacific Fisheries Commission (WCPFC) to strengthen conservation and management measures that would reduce sea turtle interactions by all longline fishing fleets operating in the Western and Central Pacific Ocean.

At the 148th meeting, the Council recommended NMFS PIRO conduct the necessary administrative action to revise the common and scientific species names of four PMUS in the regulations implementing the Pelagics FEP (Table 1). This amendment would also make technical administrative clarifications to the scientific names for several tuna and marlin. The northern bluefin tuna (*Thunnus thynnus)* is only found in the Atlantic Ocean; the correct name of the Pacific bluefin tuna is *Thunnus orientalis*. Also, changes to the scientific names for blue, striped, and black marlin were recently made by Collette et al. (2006); therefore, the PMUS list would be updated as follows: blue marlin is *Makaira nigricans*, black marlin is *Istiompax indica*, and striped marlin is *Kajikia audax*. These changes will have no effect on the proposed action and are not analyzed in this Environmental Assessment.

Table 1: Revisions to common and scientific names for pelagic management unit species of the Pelagics FEP.

Current common name in FEP and regulations	Current scientific name in FEP and regulations	Revised common name	Revised scientific name
Northern bluefin tuna	*Thunnus thynnus*	Pacific bluefin tuna	*Thunnus orientalis*
Indo-Pacific blue marlin	*Makaira mazara*	Blue marlin	*Makaira nigricans*
Black marlin	*Makaira indica*	Black marlin	*Istiompax indica*
Striped marlin	*Tetrapturus audax*	Striped marlin	*Kajikia audax*

Based on Collette et al. (2006).

6.0 Development of the Alternatives

6.1 Background on Development of Alternatives Considered

Hook Type Modifications

All of the American Samoa longline fishery interactions have involved juvenile green sea turtles with size 13/0, 14/0, or 15/0 circle hooks using sardine bait. Based on experience in the Hawaii-based shallow-set longline fishery, consideration was given to requiring larger-sized hooks and modifying their configuration. In Hawaii, the shallow-set longline fishery must use 18/0 or larger circle hooks with a 10° or less offset to reduce the number and severity of interactions with sea turtles. Since the 2004 requirement for 18/0 or larger circle hooks and mackerel-type bait in the Hawaii-based shallow-set fishery, interactions with loggerhead and leatherback sea turtles have been reduced by a combined 89 percent compared to 1994-2002, i.e., before these regulations were in place (Gilman and Kobayashi 2007). Since the American Samoa longline fishery is already using circle hooks (as opposed to J-hooks), no change in the type or shape of hook was warranted. The use of circle hooks in this fishery is not required; however, if for some reason in the future fishers began using J-hooks subsequent action by the Council may be warranted to mandate the use of circle hooks. Requiring larger circle hooks is under consideration in Alternatives 3 and 4, and impacts on participants are described in Section 9.3.4 and 9.4.4. The Council continues to encourage the fishery to use circle hooks as an environmentally responsible method of fishing, since circle hooks have the dual effect of reducing the number and severity of interactions compared to J-hooks.

Bait Modifications

Longline fishermen and researchers alike have found some bait types used have effected both catches of target and bycatch species. Bait trials would best determine the type of bait attractive to target species and less so to green sea turtles. Using blue-dyed bait as a deterrent to incidental interaction of sea turtles has not been very successful, but may need more testing (Beverly and Chapman 2007). This technique has been shown to reduce bycatch of seabirds during hook deployment, but not sea turtles (Werner et al. 2006). Swimmer et al. 2005 tested the effectiveness of blue-dyed squid bait in reducing sea turtle bycatch on commercial longline boats in Costa Rica. Their results, which differed from results of captive trials, showed no difference in rates of sea turtle interactions when using untreated vs. blue-dyed bait. Use of blue-dyed squid bait was also found to be ineffective at reducing rates of sea turtle bycatch in the North Atlantic Ocean during field trials conducted on commercial longline fishing vessels over two fishing seasons (J. Watson et al. unpublished data). The Council did not consider an alternative to require using blue-dyed bait, because of the lack of scientific justification.

Foraging studies of 31 green sea turtles in Mexico found these turtles primarily consumed algae with small amounts of squid, sponges, tube worms, and other invertebrates in their diet, but no fish (Seminoff et al. 1997). However, turtles in the study averaged 78.4 cm long, which are at or just below adult life stage. The American Samoa longline fishery has incidentally caught only juvenile green turtles no larger than 50 cm straight carapace length. Another study in Baja, Mexico examined stomach contents of 24 dead green sea turtles (12 from Magdalena Bay and 12 from Pacific coastal waters; sizes averaged 67.7 and 55.8 cm, respectively) which found stomach contents to be almost exclusively algae and other plant matter with small amounts of invertebrates (Lopez-Mendilaharsu et al. 2005). However, it is widely thought that green sea turtles feeding habits vary regionally and that food preferences may be dependent on local availability of foods and influenced by differing digestive capabilities (many references cited *in* Lopez-Mendilaharsu et al. 2005).

There are limited scientific data on feeding habits of green sea turtles in the western Pacific during juvenile or pelagic life history phases; therefore, it is not well-known if they naturally consume fish or how attracted they are to fish bait. Necropsies conducted on green sea turtles caught in both the Hawaii and American Samoa longline fisheries were found to have consumed only fish bait and no other fish stomach contents have been observed (Thierry Work, USGS, pers. comm.). Moreover, if green turtles were consuming fish other than bait it is likely it would be broken down relatively quickly and not be detected in necropsy stomach content analysis (Thierry Work, USGS, pers. comm.).

Turtles are believed to feed differently on squid versus fish. Gilman et al. (2007a) report that fewer turtles in the Hawaii fishery were hooked deep in the esophagus in the Hawaii longline fishery when using fish bait. It is thought that green turtles tend to eat fish from the hook in small bites, thus avoiding ingesting the hook, as opposed to squid bait, which it is thought to be gulped down whole leading to more deep hooking. Kiyota et al. (2005) conducted a captive experiment in a water tank about hooking mechanisms and observed loggerheads feeding on baited hooks. In the experiment, loggerheads were likely to swallow the whole squid bait which had flexible and tough muscle texture. In contrast, loggerheads bit and cut fish baits and ingested small pieces of fish muscle. They interpreted that the bait texture was related to the difference in feeding mechanism and hooking rates. Kiyota et al. concluded that the use of fish bait is expected to be one of the most effective methods to reduce incidental catch of loggerhead sea turtle.

Moreover, juvenile green sea turtles are relatively small-sized with small jaws and may not be able to effectively bite through large fish bait. Using larger fish might be a means of reducing sea turtles from biting hooks, and using larger-sized fish bait than the sardines currently used is included in Alternatives 3 and 4 under consideration.

Increasing the Depth at which Gear Fishes

Deep-set longline gear interactions with sea turtles typically occur on the shallowest hooks in a set, i.e., the hooks nearest the floats (SPC 2001 *in* Beverly and Chapman 2007). Estimates from the Secretariat of the Pacific Community's (SPC) Oceanic Fisheries Program observer data show that turtle encounters on shallow sets are an order of magnitude higher than on deep sets, and that when there are turtle encounters on deep sets they are almost always on the shallowest hooks in the set, which suggests that there is probably a critical depth range of hooks where most marine turtle encounters would be expected to occur in western tropical Pacific longline fisheries (Beverly et al. 2004).

Observer reports of 13 interactions through August 2010 for the American Samoa longline fishery reported 9 interactions (69%) of the green sea turtle interactions occurred within the first three hooks from the float (i.e., on hooks 1-3 and 28-30, assuming 30 hooks between floats; (see Table 2). Specifically, of the 13 green sea turtles, all juveniles, recovered from different longline fishing trips, nine were found hooked within the first or last three hooks, two were on the 6th

hook from the float, and two were found (one entangled and one hooked by branch lines) in the middle section of the catenary (curve of mainline between floats).

This information may not be reflective of the entire fishery, but observed interactions comprise the best available information. The observer reports in the future should continue to yield more statistically robust information as NMFS has been increasing observer coverage to a target at least 40 percent for a year as recommended by PIFSC (McCracken 2006). Observer coverage in 2010 averaged about 25 percent for the year and was approximately 48 percent of longline trips during the fourth quarter of the year. The future minimum level of coverage will be evaluated based on analysis of the data and available resources (NMFS PIRO Observer Program, pers. comm. Dec. 2010).

Setting longline gear to fish below the upper 100 meters of the water column has been shown to reduce capture of epi-pelagic species in longline fisheries (e.g., billfishes and mahimahi) and has been inferred to reduce interactions with sea turtles (Beverly et al. 2009, Beverly and Chapman 2007, Werner et al. 2006, Beverly 2004) primarily because sea turtles are known to forage in the upper 100 meters of the water column (Beverly and Chapman 2007, Beverly 2004). A study using time-depth recorders (TDRs) on six green sea turtles reported their maximum dive depth at 48.5 m and a mean dive depth of approximately 14 m during the day and 17 m at night (Seminoff et al. 2001). The authors reported shorter day dive (vs. night dive) durations suggesting that turtles were more active in the daytime.

A management measure to keep hooks out of the upper water column and fishing at depths below 100 m is expected to best reduce sea turtle interactions, while causing the least impact on catch rates of target stocks and thus, fishery participants and communities. The Council's preferred alternative is intended to keep hooks from fishing the upper 100 m of the water column during fishing operations (Figure 2). This would be accomplished by requiring 30 m or longer float lines, 15 or more branch lines between each float, and restricting hook deployment to at least 70 m away from either side of floats, such that the hooks closest to the float would fish deeper than with the status quo. The Council determined that this would be the simplest method expected to achieve success, i.e., minimize green sea turtle interactions, and was preferred by fishery participants as described in Section 5.0 and was, therefore, selected to be considered in this amendment.

Table 2: Details of Incidental Green Sea Turtle Interactions in the American Samoa Longline Fishery.

Interaction Date	Hook Type	Hook Size	Bait	Float line mean length (m)	Branch line mean length (m)	Hook #	Hooks per Float
June 2006	Offset Circle	14/0	Sardines	20.2	11.5	17	27
June 2006	Offset Circle	14/0	Sardines	22.6	12.1	35	35
October 2006	Offset Circle	15/0	Sardines	30.0	11.0	1	30
July 2007	Circle	14/0	Sardines	25.2	10.2	5	32

Interaction Date	Hook Type	Hook Size	Bait	Float line mean length (m)	Branch line mean length (m)	Hook #	Hooks per Float
May 2008	Offset Circle	14/0	Sardines	26.3	8.8	2	32
June 2009	Circle	13/0	Sardines	23.4	6.8	26	26
September 2009	Offset Circle	14/0	Sardines	24.6	13.1	6	34
October 2009	Offset Circle	15/0	Sardines	27.0	12.0	21	36
February 2010*	Offset Circle	15/0	Sardines	21.4	7.0	1	34
April 2010	Offset Circle	14/0	Sardines	25.4	9.3	6	28
May 2010	Offset Circle	15/0	Sardines	28.1	9.1	33	35
July 2010	Offset Circle	15/0	Sardines	19.5	11.2	1	30
July 2010	Offset Circle	15/0	Sardines	19.5	11.2	2	30

Source: PIRO Observer Program, as of Sept. 2, 2010.
Note: All turtles described as juvenile green sea turtles. * Released injured.

6.2 Alternatives Considered but Rejected from Detailed Consideration

Lightstick Restriction
A possible gear modification which has been tested with regards to reducing sea turtle interactions was eliminating the use of chemical lightsticks attached to branch lines for purposes of attracting certain fish. The American Samoa longline data for 2007 show that the gear are primarily deployed to catch fish during the day with about 96 percent of the begin-set times occurring between 5-9 A.M. and 96 percent of the begin-haul times taking place between 3-7 P.M. (D. Hamm, PIFSC, pers. comm.). The use of lightsticks by American Samoa's tuna-targeting longline fishery is limited (an average of 0.44 lightsticks per trip or 0.026 per set were used in 2008; WPRFMC 2010). Lightsticks have been implicated in leatherback interactions due to their bioluminescent prey, but interactions with this fishery and leatherback sea turtles have not been observed and a lightstick prohibition would not be considered an appropriate means of reducing green sea turtle interactions (S. Pooley, PIFSC, Letter received August 19, 2008), and therefore, was not further analyzed as an alternative.

Seasonal or Area Closures
Available data on reported sea turtle interactions do not reflect a distinctive seasonal pattern, nor do they indicate a high degree of incidental hookings in particular locations or an association with particular habitat features (see Figure 1). Rather, interactions have been dispersed over time (Table 2) and within a large portion of the U.S. EEZ around American Samoa, in addition to interactions in the Cook Islands EEZ. In addition, the small number of interaction events and limited observer data currently available preclude drawing conclusions with respect to identifying patterns in seasonality of interactions in time and space. Therefore, at this time, there

is insufficient information available to either develop appropriate seasonal or area closures or to expect them to appreciably reduce interactions, so these types of measures were not considered further by the Council.

Adding Weights to the Branch Lines

The Council considered including an alternative which would require the addition of 45 g weights to branch lines to get the lines to sink more rapidly. This measure has proven to be effective in reducing seabird interactions as seabirds actively dive for baited hooks; however, it is unlikely to prove true for green sea turtles which are more likely to incidentally encounter lines during the turtle's foraging activities rather than by active pursuit. Adding weights to longline gear can pose safety issues with regards to hazards to fishermen associated with hauling up lines with weights attached. The danger of lines under tension from large fish snapping back and weights striking fishermen and observers is a real threat which must be considered. National Standard 10 states that safety considerations must be included in analysis of any proposed fishery management measure. In addition, longline fishermen in American Samoa do not currently use weights on their lines. Given the lack of evidence that weighted branch lines are effective in reducing sea turtle interactions, and the economic burden on fishermen in terms of costs in equipment and time to modify all gear, this alternative is not being further considered at this time.

Including smaller vessels (≤ 40 ft) in the gear modification measures

Implementation of the gear alterations in the Council's preferred alternative was considered for all vessels; however, for the following reasons theses gear modification requirements would apply to Class B, C, and D vessels, but not to Class A vessels (≤ 40 ft). Class A vessels were omitted in part due to the small size and low technological configuration of alia gear, the float line length requirement may be unduly burdensome and restrict a vessel's fishing operations. Also, for the last several years, there have been very few alia conducting longline fishing and this is not expected to change in the future. Many alia were damaged or destroyed in the September 2009 tsunami and even before this occurred there were only two alia in operation in 2007 and only one fishing in 2008 and 2009 (WPRFMC 2010, WPRFMC unpublished 2009 Pelagics Annual Report module).

In addition, the alia vessels are not known to interact with sea turtles during their normal fishing operations in the past when there were a sizeable number of alia in the longline fleet. In 2003 – 2004, the operation of an alia highliner (i.e., a high producing vessel) in the American Samoa albacore longline fishery was evaluated by monitoring its fishing activity and although over 65,000 hooks were set during the study, the trained data collectors (the alia owner/manager, captains and crew) reported no sea turtles, seabirds, or marine mammal interactions (Kaneko and Bartram 2005). Non-observed interactions have been recorded in vessel logbooks over the course of the Federal logbook program (since 1996) in this fishery; however, the accuracy of these reports cannot be independently verified (NMFS 2010c). Only one sea turtle interaction has ever been reported in association with the alia fishery, and this was a logbook report of a capture of a leatherback turtle. An alia longline observer program conducted in Independent Samoa by SPC from 1990-2002 also recorded no sea turtle interactions (Peter Sharples, SPC Oceanic Fisheries Program, pers. comm.).

Between 1999 (when alia and monohull effort was first reported separately) and 2005 (the last year when three or more alia fished) the volume of longline hooks set annually by this segment of the fishery ranged from approximately 196,000 hooks to over 660,000 hooks with an average of 470,000 hooks annually (PIFSC unpublished report). By contrast, the approximate annual volume of hooks set by monohull vessels from 1999 to 2009 ranged from between 389,000 hooks to 17,500,000 hooks with an average of about 10,563,000 hooks. On average, the annual volume of alia hooks set as a percentage of the total fishery from 1999 to 2005 amounted to about six percent of the total. Although there is a possibility that alia longliners may have had interactions with green sea turtles, none were reported by fishermen in logbooks. If the sea turtle interaction rate from monohull vessels (0.002 turtles per 1,000 hooks) is applied to the total volume of alia hooks set between 1999 and 2005 (about 3,320,000 hooks) this gives an estimated 6.6 turtles over the seven year period or 0.94 turtles per year.

If future alia fleet operations are shown to interact with turtles, or other reasons indicate management measures are required, the Council may take future actions to regulate Class A vessels.

7.0 Description of Alternatives

The alternatives under consideration would only apply to all vessels longer than 40 ft in length (i.e., Class B, C, and D vessels) permitted for use in the American Samoa longline limited entry fishery. Under all alternatives considered, the existing regulations described in Section 3.0 and 5.0 would remain in effect. Limiting the retention of swordfish is intended to discourage targeting swordfish by shallow-set fishing. If there is future interest in targeting swordfish by American Samoa-based longline vessels, the Council would consider further management actions to regulate a shallow-set fishery.

7.1 Alternative 1: No-Action

Under the no-action alternative the American Samoa longline fishery would continue as it is operating under the current regulations with no changes. The fishery would likely continue to take sea turtles incidentally and would consequently have management measures imposed upon them under the ESA (see Section 10.10), as opposed to this Magnuson-Stevens Act process. This alternative would, therefore, be inconsistent with the ESA and the Magnuson-Stevens Act.

7.2 Alternative 2: 100 m Hook Depth Requirement (Preferred)

Under this alternative, participants in the American Samoa longline fishery would be required to have their hooks fish deeper than 100 meters. This would be done by increasing the distance from each float to adjacent branch lines to at least 70 m away from any float line and associated float to help ensure to the extent practicable that all hooks fish deeper than 100 m. (see Figure 2). To help achieve this hook depth, participants would also be required to utilize float lines at least 30 m in length with a minimum of 15 branch lines between any two floats, and branch line lengths of at least 10 m. Participants in the American Samoa longline fishery would be prohibited from possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip. Limiting the retention of swordfish is intended to further discourage shallow-set fishing and targeting swordfish.

7.3 Alternative 3: Hook and Bait Size Requirements

Under this alternative, participants in the American Samoa longline fishery would be required to use size 16/0 or larger circle hooks with an offset of no more than 10 degrees, as well as the largest practical whole fish bait[4] with the hook point covered.

7.4 Alternative 4: Combined Gear Restrictions

Under this alternative, participants in the American Samoa longline fishery would be required to use size 16/0 or larger circle hooks with an offset of no more than 10 degrees and the largest practical whole fish bait with the hook point covered. In addition, participants would be required to set hooks to fish at least 100 meters deep by increasing the distance from each float to adjacent branch lines to least 70 m away from any float line and associated float to help ensure that all hooks are deeper than 100 m. (see Figure 2). To achieve this, participants would also be required to utilize float lines at least 30 m in length with a minimum of 15 branch lines between any two floats. Fishermen would also be prohibited from possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip.

[4] Bait size used is partially a function of hook size and the species being targeted. Current regulations for bait in the western Pacific region pertain only to the type of bait while shallow-set fishing north of the equator for swordfish by the Hawaii longline limited entry fishery or general permit holders; in both cases, vessels must use 18/0 or larger circle hooks and mackerel-type bait. If hook size regulations are contemplated for the American Samoa fishery there may also be consideration of the minimum size of bait to be employed.

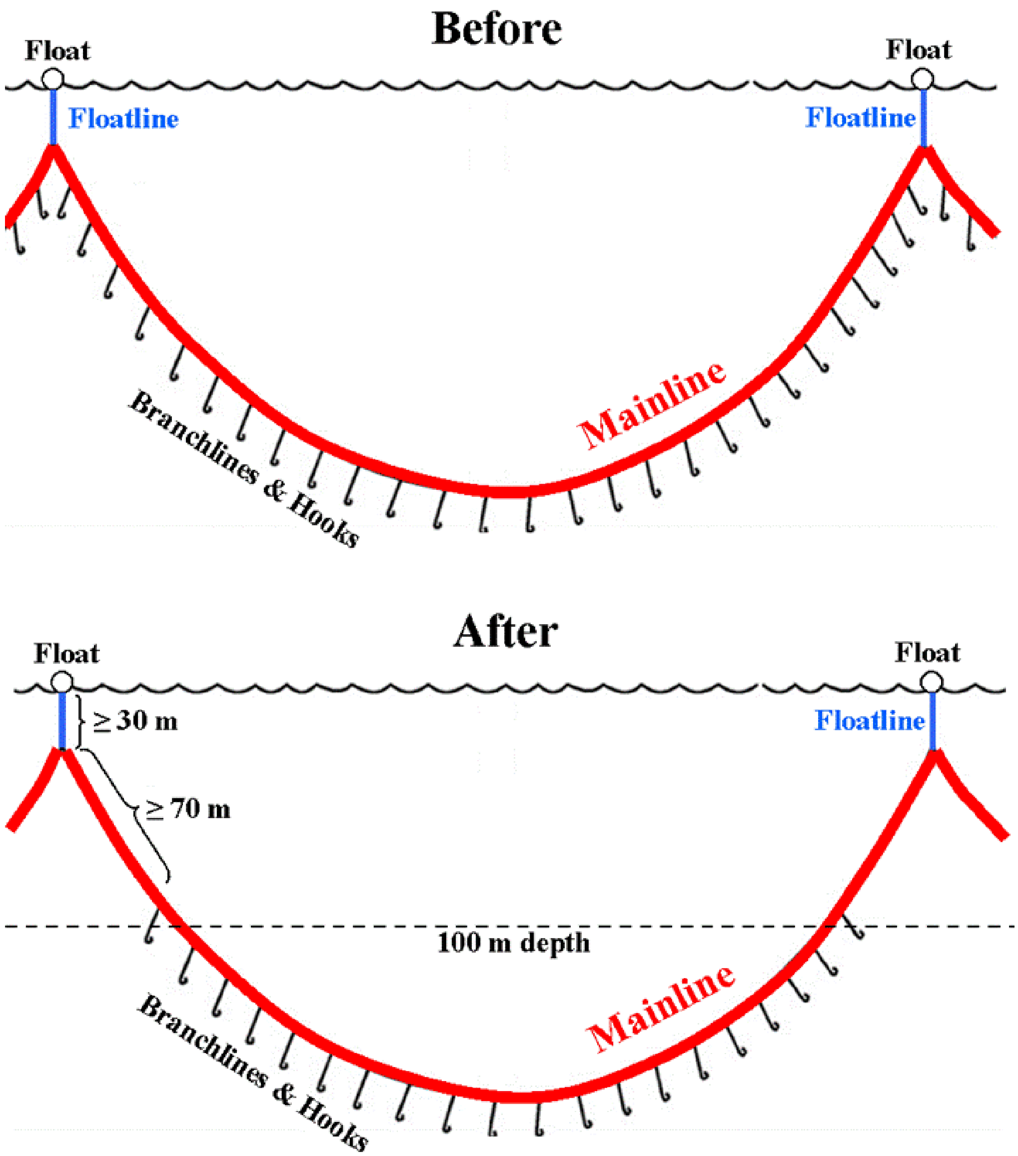

Figure 2: Gear Configuration Before and After Implementation of the Preferred Alternative.

Source: NMFS PIRO.

Note: Figure 2 shows the results of implementing the proposed hook depth requirement in Alternative 2 or 4. Note the reduction in number of hooks between two floats is one potential fishery result, but fishermen could also lengthen the mainline and distribute the same number of hooks between floats. The environmental impact analysis considers the effects of these potential outcomes.

8.0 Description of the Affected Environment

8.1 American Samoa

American Samoa has been a U.S. territory since 1899, in part, because of U.S. interests in Pago Pago harbor. New Zealand occupied Western Samoa in 1914, and in 1962 Western Samoa gained independence. In 1997, Western Samoa changed its name to Samoa (also referred to as Independent Samoa). The demarcation between Independent Samoa and American Samoa is political. Cultural and commercial exchange continues with families living and commuting between the two. American Samoa is more than 89 percent native Samoan. This population is descended from the aboriginal people who occupied and exercised sovereignty in Samoa before the arrival of outside people.

There is approximately 199 sq km (~ 77 sq mi) of land divided between five islands and two coral atolls (Rose and Swains Islands). EEZ waters around American Samoa comprise 390,000 square kilometers and are truncated by the EEZs around the other nearby island nations (Figure 2). Because American Samoa is substantially dependent on and engaged in the harvest and processing of fishery resources in order to meet social and economic needs of its citizens, American Samoa is a fishing community under the Magnuson-Stevens Act.

American Samoa has a small developing economy, dependent mainly on two primary income sources: the American Samoa Government (ASG), which receives income and capital subsidies from the federal government, and the fish processing industry on Tutuila (BOH 1997). Prior to 2009, there had been two operating tuna canneries in American Samoa; however, one of two canneries, Chicken-of-the-Sea, closed in September 2009. These two primary income sources have given rise to a third: a services sector that derives from and complements the first two.

American Samoan dependence on fishing undoubtedly goes back as far as the peopled history of the islands of the Samoan archipelago, which is about 3,500 years ago (Severance and Franco 1989). Many aspects of the culture have changed in contemporary times, but American Samoans have retained a traditional social system that continues to strongly influence and depend on the culture of fishing. Traditional American Samoan values still exert a strong influence on when and why people fish, how they distribute their catch, and the meaning of fish within the society. When distributed, fish and other resources move through a complex and culturally embedded exchange system that supports the food needs of `aiga (extended family system), as well as the status of both matai (talking chiefs) and village ministers (Severance et al. 1999).

The excellent harbor at Pago Pago and certain special provisions of U.S. law form the basis of American Samoa’s largest private industry, fish processing, which is now more than 40 years old (BOH 1997). The territory is exempt from the Nicholson Act, which prohibits foreign ships from landing their catches in U.S. ports. American Samoan products with less than 50 percent market value from foreign sources enter the United States duty free (Headnote 3(a) of the U.S. Tariff Schedule). Currently, no foreign vessels may fish in the US EEZ around American Samoa and there are no foreign fishing access agreements at this time to provide access to foreign fleets.

In 1997, the ASG estimated the tuna processing industry directly and indirectly generated about 15 percent of money wages, 10 to 12 percent of aggregate household income, and 7 percent of government receipts in the territory (BOH 1997). Until 2009, the canneries provided 8,118 jobs – 45.6 percent of total employment (in American Samoa) including both directly (5,538 jobs) and indirectly (2,580 jobs) . On the other hand, both tuna canneries in American Samoa, until September 2009, were tied to multinational corporations that supplied virtually everything but unskilled labor, shipping services, and infrastructure facilities (Schug and Galeai 1987) including a substantial portion of the raw tuna processed by StarKist Samoa landed by vessels owned by the parent company. Furthermore, most of the unskilled labor of the cannery is imported. Up to 90 percent of cannery jobs have been filled by foreign nationals from Independent Samoa and Tonga. The result is that much of the cannery payroll is remitted overseas.

The closure of the Chicken of the Sea (COS) cannery in 2009, resulted in the loss of 2,000 jobs or just over one third of the direct employment at the canneries. The remaining StarKist cannery has reduced its workforce to 1,200, or about 22 percent of the direct cannery employment and 40 percent of the peak employment at this cannery of 3,000 jobs in 2008[5]. Recently, Tri Marine, a fishing company supplying the canning industry has acquired the COS cannery which may include an association with another major fishing company, Luen Thai Fishing Venture, based in Hong Kong.

On September 29, 2009, a submarine earthquake of magnitude 8.0 triggered a tsunami which made landfall in several Pacific island locations including American Samoa, with a population around 65,000. Four tsunami waves 15 to 20 ft (4 to 6 m) high arrived ashore on American Samoa about 15 minutes after the quake, reaching up to a mile (1.6 km) inland, officials said. In Pago Pago, streets and fields filled with debris, mud, and overturned cars and boats. Several buildings in the city situated only a few feet above sea level were flattened. For a period following the disaster, there were an estimated 2,200 people being housed in seven shelters across the island. American Samoa suffered much damage including damage and destruction of the floating docks and boat ramps in Pago Pago, and likely elsewhere. Major boat docks were unusable because of the many derelict vessels around them and other boats left sitting on the dock.

The first floor of the American Samoa Department of Marine and Wildlife Resources (DMWR) office building was swamped by the rising sea waters and was without electricity for more than a week. Several DMWR vehicles, boats, equipment, and the floating docks were damaged. The Community Development Project Program-funded facility for the Pago Pago Commercial Fishermen Association project located in Pago Pago was destroyed and washed to sea, including some recently purchased equipment. The shipyard dry-docking facilities were damaged with the last purse seiner serviced and released the day before the tsunami. There were relatively minor damages to the cannery facilities. Inside Pago Pago bay area, huge amounts of trash and layers of oil pollution were observed. More than half of the alia vessels berthed at the docks behind DMWR were damaged, destroyed, or floated out to sea including the only one actively involved in longlining. Recreational boats were also damaged and destroyed (W. Sword, Council member, pers. comm.). Longline, foreign distant water fishing (DWF) and purse seine vessels supplying the cannery that were inside Pago Pago harbor may have sustained some damages. The ASG has

[5] Recent information on cannery employment obtained from Agence France Presse news article dated May 13, 2010.

received funds from the Federal Emergency Management Agency (FEMA) and is currently rebuilding damaged infrastructure around Tutuila.

8.1.1 U.S. EEZ Waters around American Samoa

The EEZ waters around American Samoa comprise about 400,000 square kilometers and are truncated by the EEZs around the other nearby island nations (Figure 3). The islands of American Samoa are in an area of modest oceanic productivity relative to areas to the north and northwest. To the south of American Samoa, lie the subtropical frontal zones consisting of several convergent fronts located along latitudes 25° – 40° N and S often referred to as the Transition Zones. To the north of American Samoa, spanning latitudes 15° N – 15° S lies the equatorial current system consisting of alternating east and west zonal flows with adjacent fronts with the southern branch of the westward flowing South Equatorial Current (SEC) from June - October and the eastward-flowing South Equatorial Counter Current (SECC) from November through April.

Domokos et al. (2007) have investigated the oceanography of the waters surrounding American Samoa and noted the impact of the SEC and SECC on the productivity of the longline fishery. They note that the American Samoa fishing ground is a dynamic region with strong mesoscale[6] eddy activity and temporal variability on scales of less than one week. Seasonal and interannual variability in eddy activity, induced by baroclinic[7] instability that is fueled by horizontal shear between the eastward-flowing SECC and the westward-flowing SEC, seems to play an important role in the performance of the longline fishery for albacore.

Mesoscale eddy variability in the EEZ around American Samoa peaks from March to April, when the kinetic energy of the SECC is at its strongest. Longline albacore catch tends to be highest at the eddy edges, while albacore catch per unit effort (CPUE) shows intra-annual variability with high CPUE that lags the periods of peak eddy activity by about two months. When CPUE is highest, the values are distributed toward the northern half of the EEZ, the region affected most by the SECC. Further indication of the possible importance of the SECC for longline performance is the significant drop in eddy variability in 2004 when compared with that observed in 2003 – resulting from a weak SECC – which was accompanied by a substantial drop in albacore CPUE rates and a lack of northward intensification of CPUE.

From an ecosystem perspective, evidence to support higher micronekton (cephalopods, crustaceans, fishes) biomass in the upper 200 m at eddy boundaries is inconclusive. The vertical distribution of albacore seems to be governed by the presence of prey. Albacore spend most of their time between 150 and 250 m, away from the deep daytime and shallow nighttime sonic scattering layers, at depths coinciding with those of small local maxima in micronekton biomass whose backscattering properties are consistent with those of albacore's preferred prey. Settling depths of longline sets during periods of decreased eddy activity correspond to those most occupied by albacore, possibly contributing to the lower CPUE by reducing catchability through rendering bait less attractive to albacore in the presence of prey.

---

[6] Pertaining to marine and atmospheric phenomena having horizontal scales ranging from a few to several hundred kilometers.
[7] In fluid dynamics, the baroclinity or baroclinicity is a measure of the stratification in a fluid.

In January 2009, Proclamation 8377 established the Rose Atoll Marine National Monument in American Samoa (74 FR 1577; January 6, 2009) and directed the Secretaries (Interior and Commerce) to prohibit commercial fishing within the monument boundaries which extend to 50 nm. The boundaries of the marine national monument at Rose Atoll do not completely comport with the existing boundaries of one of the two large vessel prohibited areas around Tutuila, the Manua Islands, and Rose Atoll in the southern portion of the EEZ. As a result of the monument, the area within which large vessels may no longer fish has increased due to the monument boundaries projecting farther to the east and south of the current management zone.

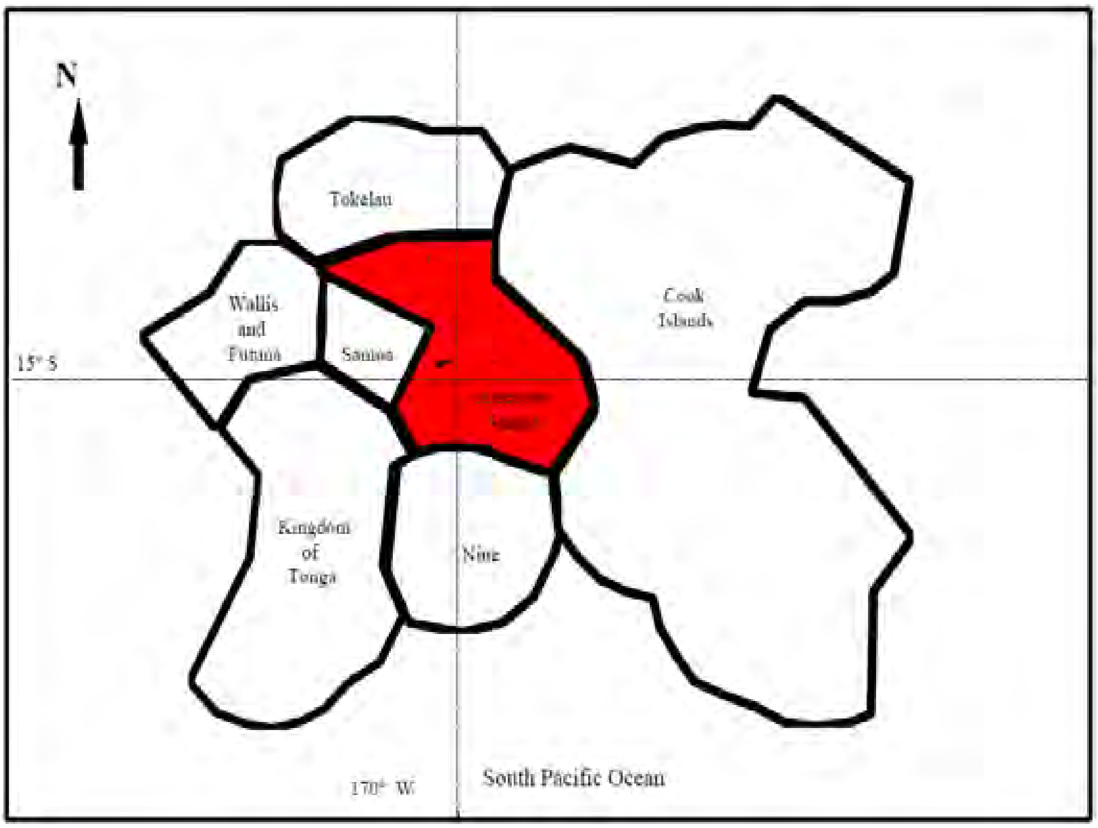

Figure 3: EEZ waters around American Samoa.
Source: NMFS and WPacFIN.

8.2 American Samoa-based Pelagic Fisheries

The harvest of pelagic fish has been a part of the way of life in the Samoan archipelago since the islands were first settled some 3,500 years ago (Severance and Franco 1989). In 1995, small-scale longline fishing began in American Samoa following training initiated by the Secretariat of the Pacific Community (SPC; Chapman 1998). Commercial ventures are diverse, ranging from small-scale vessels having very limited range to large-scale vessels catching tuna in the EEZ and beyond, and distant high seas waters, then delivering their catches to the cannery based in American Samoa. Currently the commercial pelagic fisheries of American Samoa are based on supplying frozen albacore, and small amounts of other pelagic fish directly to the Pago Pago cannery. These fisheries include small and large-scale longlining; and a pelagic trolling fishery. All American Samoa limited access longline vessel owners and operators are required to obtain a federal permit and to submit logbooks containing detailed data on each of their sets and the resulting catch. Boat-based creel surveys, a Commercial Purchase System, and Cannery Sampling Forms also are used to collect fishery information for all fishing activity. Additional detailed statistical data can be found in the Council's 2008 Pelagic Fisheries Annual Report (WPRFMC 2010).

Small-Scale Longline and Troll

Historically, most participants in the small-scale domestic longline fishery had been indigenous American Samoans with vessels under 50 ft in length, most of which were alia; locally-built fiberglass or aluminum catamaran boats under 40 ft in length. In the mid-1990s American Samoa's commercial fishermen shifted from troll gear to longline gear largely based on the fishing success of 28' alia that engaged in longline fishing in the EEZ around Samoa. Following this example, the alia fishermen in American Samoa began deploying short monofilament longlines, with an average of 350 hooks per set from hand-operated reels. Their predominant catch was albacore tuna, which was marketed to the tuna cannery (DMWR 2001). By 1997, 33 alia vessels received general longline permits from NMFS to fish in federal waters around American Samoa, although only 21 were reported to have been actively fishing on a monthly basis at that time. In recent years, the alia longline fleet has been greatly reduced with only two vessels active in 2007, and one active since 2008 (Table 6).

Troll fishers land relatively small amounts of PMUS, such as skipjack and yellowfin tuna, with just over 5,300 lb reported in 2009. The average number of vessels participating in the troll fishery from 1982-2009 is 29 and only 10 in 2009 (WPacFIN data).

Large-Scale Longline

In 2000, the American Samoa longline fishery began to expand rapidly with the influx of large (>50 ft) conventional monohull vessels similar to the type used in the Hawaii-based longline fisheries, including some vessels from Hawaii. These vessels were larger, had a greater range, and were able to set more hooks per trip than the average alia vessel. The number of permitted longline vessels in this sector increased from three in 2000 to 30 in 2002 (DMWR, unpublished data). Of these 30 permitted vessels, 10 permits were believed to be held by indigenous American Samoans as of March 21, 2002 (P. Bartram, pers. comm., March 2002). Economic barriers, such as the large capital needed to purchase and operate a large vessel, have prevented more substantial indigenous participation in the large-scale sector of the longline fishery. During 2008 there were 27 large vessels engaged in the American Samoa longline fishery (Table 6).

Vessels over 50 feet can fish 2,000 to over 4,000 hooks per set (usually one set per day) and have a greater fishing range and capacity for storing fish (8–40 metric tons) as compared with (0.5–2 metric tons) small-scale vessels. During 2002-2007, WPacFIN[8] reports the fleet used about 2,700 hooks per set with a slight increase over this same time period. Based on 39 observed trips from April 2006 through December 2009 (Table **Error! Reference source not found.**3) the fleet uses an average of 3,006 hooks per set. Typically one set is made per day. Large vessels are outfitted with hydraulically powered reels to set and haul mainline, and modern electronic equipment for navigation, communications, and fish finding. All are presently being operated to freeze albacore onboard, rather than to land chilled fish. It does not appear that large numbers of

[8] Found at: http://www.pifsc.noaa.gov/wpacfin/index.php

longliners from Hawaii are relocated in American Samoa, although several vessels have permits to fish in both locations. Instead, large vessels have participated in the American Samoa longline fishery from diverse ports and fisheries, including the U.S. West Coast (six), Gulf of Mexico (three), and foreign countries (four now under U.S. ownership; O'Malley and Pooley 2002).

Table 3: Average, and when available, standard deviation and range (in parentheses) of longline gear attributes from the American Samoa longline fishery.

Variable	Observed sets (n≈1,296) ~3.9 mil hooks	Observed sets (n=988) in Bigelow and Fletcher 2009	Observed sets with valid TDR data (n=320) ~988,160 hooks
Line shooter (nm/h) **Line shooter (m/s)**	**≈8** * **≈4.1** *	8.1±2.3 (4.2−16.5) 4.2±1.2 (2.1−8.5)	7.7±1.7 (4.4−14.4) 4.0±0.9 (2.3−7.4)
Hooks per set	**3,006** (391–4,126); Class C- 2,843; Class D- 3,072	3,058±446 (420–4,126)	3,088±414 (420−4,126)
Hooks between floats	**31.5** (25–36)	31.6±2.5 (25–36)	32.2±2.0 (28−36)
Floats per set	**≈100.3** *	100.7± 16.7 (16–138)	99.5±15.2 (16−137)
Float line length (m)	**25.99,** (18.4–36.5)	26.1± 4.0 (18.4–36.5)	25.8±3.4 (18.4−36.5)
Branch line length (m)	**10.3** (6.8–15.1)	10.4± 1.5 (6.8–15.1)	10.4±1.8 (6.8−15.1)
Mainline length (km)	**≈75 (40.5 nm)** *	75.7± 18.4 (9.2–120.4)	73.7±16.2 (9.3−100.0)
Length (m) between floats	**≈759** *	766± 202 (431–1,511)	744±145 (463−1,218)
Length (m) between hooks	**≈23.25** *	23.6± 6.4 (13.6–48.7)	22.5±5.5 (13.6−32.9)

Sources: Bigelow and Fletcher 2009; NMFS unpublished. * = weighted mean
Note: Data are from 39 observed trips departing from April 2006 to October 2009, and from Bigelow and Fletcher (2009); 988 observed longline sets and a subset of 320 sets monitored with temperature-depth recorders (TDR) in the American Samoa-based fishery from 2006 to 2008.

In 2001-2002, American Samoa's active longline fleet increased from 21 mostly small alia to 75 vessels of a variety of sizes with American Samoans mostly owning small vessels and non-American Samoans mostly owning large vessels (WPRFMC 2003). The rapid expansion of longline fishing effort within the EEZ waters around American Samoa prompted the Council to develop a limited entry system for the American Samoa pelagic longline fishery. In developing the limited entry program, the Council identified 138 individuals who owned a longline vessel at any time prior to March 21, 2002 with 93 individuals owning Class A size vessels, nine owning Class B size vessels, 15 owning Class C size vessels and 21 owning Class D size vessels (WPRFMC 2003). However, upon initiation of the initial permit application and issuance process, only sixty initial permits were approved and issued by NMFS. Table 6 shows the number of permitted and active vessels in the fishery since 2000.

Since inception of the limited entry program in 2005, American Samoa's longline fishery continued to undergo changes, predominantly in fleet composition. The fleet composition has transformed into a fleet comprised mainly of large monohull longline vessels in Class D. Class A vessel participation has declined to one or two vessels in recent years, with no recent activity from Class B vessels.

The limited entry program regulations specify that a maximum number of permits for each class would be capped at the number of initial permits issued by NMFS. However, the program also allowed for a total of 26 permit upgrades to be made available for the exclusive use of permit holders in Class A, distributed over a four-year period. The permits are effective for three years after the date of issuance and most of the permits would have expired by the end of 2008.

When permits come close to expiring, NMFS PIRO mails letters to all permit holders reminding them of the expiration date of their permit and that there are minimum landings requirements to be met for renewal. Periodically when permits become available due to non-renewal or permit expiration, NMFS solicits applications for permits. In 2009, NMFS received 26 applications for 24 available permits. Most recently, on July 15, 2010 (75 FR 41142) NMFS advertised the availability of at least 10 permits of various class sizes (4 in Class A, 5 in Class B, and one in Class D), which were available for 2010. Completed applications were accepted until November 12, 2010. Persons with the earliest documented participation in the fishery on a Class A sized vessel received the highest priority for obtaining permits in any size class, followed by persons with the earliest documented participation in Classes B, C, and D, in that order. In the event of a tie in priority, the person with the second earliest documented participation will be ranked as higher priority.

Twelve of the American Samoa longline limited access permit holders also hold Hawaii longline limited access permits for the Hawaii-based fisheries (W. Ikehara, NMFS, pers. comm., Nov. 2010). When dual-permitted vessels are fishing outside of the historical action area fished by vessels registered under the American Samoa limited access permit, the gear modifications of this amendment will not apply. That is, if a dual-permitted vessel is fishing in the U.S. EEZ around Hawaii and on the high seas surrounding Hawaii, the vessel is required to adhere to Hawaii longline fishing regulations. Further, the Hawaii longline fisheries are currently subject to an annual catch limit of bigeye tuna of 3,763 mt stemming from a 2008 conservation and management measure from the Western and Central Pacific Fishery Commission (CMM 2008-01) for the years 2009-2011. In the administration of this catch limit (74 FR 68190, December 23, 2009), NMFS regulations provide that bigeye tuna caught by longline gear may be retained on board, transshipped, and landed if the fish are caught by a vessel registered for use under a valid NMFS-issued American Samoa longline limited access permit, if the bigeye tuna have not been caught in the EEZ around Hawaii (50 CFR 300, Subpart O). When NMFS has determined the 3,763 mt bigeye tuna catch limit is reached, all vessels holding a Hawaii limited entry longline permit will no longer be able to land bigeye tuna in Hawaii, regardless of whether it was caught on the high seas, except under authorized limited conditions. However, vessels with a valid American Samoa limited entry permit, as well as a valid Hawaii longline limited access permit (dual-permitted), would still be able to retain and land bigeye tuna into Hawaii and American Samoa as long as the fish was not caught in the EEZ around Hawaii (74 FR 63999, December 7, 2009).

U.S. Purse Seine Fishery

Prior to beginning purse seine fishing operations in the western Pacific, the U.S. fleet had been fishing out of California in areas of the eastern Pacific for decades. The main impetus for the transition from fishing in the eastern Pacific to the western Pacific was due to economic (overcapitalization) reasons, eroding relations with central America states over fishing access issues, increased management controls enacted by the Inter-American Tropical Tuna Commission (IATTC), and difficulties over environmental concerns associated with fishing on tuna associated with dolphins. During the years when the fleet transitioned from fishing in the eastern Pacific to western Pacific operations, U.S. vessels made several gear changes including deepening nets, installing larger power blocks and winches to accommodate larger seines, and using helicopters to spot schools of fish, among other changes (Gillett et al. 2002).

In 1988, the South Pacific Tuna Treaty (SPTT) entered into force and provided licensed U.S. vessels with access to most of the EEZ waters of the 16 member states of the Pacific Islands FFA, which together with the U.S. comprise the parties to the SPTT. Under the current terms of the Treaty, 45 licenses are available to the United States, five of which are reserved for joint venture arrangements with Pacific Island parties . The number of vessels licensed and active in the fleet had been steadily declining since the late 1990s. However, since 2007 this trend has reversed and the number of vessels increased to 36 by 2010 (USCG 2010). Many of these newer vessels have foreign built hulls constructed in Taiwan and 51 percent U.S. ownership. However, only U.S.-built hulls are permitted to fish in U.S. EEZ waters.

The U.S. purse seine fleet, in common with other tropical tuna purse seine fisheries in the WCPO, operates predominantly in equatorial latitudes, to the north and northwest of the U.S. EEZ around American Samoa. Most of the fishing activity by U.S. purse seine vessels occurs in areas between 5° N and 10° S latitude and 150° E and 170° W longitude in the EEZ waters of PNG, the Federated States of Micronesia and other Pacific island nations. During El Niño events, however, these vessels may shift their fishing activity to the equatorial central Pacific following tuna schools.

Summary of American Samoa's Pelagic Fisheries

In summary, more than $10.3 million worth of pelagic species were landed in American Samoa during 2009 (WPRFMC unpublished 2009 Pelagics Annual Report module) from all pelagic fisheries, not including landings by the U.S. purse seine fleet to the Pago Pago canneries. Longline fishing dominated (99.6%) the value of pelagic landings during 2009. Over $8.6 million worth of albacore dominated (83%) the value of longline caught pelagic species during 2009 followed by yellowfin (~ $800,000), bigeye (~$378,000), and skipjack (~$206,400) tunas. Wahoo (~$181,000), blue marlin (~$52,800), mahimahi ($57,270), and swordfish (~$41,000) were the top-value non-tuna species during 2009.

Landings of skipjack, yellowfin, and bigeye tuna by the U.S. purse seine fleet at the Pago Pago canneries are substantial, especially since the U.S. purse seine recently rebuilt. However, although the canneries routinely report the landings to the American Samoa Government and the National Marine Fisheries Service, these figures are confidential since there are less than three entities (canneries) reporting.

8.2.1 Effort and Catch

Effort

Since 2001, the number of American Samoa troll and longline vessels landing pelagic species has decreased from a high of 80 vessels in 2001 to 36 in 2009 (Table 4). Effort is currently dominated by large longline vessels (Class C and D) as the troll fleet continues to decrease in numbers of vessels and trips (Table 5). Participation by alia vessels (Class A) in the longline fishery continues to decrease while participation by the largest vessels increases gradually. In 2008, 27 vessels larger than 50 ft were active while only one alia vessel less than 40 ft fished.

Table 4: Number of Vessels Using Different Fishing Methods, 2000-2009.

Year	Number of Boats		
	Longlining	**Trolling**	**Total**
2000	37	19	56
2001	62	18	80
2002	58	16	74
2003	50	20	70
2004	41	18	59
2005	36	9	45
2006	31	9	40
2007	29	19	48
2008	28	16	44
2009	26	10	36

Source: WPRFMC unpublished 2009 Pelagics Annual Report module.

In 2010, the active longline fleet consisted of one alia, and 26 conventional, monohull longline vessels 50 ft or longer in length (PIRO Sustainable Fisheries Division, pers. comm.). Fishing power[9] is clearly distinct between the different size classes of vessel and separate catch statistics are compiled. The alia vessels use manually powered mainline drums that hold about four miles of monofilament line. The boats make single day trips with a crew of three, setting around 300 – 350 hooks per set and keep their catch on ice. The large monohull vessels are similar and in some cases the same vessels that have engaged in the Hawaii longline fisheries. These boats are typically steel hulled vessels of around 20 – 27 m operating hydraulically driven mainline reels holding 30 – 50 miles of monofilament, setting around 3,000 hooks per day with crews of 5 – 6. They are also likely to be well equipped with marine electronics and have refrigeration systems to freeze catch onboard for extended trips. Therefore, the larger vessels can range out to the outer portions of the EEZ, and beyond to some high seas areas, and some have negotiated fishing access with neighboring states.

Recent fishing effort has occurred in EEZ waters surrounding American Samoa, excluding existing large vessel prohibited areas; some foreign EEZ waters surrounding American Samoa where vessels have fishing access agreements, including the Cook Islands, Samoa, Tokelau, and

[9] Fishing power provides a measure of vessel efficiency. Full explanation may be found on FAO website at: http://www.fao.org/DOCREP/003/X2250E/x2250e0f.htm

others, as well as all four high seas areas (NW, NE, E, and S) giving an operational area roughly 155° W to 180°, and from 3° to 32° S from 2000 through 2009 (NMFS 2010c) (Figure 4).

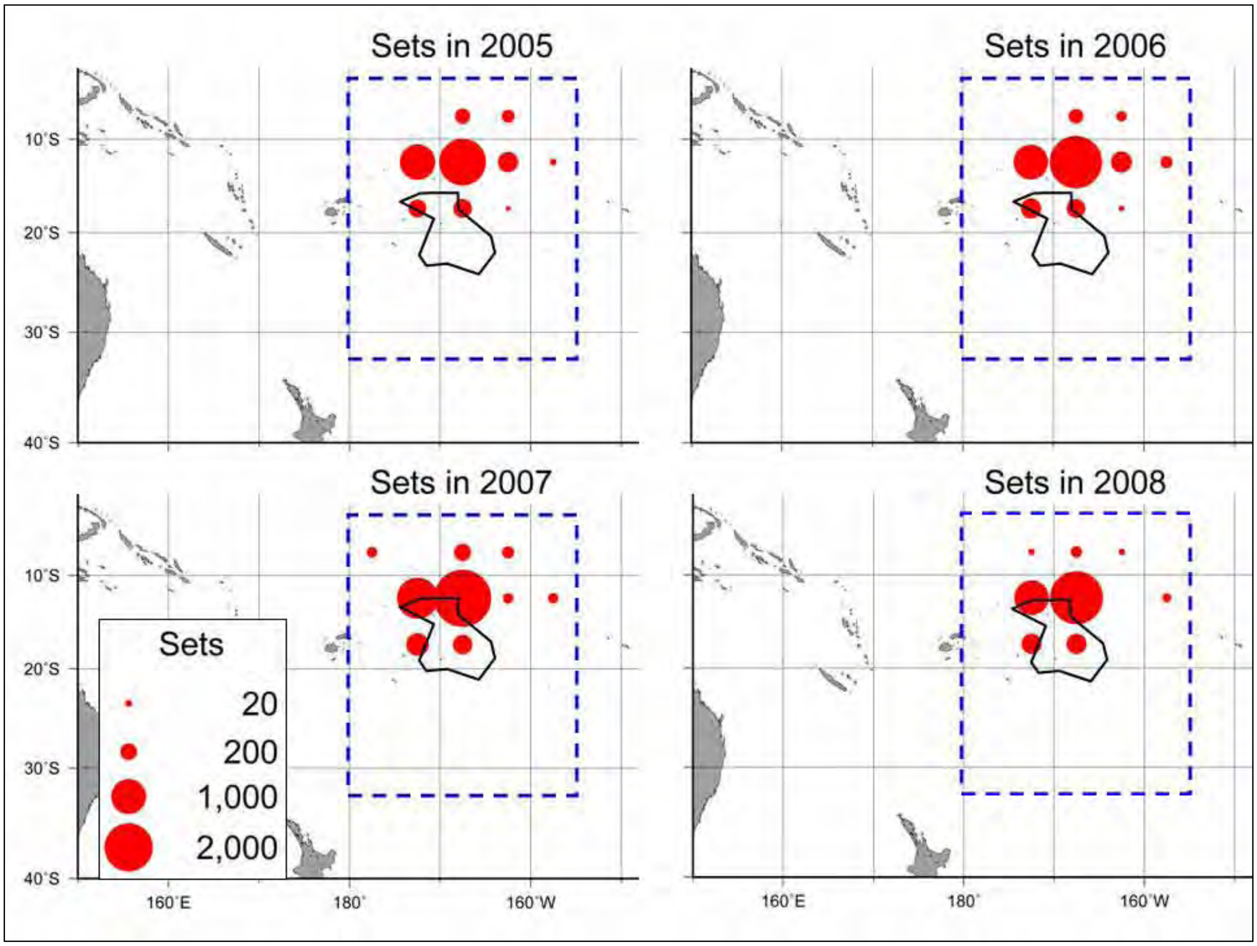

Figure 4: Area of operations of the American Samoa longline fleet within and beyond the EEZ around American Samoa.

Source: NMFS 2010c.

Note: The EEZ around American Samoa is outlined with a solid line. Fishing in 2009 also occurred within the area bounded by the dashed line. The fishery made fewer than 20 sets annually between 3° and 5° S and 20° and 32° S so confidentiality restrictions prevent their locations from being shown in the figure.

Individual vessels have negotiated access agreements with the neighboring countries surrounding American Samoa. Most agreements have been made with the Cook Islands, which has a special arrangement with the United States, whereby U.S. vessels fishing in the Cook's EEZ do not have to re-flag their vessels to the Cook Islands. A limited number of permits exist for these arrangements in the Cook Islands. Since 2001, American Samoa-based longline vessels have fished in several foreign EEZ waters surrounding American Samoa, such as Samoa, Tokelau, and others. Fishing effort in these countries ranges from a couple thousand hooks per year to over 2.7 million hooks set in the Cook Islands in 2006.

By 2005, the fishery had transitioned to a limited access program developed by the Council and implemented by NMFS, with 60 permits allowed in the program (Table 5). In 2006, only 28 vessels were active in American Samoa, most of which were large conventional monohull longline vessels. Recent operations information and landings from the American Samoa longline fleet are given in Table 5.

The number of hooks set by the American Samoa-based longline fleet has varied over time, but has recently held fairly steady (Figure 5). Data for 2009 show about 15 million hooks were set by 26 American Samoa-based longline vessels during 2009, roughly the same as 2008, but down from a high of 17.5 million set in 2007 (WPacFIN data).

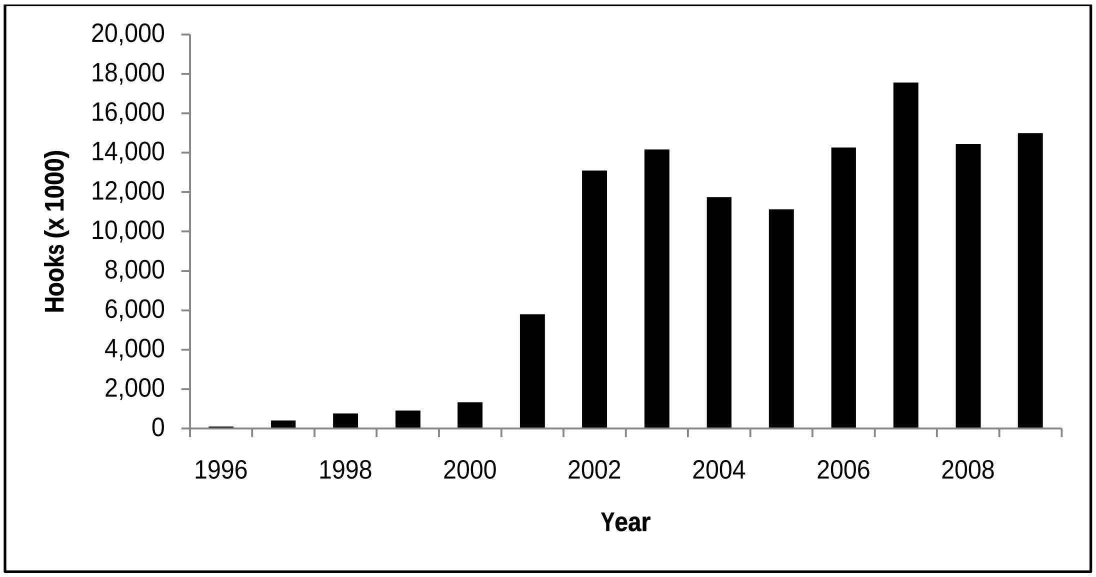

Figure 5: Longline Hooks Set by the American Samoa Fleet, 1996-2009.
Source: WPacFIN data.

Table 5: American Samoa Longline Fishery Landings and other Statistics, 2002-2009.

Item	2002	2003	2004	2005	2006	2007	2008	2009
Active Vessels	60	52	40	36	28	29	28	26
Hooks set (millions)	13.1	14.2	11.7	11.1	14.3	17.5	14.4	15
Trips	NA	650/282*	430/193*	223/179*	331	377	287	177
Sets Made	6,872	6,221	4,853	4,359	5,069	5,919	4,754	4,689
Total Landings (mt)	7,146	5,085	4,101	4,003	5,482	6,491	4,359	4,835
Bigeye Tuna Landings (mt)	198	253	228	133	201	231	124	159
Yellowfin Tuna Landings (mt)	487	517	891	526	501	638	345	394

Item	2002	2003	2004	2005	2006	2007	2008	2009
Albacore Tuna Landings (mt)	5,946	3,931	2,483	2,916	4,177	5,188	3,540	3,903
Catch Composition (in percent)								
Albacore Tuna	83%	77	61	73	76	80	81	81
BET, YFT tunas	10%	15	27	16	13	13	11	11
Miscellaneous Fish	7%	8	12	11	11	7	8	8
Total Ex-vessel Value (adjusted) ($ millions)	$13.7	$10.3	$8.9	$8.7	$11.7	$14.1	$9.5	$10.4

Source: WPacFIN data, WPRFMC 2010, WPRFMC unpublished 2009 Pelagics Annual Report module.
Notes: *The first number is trips by alia and the second is by larger monohull vessels. After 2005, data confidentiality rules prevent disaggregating the trip types. BET, bigeye tuna; YFT, yellowfin tuna.

Table 6: Actual and Active Permits in American Samoa's Longline Fishery, 2000-2009.

Year	Class A ≤ 40 feet		Class B 40.1 – 50 feet		Class C 50.1 – 70 feet		Class D > 70 feet	
	Permitted	Active	Permitted	Active	Permitted	Active	Permitted	Active
2000	45	37	2	2	5	3	2	2
2001	61	37	6	6	11	9	23	18
2002	55	32	6	6	14	6	24	17
2003	31	17	5	4	15	9	23	22
2004	11	9	2	2	13	8	22	21
2005	8	5	3	2	11	9	20	18
2006	21	3	5	0	12	6	24	19
2007	19	2	6	0	11	5	26	22
2008	19	1	6	0	11	5	26	22
2009	12	1	0	0	12	5	26	20

Source: NMFS PIRO and NMFS unpublished data[10].
Note: 2006-2008 permitted vessels add up to 62. Double-counting can occur if permits are transferred to different owners or vessels during the year. The total number of available permits is 60.

Catch

More than 10.6 million lb of pelagic species were landed in American Samoa during 2009 (WPacFIN data). Tuna species account for about 95 percent of the total landings and albacore dominates (85%) tuna landings and accounts for 81 percent of the total pelagic landings. Albacore landings in 2009 increased (10%) to about 8.6 million pounds from about 7.8 million in 2008. Non-tuna PMUS totaled about 500,000 pounds in 2009. Wahoo dominated (61%) the non-

[10] http://www.pifsc.noaa.gov/wpacfin/as/Pages/as_data_6.php Last updated June 30, 2010

tuna landings, and barracuda dominated the other pelagic fish species. Of the total landings, about 10.5 million pounds account for commercial landings, most of which were landed by the large Class D vessels.

In the future, the fleet may also diversify into other fish products in response to uncertainties about the long-term continuity of the Pago Pago-based fish processing industry (TEC, Inc. 2007); however, currently the fleet primarily targets albacore tuna using deep-set longline gear and is the major species landed. Yellowfin, skipjack, and bigeye tunas and wahoo contribute the bulk of the non-albacore landings (18%). The 2007 American Samoa tuna landings were the second highest recorded in the 28-year data record; 91.8 percent of the highest annual landings estimate from 2002. Estimated non-tuna pelagic management unit species (PMUS) landings had generally been increasing overtime with two peaks in 2002 and 2007 (Figure 6). Since 2007 total landings and tuna landings have both decreased from the recent 2007 peak. Albacore average weight-per-fish has been steadily increasing since 2005, the average size of bigeye has been increasing since 2004, average size of wahoo has been gradually declining since 2002, and yellowfin tuna average size appears to fluctuate on an inter-annual basis from samples taken by the cannery (WPRFMC 2010).

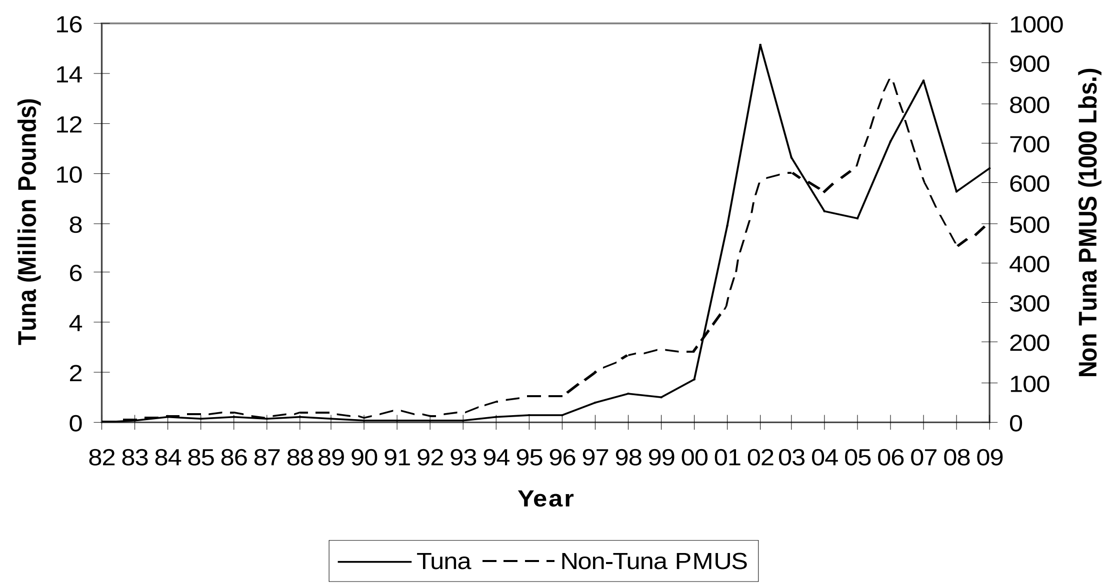

Figure 6: American Samoa Pelagic Landings, 1982-2009.
Source: WPRFMC 2010 and WPRFMC unpublished 2009 Pelagics Annual Report module.

8.2.2 Catch-per-unit effort

The CPUE of albacore, the main target species, reached a peak in 2001 at 33 fish per 1,000 hooks and decreased to approximately 15 fish per 1,000 hooks in 2009. The CPUE for all important PMUS harvested by all longline vessels shows a downward trend from 2006 to the most recent catch data (2009; Table 7).

Table 7: CPUE (catch/1,000 hooks) for all American Samoa Longline Vessels, 2006-2009.

Species	2006 All Vessels	2007 All Vessels	2008 All Vessels	2009 All Vessels
Skipjack tuna	3.2	2.3	2.4	2.3
Albacore tuna	18.4	18.3	14.2	14.8
Yellowfin tuna	1.6	1.9	1.0	1.1
Bigeye tuna	0.9	0.9	0.5	0.6
TUNAS SUBTOTALS	24.2	23.5	18.2	18.8
Mahimahi	0.4	0.1	0.1	0.2
Blue marlin	0.2	0.2	0.2	0.2
Wahoo	1.5	1.0	0.7	1.0
Sharks (all)	0.5	0.4	0.4	0.4
Swordfish	0.1	0.0	0.0	0.0
Spearfish	0.1	0.0	0.1	0.1
Oilfish	0.5	0.5	0.4	0.5
Pomfret	0.0	0.1	0.1	0.1
NON-TUNA PMUS SUBTOTALS	3.3	2.4	2.0	2.5
Pelagic fishes (unknown)	0.0	0.2	0.1	0.2
OTHER PELAGICS SUBTOTALS	0.0	0.2	0.1	0.2
TOTAL PELAGICS	**27.5**	**26.0**	**20.3**	**21.5**

Source: WPRFMC unpublished 2009 Pelagics Annual Report module

8.2.3 Bycatch

Table 8 shows the number of fish kept and released in the American Samoa longline fishery during 2009. Overall nearly 12 percent of the total catch was released with skipjack tuna having the highest number released. Nearly all sharks and approximately 96 percent of oilfish were also not retained. Fish are released for various reasons including quality, size, handling, and storage difficulties, and marketing problems. The relatively high rates of release of some PMUS in the American Samoa longline fishery may warrant further investigation. However, it is expected that catch rates and total catches of epipelagic MUS such as the billfishes and mahimahi would be reduced by fishing with gear deeper than 100 meters, as proposed in this amendment.

Table 8: Number of fish kept and released in the American Samoa Longline Fishery, 2009.

Species	Number Kept	Number Released	Percent Released
Skipjack tuna	26,866	7,517	21.9
Albacore tuna	221,315	673	0.3
Yellowfin tuna	15,585	911	5.5
Bigeye tuna	8,118	570	6.6
Tunas (unknown)	11	15	57.7
TUNAS SUBTOTALS	271,895	9,686	3.4
Mahimahi	1,629	1,602	49.6
Black marlin	2	26	92.9
Blue marlin	675	2,691	79.9
Striped marlin	116	224	65.9
Wahoo	10,776	3,670	25.4
Sharks (all)	37	5,926	99.4
Swordfish	215	90	29.5
Sailfish	64	612	90.5
Spearfish	145	1,210	89.3
Moonfish	128	584	82.0
Oilfish	326	7,014	95.6
Pomfret	141	1,249	89.9
NON-TUNA PMUS SUBTOTALS	14,254	24,898	63.6
Barracudas	48	360	88.2
Rainbow runner	8	1	11.1
Dogtooth tuna	0	10	100
Pelagic fishes (unknown)	11	2,909	99.6
OTHER PELAGICS SUBTOTALS	67	3,280	98.0
TOTAL PELAGICS	286,216	37,864	11.7

Source: WPRFMC unpublished 2009 Pelagics Annual Report module.
Note: Figure uses "haul-year" (when the haul commenced) annual summaries. This may cause minor differences if compared to when the set commenced at the start and end of a calendar year.

8.2.4 Observer Program

NMFS funds fishery observer recruitment, training, and support in the western Pacific region including its observer program in American Samoa. NMFS is in the process of increasing American Samoa longline observer coverage. By the end of 2010, annual coverage was 25.0 percent, with more than 40 percent coverage in the final quarter of the year. Prior to beginning the observer program in American Samoa, NMFS conducted a pilot program from August through October 2002. The pilot program observed 76 sets on one Class C and two Class D vessels, which set 197,617 hooks. There were no sightings of, or interactions with any protected species including sea turtles, marine mammals, or seabirds (NMFS 2003).

Mandatory observer placement to monitor protected interactions on American Samoa longline vessels first began in April 2006, to monitor protected species interactions. Since inception of the American Samoa Observer Program in April 2006 through December 2009, observers monitored

40 out of 550 trips (or approximately 7.2 percent), which included 1,382 sets. Although direct observation is the most accurate method, unless observer coverage of the fleet is complete, estimation of bycatch from observer data requires sampling of the fleet and then extrapolating from the samples (i.e., the observations) to the entire fleet using statistical estimators. This risk of overestimating interactions is proportionately increased as observer coverage is reduced (or set too low to reduce the standard error and account for the rareness of the event) as in this fishery. With a few years of observer coverage at less than 20 percent each year, caution must be taken in extrapolating to the entire fishery. As noted earlier, NMFS is in the process of increasing American Samoa longline observer coverage. In 2010, annual coverage reached 25.0 percent.

Between April 2006 and December 2009, eight green sea turtle interactions and a total observed effort in excess of 4.1 million hooks were reported in PIRO Observer Program status reports for American Samoa longline fishery for a mean interaction rate of approximately 0.002 turtles per 1,000 hooks. The sea turtle interaction rate in the American Samoa longline fishery from 2006-2009 ranged from 0.001-0.004 turtles per 1,000 hooks, with a mean of 0.002 turtles per 1,000 hooks. The Hawaii deep-set longline fishery, which fishes at the same or greater depths than the American Samoa fishery, had turtle interaction rates over the same period ranging from 0.0004-0.002 turtles per 1,000 hooks, with a mean of 0.001 turtles per 1,000 hooks or half the American Samoa longline fishery average. In 2010, six additional green sea turtle interactions were observed (see Table 9).

Also, from April 2006-December 2010, three out of five years reported zero marine mammal interactions; only in 2008 and 2010 a total of five marine mammal interactions (two false killer whales, three rough-toothed dolphin) were observed and one seabird interaction (unidentified shearwater in 2007) was reported[11] by observers as shown in Table 9. Some gear configuration data as observed by the American Samoa Observer Program through 2009 is summarized in Table 10.

Table 9: Number of Longline Fishery Protected Species Interactions, 2006-2010.

Year	**2006**	**2007**	**2008**	**2009**	**2010**
Number of sets observed	287	410	379	306	798
Observer coverage (percent)	8.1	7.1	6.4	7.7	25.0
Green sea turtles, released dead	3	1	1	2	6
Green sea turtles, released injured	0	0	0	0	1
Marine mammals, released injured	0	0	2	0	1
Marine mammals, released dead	0	0	1	0	1
Seabirds, released dead	0	1	0	0	0

Source: NMFS PIRO American Samoa Observer Program 2006-2010 Status Reports
Note: Protected species interactions for Observer Program Quarterly and Annual Reports are based on vessel arrivals. The tally of an interaction may fall in a year other than the year when the interaction actually occurred.

[11] Found on NMFS PIRO website at: http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html

Table 10: American Samoa Longline Fishery Gear Configuration, 2006-2009.

	Minimum	Average (mean)	Maximum
Hooks used	13/0 circle	14/0 circle	16/0 circle
Hooks between floats	25	31.5	36
Hooks per set	391	3,006	4,126
Float line length (meters)	18.4	26.0	36.5
Branch line length (meters)	6.8	10.3	15.1
Line shooter used	Yes	Yes	Yes

Source: NMFS PIRO Observer Program 2009.
Note: Based on 39 observed trips departing from April 2006-October 2009, including approx. 3.9 million hooks observed.

8.2.5 Recreational Fishing

Levine and Allen (2009) provide an overview of fisheries in American Samoa, including subsistence and recreational fisheries. Citing a survey conducted in American Samoa by Kilarski et al. 2006, Levine and Allen noted that approximately half of the respondents stated that they fished for recreation, with 71 percent of these individuals fishing once a week or less. Fishermen also fished infrequently for cultural purposes, although cultural, subsistence, and recreational fishing categories were difficult to distinguish as one fishing outing could be motivated by all three reasons.

Boat-based recreational fishing in American Samoa has been influenced primarily by the fortunes of fishing clubs and fishing tournaments. Tournament fishing for pelagic species began in American Samoa in the 1970s, and between 1974 and 1998, a total of 64 fishing tournaments were held in American Samoa (Tulafono 2001). Most of the boats that participated were alia catamarans and small skiffs. Catches from tournaments were often sold, as most of the entrants are local small-scale commercial fishermen. In 1996, three days of tournament fishing contributed about one percent of the total domestic landings. Typically, 7 to 14 local boats carrying a total of 55 to 70 fishermen participated in each tournament, which were held two to five times per year (Craig et al. 1993).

The majority of tournament participants operated 28-foot alia, the same vessels that engage in the small-scale longline fishery. With more emphasis on commercial longline fishing since 1996, interest in the tournaments waned (Tulafono 2001) and pelagic fishing effort shifted markedly from trolling to longlining. Catch-and-release recreational fishing is virtually unknown in American Samoa. Landing fish to meet cultural obligations is so important that releasing fish would generally be considered a failure to meet these obligations (Tulafono 2001). Nevertheless, some pelagic fishermen who fish for subsistence release fish that are surplus to their subsistence needs (S. Steffany, pers. comm. to P. Bartram, Akala Products Inc., September 15, 2001).

A summary of the species composition of fishery tournaments held between 1974 and 2010 is shown below in Table 11. The data do not document every tournament held in the four decades since records were kept, but cover 55 individual competitions. Of the nearly 136,000 lb of fish landed in the tournaments, almost two- thirds of the catch comprised equal amounts of skipjack and yellowfin tuna, while blue marlin, wahoo, mahimahi, and sailfish made up the majority of the remaining catch. There is no information on any protected species interactions associated with recreational fishing.

Table 11: Species composition of fishery tournaments held in American Samoa between 1974 and 2010.

Species	Weight (lb)	Percent
Skipjack tuna	40,655.85	29.93
Yellowfin tuna	39,458.34	29.05
Blue marlin	21,102.25	15.54
Wahoo	11,807.25	8.69
Mahimahi	11,035.20	8.13
Sailfish	3,215.00	2.37
Sharks (unknown)	2,805.75	2.07
Dogtooth tuna	1,786.05	1.32
Others	3,951.75	2.91
Total	135,817.44	100.00

Source: American Samoa Dept. of Marine and Wildlife Resources.

More recently, recreational fishing has undergone a renaissance in American Samoa through the establishment of the Pago Pago Game Fishing Association (PPGFA), which was founded by a group of recreational anglers in 2003[12]. The motivation to form the PPGFA was the desire to host regular fishing competitions. There are about 15 recreational fishing vessels ranging from 10 ft single engine dinghies to 35 ft twin diesel engine cabin cruisers. The PPGFA has annually hosted international tournaments in each of the past five years with fishermen from neighboring Samoa and Cook Islands attending. The recreational vessels use anchored fish aggregating devices (FADs) extensively, and on tournaments venture to the various outer banks which include the South Bank (35 miles), North East Bank (40 miles NE), South East bank (37 miles SE), 2% bank (40 miles), and East Bank (24 miles East). Several recreational fishermen have aspirations to become charter vessels and are in the process of obtaining captains (6 pack) licenses. In 2010, PPGFA played host to the 11th Steinlager I'a Lapo'a Game Fishing Tournament, which was a qualifying event for the International Game Fish Association’s Offshore World Championship in Cabo San Lucas, Mexico.

There is no full-time regular charter fishery in American Samoa similar to those in Hawaii or Guam. However, Pago Pago Marine Charters[13], which is concerned primarily with industrial work such as underwater welding, construction, and salvage, also includes for-hire fishing among the services it offers.

Estimation of the volume and value of recreational fishing in American Samoa is not known with any precision. A volume approximation of boat based recreational fishing is generated in the Council’s Pelagics Annual Report, based on the annual sampling of catches conducted under the

[12] http://ppgfa.com/page/about-ppgfa
[13] http://pagopagomarinecharters.com/

auspices of WPacFIN[14]. Boat-based recreational catches have ranged from 2,100 to 6,100 lb between 2006 and 2008, comprising primarily pelagic fish (WPRFMC 2007, WPRFMC 2010). These catches are unsold, but based on the 2008 average price for pelagic fish ($2.19/lb) (WPRFMC 2010) this would be worth $4,600 - $18,360. An additional volume of fish is caught recreationally by fishing tournaments mounted by the PPGFA, but these landings are not monitored by WPacFIN.

8.3 Additional Fishery Research Needs

Under all alternatives, the Council recommended an adaptive management approach be utilized. Therefore, the selected alternative will be monitored for effectiveness, and if additional changes are needed, the Council will develop additional management measures. Because of the dearth of information on fishery interactions between green sea turtles and longline fishing gear, conducting research, ideally cooperative research using the local fishermen, was recommended by the Council. This research would optimally utilize the skill and knowledge of fishery participants to test gear and potentially develop other means of turtle interaction avoidance, while maintaining or improving catches of target species specific to their waters and their fishery as an ongoing collaborative effort within an adaptive management structure.

The Council recommended research be undertaken on the effect of larger circle hooks on albacore catch rates to evaluate whether larger circle hooks would be a viable option to potentially reduce sea turtle interaction rates. A recent experimental study conducted in the American Samoa longline fishery showed that size 16/0 circle hooks appear to have catch rates almost identical to control hooks (size 14/0) (Beverly et al. 2011). The same study noted, however, that there may be significant differences in catch rates for skipjack, wahoo, and mahimahi between the two hook sizes, with lower catch rates on the larger hook. Further, the SPC study also suggested that there were lower bycatch rates on the larger hooks, with only a third of all lancet-fish in the study taken on the size 16/0 circle hooks.

Also recommended was an intensive year-long experiment with high observer coverage, at a minimum of 30 percent of trips, as recommended by the Council’s SSC, be conducted to explore the variability in turtle interactions over time and space and with different gear configurations. Increased observer coverage in American Samoa is contingent upon NMFS funding. The American Samoa Observer Program is now incrementally increasing the annual coverage level up to 40 percent. Once reached, this higher level of coverage is expected to continue for at least one year. A higher coverage level may provide valuable genetic samples of any incidentally-caught sea turtles in the future. Genetic samples will yield better data about which sea turtle populations are being affected by the longline fishery.

The impacts of the proposed action may have social and economic impacts resulting from the gear modifications. As such, some form of post-hoc or follow-up research (e.g., interviews with the fishermen) about the actual effects of the action should be conducted. The gear modifications outlined in this amendment may result in social impacts of an economic nature. These potential impacts have been examined by the NMFS’ Pacific Islands Regional Office. They include direct costs associated with purchasing or modifying gear, as well as less direct costs associated with

[14] http://www.pifsc.noaa.gov/wpacfin/).

potential changes to CPUE of target species. As it is not clear how the effects will be felt according to individual vessels (i.e., it is not known what the vessel-specific responses will be), there is some uncertainty about the specific magnitude of any impact on the fishery. Therefore, it is advisable that a research project be developed and implemented that examines the effects of the action at the vessel level.

This will accomplish three objectives. First, it will illuminate the differential effects stemming from variables such as vessel size and mainline reel capacity. Second, that data can be aggregated to provide an understanding of the effects on the fishery as a whole. Both pieces of information will also presumably be useful generally in the event of future gear modification actions, to this fishery or another. Third, it should engender some trust amongst participants that fishery managers are indeed interested in the effects of such actions. In terms of project timeline, a balance should be struck so that the general economic context of the fishery is largely the same but that enough time passes to allow for participants to understand how the modifications have in fact affected them. Certainly, it would be advisable to communicate with the participants the intention to conduct such research in order that they may maintain records and information that would assist with the collection and interpretation of data at a later date.

8.4 Target Species: Albacore Tuna Life History and Distribution

Separate northern and southern stocks of albacore (*Thunnus alalunga*), with separate spawning areas and seasons, exist in the Pacific. Growth rates and migration patterns differ between populations north and south of 40° N (Laurs and Wetherall 1981). In the North Pacific, they are absent from the equatorial eastern Pacific as Hawaii appears to be at the southern edge of their range. In the South Pacific from 150° E to 120° W, albacore are concentrated between 10° S and 30° S; in the west they may be found as far as 50º S. A 2006 stock assessment indicates the level of albacore biomass available to the Pacific Island nations' domestic fisheries is relatively modest; i.e., of the order of 300,000 mt distributed over an ocean area of approximately 14.5 million sq km (5.5 million sq mi) (10–28°S, 160°E to 140°W) including waters around American Samoa (Langley 2006).

The main albacore fisheries in the Pacific may be distinguished as either surface or deep water. The surface fisheries are trolling operations off the American coast from Baja Mexico to Canada, baitboat operations south of Japan at the Kuroshio Front and a fishery in New Zealand waters. A troll fishery has also developed south of Tahiti. Purse seine fishing is also considered a surface method but is currently of minor importance in the albacore fishery. Albacore are occasionally taken as bycatch in other tuna fisheries. Elsewhere, throughout the subtropical and temperate north and south Pacific including American Samoa, longline gear is used to capture deep-swimming fish. The longline fishery, targeting deep-swimming fish, occurs closer to the equator including waters around American Samoa.

Temperature is recognized as the major determinant of albacore distribution. Albacore are both surface dwelling and deep-swimming. Deep-swimming albacore tuna are generally more concentrated in the western Pacific but with eastward extensions along 30° N and 10° S (Foreman 1980). The 15.6° to 19.4° C sea surface temperature (SST) isotherms mark the limits of abundant distribution although deep-swimming albacore tuna have been found in waters between 13.5° and 25.2° C (Saito 1973).

The overall thermal structure of water masses, rather than just SST, has to be taken into account in describing total range because depth distribution is governed by vertical thermal structure. Albacore are found to a depth of at least 380 m and will move into water as cold as 9° C at depths of 200 m. They can move through temperature gradients of up to 10° C within 20 minutes. This reflects the many advanced adaptations of albacore; it is a thermoregulating endotherm with a high metabolic rate and advanced cardiovascular system. Generally, albacore have different temperature preferences according to size, with larger fish preferring cooler water, although the opposite is true in the northeast Pacific. They are considered epi- and mesopelagic in depth range.

8.5 Status of Tuna Stocks

Maximum sustainable yields (MSYs) for tuna stocks are as follows: bigeye- 73,840 mt; skipjack- 1,375,600 mt; and S. Pacific albacore- 81,580 mt. Langley et al. (2009) estimate MSY of WCPO yellowfin tuna between 552,000-637,000 mt.

8.5.1 South Pacific Albacore Tuna

A 2009 assessment of South Pacific albacore conducted by Hoyle and Davies (2009) covering the period 1960 to 2008 determined South Pacific albacore were not subject to overfishing, and are not overfished. The 2009 assessment made some changes to the model; two major sources of uncertainty were addressed and the assessment reappraised (Hoyle and Davies 2009). Hoyle and Davies (2009) concluded that there is no indication that current levels of catch are not sustainable in terms of recruitment overfishing[15], particularly given the age selectivity of the fisheries (which primarily catch larger, older (7-12 yr) fish); however, current levels of fishing pressure appear to be affecting longline catch rates. Langley (2006) predicted that increases in fishing effort in the Pacific Islands longline fisheries would result in declines in CPUE due to a decline in exploitable biomass. Catch rates in domestic longline fisheries exhibit strong seasonal trends due to fluctuations in the oceanographic conditions and inter-annual variation in albacore catch rates are evident in most of the Pacific Island fisheries (Langley 2006).

8.5.2 Skipjack Tuna

The most recent assessment of skipjack tuna in the WCPO included data from 1972 to 2009 (Hoyle et al. 2010). Current fishing mortality rates for skipjack tuna are estimated to be well below the F_{MSY} reference point, and therefore, overfishing is not occurring (i.e., current fishing mortality is less than F_{MSY}). The total biomass of skipjack tuna has fluctuated above the biomass based reference point B_{MSY} and recent biomass levels are estimated to be well above the B_{MSY} level. According to the authors, these conclusions appear relatively robust (i.e., scientifically valid), at least within the statistical uncertainty of the current assessment. Recruitment

[14] Recruitment overfishing is the rate of fishing above which recruitment to the exploitable stock becomes significantly reduced.

variability, influenced by environmental conditions, will continue to be the primary influence on stock size and fishery performance.

The American Samoa longline fishery is considered to have a sustainable catch of skipjack tuna. This species comprised about 12 percent of the total longline catch between 2004 and 2009, ranging from roughly 136 to 235 mt landed during this period (unpublished information from draft 2009 American Samoa pelagics annual report module). In 2007 and 2008, the price for skipjack showed a strong uptrend and reached record levels around mid-2008 with Bangkok benchmark skipjack prices at US$1,920 per mt and Yaizu prices at US$1,929 per mt (Williams and Terawasi 2009). As such, longline vessels in American Samoa began to retain greater amounts of skipjack in 2008. Skipjack retention rates averaged about 74 percent between 2002 and 2007, but rose to almost 88 percent in 2008 with the higher value of skipjack.

8.5.3 Yellowfin Tuna

Western and Central Pacific yellowfin tuna were determined by NMFS to be subject to overfishing in 2006 (71 FR 14837); however, based on recent stock assessments, they are no longer considered to be subject to overfishing. Langley et al. (2009) estimate MSY of WCPO yellowfin tuna between 552,000-637,000 mt and state that estimates of current fishing mortality are generally well below the fishing mortality at MSY, and any increase in fishing mortality would most likely occur with the waters of the Pacific Warm Pool, i.e., between the islands of New Guinea and the Federated States of Micronesia. Overall, spawning biomass is greater than that needed to produce MSY. There is no indication that the American Samoa longline fishery’s catch of yellowfin tuna is not sustainable. No stock assessment of yellowfin tuna was conducted for WCPO in 2010.

International Stock Management
In December 2008, the WCPFC adopted a conservation and management measure (CMM 2008-01, “Conservation and Management Measure for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean”) for the years 2009-2011, applicable to bigeye and yellowfin tuna catches from the WCPO. For the U.S., the catch of yellowfin tuna is not to be increased in the longline fishery from the 2001–2004 levels. American Samoa is among the small island developing State members and participating territories to the WCPFC. As such, the catch limit for yellowfin under CMM 2008-01 does not apply to American Samoa; however, the Council may recommend, and NMFS may implement domestic yellowfin tuna catch limits for the American Samoa longline fishery through the Magnuson-Stevens Act. Yellowfin tuna are a non-target fish retained in the American Samoa longline fishery (Table 5 and Table 8).

8.5.4 Bigeye Tuna

The 2010 WCPO bigeye tuna stock assessment concluded that overfishing is occurring, and it is likely bigeye tuna is approaching an overfished state, if it is not already slightly overfished. It also concluded that MSY levels would rise if small fish mortality were reduced, which would allow greater overall yields to be harvested sustainably (Harley et al. 2010). According to NMFS, the Pacific-wide bigeye tuna stock is classified as subject to overfishing, not overfished and not approaching an overfished state. Catches of bigeye tuna in American Samoa are small, relative to Hawaii, averaging 183 mt between 2004 and 2008 (WPRFMC 2010). While these catches contribute to the overall fishing mortality of bigeye in the WCPO, they are negligible in comparison to the approximately 40,000 mt caught by purse seines and 60,000 mt caught by longliners in total. Moreover, American Samoa and its longline fishery primarily operate in an area to the south of the main concentration of longline fishing (Fig. 4 in Harley et al. 2010), and is therefore, likely to be sustainable, although fishing has had an impact on the stock.

International Stock Management

As discussed above in Section 8.5.3, the WCPFC adopted CMM 2008-01 for the years 2009-2011, applicable to bigeye and yellowfin tuna catches from the WCPO. The measure includes a phased reduction of bigeye tuna catches for the longline fishery from 2001-2004 or 2004 levels over three years, so that the catch would be reduced 10 percent in 2009, 20 percent in 2010 and 30 percent in 2011. For fresh fish longline fisheries catching less than 5,000 mt annually (such as the Hawaii-based longline fleet), the reduction applies to 2009, with 2010 and 2011 catches to be maintained at the 2009 level, i.e., at a 10 percent reduction. Under CMM 2008-01, the specified bigeye tuna catch limits do not apply to the small island developing State members and participating territories to the WCPFC, including American Samoa, provided they are undertaking responsible development of their domestic fisheries. However, the Council may recommend, and NMFS may implement domestic catch limits for the American Samoa longline fishery through the Magnuson-Stevens Act. Bigeye tuna are a non-target fish retained in the American Samoa longline fishery (Table 5).

8.6 Protected Species

8.6.1 Sea Turtles

All Pacific sea turtles are designated under the Endangered Species Act (ESA) as either threatened or endangered. The breeding populations of Mexico's olive ridley sea turtles (*Lepidochelys olivacea*) are currently listed as endangered, while all other ridley populations are listed as threatened. Leatherback sea turtles (*Dermochelys coriacea*) and hawksbill turtles (*Eretmochelys imbricata*) are also classified as endangered. Loggerhead (*Caretta caretta*) and green sea turtles (*Chelonia mydas*) 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 highly migratory phase in their life history (NMFS 2001). For more detailed information on the life history of sea turtles, see the Council's Environmental Impact Statement on Amendment 18 to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region (WPRFMC 2009a).

8.6.1.1 Green Sea Turtles

Green sea turtles are the primary species documented to interact with the American Samoa longline fishery, although other sea turtles are found in American Samoa's waters.

General Distribution

Green turtles are found throughout the world, occurring primarily in tropical, and to a lesser extent, subtropical waters. The species occurs in five major regions: the Pacific Ocean, Atlantic

Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea. These regions can be further divided into nesting aggregations within the eastern, central, and western Pacific Ocean; the western, northern, and eastern Indian Ocean; Mediterranean Sea; and eastern, southern, and western Atlantic Ocean, including the Caribbean Sea Green turtles appear to prefer waters that usually remain around 20° C in the coldest month; for example, during warm spells (e.g., El Niño), green turtles may be found considerably north of their normal distribution. Stinson (1984) found green turtles appear most frequently in U.S. coastal waters that have temperatures exceeding 18° C.

The genus *Chelonia* is composed of two taxonomic units at the population level; the eastern Pacific green turtle (referred to by some as “black turtle,” *C. mydas agassizii*), which ranges (including nesting) from Baja California south to Peru and west to the Galapagos Islands, and the nominate *C. m. mydas* in the rest of the range (insular tropical Pacific, including Hawaii). The non-breeding range of green turtles is generally tropical, and can extend thousands of miles from shore in certain regions. Hawaiian green turtles monitored through satellite transmitters were found to travel more than 1,100 km from their nesting beach in the French Frigate Shoals, south and southwest against prevailing currents to numerous distant foraging grounds within the 2,400 km span of the archipelago (Balazs 1994, Balazs et al., 1994, Balazs and Ellis 1996).

Three green turtles outfitted with satellite tags on Rose Atoll (the easternmost island of the Samoan Archipelago) traveled on a southwesterly course to Fiji, a distance of approximately 1,500 km (Balazs et al. 1994). Tag returns of eastern Pacific green turtles establish that these turtles travel long distances between foraging and nesting grounds. In fact, 75 percent of tag recoveries from 1982-1990 were from turtles that had traveled more than 1,000 km from Michoacán, Mexico.

Pacific Ocean Nesting Distribution

Green turtles occur in the eastern, central, and western Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998a). Nesting is known to occur at hundreds of sites throughout the Pacific, with major nesting occurring in Indonesia, Malaysia, the Philippines, Australia, Micronesia, Hawaii, New Caledonia, Mexico, the Galapagos Islands, and other sites (NMFS and USFWS 2007a). In Oceania (Polynesia, Micronesia, Melanesia, and eastern Australia) there are nearly 200 known nesting sites (NMFS 2010b). Conservation efforts over the past 25 years or more appear to have had some positive results. Chaloupka et al. (2008) report that green sea turtle index rookeries at the Ogasawara Islands (southern Japan), Raine Island (northern Great Barrier Reef), Hawaii, and Heron Island (southern Great Barrier Reef) have shown significant increases in nester or nest abundance (Figure 7).

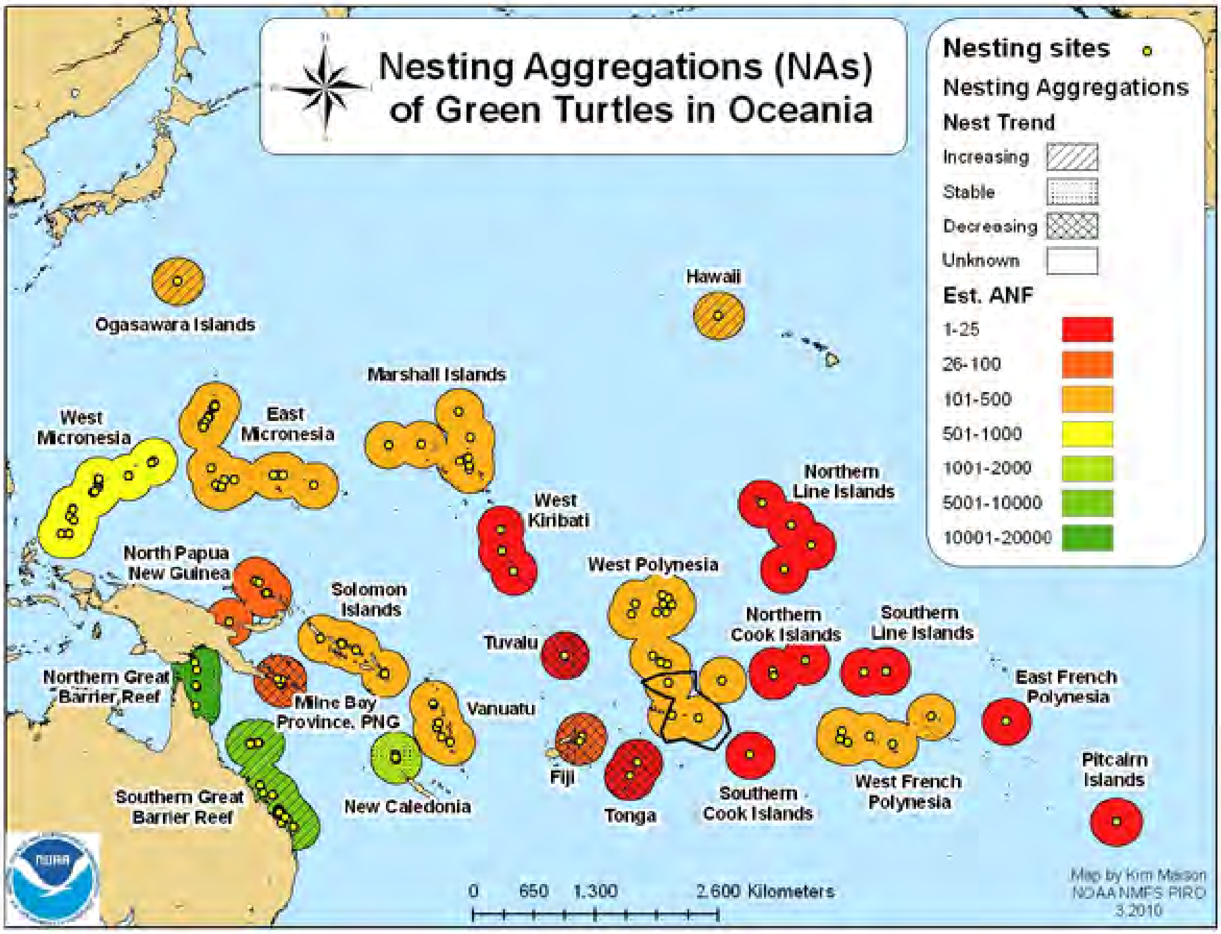

Figure 7: Green turtle nesting aggregations in Oceania.
Source: NMFS PIRO Protected Resources Division.
Note: EEZ around American Samoa shown in black outline; “Est. ANF” = estimated annual nesting females.

Based on the best information currently available, about 18,000 to 38,000 female green turtles nest annually in Oceania (NMFS 2010b). However, about 90 percent of nesting takes place among two Australian nesting aggregations (Northern GBR and Southern GBR which includes the Coral Sea Platform), with over half of all the nesting occurring on a single island; Raine Island in the Northern GBR (Chaloupka et al. 2008, Limpus 2009). Nesting trends appear stable at Raine Island, and are increasing at Heron Island in the Southern GBR, as well as at Chichi-jima in the Ogasawara Islands (Chaloupka et al. 2008). However, these trends do not necessarily correlate with a stable or increasing total number of turtles because of low nesting success and hatchling production at Raine Island, where the majority of nesting for Oceania occurs (Limpus et al. 2003; Limpus 2009; Hamann et al. 2009). Also, nesting aggregations with small numbers of nesting females, like those throughout the islands and atolls of central and south Pacific, may be of greater importance than their proportional numbers indicate. Many of these nesting aggregations are geographically isolated, and likely harbor unique genetic diversity, which may be lost if these small nesting aggregations or their components become extirpated (Avise and Bowen 1994).

Sub-adult and adult green turtles occur in low abundance in nearshore waters around the islands of American Samoa. No population trend data are available, but anecdotal information suggests major declines over the last 50 years (Tuato'o-Bartley et al 1993, Utzurrum 2002). Genetics samples have been collected from stranded or foraging green turtles around Tutuila. To date, four samples have been analyzed: two samples from stranded green turtles in Pago Pago Harbor had a haplotype known from nesting green turtles in American Samoa, Yap, and the Marshall Islands. However, since many green turtle nesting aggregations in the Pacific still have not been sampled, it is possible that this haplotype occurs at more than these three sites. In addition, two samples have been analyzed from foraging green turtles at Fagaalu, but the haplotype is of unknown nesting origin (Peter Dutton, NMFS SWFSC, pers. comm.).

Size and Identification

Green turtles are distinguished from other sea turtles by their smooth carapace with four pairs of lateral scutes, a single pair of prefrontal scutes, and a lower jaw-edge that is coarsely serrated. Adult green turtles have a light to dark brown carapace, sometimes shaded with olive, and can exceed one meter in carapace length and 100 kg in body mass. Females nesting in Hawaii averaged 92 cm in straight carapace length (SCL), while at the Olimarao Atoll in Yap, females averaged 104 cm in curved carapace length (CCL) and approximately 140 kg. In the rookeries of Michoacán, Mexico, females averaged 82 cm in CCL, while males averaged 77 cm CCL (in NMFS and USFWS 1998a).

Growth and Age at Maturity

Green turtles exhibit a slower growth rate than other sea turtles, and age to maturity appears to the longest. Based on age-specific growth rates, green turtles are estimated to attain sexual maturity beginning at age 25 to 50 years (Limpus and Chaloupka 1997, Bjorndal et al. 2000, Chaloupka et al. 2008, Seminoff 2002, Zug et al. 2002). The period of reproductivity has been estimated to range from 17 to 23 years (Carr 1978, Fitzsimmons et al. 1995 *in* Seminoff 2002).

Diet

Although most green turtles appear to have a nearly exclusive herbivorous diet, consisting primarily of sea grass and algae (Wetherall et al. 1993; Hirth 1997), those along the east Pacific coast seem to have a more carnivorous diet. Analysis of stomach contents of green turtles found off Peru revealed a large percentage of mollusks and polychaetes, while fish and fish eggs, and jellyfish and commensal amphipods comprised a lesser percentage (Bjorndal 1997). Foraging studies of 31 green sea turtles in Mexico found the turtles to have consumed primarily algae with small amounts of squid, sponges, tube worms, and other invertebrates in their diet (Seminoff et al. 1997). A later study, however, documented a number of deep water invertebrate prey in the diet of local green turtles in Bahia de los Angeles, Mexico, suggesting that green turtles forage in offshore regions as well (Seminoff et al. 2006). Seminoff and Jones (2006) suggest that green sea turtles also exhibit offshore resting activity and they cite studies in the Caribbean where greens showed predictable diel movement patterns with turtles feeding on grass flats in mid-morning and mid-afternoon and moving into deeper water during midday hours. In the Hawaiian Islands, green turtles are thought to be site-specific and consistently feed in the same areas on preferred substrates, which vary by location and between islands (Landsberg et al. 1999).

Global Status
Green turtles were listed as threatened under the ESA on July 28, 1978, except for breeding populations found in Florida and the Pacific coast of Mexico, which were listed as endangered. Using a conservative approach, Seminoff (2004) analyzed subpopulation changes at 32 index sites, and estimated that globally the number of nesting female green turtles has declined by 48 to 67 percent over the last three generations (approximately 107 to 149 years). Causes for this decline include harvest of eggs, subadults, and adults, incidental interaction by fisheries, loss of habitat, and disease. The degree of population change was not consistent among all index nesting beaches or among all regions. Some nesting populations are stable or increasing. A 2007 study looked at global green sea turtle seasonal nesting activity data from all reliable available long-term datasets and found that rates of nesting population increase in the six main rookeries ranged from 4-14 percent per year over the past 20 to 30 years (Chaloupka et al. 2007). In the Pacific, the only major (> 2,000 nesting females) populations of green turtles occur in Australia and Malaysia. Smaller colonies occur in the insular Pacific islands of Polynesia, Micronesia, and Melanesia (Wetherall 1993) and on six small, sand islands at French Frigate Shoals, a long atoll situated in the middle of the Hawaii Archipelago (Balazs et al. 1995).

Green Sea Turtles in American Samoa
In Samoan folklore, green sea turtles, known in Samoan as *I`a sa* (sacred fish). Other names include *laumei ena'ena, tualimu,* or *laumei meamata* and were believed to have the power to rescue fishermen lost at sea (Craig 2002). The life cycle of the green sea turtle involves a series of long-distance migrations back and forth between their feeding and nesting areas (Craig 2002). In American Samoa, their only known nesting area is at Rose Atoll[16]. When they finish laying their eggs there, green turtles leave Rose Atoll and migrate to their feeding grounds elsewhere in the South Pacific. After several years, the turtles will return to Rose Atoll to nest again. Every turtle returns to the same nesting and feeding areas throughout its life, but that does not necessarily mean that all turtles nesting at Rose Atoll will migrate to exactly the same feeding area.

Following hatching from their natal beaches, green turtle life history is characterized by early development in the pelagic zone followed by development in coastal areas where post-recruitment juveniles and adults forage in shallow coastal areas, primarily on algae and seagrasses. Upon maturation, adult greens typically undertake long migrations between their resident foraging grounds and their natal nesting areas (NMFS 2010a). From 1971-1996, 46 adult female turtles were flipper tagged at Rose Atoll with only three ever recaptured; two in Fiji and one in Vanuatu, all dead. A satellite tagging study, conducted in the mid-1990s tracked seven tagged green sea turtles by satellite telemetry from their nesting sites at Rose Atoll to Fiji (Balazs et al. 1994). Most of the recovered tagged turtles migrated westward to Fiji perhaps for better feeding opportunities in Fiji's abundant, shallow seagrass and algae habitats (Craig et al. 2004). Of 513 greens tagged in French Polynesia between 1972 and 1991, six were recovered in Fiji, three in Vanuatu, two in New Caledonia, and one each were recovered at Wallis Island, Tonga, and the Cook Islands (NMFS 2010a).

[16] See http://www.nps.gov/archive/npsa/5Atlas/partq.htm#top

Green Sea Turtle Interactions with the American Samoa-based Longline Fishery

Sea turtle interactions have occurred in waters around American Samoa with juvenile green sea turtles (see Figure 1). Tissue samples for genetic analysis were obtained from several of the turtle specimens. The first sample was collected in 2006, and was identified as being a haplotype consistent with the northern Australian stock that include nesting populations in the Northern and Southern Great Barrier Reef and Coral Sea and in New Caledonia. This is quite different from the haplotypes of the few samples obtained from nesting females in American Samoa (NMFS PIRO, pers. comm.). The second sample collected in 2007, is a haplotype that researchers have only found in Micronesia, the Marshall Islands and in American Samoa (NMFS PIRO, pers. comm.).

NMFS and other regional partners including the Southwest Fisheries Science Center (SWFSC) are currently working together to obtain better information on the status and stock structure of the western and central Pacific populations including the following projects shown in Table 12.

Table 12: NMFS-Sponsored Green Sea Turtle Projects.

Project	Collaborators	Location	Target	Results to Date
Micronesian green turtle genetics study	SWFSC, Regional partners	CNMI, Guam, Palau, FSM, RMI	Nesting and foraging turtles	>600 samples collected for genetic analysis
Central Pacific green turtle genetics and migration studies	SWFSC, Regional partners	FSM, Palmyra, American Samoa	Nesting turtles	>100 samples collected for genetic analysis; ~1000 turtles tagged in FSM
American Samoa longline fishery observer program	PIFSC, SWFSC	American Samoa	Incidentally-caught turtles	3 samples collected from turtles caught in fishery from 2006-2008
Various PIRO-supported green turtle conservation projects	PIFSC, Regional partners	CNMI, Guam, Palau, FSM, RMI, Palmyra, American Samoa	Nesting turtles	>100 samples opportunistically collected for genetic analysis for genetic analysis during project implementation

8.6.1.2 Hawksbill Sea Turtles

The hawksbill turtle (*Eretmochelys imbricata*) is listed as endangered under the ESA throughout its range. The primary global threat to hawksbills is habitat loss of coral reef communities. In the Pacific, the primary threat is the harvesting of the species for its meat, eggs, and shell, as well as the destruction of nesting habitat by human occupation and disruption (NMFS and USFWS 1998b). Along the eastern Pacific Rim, hawksbill turtles were common to abundant in the 1930s, but by the 1990s, the hawksbill turtle was rare to absent in most localities where it was once abundant (Cliffton et al. 1982).

Hawksbills are circumtropical in distribution, generally occurring from latitudes 30° N to 30° S within the Atlantic, Pacific, and Indian Oceans and associated bodies of water (NMFS and

USFWS 1998b). Within the Central Pacific, nesting is widely distributed, though scattered and in very low numbers with the largest concentrations of nesting hawksbills in the Pacific occurring on remote oceanic islands of Australia and in the Indian Ocean. Foraging hawksbills have been reported from virtually all of the island groups of Oceania and from the Galapagos Islands in the eastern Pacific to the Republic of Palau in the western Pacific (Witzell 1983, Pritchard 1982a, b)[17].

Research indicates adult hawksbill turtles are capable of migrating long distances between nesting beaches and foraging areas, which are comparable to migrations of green and loggerhead turtles. Hawksbills have a unique diet comprised primarily of sponges (Meylan 1985, 1988). While data are somewhat limited on their diet in the Pacific, it is well documented that in the Caribbean hawksbill turtles are selective spongivores, preferring particular sponge species over others (Van Dam and Diez 1997). Foraging dive durations are often a function of turtle size, with larger turtles diving deeper and longer. As a hawksbill turtle grows from a juvenile to an adult, data suggest that the turtle switches foraging behaviors from pelagic surface feeding to benthic reef feeding (Limpus 1992). Within the Great Barrier Reef of Australia, hawksbills move from a pelagic existence to a “neritic” life on the reef at a minimum CCL of 35 centimeters. The maturing turtle establishes foraging territory and will remain in this territory until it is displaced (Limpus 1992). As with other sea turtles, hawksbills will make long reproductive migrations between foraging and nesting areas (Meylan 1999), but otherwise they remain within coastal reef habitats. In Australia, juvenile turtles outnumber adults 100:1. These populations are also sex-biased, with females outnumbering males approximately 2.5:1 (Limpus 1992).

Throughout the far western and southeastern Pacific, hawksbill turtles nest on the islands and mainland of southeast Asia, from China to Japan, and throughout the Philippines, Malaysia, Indonesia, Papua New Guinea, the Solomon Islands (McKeown 1977), and Australia (Limpus 1982). The largest nesting population of hawksbills appears to occur in Australia. Approximately 2,000 hawksbills nest on the northwest coast of Australia and about 6,000 to 8,000 off the Great Barrier Reef each year (Spotila 2004). Additionally, about 2,000 hawksbills nest each year in Indonesia and 1,000 in the Republic of Seychelles (Spotila 2004)[18].

Hawksbill Sea Turtles in American Samoa

Hawksbill turtles are known in Samoan as *laumei uga or laumei ulumanu*. Hawksbills are solitary nesters, and are most commonly found at Tutuila and the Manua Islands, and are also known to nest at Rose Atoll and Swains Island (Utzurrum 2002). These turtles could be occasionally poisonous -- in the late 1950s, people in Aunu'u got very sick after eating one. In October, 2007, a nest was found containing a total of 167 shells, of which there were 142 live baby turtles, four of which died, and 25 unhatched eggs were located. Students from the village of Amanave where the nest was found assisted and kept the hatchlings safe overnight until DMWR staff arrived the next morning when they all let the hatchlings free at Amanave Beach. DMWR believes it is the largest group of hawksbill hatchlings to have been found in American Samoa[19]. In the Samoan Islands (Samoa and American Samoa), it is estimated fewer than 30 hawksbills nest annually, and the nesting trends are declining (NMFS and USFWS 2007b).

[17] From NMFS website at: http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm
[18] http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm
[19] From an article by Tina Mata’ afa in the Samoa News. October 2007.

8.6.1.3 Olive Ridley Sea Turtles

Olive ridleys (*Lepidochelys olivacea*) lead a highly pelagic existence (Plotkin 1994). These sea turtles appear to forage throughout the eastern tropical Pacific Ocean, often in large groups, or flotillas. Olive ridleys generally have a tropical range; however, individuals do occasionally venture north, some as far as the Gulf of Alaska (Hodge and Wing 2000). The post-nesting migration routes of olive ridleys, tracked via satellite from Costa Rica, traversed thousands of kilometers of deep oceanic waters ranging from Mexico to Peru and more than 3,000 km out into the central Pacific (Plotkin 1994). Stranding records from 1990-1999 indicate that olive ridleys are rarely found off the coast of California, averaging 1.3 strandings annually (J. Cordaro, NMFS, pers. comm., 2004). At least one olive ridley was reported in Yap, Micronesia in 1973 (Falanruw et al. 1975).

The olive ridley turtle is omnivorous, and identified prey include a variety of benthic and pelagic prey items such as shrimp, jellyfish, crabs, snails, and fish, as well as algae and seagrass (Marquez 1990). It is also not unusual for olive ridley turtles in reasonably good health to be found entangled in scraps of net or other floating synthetic debris. Small crabs, barnacles, and other marine life often reside on debris and are likely to attract the turtles. Olive ridley turtles also forage at great depths; a turtle has been sighted foraging for crabs at a depth of 300 m (Landis 1965 *in* Eckert et al. 1986).

Olive Ridley Sea Turtles in American Samoa

Olive ridley turtles are uncommon in American Samoa, although there have been at least three sightings. A necropsy of one recovered dead olive ridley found that it was injured by a shark, and may have recently laid eggs, indicating that there may be a nesting beach in American Samoa (Utzurrum 2002).

8.6.1.4 Leatherback Sea Turtles

Leatherback turtles (*Dermochelys coriacea*) are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans; the Caribbean Sea; and the Gulf of Mexico (Dutton et al. 1999). Increases in the number of nesting females have been noted at some sites in the Atlantic (Dutton et al. 1999), but these are far outweighed by local extinctions, especially of island populations, and the demise of once-large populations throughout the Pacific, such as in Malaysia (Chan and Liew 1996) and Mexico (Sarti et al. 1996; Spotila et al. 1996). In other leatherback nesting areas, such as PNG, Indonesia, and the Solomon Islands, there have been no systematic, consistent nesting surveys, so it is difficult to assess the status and trends of leatherback turtles at these beaches. In all areas where leatherback nesting has been documented, current nesting populations are reported by scientists, government officials, and local observers to be well below abundance levels of several decades ago. The collapse of these nesting populations was most likely precipitated by a tremendous overharvest of eggs coupled with incidental mortality from fishing (Sarti et al. 1996).

Leatherback turtles lead a mostly pelagic existence, foraging widely in temperate waters, except during the nesting season when gravid females return to tropical beaches to lay eggs. Males are rarely observed near nesting areas, and it has been proposed that mating most likely takes place outside of tropical waters, before females move to their nesting beaches (Eckert and Eckert 1988). Leatherbacks are highly migratory, exploiting convergence zones and upwelling areas in the open ocean, along continental margins, and in archipelagic waters (Eckert 1998). In a single year, a leatherback may swim more than 10,000 kilometers (Eckert 1998).

Satellite telemetry studies indicate that adult leatherback turtles follow bathymetric contours over their long pelagic migrations and typically feed on cnidarians (jellyfish and siphonophores) and tunicates (pyrosomas and salps), and their commensals, parasites, and prey (NMFS 1998). Females are believed to migrate long distances between foraging and breeding grounds, at intervals of typically two or four years (Spotila et al. 2000). In the western Pacific, nesting peaks on Jamursba-Medi Beach (Papua, Indonesia) from May to August, on War-Mon Beach (Papua) from November to January (Starbird and Suarez 1994), in peninsular Malaysia during June and July (Chan and Liew 1989), and in Queensland, Australia in December and January (Limpus and Reimer1994).

The Secretariat of the Pacific Community observer database also has records of one leatherback incidentally caught in purse seine fisheries within the central region of theWCPFC area from 1990 – 2004 (Molony 2005 in NMFS 2010) however, these data are not reliable in a quantitative sense because of low and variable observer coverage and inconsistent logsheet recording. The US purse seine fishery has an overlapping action area with that of the American Samoa longline fishery and is authorized to interact with 11 leatherbacks annually with no mortalities (NMFS 2006).

Leatherback Sea Turtles in American Samoa

In 1993, the crew of an American Samoa government vessel engaged in experimental longline fishing, pulled up a small, freshly dead leatherback turtle about 5.6 kilometers south of Swains Island (Grant 1994). This was the first leatherback turtle seen by the vessel's captain in 32 years of fishing in the waters of American Samoa.

8.6.1.5 Loggerhead Sea Turtles

The loggerhead turtle (*Caretta caretta*) is listed as threatened under the ESA throughout its range, primarily due to direct take, incidental interaction in various fisheries, and the alteration and destruction of its habitat. In the South Pacific, Limpus (1982) reported an estimated 3,000 loggerheads nesting annually in Queensland, Australia during the late 1970s. However, long-term trend data from Queensland indicate a 50 percent decline in nesting by 1988–89 due to incidental mortality of turtles in the coastal trawl fishery. This decline is corroborated by studies of breeding females at adjacent feeding grounds (Limpus and Reimer 1994). Currently, approximately 300 females nest annually in Queensland, mainly on offshore islands (Capricorn-Bunker Islands, Sandy Cape, Swains Head; Dobbs 2001). In southern Great Barrier Reef waters, nesting loggerheads have declined approximately 8 percent per year since the mid-1980s (Heron Island), while the foraging ground population has declined 3 percent and comprised less than 40 adults by 1992. Researchers attribute the declines to recruitment failure due to fox predation of eggs in the 1960s and mortality of pelagic juveniles from incidental interaction in longline fisheries since the 1970s (Chaloupka and Limpus 2001).

Loggerhead Sea Turtles in American Samoa
There are no known reports of loggerhead turtles in waters around American Samoa (Tuato'o-Bartley et al. 1993).

8.6.2 Threatened and Endangered Marine Mammals

Cetaceans listed as threatened or endangered under the ESA and that have been observed in the waters around American Samoa include the humpback whale (*Megaptera novaeangliae*), sperm whale (*Physeter macrocephalus*), and sei whale (*Balaenoptera borealis*). To date, no humpback, sperm, blue, fin or sei whale interactions have been observed or reported in the American Samoa longline fishery.

8.6.2.1 Humpback Whales

The humpback whale is known in Samoan as *tafola*. These whales can attain lengths of 16 meters and winter in nearshore waters of usually 100 fathoms or less. Mature females are believed to conceive on the breeding grounds one winter and give birth the following winter. At least six well-defined breeding stocks of humpback whales occur in the Southern Hemisphere. Humpbacks arrive in American Samoa from the south as early as July and stay until as late as December (Reeves et al. 1999). They are most common around Samoa during September and October. They occur in small groups of adults or in mother-calf pairs. Humpbacks have been sighted around all seven of the islands in American Samoa, but it is unknown how many spend time in the area or the population size of this stock.

The appearance of humpbacks around American Samoa is an important segment of their migration north and south in the South Pacific Ocean[20]. During the warm months of the southern hemisphere, they feed in Antarctica's waters, about 3,200 miles to the south. When Antarctic's winter sets in, these whales seek warmer waters by migrating northward, with some going towards Australia and others migrating towards Tonga. According to the Natural History Guide to the National Park of American Samoa most of this latter group remains near Tonga, but at least some migrate onward to Samoa. One whale seen in Samoan waters was sighted near Tahiti, so their migration patterns are not entirely predictable.[21]

8.6.2.2 Sperm Whales

The sperm whale is the most easily recognizable whale with a darkish gray-brown body and a wrinkled appearance. The head of the sperm whale is very large, making up to 40 percent of its total body length. The current average size for male sperm whales is about 15 meters, with females reaching up to 12 meters.

Sperm whales are found in tropical to polar waters throughout the world (Rice 1989). They are among the most abundant large cetaceans in the region. Historical observations of sperm whales

[20] See http://www.nps.gov/archive/npsa/5Atlas/parts.htm#top
[21] Ibid

around Samoa occurred in all months except February and March (Reeves et al. 1999). Sperm whales are occasionally seen seaward of Fagatele Bay Sanctuary[22].

The world population of sperm whales had been estimated to be approximately two million. However, the methods used to make this estimate are in dispute, and there is considerable uncertainty over the remaining number of sperm whales. The world population is at least in the hundreds of thousands, if not millions.

8.6.2.3 Sei Whales

Sei whales are members of the baleen whale family. There are two subspecies of sei whales recognized, *B. b. borealis* in the Northern Hemisphere and *B. B. schlegellii* in the Southern Hemisphere. They can reach lengths of about 40-60 ft (12-18 m) and weigh 100,000 lbs (45,000 kg). Sei whales have a long, sleek body that is dark bluish-gray to black in color and pale underneath. The body is often covered in oval-shaped scars (probably caused from cookie-cutter shark and lamprey bites) and sometimes has some mottling, i.e., has spots or blotches of different color or shades of color[23].

Sei whales have a worldwide distribution but are found mainly in cold temperate to subpolar latitudes rather than in the tropics or near the poles (Horwood 1987). They are distributed far out to sea and do not appear to be associated with coastal features. Two sei whales were tagged in the vicinity of the Northern Mariana Islands (Reeves et al. 1999). The International Whaling Commission considers there to be one stock of sei whales in the North Pacific, but some evidence exists for multiple populations (Forney et al. 2000). In the southern Pacific most observations have been south of 30° (Reeves et al. 1999).

8.6.2.4 Fin Whales

Fin whales (*Balaenoptera physalus*) are found throughout all oceans and seas of the world from tropical to polar latitudes (Forney et al. 2000). Although it is generally believed that fin whales make poleward feeding migrations in summer and move toward the equator in winter, few actual observations of fin whales in tropical and subtropical waters have been documented, particularly in the Pacific Ocean away from continental coasts (Reeves et al. 1999).

8.6.2.5 Blue Whales

The blue whale (*Balaenoptera musculus*) is the largest animal ever known to have lived. The International Whaling Commission recognizes only one stock of blue whales in the North Pacific (eastern North Pacific stock), but some evidence suggests that there may be as many as five separate stocks (Carretta et al. 2007). Blue whales are listed as endangered under the ESA. Increasing levels of anthropogenic noise in the world’s oceans has been suggested to be a habitat concern for blue whales (Reeves et al. 1998). No estimate of abundance is available for the western Pacific blue whale stock.

---

[22] See http://sanctuaries.noaa.gov/science/condition/fbnms/history.html
[23] From: http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/seiwhale.htm

8.6.3 Other Marine Mammals

Other marine mammals that occur in the western Pacific region and have been recorded as being sighted or probable in waters around American Samoa are shown in Table 13.

Table 13: Non ESA-listed Marine Mammals Occurring around American Samoa

Common Name	Scientific Name	Common Name	Scientific Name
Blainville's beaked whale	*Mesoplodon densirostris*	**Minke whale**	*Balaenoptera acutorostrata*
Bottlenose dolphin	*Tursiops truncatus*	**Pygmy killer whale**	*Feresa attenuata*
Bryde's whale	*Balaenoptera edeni*	**Pygmy sperm whale**	*Kogia breviceps*
Common dolphin	*Delphinus delphis*	**Risso's dolphin**	*Grampus griseus*
Cuvier's beaked whale	*Ziphius cavirostris*	**Rough-toothed dolphin**	*Steno bredanensis*
Dwarf sperm whale	*Kogia simus*	**Short-finned pilot whale**	*Globicephala macrorhynchus*
False killer whale	*Pseudorca crassidens*	**Spinner dolphin**	*Stenella longirostris*
Fraser's dolphin	*Lagenodelphis hosei*	**Spotted dolphin**	*Stenella attenuata*
Killer whale	*Orcinus orca*	**Striped dolphin**	*Stenella coeruleoalba*
Melon-headed whale	*Peponocephala electra*		

Sources: NMFS PIRO and PIFSC unpublished .
Note: Marine mammal survey data are limited for this region. This table represents likely occurrences in the action area.

8.6.4 ESA-listed Seabirds

Newell's Shearwater[24]
Newell's shearwater (*Puffinus auricularis newelli*) is listed as threatened under the Endangered Species Act. The Newell's shearwater, generally known with other shearwaters and petrels as ta`i`o in Samoan, has been identified as a 'seabird visitor' to Tutuila by the National Park Service (NPS) . The status given by the NPS is based on one documented case of a single bird. On January 26, 1993, a female Newell's shearwater was found alive but injured in a banana plantation near Pavaiai, Tutuila. The bird was in an emaciated condition and lacked any fat. It weighed only 291 g, well below the range of 353-439 g (n = 11) given by King and Gould (1967 in Grant et al. 1994) and may indicate that something was wrong with this bird. King and Gould (1967 in Grant et al. 1994) recorded a Newell's shearwater 34.5 nm south of the equator near Baker Island. The 1994 specimen is only the second recorded occurrence of this species in the

[24] The USFWS is the primary federal agency with authority and responsibility to manage ESA listed seabirds.

Southern Hemisphere. Local biologists have not documented any other Newell's shearwater in American Samoa (J. Seamon, NPS, pers. comm. Nov. 2009). In addition, a recent publication prepared for the WCPFC 2009 Scientific Committee meeting presents distribution maps of seabirds in the WCPO and shows this seabird's distribution as being north of American Samoa (Waugh et al. 2009). Therefore, Newell's shearwater is very rare in the archipelago and should be considered an accidental visitor to American Samoa.

They are difficult to identify at sea, especially from other Manx-type shearwaters. The species is characterized by mostly dark plumage dorsally, mostly white plumage ventrally, including white central proximal under-tail coverts (as opposed to black), long, thin wings, and a black bill. (Ainley et al. 1997, USFWS 1983). They are notably present from about 18° to 25° N and from about 160° to 120° W (Ainley et al. 1997) and have been associated with the North Equatorial Counter Current (NECC) directly south of Hawaii, and from about 160° to 120° W with occasional sighting throughout the tropical Pacific (USFWS 1983; Spear et al. 1995; Ainley et al. 1997; N. Holmes, KESRP, pers. comm. June 2009).

The Newell's shearwater breeds only in colonies on the main Hawaiian Islands, especially Kauai, from April to October-November (Sincock and Swedberg 1969 in Grant et al. 1994). It is threatened by urban development and introduced predators like rats, cats, dogs, and mongooses (Ainley et al. 1997). The Newell's shearwater has been listed as threatened because of its small population, approximately 14,600 breeding pairs, its isolated breeding colonies, and the numerous hazards affecting them at their breeding colonies (Ainley et al. 1997).

Petrel (*Pterodroma*) Species

In addition to the Newell's shearwater, three other seabirds were determined to be endangered under the ESA in 2009 that occur in the South Pacific, including the Chatham petrel (*Pterodroma axillaris*), Fiji petrel (*Pseudobulweria macgillivrayi*), and the magenta petrel (*Pterodroma magentae*) (74 FR 46914; Sep. 14, 2009). According to the final rule for these listings, factors affecting some or all of these birds include: breeding habitat degradation (magenta petrel), predation by introduced species, inadequacy of existing regulatory mechanisms, and other natural or manmade factors, such as small population size and restricted breeding range.

According to NMFS (Mecum, in litt. 2008) and BirdLife International (Small, in litt. 2008), the main seabirds killed in longline fisheries are albatrosses and other species of petrels (not *Pterodroma* species). The characteristics of a petrel species vulnerable to longline fishing (a seabird that is aggressive and good at seizing prey (or baited hooks) at the water's surface, or is a proficient diver) do not describe these three species. Threats other than fishing are mentioned as significant threats to the Chatham petrel, Fiji petrel, and magenta petrel. Waugh et al. (2009) illustrate the entire assumed range of these species within their annual cycles.

BirdLife International estimates the range of the Chatham petrel to be 168,300 mi^2 (436,000 km^2) and the species is currently only known to breed on South East Island in the Chatham Islands, New Zealand. During the non-breeding season, birds migrate far from their breeding range, where they remain at sea until returning to breed from November to June. It is believed that the species migrates to the North Pacific Ocean in the non-breeding season, based on the habits of closely related species; however, no sightings have been recorded in the Northern Hemisphere.

The range of the Fiji petrel is estimated to be 59,460 mi^2 (154,000 km2). During the non-breeding season, birds migrate far from their breeding range, where they remain at sea until returning to breed. The Fiji petrel’s range at sea is poorly known; the species has been recorded once at sea near Gau Island and once at sea 124.3 mi (200 km) north of Gau Island. Its current breeding range, which according to the best available information is limited to Gau Island, where an estimated 27 mi^2 (70 km^2) of potential breeding habitat is available. However, based on what is known about the species, this is considered a relatively small amount of appropriate habitat for breeding.

The range of the magenta petrel is estimated to be 7,568,000 mi^2 (1,960,000 km^2) and changes intra-annually based on an established breeding cycle. During the non-breeding season, birds migrate far from their breeding range where they remain at sea until returning to breed (September to May). The magenta petrel’s range at sea is poorly known; however, research has documented foraging behavior south and east of the Chatham Islands. In addition, because the original specimen of this species was shot at sea eastwards in the temperate South Pacific Ocean, it is believed birds disperse there during the non-breeding season. The magenta petrel breeds exclusively on Chatham Island, New Zealand, within relatively undisturbed inland forests. None of these species are assumed to range within several hundred nautical miles of the EEZ around American Samoa and even farther in the cases of the Chatham and magenta petrels.

8.6.5 Other Seabirds

Other seabirds not listed under the ESA found in American Samoa are listed in Table 14.

Table 14: Seabirds Occurring in American Samoa.

Residents (i.e., breeding)		
Samoan name	**English name**	***Scientific name***
ta'i'o	Wedge-tailed shearwater	*Puffinus pacificus*
ta'i'o	Audubon’s shearwater	*Puffinus lherminieri*
ta'i'o	Christmas shearwater	*Puffinus nativitatis*
ta'i'o	Tahiti petrel	*Pterodroma rostrata*
ta'i'o	Herald petrel	*Pterodroma heraldica*
ta'i'o	Collared petrel	*Pterodroma brevipes*
fua'o	Red-footed booby	*Sula sula*
fua'o	Brown booby	*Sula leucogaster*
fua'o	Masked booby	*Sula dactylatra*
tava'esina	White-tailed tropicbird	*Phaethon lepturus*
tava'e'ula	Red-tailed tropicbird	*Phaethon rubricauda*
atafa	Great frigatebird	*Fregata minor*
atafa	Lesser frigatebird	*Fregata ariel*
gogouli	Sooty tern	*Sterna fuscata*
gogo	Brown noddy	*Anous stolidus*

Residents (i.e., breeding)		
gogo	Black noddy	*Anous minutus*
laia	Blue-gray noddy	*Procelsterna cerulea*
manu sina	Common fairy-tern (white tern)	*Gygis alba*
Visitors/vagrants		
ta'i'o	Short-tailed shearwater	*Puffinus tenuirostris*
ta'i'o	Mottled petrel	*Pterodroma inexpectata*
ta'i'o	Phoenix petrel	*Pterodroma alba*
ta'i'o	White-bellied storm petrel	*Fregetta grallaria*
ta'i'o	Polynesian storm petrel	*Nesofregetta fuliginosa*
-----	Laughing gull	*Larus atricilla*
gogosina	Black-naped tern	*Sterna sumatrana*

Source: WPRFMC 2003 (updated in 2009).

9.0 Impacts of the Alternatives

9.1 Alternative 1: No action

Under the no-action alternative the American Samoa longline fishery would continue operating under the current regulations with no changes. The fishery would likely continue to take sea turtles incidentally and would consequently have management measures imposed upon them under the ESA to protect green sea turtles.

9.1.1 Impacts on Target and Non-target Stocks

The no-action alternative would not alter catches or effort levels and thus would not be expected to result in a substantial change in impacts to target or non-target stocks from current levels of harvest. The American Samoa-based longline fleet would be expected to continue targeting albacore tuna with recent annual catches of 7.8 to 11.4 million pounds likely. They would be expected to continue to catch other non-target pelagic species including yellowfin, skipjack, and bigeye tunas, wahoo, and other PMUS. More than 10.5 million lb of PMUS were landed in American Samoa during 2009 with tuna species accounting for about 95 percent of the total landings and a similar situation is expected to continue under this alternative (Table 15).

Albacore landings are expected to dominate total landings under this alternative. Non-tuna and other PMUS landings accounted for about 500,000 pounds in 2009 and this would be expected to continue. Wahoo dominated (61%) the non-tuna landings, and barracudas comprised most of the small non-PMUS volume caught by the fishery. Due to the limited marketing opportunities in American Samoa, much of the non-tuna PMUS non-target stocks are discarded as shown in Table 8. Under this alternative these catches and levels of discard are expected to continue.

As described in Section 8.5.1, catches of South Pacific albacore are likely to continue to be sustainable. In the future, catches of pelagic fish stocks may be regulated pursuant to catch limits set by international organizations such as the WCPFC, and implemented by NMFS. In addition, the WCPFC adopted a conservation and management measure for bigeye and yellowfin tuna in 2009, which is implemented through domestic regulations.

The American Samoa longline fishery will continue to be monitored and catches of target and non-target species will continue to be subject to management under the no-action alternative.

Table 15: American Samoa 2009 Commercial Landings and Ex-vessel Value.

	Longline			Troll/Non-Longline		
Species	**Pounds**	**Value($)**	**Price/ LB**	**Pounds**	**Value($)**	**Price/ LB**
Skipjack tuna	341,829	$206,410	$0.60	2,379	$4,219	$1.77
Albacore tuna	8,604,024	$8,616,157	$1.00	0	$0	
Yellowfin tuna	853,036	$796,992	$0.93	2,560	$7,304	$2.85
Bigeye tuna	320,576	$378,821	$1.18	0	$0	
TUNAS SUBTOTALS	10,119,465	$9,998,380	$0.99	4,939	$11,523	$2.33
Mahimahi	24,417	$57,271	$2.35	171	$445	$2.61
Black marlin	187	$168	$0.90	0	$0	
Blue marlin	55,556	$52,778	$0.95	0	$0	
Striped marlin	1,785	$1,964	$1.10	0	$0	
Wahoo	299,404	$181,105	$0.60	0	$0	
Sharks (all)	0	$0		68	$34	$0.50
Swordfish	18,843	$40,996	$2.18	0	$0	
Sailfish	1,751	$4,359	$2.49	0	$0	
Spearfish	953	$1,096	$1.15	0	$0	
Moonfish	4,863	$7,294	$1.50	80	$120	$1.50
Oilfish	4,549	$4,549	$1.00	0	$0	
Pomfret	1,019	$2,293	$2.25	0	$0	
NON-TUNA PMUS SUBTOTALS	413,328	$353,875	$0.86	318	$599	$1.88
Barracudas	192	$516	$2.68	3,750	$10,012	$2.67
Rainbow runner	48	$128	$2.65	219	$581	$2.65
Dogtooth tuna	0	$0		641	$1,700	$2.65
OTHER PELAGICS SUBTOTALS	241	$644	$2.68	4,609	$12,293	$2.67
TOTAL PELAGICS	**10,533,034**	**$10,352,899**	**$0.98**	**9,867**	**$24,415**	**$2.47**

Source: WPRFMC unpublished 2009 Pelagics Annual Report module.

9.1.2 Impacts on Protected Species

Through internal consultation involving NMFS PIRO Sustainable Fisheries Division (SFD) and PIRO Protected Resources Division (PRD), it was initially determined that sperm whales and loggerhead turtles are not likely to be adversely affected by the no-action alternative. Based on the low densities and pelagic distributions (i.e., neither are concentrated near land) of loggerhead turtles, humpback and sperm whales within the action area, and that about 25-30 vessels are annually involved in the fishery, it is considered discountable that individuals or either species would be struck by American Samoa-based longline fishing boats (NMFS 2008a). This additional information revised the effects determination for continuation of the fishery and NMFS concluded that under the proposed gear modifications, including the no action alternative, loggerhead turtles, sperm whales, and humpback whales are not likely to be adversely affected.

Green sea turtles

Under the no-action alternative the American Samoa longline fishery would continue operating under the current regulations. From 2006 through 2009, the NMFS American Samoa Observer Program monitored 1,382 sets and 4,124,717 hooks, and documented eight green sea turtle interactions all resulting in mortalities (PIRO Observer Program Annual Reports)[25]. Direct extrapolation of the total number of hooks observed in the fishery during this period to the observed rate of sea turtle interactions would result in an estimate of approximately 31 interactions per year, with a range from zero to 36. The no-action alternative would be expected to result in a similar interaction rate between green sea turtles and longline gear resulting in an estimated zero to 36 green sea turtle interactions per year.

More broad impacts of interactions to green turtles from the American Samoa longline fishery will depend on which nesting stock the turtles originate. According to the BiOp (NMFS 2010c), 11 of the 13 green turtles incidentally caught in the American Samoa longline fishery from April 2006-August 2010 were sampled for genetic analysis in an effort to identify stock origin of sea turtle interactions. Results of mitochondrial DNA sequencing are available for nine of the sampled animals and reveal the following:

1. One individual with a haplotype representing nesting aggregations of the Great Barrier Reef (GBR) area, the Coral Sea, and New Caledonia.

2. Two individuals with a haplotype representing nesting aggregations of the Marshall Islands, Yap and American Samoa.

3. Two individuals with a rare haplotype only found so far in the nesting aggregation in the Marshall Islands.

4. Two individuals with haplotypes of unknown nesting stock only found so far in foraging green turtles around Fiji.

5. One individual with a haplotype commonly found in nesting aggregations in Guam, Palau, Marshall Islands, Yap, Northern Mariana Islands, Taiwan, and Papua New Guinea.

6. One individual with a haplotype found in nesting aggregations in Yap, northern and southern GBR, New Caledonia, Coral Sea, Timor Sea, and east Indian Ocean.

An additional two new samples were received by NMFS in the first quarter of 2011 and the total number of specimens processed in 2010 amounted to 14 green turtles. A haplotype for French

[25] In 2010, there were six green sea turtles taken in the American Samoa fishery (NMFS PIRO Observer Program, unpublished data). The 2010 BiOp included five of the six green sea turtles taken in 2010 in its analyses.

Polynesia has been identified in addition to the haplotypes listed above (Peter Dutton, NMFS Southwest Fisheries Science Center, pers. comm.).

The four larger nesting aggregations (NAs) in this region (Northern GBR, Southern GBR, New Caledonia, Western Micronesia) make up 90 - 95 percent of the aggregation. These four NAs together consist of tens of thousands of nesting adult females annually and three out of the four NAs have stable or increasing trends (NMFS 2010c). Since a very small number of adult female equivalents are expected to be killed annually, the risk to the four largest green turtle NAs in Oceania from the no action alternative is expected to be minimal (NMFS 2010c). Virtually no demographic information exists on the Micronesia/American Samoa stock (Chaloupka et al. 2004). The Australian stock, however, is reputed to be in a healthy state with a nesting beach on Raine Island in Queensland having the largest known green turtle nesting population in the world.[26] It is, therefore, unlikely that the American Samoa longline fishery would impact the robust Australian stock under the no-action alternative.

As noted above, genetic analysis has currently only identified the origin of nine individuals captured by the fishery, and therefore, it is difficult without more information and an increased sample size to predict the stock origin and corresponding impacts of future interactions which would occur under the no-action alternative. The rarity of interactions and subsequent data collection on observed occurrences renders making a statistically sound extrapolation from the available fishery observer data difficult; however, it is expected impacts on the different stocks would differ because of potentially different turtle stock characteristics. Until more genetic samples are analyzed for stock identification, predicting the magnitude of potential impacts of the no-action alternative with confidence is not possible. Therefore, the Council finds it appropriate to reduce impacts to sea turtles, while continuing to collect information and determine the stock status of green turtles from the Micronesian/American Samoa stock.

If the fishery interactions with green sea turtles exceed the anticipated take authorized by the NMFS 2010 BiOp, this will trigger a re-consultation under ESA to determine the reasons why the anticipated take has been exceeded. A new BiOp may be issued containing a revised anticipated take and jeopardy finding. If it is concluded that the proposed action discussed in this amendment has failed to maintain the take rate at non-jeopardy levels then additional measures, including possible reasonable and prudent alternatives, may need to be implemented for the fishery.

As a contingency, the Council conducted a study in 2010 investigating the use of 16/0 circle hooks and the impacts on catch rates of the principal target species and incidental catch of other commercially important pelagic species (Beverly et al. 2011). In the event of the failure of the preferred alternative maintaining interactions at or below the anticipated take, the Council may require the use of size 16/0 or larger circle hooks in the American Samoa longline fishery. The efficacy of larger circle hooks for mitigating green sea turtle interactions has not been directly tested directly in the American Samoa fishery. However, experiments elsewhere on hardshell turtles such as loggerhead and olive ridley turtles demonstrate the efficacy of larger circle hooks in reducing the number and severity of interactions when they occur (Gilman et al. 2007a; Swimmer et al. 2010).

[26] See http://www.seaturtle.org/mtn/archives/mtn118/mtn118p17.shtml

Other Sea Turtles

Under the no-action alternative, the American Samoa longline fishery would be expected to continue to operate similarly. Olive ridleys are the most commonly caught sea turtle in the Hawaii-based deep-set longline fishery, which fishes deeper overall than American Samoa at approximately 150-400 m depth. Continuation of this fishery under Alternative 1 may lead to incidental interactions with olive ridleys. One olive ridley sea turtle interaction occurred in the EEZ around American Samoa, although the take was initially ascribed to the Hawaii deep-set longline fishery, because the vessel departed from Hawaii as the vessel had permits for both limited entry fisheries. Under the 2010 BiOp (Table 16) one interaction is anticipated every three years in the American Samoa longline fishery, and unlikely to cause jeopardy to the population.

Loggerheads are unlikely to be captured in the American Samoa longline fishery because: (1) they are exceptionally rare in the action area - there are no confirmed sightings despite their distinct appearance and tendency to remain at or near the surface, and there are no reports of bycatch in any American Samoa fishery; and (2) loggerheads rarely dive deeper than 40 m, whereas the longline fishery operates at deeper depths. Thus, it was considered unlikely that this species will be hooked or entangled by the fishery.

Increased funding has allowed the American Samoa Observer Program to increase coverage of the longline fleet. In 2010, coverage levels were approximately 25 percent for the year, with a 41 percent coverage rate in the last quarter of 2010. It is estimated that under the no-action alternative the fishery would continue to have minimal affects on sea turtles other than green turtles. However, the increased level of observer coverage in 2010 and 2011 provides an opportunity to test this conclusion.

Seabirds

American Samoa-based observers report seabird sightings limited to one or two birds at time. Seabirds sighted so far have included shearwaters (not Newell’s), juvenile red-footed boobies, frigatebirds, tropicbirds, terns, and noddies (S. Kostelnik, American Samoa Observer Program, pers. comm. November 30, 2010). Since observers were regularly deployed in April 2006, there has been only one unidentified shearwater (not Newell’s) interaction observed in 2007. This is expected as typically longline-seabird interactions are minimal in tropical latitudes, being more or less restricted to higher sub-tropical and temperate latitudes (Molony 2005). It is difficult to accurately extrapolate across the entire fleet with five years of data from relatively low coverage levels, four of which reported zero interactions. Alternative 1 would continue the fishery without change, and therefore, impacts to seabirds are expected to remain minimal and not anticipated to increase under this alternative. It is assumed that because the American Samoa longline observer data have recorded no sightings of or interactions with the Newell’s shearwater, Chatham petrel, Fiji petrel, or magenta petrel, and their assumed ranges are well outside the EEZ around American Samoa, there will be insignificant or discountable effects on these ESA- listed seabird species under the alternative 1.

Marine Mammals

From observed trips from April 2006 through 2010, a total of five marine mammal interactions (two false killer whales, three rough-toothed dolphin) were observed in 2008 and 2010; the remaining years had zero observed interactions. It is difficult to accurately extrapolate interactions across the entire fleet with data from several years of relatively low coverage levels (and higher levels in 2010 notwithstanding), four of which had zero interactions. Under Alternative 1, the fishery would continue to operate without changes and would likely have occasional interactions with marine mammals but not affect marine mammals in any manner not previously considered or authorized by the commercial fishing incidental take authorization under section 118 of the MMPA.

9.1.3 Impacts on Marine Habitat

The no-action alternative would not be expected to impact marine habitat as it would be a continuation of the American Samoa longline fishery as it currently operates. Longline fishing occurs in pelagic waters within the upper portion of the water column and is not known to have any documented impacts on habitat during fishing operations. However, despite all efforts by fishermen to prevent it, gear loss does occur in longline fisheries and has the potential to impact reefs and other habitats by accumulating as marine debris. The current level of gear loss, and impact to the environment is not known, but it is not believed to be substantial in the American Samoa longline fishery, because the lines are attached to floats and can and are retrieved. Also, Federal fishery logbooks enable fishermen to report the number of hooks lost per fishing set.

All longliners lose hooks while fishing. Based on unpublished data from NMFS PIFSC, an average of 38,426 hooks (range: 14,215-49,370) were lost annually between 2001 and 2009 within the action area (Figure 4), or an average of about 7.3 hooks per set. Lost hooks are unlikely to have a major impact to the physical marine environment being composed of steel. Depending on quality, the hooks will corrode, although hooks on the deep sea bed in water just above freezing will corrode more slowly, and stainless steel hooks will corrode at a slower rate than non-stainless steel hooks.

9.1.4 Impacts on Fishery Participants and Fishing Communities

The no-action alternative would not initially result in any changes to how the fishery operates, and therefore, it would be expected that interactions with sea turtles would continue to occur. This may not immediately impact fishery participants as the fishery would likely continue as it is; however, participants would be at risk of violating the ESA with subsequent sea turtle interactions beyond the Incidental Take Statement (ITS) level set in the 2004 BiOp at one hardshell turtle mortality annually, which may occur under the no-action alternative.

NMFS reinitiated consultation on this fishery pursuant to the ESA as described in Section 10.10 based on the proposed action of the preferred alternative (NMFS 2010). Under the no-action alternative, the fishery would not be in compliance with the ESA, making the Federal government vulnerable to legal challenge for permitting longline fishing in the EEZ around American Samoa. Developing measures for the fishery through the Magnuson-Stevens Act and Council process to maintain ESA compliance is preferable than having regulations directly imposed through the ESA. There is no requirement under the ESA to consider a range of alternatives, nor the impacts of any reasonable and prudent alternative on fishermen.

9.1.5 Impacts on Biodiversity and Ecosystem Function

The no-action alternative would not result in any changes to the fishery. The American Samoa longline fishery is not known to or believed to adversely impact biodiversity or ecosystem function. The longline fishery targets certain pelagic fish species, primarily albacore tuna to supply the cannery. The removal of top predators such as tunas likely has some ecosystem impacts such as modifications in trophic interactions; however, there is no indication that the level of fishing that is occurring has resulted in ecosystem shifts or imbalances that can be discerned. If such impacts were found to be occurring, the Council would implement management measures to address concerns. At this time South Pacific albacore stocks are being sustainably fished as described in Section 8.5.1.

9.1.6 Impacts on Enforcement and Administration

The no-action alternative, by itself, would not result in any changes to fishery operations, and this alone would not be expected to impact on enforcement or administration. However, if the no-action alternative was selected, there may be increased burden on NOAA OLE if the ITS contained in the 2004 BiOp continued to be exceeded as those who subsequently had turtle "takes" could be subject to an ESA violation. PIRO's Sustainable Fisheries Division consulted the PRD on the proposed action, Alternative 2, pursuant to the ESA as described in Section 10.10.

9.1.7 Impacts on Public Health and Safety

The no-action alternative would not change the manner in which the American Samoa longline fishery operates under the current regulations, which include considerations for safety-at-sea. This alternative would not cause vessels to travel farther or in adverse conditions. As such, no impacts on public health and safety are expected under the no-action alternative.

9.2 Alternative 2: Minimum 100 m Hook Depth Requirement (Preferred)

Under this alternative, participants in the American Samoa longline fishery with a Class B, C, or D permit (vessels longer than 40 ft) would be required to have their hooks set to fish at least 100 meters deep. This would be accomplished by requiring the section of blank mainline between the float and closest hooks to be increased to at least 70 m to help ensure to the extent practicable that all hooks fish deeper than 100 m. To help achieve this hook depth, participants would also be required to utilize float lines at least 30 m in length with a minimum of 15 branch lines between any two floats (see Figure 2). Participants would also be prohibited from possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip. Limiting the retention of swordfish is intended to further discourage shallow-set fishing and targeting swordfish.

The American Samoa Observer Program's data set was analyzed to obtain a baseline operational snapshot of the American Samoa longline fishery. This was combined with information in Bigelow and Fletcher (2009) which characterized hooks depths and hook-at-interaction distributions in the fishery to recommend a method for compliance with the requirement to keep branch lines at least 70 m away from floats. Individual vessel and fleet-wide operational characteristics vary according to fishery, environmental, and oceanographic conditions. Individual vessel operators may tailor their exact operations based on their preferred fishing styles. To achieve the minimum 70 m distance from the float line to adjacent hooks and based on average fleet operational characteristics when using a line setting device, or line shooter, fishermen will likely need to wait approximately 17-18 seconds after attaching the float to the mainline before attaching the first hook, and wait 17-18 seconds after the last hook before attaching the next float.

9.2.1 Impacts on Target and Non-target Stocks

Under Alternative 2 the gear would be modified so the depth of the shallowest hook is, to the maximum extent possible, below 100 meters in depth. The impacts on catches of albacore tuna under Alternative 2 are not fully quantifiable. Domokos et al. (2007) found that two satellite tagged albacore tuna spent the majority of their time between 150 and 250 m (75% and 60%, respectively). The tagged fish were 95 and 93 cm long, representing young adult fish and mean longline catch in the EEZ. During the day (0800-1700 as defined in Domokos et al. 2007) when the American Samoa fleet's gear fishes, tag data indicated less than 2.5 percent of time was spent shallower than 100 m. In their paper on factors contributing to size differences of albacore tuna South Pacific albacore longline fisheries, Bromhead et al. (2009) describe that evidence exists for fisheries used in their analysis to catch larger albacore on deeper hooks. It is important to note that the number of hooks between floats was used as a proxy for the depth of setting of the hooks, and this was not found in all fisheries examined. Therefore, albacore catch rates and weight per fish may be improved relative to the status quo under Alternative 2 by modifying the gear configuration to fish at least 100 m in depth. However, the gear modification, specifically the requirement for at least 70 m of blank mainline adjacent to all floats with hooks between them, will result in more mainline to be deployed for the same number of hooks between two floats. The same length of mainline will have fewer hooks; approximately 12 percent fewer than under the no-action alternative and reduced catch per set is probable. If this occurs, Alternative 2 could result in gains in weight per fish, but fewer fish. It is unknown if this may outweigh or neutralize the biomass lost due to reduced numbers of fish caught.

The gear configuration in Alternative 2 could be achieved, in part, by removal of the first and last two hooks between each float by requiring a minimum mainline length of 70 m from each float before and after the first and last hook may be attached to the mainline, and therefore, catches of the target stock, albacore tuna, are expected to follow suit and decline slightly. This is illustrated in Bigelow and Fletcher (2009) whereby their time-depth recorder (TDR) study and analysis of fishery observer data indicated that albacore catches declined by 5 percent by not attaching the two hooks closest to each float with hooks between them. However, the additional distance required from the float to the first hooks on the mainline could be compensated for by participants by adding more mainline and redistributing hooks. Bigelow and Fletcher (2009) also concluded that complete redistribution of the four hooks closest to the floats increased target catches by 8 percent. NMFS cannot predict exactly how the fishery or individual fishermen will eventually operate, but it is thought that some hooks would have to be redistributed if albacore catches are expected to remain the same or slightly increase.

Also in Bigelow and Fletcher's (2009) study, the shallowest hooks (adjacent to the floats) had substantially higher CPUEs for non-target species including mahimahi, skipjack tuna, wahoo, barracuda, and shortbill spearfish. Therefore, it is expected that Alternative 2 would similarly result in reduced catches of these epipelagic fishes. Overall catches of these epipelagic species are at relatively low levels in the American Samoa longline fishery in comparison to the target and reduced catches of these are not expected to substantially affect stocks. They also found the deepest hooks to have the highest CPUEs for bigeye tuna, sickle pomfret (monchong), and longfin escolar, and the intermediate depth hooks to have highest CPUE for yellowfin and albacore. Figure 8 below, from Bigelow and Fletcher (2009) illustrates the hook positions where most albacore and mahimahi are caught. Albacore are spread across all hooks with the majority of fish caught on hooks deeper than the first several hooks from the float and mahimahi are caught almost exclusively on the shallowest first to third hooks closest to floats.

Another study, Beverly (2004), tested a method of fishing below 100 m using a weighted mainline and found slightly higher CPUEs for tunas in test trials targeting bigeye tuna while Beverly et al. (2009) found that by eliminating shallow hooks from tuna longline sets the catch rates of bigeye tuna were not statistically different but the catch rate of monchong (*Taractichthys steindachneri*) was higher and catch rates of other epi-pelagic MUS (wahoo, mahimahi, blue marlin, striped marlin, etc.) were reduced. This may or may not hold true for albacore, because their experimental gear design yielded a slightly different configuration than is used in American Samoa. However, Bigelow and Fletcher (2009) reported redistribution of hooks did not substantially alter amount of catches of non-target stocks, although species composition of these non-target catches changed (Table 18), specifically they reported lower catches of skipjack and wahoo.

Stocks of South Pacific albacore are estimated to be sustainable in terms of fishing levels (described in Section 8.5.1). It is not possible to predict how each fishermen will operate under Alternative 2, and without redistribution of hooks, the gear modification may result in12.7 percent fewer hooks in the water overall and reduce albacore catch by 5.1 percent. Moreover catch rates of epipelagic fishes may decline as a result of the gear modifications, and those of deeper-dwelling fishes, such as bigeye tuna and sickle pomfret (monchong) may increase. If albacore catch is reduced as a result of the proposed action fishermen might increase fishing effort (hooks set or sets made) to compensate for the loss; nonetheless, any increase in fishing effort would likely be within the bounds of the effort made in 2006 to 2009 (Table 5). Thus, the impacts on target and non-target species and protected resources would be similar to the analysis in this EA and conclusions would remain the same.

The requirement prohibiting fishery participants from possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip is not expected to impact swordfish stocks as they currently catch swordfish on an occasional basis only. In 2009, 27,361 lb of swordfish were landed in American Samoa which is an average of 154 lb, or approximately one or two fish, per trip. This amount of harvest would not have more than a minimal impact on swordfish in the South Pacific.

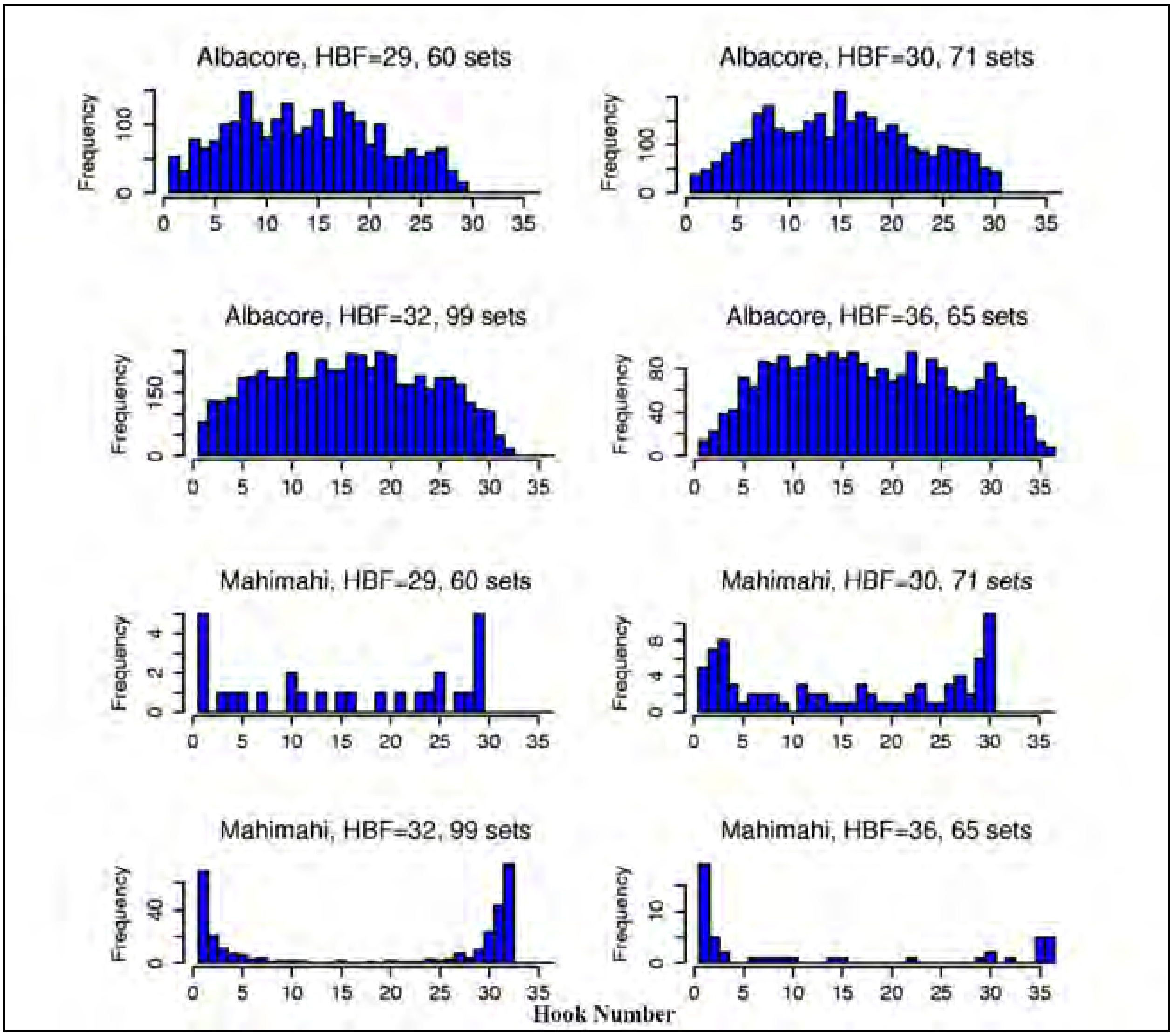

Figure 8: Frequency of hook-at-capture (horizontal axis) for two species in commonly used longline gear configurations.

Source: Bigelow and Fletcher (2009).

Note: HBF (hooks between floats) observed in the American Samoa-based fishery. Hooks are numbered sequentially between each float and are displayed on the x-axis above. Hook number 1 and the highest number are closest to the float and the shallowest hooks.

9.2.2 Impacts on Protected Species

Through internal consultation between NMFS PIRO SFD and PRD, it was determined that sperm and humpback whales, and loggerhead turtles are not likely to be adversely affected by the preferred alternative. The alternative would not affect blue, fin, or sei whales. Under the preferred alternative, the fishery may affect, and is likely to adversely affect green, hawksbill, leatherback, and olive ridley turtles. Based on the low densities and pelagic distributions (i.e., neither are concentrated near land) of loggerhead turtles and sperm whales within the action area, and that about 25-30 vessels are annually involved in the fishery, NMFS considers it discountable that individuals or either species will be struck by American Samoa-based longline fishing boats (NMFS 2008a). A summary of the consultation process is given in the 2010 BiOp (NMFS 2010c).

Green sea turtles

Longline fishing affects green turtles primarily by hooking, but also by entanglement and trailing of gear (NMFS 2010c). Under Alternative 2 gear changes would be implemented which would require hooks to fish at least 100 m deep and is both intended and expected to reduce interactions with green sea turtles in waters around American Samoa where the longline fleet operates. The American Samoa longline fishery had eight observed interactions with green sea turtles from 2006 through December 2009, with approximately 7.2 percent observer coverage, for a mean interaction rate of 0.002 turtles per 1,000 hooks for this time period. Assuming fishermen currently, i.e., prior to Alternative 2 gear modifications, deploy floats and hooks at regular intervals and use 3,006 hooks per set, the impact of this gear configuration will result in a net loss of the equivalent of 381 hooks (from the proposed 70 m distance requirement from floats to any adjacent hooks; currently this distance is assumed to be 23.25 m). If adding more mainline to vessels to deploy more hooks is operationally prohibitive, then fewer hooks will be set per fishing day, and may translate into an additional slight reduction in protected species interactions annually if no additional sets or trips are made to compensate reduced catches. If albacore catch is reduced as a result of the proposed action fishermen might increase fishing effort (hooks set or sets made) to compensate for the loss; nonetheless, any increase in fishing effort would likely be within the bounds of the effort made in 2006 to 2009 (Table 5). This level of effort was analyzed in NMFS 2010 BiOp and NMFS determined that the level of incidental take anticipated from the proposed action is not likely to jeopardize green sea turtles hawksbill turtle, leatherback turtle, or olive ridley turtles.

The proposed gear modifications are based in part on research conducted by Beverly et al. (2006, 2009) in Hawaii, whereby tuna longline setting techniques were altered to eliminate all shallow-set hooks (Beverly et al. 2009), and recent work in American Samoa by Bigelow and Fletcher (2009). In both these studies there were no statistical data to demonstrate reduced interactions with sea turtles, rather the authors contended that experimental gear fished deeper than 100 m would likely reduce interactions with sea turtles, given that sea turtles spend the majority of their time in the upper 100 m of the water column (Beverly et al. 2009). Due to inter-set variability, Bigelow and Fletcher (2009) demonstrated that without lengthening the float lines some hooks would still fish shallower than 100 m, even with the removal of the first and last two hooks between two floats.

Observer reports of 13 interactions through August 2010 for the American Samoa longline fishery reported 9 interactions (69 percent) of the green sea turtle interactions occurred within the first three hooks from the float and 54 percent occurred within the first two hooks from the float (see Table 2). Of these interactions, all were with juvenile green turtles recovered from different longline fishing trips, seven were found hooked within the first or last two hooks, four were within six hooks of the float, and two were found (one entangled and one hooked) in the middle (deepest) third of the section. Green sea turtles are known to mainly inhabit waters within the upper 100 m of the water column, and it is expected that keeping hooks below the shallow waters, i.e., below 100 m, and out of the “turtle zone”, would result in fewer green sea turtles in the vicinity of the longline gear, and therefore, it is expected that under Alternative 2 interactions with green sea turtles may be substantially reduced.

NMFS issued a new BiOp for the operations of American Samoa longline fishery in September 2010 (NMFS 2010c). The 2010 BiOp estimated that there were on average 33 interactions per year between the American Samoa longline fishery and green sea turtles, with a 92 percent mortality rate. The 2010 BiOp included as part of its Reasonable and Prudent Measures (RPM), a requirement for the American Samoa longline fishery to set all hooks below 100 m. This was based on extrapolation (i.e., expansion) from the 13 observed green turtle takes from April 2006 through August 2010. Estimating the expected reduction based solely on limited data from these 13 observed interactions (whereby 54 percent were hooked on the nearest, and assumed shallowest, two hooks to a float) would result in a 54 percent reduction or 17.8 fewer annual interactions with green sea turtles under Alternative 2.

The annual numbers of interactions and mortalities expected to result from implementation of the proposed action are shown for a 3-year period in Table 16. The incidental take of up to 45 green sea turtles over three years (average of 15 interactions per year) is expected to occur as a result of the RPMs in the BiOp. Also included in the incidental take statement were anticipated takes of hawksbill, leatherback, and olive ridley turtles at a rate of no more than 1 every three years. NMFS determined in the 2010 BiOp that the level of incidental take anticipated from the proposed action is not likely to jeopardize green turtles, hawksbill turtles, leatherback turtles, or olive ridley turtles.

Table 16: The number of turtle interactions expected in the American Samoa longline fishery as a result of the proposed action.

Species	Interactions	Mortalities	Adult female equivalents
Green turtles	45 every 3 years	41 every 3 years	10 every 3 years
Hawksbill turtles	1 every 3 years	1 every 3 years	1 every 3 years
Leatherback turtles	1 every 3 years	1 every 3 years	1 every 3 years
Olive ridley turtles	1 every 3 years	1 every 3 years	1 every 3 years

Source: NMFS 2010c.

Other Sea Turtles

Under Alternative 2, hooks would be fishing deeper. All sea turtles, being air-breathers, are typically found closer to the surface, e.g., in the upper 100 m of the water column; however, some turtles such as olive ridleys, are susceptible to deep-set longlining because of their deep foraging (NMFS 2008b). Olive ridleys are the most commonly caught sea turtle in the Hawaii-based deep-set longline fishery which fishes deeper than the American Samoa longline fishery at approximately 150-400 m depth.

One olive ridley interaction was observed in July 2010 within the EEZ around American Samoa. The turtle was on hook four of 27 and released injured. Continuation of this fishery under Alternative 2 may lead to incidental interactions with olive ridleys; however, deeper hook depths may reduce interaction rates. Tagging studies have shown olive ridleys spend much more time shallower than 100 m, compared to deeper than 100 m during foraging dives (NMFS 2005;

NMFS and USFWS 2007b; Polovina et al. 2003). The 2010 BiOp (NMFS 2010c) anticipated Alternative 2 to result in one juvenile or adult olive ridley turtle mortality every three years and authorized take at that level. There have been no observed interactions with any other sea turtle species. It is expected that under this alternative the fishery would continue with potential minor effects on olive ridley, leatherback, and hawksbill sea turtles.

Loggerheads are unlikely to be captured in the American Samoa longline fishery because: (1) they are exceptionally rare in the action area - there are no confirmed sightings despite their distinct appearance and tendency to remain at or near the surface, and there are no reports of bycatch in any American Samoa fishery; and (2) loggerheads rarely dive deeper than 40 m, whereas the longline fishery operates at deeper depths. Thus, it was considered unlikely that this species will be hooked or entangled by the fishery.

Seabirds

From observed trips from 2006 through 2010, one seabird interaction (unidentified shearwater in 2007) was reported[27] by observers (Table 10). Alternative 2 would require hooks be set to fish at least 100 m deep and as seabird interactions are already rare and because seabirds interact with longlines primarily by visual attraction to bait, no increased impacts to seabirds are expected under this alternative. This is expected as typically longline-seabird interactions are minimal in tropical latitudes, being more or less restricted to higher sub-tropical and temperate latitudes (Molony 2005). It is assumed that because the American Samoa longline observer data have recorded no sightings of or interactions with the Newell's shearwater, Chatham petrel, Fiji petrel, or magenta petrel, and their assumed ranges are well outside the EEZ around American Samoa, there will be insignificant or discountable effects on these ESA-listed seabird species under alternative 2.. If albacore catch is reduced as a result of the proposed action fishermen might increase fishing effort (hooks set or sets made) to compensate for the loss; nonetheless, any increase in fishing effort would likely be within the bounds of the effort made in 2006 to 2009 (Table 5). Thus, sea bird interactions are not expected to change if fishermen redistribute hooks or make more sets to compensate any loss of albacore catch.

Marine Mammals

From observed trips from April 2006 through 2010, three out of the five years reported zero marine mammal interactions; in 2008 and 2010 a total of five marine mammal interactions (two false killer whales, three rough-toothed dolphin) were observed. It is difficult to accurately extrapolate interactions across the entire fleet with data from several years of relatively low coverage levels, four of which had zero interactions, even though 2010 coverage levels were higher. It is not anticipated that interaction rates with small cetaceans would be affected by Alternative 2, or by the potential for redistribution of hooks or a possible increase in the number of sets to compensate any loss of albacore catch. In the Hawaii-based longline fishery the marine mammal interaction rate is higher in the shallow-set fishery than in the deep-set fishery; however, there are not sufficient data and there are many operational, spatial, and temporal differences between the deep and shallow set fisheries. Therefore, no conclusion can be made as to whether interaction rates are affected by set depth (see Table 9).

NMFS has determined that humpback whales are not likely to be adversely affected by Alternative 2. No large whale interactions have been observed in the American Samoa fishery,

[27] Found on NMFS PIRO website at: http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html

since observers have been regularly deployed from 2006. The minimum population size for the American Samoa humpback whale stock is 150 whales, compared to a minimum population size for the central N. Pacific stock of about 5,833 whales (Final 2009 Pacific and Alaska SARs). Humpback whales are much scarcer in American Samoa than in the Hawaii longline fleet fishing areas and in the Hawaii deep-set fishery there have been three observed humpback interactions in the last eight years with 20 percent observer coverage. In Hawaii's shallow-set fishery, there have been two observed humpback interactions in the last five years with 100 percent coverage.

Sperm whales interact with demersal longline fisheries off of South America. They are unlikely to prey on target and bycatch species caught by this pelagic longline fishery, and no interactions with this species have been reported. In the unlikely event of an interaction, based on the size and shape of the hooks and the relatively light test lines involved in the fishery, it is unlikely that sperm whales could be seriously injured by hooking, or seriously impaired by entanglement in lines (NMFS 2008a). Thus, hooking or entanglement of sperm whales will result in effects that are considered insignificant.

9.2.3 Impacts on Marine Habitat

Alternative 2 would not be expected to result in any additional impacts to marine habitat. Longline fishing occurs in pelagic waters within the upper portion of the water column and is not known to have any documented impacts on habitat during fishing operations. Gear loss, however, does occur in longline fisheries and has the potential to impact reef or other habitats. The provision to set hooks to be at least 100 m deep in the water column would not increase the likelihood of gear loss.

All longliners occasionally lose hooks and other gear while fishing. Fishermen do try to recover all gear, and are normally successful as the floats used in the fishery are marked to be visible from distance, even at night. Based on NMFS PIFSC unpublished data, an average of 38,426 hooks (range: 14,215-49,370) were lost annually between 2001 and 2009 within the action area (Figure 4), or an average of about 7.3 hooks per set. Lost hooks are unlikely to have a major impact to the physical marine environment, being composed of steel. Depending on quality, the hooks will corrode, although hooks on the deep sea bed in water just above freezing, will corrode more slowly, and stainless steel hooks will corrode at a slower rate than non-stainless steel hooks.

9.2.4 Impacts on Fishery Participants and Fishing Communities

Under Alternative 2, fishery participants would be required to deploy the mainline with a 70 m or greater distance from where each float to the adjacent hooks is attached. Participants would also have to reconfigure their gear by lengthening their float lines (see Figure 2) if they were less than 30 m in length, which would require time and expense. From existing observer data the fleet's mean float line length is 26 m with a minimum of 18 and a maximum of 36 m.

The main concern with requiring modified gear configuration is the potential for such modifications to reduce catches of the target, albacore tuna, and therefore cause economic harm to fishery participants. Bigelow and Fletcher (2009) estimate a 5.1 percent reduction in albacore

CPUE from removing the two hooks nearest the floats (i.e., the four assumed shallowest hooks). Analysis suggests that a 5.1 percent reduction in albacore CPUE could correspond to an economic loss generated from albacore alone of up to $94 per set, or $16,900 per year per vessel or an annual fleet-wide loss of $439,406 per year from the fishery, based on 2009 effort, landings, and revenue. In addition, this alternative has the potential to result in vessels catching fewer economically-viable non-target species, which may have economic and cultural significance to longline fishermen.

However, current indications are that any potential direct negative impacts to catch from gear modification may be mitigated by several factors. Firstly, albacore tuna, especially larger individuals, are known to be more plentiful in waters between 150-250 meters during the day at depths coinciding with the main biomass of their preferred prey, micronekton (Domokos et al. 2007). Therefore, requiring fishing for albacore to occur at greater depths may in fact result in slightly higher pounds-per-fish yields. Secondly, Bigelow and Fletcher's (2009) analysis also showed potential increases in CPUE if participants lengthen the mainline and/or redistribute the hooks that would have been removed. Thirdly, participants may choose to increase their fishing effort in order to maintain current catch numbers. Though some vessels do not have the equipment capacity to accommodate much additional mainline, it is anticipated that deeper fishing, some gear-based mitigation, and increased effort can result in landings similar to those observed currently. The combination of responses will be vessel-specific.

Fishing 100 m and deeper would be expected to result in reduced catches of some epipelagic species, such as marlins, wahoo, skipjack tuna, and mahimahi, if the depth of shallow hooks near the floats is increased, as shown for mahimahi in Figure 8. American Samoa-based longline fishermen sometimes increase the distance of mainline between deployment of the float and first hook depending on conditions, in order to keep their gear deeper to avoid non-target fish that have lower or no value. Because of limited marketing opportunities in American Samoa for longline catches other than tuna species accepted by the local cannery, most "miscellaneous fish" (fish the cannery will not buy) is discarded at sea by the large longline vessels (TEC Inc. 2007). For example, a total of 2,711 blue marlins were caught in 2008 by the longline fishery, with only 20 percent of these being retained (WPRFMC 2010). The relationship between fishing below 100 m and catches of some epipelagic species is complicated by an examination of discard rates. Catch rates may go down, but landings for most species could remain the same, given discard levels of certain species, more of which could be retained in the future. Mahimahi is one exception, but the reduction in landings will likely be minor because there is some amount of fish currently discarded.

There are a few other largely epipelagic species that are kept and retained for local sale and consumption including wahoo and mahimahi. Reduced catches of these fish under this alternative may have some economic impact on fishery participants and to the community including local retail shops and restaurants. Some fishermen directly sell small amounts of fish to local businesses, in addition to fish sold to the cannery. A CPUE reduction for fish such as wahoo, mahimahi, and blue marlin as described in Table 15 will likely not significantly affect these dealings because predicted reductions in catch are less than 15 percent for the three species mentioned, and as noted by Bigelow and Fletcher (2009), the percentage of fish retained is less than 65 percent. In other words, under Alternative 2, a greater proportion may need to be retained instead of discarded to account for any overall reductions in catch. In addition, American Samoa longline vessels catch skipjack tuna, which can be a valuable non-target component of their catch. American Samoa longliners typically do not catch large volumes of skipjack, with this species comprising about 12 percent of the total longline catch between 2004 and 2009 (WPRFMC 2010 and unpublished information from draft 2009 American Samoa pelagics annual report module). However in 2007 and 2008, the price for skipjack showed a strong uptrend and reached record levels around mid-2008 with Bangkok benchmark skipjack prices at US$1,920 per mt and Yaizu prices at US$1,929 per mt (Williams and Terawasi 2009). As such, longline vessels in American Samoa began to retain greater amounts of skipjack in 2008. Skipjack retention rates averaged about 74 percent between 2002 and 2007, but rose to almost 88 percent in 2008 with the higher value of skipjack (See summary tables[28]).

Achieving the required 70 m distance between floats and the first and last hook, may result in an estimated loss of approximately two hooks from each side of the hook basket, or section of gear between two floats, assuming equal distance between the float, first hook, and subsequent hooks. Based on operational data collected by the NMFS PIRO Observer Program from the American Samoa longline fleet, the average longline set deploys 31.5 hooks between floats or 3,006 hooks per set. Combining these operational data with the experimental observations of Bigelow and Fletcher (2009), the impact of the loss of four hooks between floats without redistribution results in an estimated loss of 12.7 percent of hook effort. Table 17 shows the estimated level of catch under Alternative 2 compared to the no action alternative..

Table 17: Impact of Alternative 2 on catch in number of fish per set in the American Samoa longline fishery.

Common name	**Nominal CPUE (fish/1,000 hooks)**	**Catch: number of fish per set**	
		No Action	**Alt. 2: no hook redistribution**
Albacore tuna	16.18	48.54	46.06
Skipjack tuna	4.32	12.96	10.58
Yellowfin tuna	2.27	6.81	6.27
Wahoo	1.99	5.97	4.46
Bigeye tuna	1.38	4.14	3.91
Smith's escolar	1.01	3.03	2.74
Longnose lancetfish	0.92	2.76	2.57
Slender	0.61	1.83	1.59
Longfin escolar	0.54	1.62	1.59
Dolphinfish	0.53	1.59	0.59
Blue shark	0.43	1.29	1.12
Barracuda	0.29	0.87	0.54
Blue marlin	0.28	0.84	0.66
Silky shark	0.17	0.51	0.39
Snake mackerel	0.16	0.48	0.41

[28] http://www.pifsc.noaa.gov/wpacfin/as/Pages/as_data_2.php.

Common name	Nominal CPUE (fish/1,000 hooks)	Catch: number of fish per set	
		No Action	Alt. 2: no hook redistribution
Pelagic stingray	0.15	0.45	0.42
Shortbill spearfish	0.14	0.42	0.22
Sickle pomfret	0.12	0.36	0.35
Swordfish	0.09	0.27	0.23

Source: Bigelow and Fletcher (2009).
Note: No Action scenario considers using longline gear deployed with approximately 36 hooks between floats and 3,000 hooks set. Alternative 2 scenario considers hypothetical catches based on the proposed gear configuration without the addition of more mainline to redistribute hooks.

The 70 m minimum distance required from the float to adjacent hooks on the mainline, and subsequent loss of mainline available for the same number of hooks to be deployed, could be compensated for by participants by adding more mainline, thereby allowing for previously leftover hooks to be deployed. The addition of more mainline to compensate for the required 70 m minimum distance from the float to adjacent hooks would be an additional cost in gear. More mainline would need to purchased, as well as float lines, floats, and snaps to connect floats to the mainline. The potential difference in catch from the No-Action Alternative to Alternative 2, then deploying all leftover hooks is shown in Table 18, based on scenarios from Bigelow and Fletcher (2009). Albacore catch could possibly increase over 8 percent from current levels by setting deeper hooks.

As noted above, another option for longline fishermen would be to add extra mainline for the displaced hooks. Using average longline gear configuration characteristics as shown in Table 17, with 3,006 hooks, 31.5 hooks between floats and 95.43 floats with hooks between them, the 70 m minimum distance from the float to adjacent hooks (removal of 4 hooks between floats) results in the displacement of 381.72 hooks. Redeploying these displaced hooks will require an additional 8,827.3 m of mainline (approx. 4.8 nm) of mainline. If the vessel is able to add additional mainline to the reel, and chose to do so, the retail cost for a 5-nm spool of 3.6 mm monofilament mainline is $1,383, and the cost for a 550-meter spool of 6.4 mm “tarred” float line is $214.95. Float line materials used in the fishery are variable and range from polypropylene rope to tarred rope, the latter of which is about twice as costly as polypropylene line. The cost used here is for tarred float line to give an upper bound for the likely costs of redistributing the hooks on the mainline. About 12 additional floats would be required to suspend the mainline, and at a cost of roughly $40 per float, the floats would be about $480. Assuming this gear is used the total cost would be about $2,115, including the cost for snaps connecting the floats to the mainline and shipping to American Samoa from Hawaii (Sources: Pacific Fishing Supply, Pacific Ocean Producers, and VAK Fisheries, Honolulu, HI).

Table 18: Potential Alternative 2 catch impact (numbers of fish per set) from hook redistribution.

Common name	No Action	Removing 4 hooks between floats and redistribution on added mainline

	Catch per set (N)	Landed (N)	Bycatch (N)	Catch per set (N)	Catch percent of status quo	Landed (N)	Bycatch (N)
Albacore tuna	48.54	47.34	1.20	52.64	108.44	51.34	1.30
Skipjack tuna	12.97	6.93	6.04	12.1	93.31	6.47	5.63
Yellowfin tuna	6.80	4.66	2.14	7.17	105.38	4.91	2.26
Wahoo	5.97	3.74	2.23	5.09	85.27	3.19	1.90
Bigeye tuna	4.14	2.57	1.56	4.47	108.1	2.78	1.69
Smith's escolar	3.03	0.01	3.02	3.14	103.44	0.01	3.12
Lancetfish	2.76	0	2.76	2.94	106.5	0	2.94
Slender mola	1.82	0	1.82	1.82	100.04	0	1.82
Longfin escolar	1.62	0	1.62	1.82	112.04	0	1.82
Dolphinfish	1.59	0.75	0.85	0.67	42.19	0.31	0.36
Blue shark	1.28	0	1.28	1.28	99.98	0	1.28
Barracuda	0.88	0.13	0.75	0.61	69.63	0.09	0.52
Blue marlin	0.83	0.11	0.73	0.76	90.59	0.1	0.66
Silky shark	0.51	0	0.51	0.45	87.98	0	0.45
Snake mackerel	0.47	0	0.46	0.47	100.54	0	0.47
Pelagic stingray	0.44	0	0.44	0.48	107.65	0	0.48
Spearfish	0.43	0.02	0.41	0.25	58.96	0.01	0.24
Sickle pomfret	0.36	0.1	0.25	0.40	112.94	0.12	0.29
Swordfish	0.28	0.06	0.21	0.27	96.42	0.06	0.21

Source: Bigelow and Fletcher (2009).
Note: No Action and Alternative 2 scenarios used a longline with 3,000 hooks and 36 hooks between floats.

Another potential limiting factors for adding extra mainline for the displaced hooks, apart from costs, will be the size of the vessel's longline reel and whether extra line can be added, and the space and capacity of the vessel for additional floats and float lines. If participants are able to add more mainline to their vessel's reels and choose to redistribute hooks, more time for setting and hauling would be required, which would impact participants and may become operationally prohibitive (Bigelow and Fletcher 2009). Many American Samoa fishermen choose to fish close to their maximum effort capacity to maximize profit potential. The addition of more mainline, and other gear, as well as the added operational time required to deploy and retrieve it, may preclude some from mitigating the loss of catch and gear from the required gear modification. However, fishermen able to redistribute some hooks would likely benefit if catches of albacore increased with an overall deeper distribution of hooks as found by Bigelow and Fletcher's 2009 study.

There is currently no information available with which to adequately predict the likely behavioral response of fishermen in this fishery in terms of adding mainline to compensate for fewer hooks. Clearly any prescription of the way fishing gear must be deployed impinges on the flexibility of the fishermen to rig their fishing gear, and may result in additional costs to the fishermen. The longline fishery may respond to the proposed action in a number of ways. Fishermen may reduce the spacing between hooks such that the first and last hooks between floats are 70 m from the floats and thus at or below 100 m. Fishermen may not deploy the first and last two hooks between floats and make more sets or trips to compensate for the loss of fishing power. These and other methods are likely to be tested, and as they are now, gear configurations are likely to vary among fishermen and as fishery conditions change. If fishermen opt to reconfigure gear, there will likely be some "learning time" to figure out how to fish effectively with it over time, such as coping with the increase setting and hauling times for a longer mainline. This will add to the regulatory burden already imposed on fishermen.

If fishermen are not able to redistribute hooks, fishermen could potentially lose $94 or more per set. From 2006 to 2009, an average of 184 sets was made per vessel per year. It is possible that a vessel may incur a loss of $16,900 or more per year. To make up the difference in lost revenue the vessel would need to increase fishing effort, such as making more sets, to compensate the lost. This information is based on a potential 5.1 percent drop in albacore revenue per set. Catch rates and market prices for albacore and other marketable non-target catch, as well as additional trip expenses, such as bait, fuel, and crew may influence the effort needed to compensate any revenue lost.

Under Alternative 2, participants would also be precluded from shallow-setting to target swordfish as this alternative prohibits retention of more than 10 swordfish. Limiting the possession or landing of more than 10 swordfish is unlikely to burden fishermen. Logbook data shows the typical number of swordfish caught per trip is fewer than 10. In 2009, 27,361 lb of swordfish were landed in American Samoa, which is an average of 154 lb per trip, or approximately one or two fish per trip. Under Alternative 2, fishery participants are not expected to be impacted by the 10 swordfish trip limit.

The NMFS Pacific Islands Regional Office has conducted a limited assessment of this action's potential to impact the American Samoa longline fishery and the social viability of the American Samoa fishing community (NMFS 2010d). The conclusion reached was that the fishery in general and vessels specifically may realize adverse economic impact. However, it is likely that factors are present that will mitigate some of this potential impact.

The term social viability, when used in the context of a fishery management action, refers to the likely negative or positive effects of that action on families and general community services and structure. In others words, it is a term meant to convey whether the action will decrease or increase the ability of social structures and functions to support fishery participants or communities.

After taking into account the several potential mitigating factors, and using the most recent data known to be available, the assessment concludes that the maximum potential economic loss from the American Samoa longline fishery is unlikely and that bycatch will remain available from the fishery with which to meet various socio-cultural obligations. It is also unlikely that this action alone will significantly decrease the ability of social structures and functions to support fishery participants or the community. However, since data with which to assess some of the impacts of the preferred alternative are missing (for several reasons), the assessment cautions that there is an incomplete picture of how fishery participants and the wider fishing community of American Samoa may be impacted. This is partially due to the fact that few data have been collected with which to understand and predict fishery participants' likely behavioral responses to the action as a function of (for example) boat size, capacity to hold more mainline, or economic variables, such as vessel profitability.

In 2008, the volume of fish landed by the longline fishery that was not sold commercially amounted to about 44,700 lb or 0.5 percent of total landings (WPRFMC 2010). In 2009, about 125,600 lb of fish or 1.8 percent of the landed catch was not sold (WPRFMC unpublished information from draft 2009 American Samoa pelagics annual report module) and comprised species such as sharks, spearfish, kawakawa, marlins, and mahimahi. Most of these species are caught predominantly on shallower hooks and thus there may be some reduction in the volume of these species which do not typically enter commerce but which are socially important to the American Samoan community (Severance and Franco 1989; Levine and Allen 2009).

An unpublished 1996 survey of 60 active troll and longline fishermen (estimated by DMWR staff to be over half of the known active fishermen) found a variety of culturally defined named gifts of fish to meet cultural and ceremonial needs and obligations and sales of fish at reduced prices (Craig Severance, University of Hawaii, pers. comm.). Thirty percent of the fishermen surveyed reported that half or more of their catch was sold as Fa’ataualofa (to give or sell at a reduced price to friends or kinsmen as an expression of an ongoing sustained relationship). Forty- two percent of the fishermen reported that half or more of their catch was not sold. Of the unsold portion of the catch, 35 percent was reportedly contributed to birthdays, weddings, and funerals and 22 percent to culturally significant holidays.

The number of times fishermen reported contributing to To’onai (Sunday afternoon serving of village chiefs) ranged widely but averaged 22 times per year. Twenty-two percent of the fishermen also reported that half or more of their trips in the last year were made at the request of the Matai. Nineteen percent of the fishermen also reported that half or more of the unsold portion of the catch was contributed to their Matai as tautua (service) and this percentage is artificially low since 25 percent of the fishermen surveyed held their own Matai titles. While 18 percent of the fishermen reported almost no contributions, 32 percent of the fishermen also reported contributing to Fa’alavelave (obligation to contribute to an event on behalf of the Matai and Aiga) three or more times per year. Thirty-two percent of the fishermen also reported giving away half or more of the unsold portion of their fish as Fesoasoani (to help out: a less formal more individualized response to a less serious need than in the case of Fa’alavelave).

As cash continues to become increasingly important in a variety of Samoan customary exchanges, it is important to understand the importance of cash to the fishermen and the receivers of fish. Conventional Western economic notions of business transactions do not fit well in this cultural context, since profit is less a motive than participation in ways that benefit the collective in one’s aiga. The continued flow of fresh and even frozen fish into customary exchange is central to the perpetuation of Fa’a-Samoa or Samoan cultural identity. Continued flow of the unsold portion of the longline catch will contribute to a variety of cultural distributions and customary exchanges that are culturally acceptable and appropriate and that support the valued cultural continuity and solidarity that is symbolized in Fa’a-Samoa.

9.2.5 Impacts on Biodiversity and Ecosystem Function

Alternative 2 is not expected to adversely impact biodiversity or ecosystem function. The longline fishery around American Samoa targets primarily albacore tuna to supply the cannery. The removal of top predators such as tunas likely has some ecosystem impacts, however, there is no indication of negative ecological impacts from this fishery. At this time the stock assessment of the South Pacific albacore stock indicate it to be sustainable, as described in Section 8.5.1. Deepening the hook depth, under Alternative 2 is expected to reduce the amount of fishing mortality on other top trophic level fishes, mainly epipelagic species found in the upper 100 m of the water column such as various billfishes and mahimahi. This reduction is not expected to be large, and therefore, the impacts to ecosystem function are not expected to be large and adverse.

9.2.6 Impacts on Enforcement and Administration

Alternative 2 would result in required gear modifications and therefore enforcement agencies would need to be informed of the modifications in such detail that they could recognize compliance and non-compliance based on the requirements implemented, such as the minimum length of float lines and the 70 m distance of blank mainline between floats and adjacent hooks (see Figure 2). The float line lengths could be measured easily; however, in order to assess the minimum distance to the first and last hook from each float, enforcement would be required to board a vessel during setting or hauling operations and would be difficult.

If a vessel is boarded during the set, enforcement would have to monitor the mainline as it is being deployed and if during the haul, the mainline would have to be collected and measured on the deck. It is expected that the main enforcement activities would be dockside inspections in American Samoa. When Coast Guard resources are available in American Samoa, vessel boardings may occur and fishery requirements could be assessed.

Fishery observers may be able to collect data during setting operations if their current duties are modified and clear parameters are specified. Observers currently do not monitor vessel setting operations in American Samoa. If data collection is requested, the observer provider contract may need to be amended and funds added if additional duties are placed on observers. Further, as part of this action is to limit swordfish catches to 10 pieces per trip, the enforcement of the swordfish limit could be monitored by at-sea boarding or inspections when vessels return to port.

Initially, implementation of management measures under this alternative would require the administrative burden of rulemaking and ensuring all participants were thoroughly informed. This may include translating the requirements into Samoan and conducting outreach and education in American Samoa. The Council may take the lead on translating necessary documents. Meetings would likely be a joint effort with NMFS and facilitated by the Council’s American Samoa Island Coordinator.

9.2.7 Impacts on Public Health and Safety

Alternative 2 would require a change in gear configuration, but would not result in a large change in the general operation of the American Samoa longline fishery so as to have an impact on public health and safety. The required gear modifications would change, to a degree, the process by which fishermen deploy gear. However, these changes to mainline and float line lengths would not increase risks to fishermen while setting or retrieving their gear. This alternative would not cause vessels to travel farther or in adverse conditions. Fishermen would continue to be required to adhere to all current regulations, including those pertaining to safety-at-sea. Therefore, no impacts on public health and safety are expected under the preferred gear modifications alternative.

9.3 Alternative 3: Hook Size and Bait Size Requirements

Under this alternative, participants in the American Samoa longline fishery would be required to use size 16/0 or larger circle hooks with no more than a 10 degree offset, as well as the largest practical whole fish bait with the hook point covered.

9.3.1 Impacts on Target and Non-target Stocks

Under Alternative 3, the requirement to use larger sized hooks would be expected to select for larger-sized individuals of target and non-target stocks. The target stock, South Pacific albacore in the western and central Pacific, are estimated to be sustainable in terms of fishing levels from 2004-2006 (described in Section 8.5.1) and there is no indication that current levels of catch are not sustainable. It is expected that fishing levels and overall annual catch of albacore would not increase under Alternative 3 to the extent that stocks would be negatively impacted.

Alternative 3 would require larger hooks (size 16/0 or larger) be utilized to replace those 13/0, 14/0, and 15/0 circle hooks currently used by vessels not already using size 16/0 hooks. The requirement to use size 16/0 or larger hooks may change the selection effects of the American Samoa longline fishery. However, a recent experimental study conducted in the American Samoa longline fishery showed that size 16/0 hooks appear to have albacore catch rates almost identical to control hooks (size 14/0) (SPC 2010). There were also no significant differences in catch rates for bigeye, yellowfin, and dolphinfish, three non-target species that are economically important in the fishery. On the other hand, there were significant differences in catch rates for two other non-target but economically important species – skipjack and wahoo. Of the two species of no economic importance (at least in this fishery), blue sharks had no significant differences in catch rates between the two hook sizes while escolar showed a significant difference in catch rates between the two hook sizes. The catch rates of escolar, skipjack, and wahoo were all significantly higher on 14/0 hooks than on 16/0 hooks. Reduction of the catches of skipjack tuna and wahoo may have some economic and social impacts in American Samoa as noted earlier in Section 9.2.4.

Hook size and type are principal factors known to affect size selectivity of fish harvested (Bromhead et al. 2009). Cortez-Zaragosa et al. (1989) showed that hand-line fishermen in the Philippines used successively larger J-hooks through the yellowfin tuna fishing season as fish being encountered and caught changed from juveniles to adults. In the Hawaii longline fishery, Curran and Bigelow (2010) reported that a study to compare catches with 18/0 circle hooks versus the Japanese 3.6 sun tuna hooks and 9/0 J-hooks currently used in the fishery, and found there was no significant difference in the catch of the target species, bigeye tuna (*Thunnus* *obesus*), by hook type. However, results showed strong statistical support that the use of large circle hooks would reduce the catch of incidental species such as billfish, pelagic sharks, opah, and mahimahi in the Hawaii-based deep-set longline fishery.

9.3.2 Impacts on Protected Species

Sea Turtles

Under Alternative 3, the fishery would operate with the requirement to use size 16/0 or larger circle hooks with no more than a 10 degree offset, as well as the largest practical whole fish bait with the hook point covered.

Regulatory modifications in the Hawaii-based shallow-set longline fishery have reduced the number of interactions with loggerhead and leatherback sea turtles by 90 and 85 percent, respectively (Gilman and Kobayashi 2007b). This was accomplished largely by switching from 9/0 J-hooks to 18/0 circle hooks, and from squid bait to fish bait. All of the green sea turtles which have interacted with the American Samoa longline fishery have been juveniles and it can be surmised that larger-sized hooks may be more difficult for a small turtle to become hooked in the mouth. It is difficult to predict the outcome of using larger hooks in this fishery to reduce green sea turtle interactions. Twelve of the 13 observed interactions in the American Samoa longline fishery have occurred with smaller circle hooks size 13/0, 14/0, and 15/0 (see Table 2), and eight of those 12 were hooked in the mouth (NMFS 2010). Requiring the use of a 16/0 or larger size hook under Alternative 3 may result in fewer green sea turtles being hooked.

All sea turtles, being air-breathers, are typically found closer to the surface, e.g., in the upper 100 m of the water column; however, some turtles such as olive ridleys, are susceptible to deep-set longlining because of their deep foraging (NMFS 2008b). Olive ridleys are the most commonly caught sea turtle in the Hawaii-based deep-set longline fishery, which fishes deeper than the American Samoa longline fishery at approximately 150-400 m depth. One olive ridley interaction was observed in July 2010 within the EEZ around American Samoa. The turtle was on hook four of 27 and released injured. Continuation of this fishery under Alternative 3 may lead to incidental interactions with olive ridleys; however, larger circle hooks may reduce interaction rates. There have been no observed interactions with any other sea turtles, and therefore, it is expected that under this alternative the fishery would continue minimally affect other listed sea turtles.

Finally, larger fish baits may make it more likely for a turtle to feed from the baited hook without getting hooked in the mouth or ingesting the hook. As noted in Section 6.1, it is thought that green turtles tend to eat fish from the hook in small bites, thus avoiding ingesting the hook, as opposed to squid bait, which may be gulped down whole leading to more deep hooking. Covering the point of the hook with bait would likely have additional benefits by reducing the potential for hooking turtles.

Seabirds

From observed trips from 2006 through 2010, one seabird interaction (unidentified shearwater in 2007) was reported[29] by observers (Table 9). This is expected as typically longline-seabird

[29] Found on NMFS PIRO website at: http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html

interactions are minimal in tropical latitudes, being more or less restricted to higher sub-tropical and temperate latitudes (Molony 2005). It is difficult to accurately extrapolate across the entire fleet with five years of data from relatively low levels of observer coverage, four years of which reported zero interactions. Alternative 3 would require fishermen to use 16/0 or larger circle hooks in a fishery where seabird interactions are already rare, thus impacts to seabirds are not expected to change under this alternative and any affect would likely be insignificant or discountable.

Marine Mammals
Alternative 3 is not anticipated to affect interaction rates with marine mammals. The fishery would continue to operate largely in the same manner and would be expected to continue to have occasional interactions with some marine mammals. Table 9 lists the observed interactions for the past five years of the fishery, which included five marine mammal interactions.

No large whale interactions have been observed in the American Samoa fishery since the fishery has been regularly observed from 2006. Alternative 3 would not affect marine mammals in any manner not previously considered or authorized by the commercial fishing incidental take authorization under section 118 of the MMPA.

9.3.3 Impacts on Marine Habitat

Alternative 3 would not be expected to result in any increased gear loss over existing conditions or any additional impacts to marine habitats. Longline fishing occurs in pelagic waters within the upper portion of the water column and is not known to have any documented impacts on habitat during fishing operations. Gear loss, however, does occur in longline fisheries and has the potential to impact reef or other habitats. The provision to replace hooks with larger sized ones would not be expected to increase the likelihood of gear loss and the extent of possible impacts on habitat is unknown.

All longliners occasionally lose hooks and other gear while fishing. Fishermen do try to recover all gear, and are normally successful as the floats used in the fishery are marked to be visible from distance, even at night. Based on unpublished data from NMFS PIFSC, an average of 38,426 hooks (range: 14,215-49,370) were lost annually between 2001 and 2009 within the action area (Figure 4), or an average of about 7.3 hooks per set. Lost hooks are unlikely to have a major impact to the physical marine environment, being composed of steel. Depending on quality, the hooks will corrode, although hooks on the deep sea bed in water just above freezing, will corrode more slowly, and stainless steel hooks will corrode at a slower rate than non-stainless steel hooks.

9.3.4 Impacts on Fishery Participants and Fishing Communities

Under Alternative 3 fishery participants would be required to replace all of their size 13/0, 14/0 and 15/0 hooks with larger hooks, size 16/0 or larger. Fishery participants would, therefore, have to bear the economic burden of initial and ongoing hook replacement, and possible increased bait costs used with larger hooks. Hook costs may vary quite widely depending on the manufacturer and supplier, freight costs from point of sale to American Samoa if the hooks are not obtained locally, and potential discounts for bulk orders. For example, in Hawaii, the cost per hook between a Mustad 14/0 circle hook sold individually is $0.45 compared to a box of 100 hooks costing $0.35 per hook (POP 2011). Similarly, as shown in Table 19, a size 16/0 Mustad circle hook is $0.15 or 42 percent more expensive than a size 14/0 Mustad circle hook. The difference in hook costs between manufactures and models can also be quite substantial, with a price differential of more than 200 percent for the same sized hook based on catalog prices in Hawaii (POP 2011). The price per hook generally gradually increases as hook sizes increase across manufacturers and models, with more expensive hooks having a lower percentage cost increase as hook size increases according to the referenced catalog. For instance, an OPI offset circle hook size 14/0 is listed at $0.90 each for a box of 100, while the same hook in a 16/0 size is listed at $1.00 each for a box of 100, an increase in cost of about 10 percent (POP 2011).

The associated costs of hook replacement by hook size, based on an average of 3,006 hooks per set, 184 average annual sets per vessel from 2006 to 2009, and an ongoing hook replacement rate of 7 new hooks per set is shown in Table 19. Note however that the summary in Table 19 is meant to be illustrative of the financial burden fishermen not using size 16/0 circle hooks would likely incur if larger hooks were required. Subsequent year's costs would ultimately depend on how many hooks needed replacement. Table 19 conservatively estimates 1,500 hooks would be used each year; slightly more than the average hooks lost per set according to NMFS PIFSC unpublished logbook data.

Along with larger hooks may be the need for corresponding larger size sardine baitfish. However it is not always the case that larger hooks require larger bait, and large hooks may be baited with small or medium sized bait depending on the fish being targeted. The 40-60 g bait size is the most commonly available and used bait size in American Samoa. Table 20 shows the costs associated with using different sized bait. The bait price per carton remains relatively stable around $13, but the number of fish per carton decreases with the size of the fish by a factor of approximately 50 percent.

Results from 2010 trials comparing 14/0 to 16/0 circle hooks with 80 g fish bait in American Samoa suggest that catch rates of albacore will remain unchanged compared to those of smaller 13/0-15/0 circle hooks (Beverly et al. 2011). However, there may still be a ‘learning factor’ for fishermen not already using the larger hooks, and even a short-term period of reduced catch rates and overall catches decrease may cause economic impacts to the fishery participants and the community. This would include the cannery which provide thousands of jobs – a large percentage of total employment (in American Samoa) including both direct effects and indirect effects[30,31].

Participants would also be burdened with losing fishing time to reconfigure their gear under Alternative 3 which would require additional time and expense. Reconfiguring gear may lead to a small loss of fishing time while undertaking replacement. However, participants would likely adapt, and under this alternative it is expected that any impacts to catches from time lost would

[30] From the Statement of Nikolao I. Pula, Acting Assistant Secretary of the Interior for Insular Affairs, given before Congress on Feb. 22, 2008. Found at: http://www.doi.gov/oia/press/2008/02222008.html
[31] The employment figures from this speech were removed because they have changed since the cannery closure in September 2009.

be minimal in terms of annual landings. Moreover, some participants are already using size 16/0 circle hooks, which along with the study by Beverly et al. (2011) suggests that any operational impacts of increasing hook size would likely be minimal.

Table 19: Hook Prices and Costs by Sizes.

Circle hook size	Cost per hook ($)*	Initial hook cost for average set ($)	Number of hooks used**	Annual replacement hook cost ($)	Total hook cost in first year per vessel ($)	Projected annual cost difference from 16/0 size ($)
14/0	0.35	1,052	4,506	525	1,577	676
15/0	0.45	1,353	4,506	675	2,028	225
16/0	0.50	1,503	4,506	750	2,253	0

* Hook prices from Pacific Ocean Producers, Honolulu, HI: http://pop-hawaii.com/fileadmin/pdf/Commercial_Pricelist.pdf using the discounted cost per hook per carton of 100 hooks for Mustad circle hooks.
** Denotes 3,006 hooks for initial change, plus 1,500 for replacements during the first year.

Table 20: Bait Size and Associated Prices and Costs.

Bait Size (g)	Mean baits per carton (N)	Price per bait ($)	Cost per set ($)	Cost per vessel per year- 184 sets ($)	Increase in annual cost ($)
40-60	200	0.065	195	35,880	----
60-80	142	0.092	277	50,968	15,088
80-100	111	0.117	352	64,768	28,888
100-120	90	0.144	433	79,672	43,792

Source: Costs and information provided by C. Lutu-Sanchez, Longline Services Inc., Pago Pago, AS, pers. comm. and Uati Tanarogi, KS Mart, American Samoa, pers. comm.

9.3.5 Impacts on Biodiversity and Ecosystem Function

Under Alternative 3, operations of the fishery would continue with the requirement to use 16/0 or larger circle hooks with no more than a 10 degree offset, as well as the largest practical whole fish bait with the hook point covered. Use of a larger hook and fish bait is not expected to impact biodiversity or ecosystem function. The American Samoa longline fishery purchases their frozen fish bait from U.S. and Japan suppliers thus the longline fishery would have no impacts to coastal bait fish and nearshore ecosystem function.

Longline fishing removes top predators, such as tunas, which likely has some ecosystem impacts; however, there is no indication of negative impacts from this fishery. At this time the stock assessment of south Pacific albacore stocks indicate it to be sustainable, as described in Section 8.4.4.

9.3.6 Impacts on Enforcement and Administration

Implementation of Alternative 3 would result in a requirement to use size 16/0 or larger circle hooks with no more than a 10 degree offset, as well as the largest practical whole fish bait with the hook point covered. Therefore, the enforcement agencies would be required to be informed of the modifications in such detail that they could enforce compliance. Hook size is enforceable because it can be measured and fish bait may be recognized as such. The Council is conferring with NMFS and the U.S. Coast Guard to ensure all gear changes implemented through this action are enforceable to the extent practicable.

Implementation of management measures under this alternative would require the administrative burden of rulemaking and ensuring all participants were thoroughly informed. This may include translating the requirements into Samoan, and possibly other languages, and conducting outreach in American Samoa. The Council would likely take the lead on translating necessary documents. Meetings would likely be joint effort with NMFS. Outreach can be conducted by the Council's Island Coordinator in American Samoa.

9.3.7 Impacts on Public Health and Safety

Under Alternative 3, the general operation of the American Samoa longline fishery is not expected to change significantly. This alternative would not cause vessels to travel farther or in adverse conditions. The fishery would continue operating under current regulations, which include considerations for safety-at-sea. The considered changes in hook size and bait size are not known to be more dangerous or difficult to deploy or retrieve and would not result in any impacts on public health and safety.

9.4 Alternative 4: Combined Gear Restrictions

Under this alternative, participants in the American Samoa longline fishery would be required to use size 16/0 or larger circle hooks with no more than a 10 degree offset, and the largest practical whole fish bait with the hook point covered. In addition, participants would be required to configure the gear so all branch lines and hooks are at least 70 m away from any float line and associated float. Participants would also be required to utilize float lines at least 30 m in length with a minimum of 15 branch lines between any two floats. Participants would also be prohibited from possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip.

9.4.1 Impacts on Target and Non-target Stocks

Impacts of Alternative 4 which is a combination of Alternative 2 and 3 are described individually in detail in Sections 9.2.1 and 9.3.1. As described in Section 9.2.1, fishing with gear at depths of 100 m and deeper would be expected to reduce catches of epi-pelagic MUS, including most billfishes, wahoo, and mahimahi. Catches of species which inhabit deeper waters such as monchong (pomfret) and target albacore tuna, may increase under this alternative. Also under this alternative would be a requirement to use 16/0 or larger sized circle hooks, which would be expected to select for larger-sized individuals found at 100 m and deeper, including the target albacore tuna, and monchong, as mentioned above. The combination of larger circle hooks and fish bait, and deep-setting gear would likely not negatively impact target or non-target fish stocks because catches of these stocks are not expected to change significantly. Also, these gear modifications are not expected to change the conduct of the fishery in terms of the number of participants, area fished, and fish targeted.

The requirement prohibiting fishery participants from possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip is not expected to impact swordfish stocks as the fishery catches swordfish on an incidental basis. In 2009, 27,361 lb of swordfish were landed in American Samoa which is an average of 154 lb per trip, or approximately one or two fish per trip. This amount would not be expected to have any impact on stocks of South Pacific swordfish.

9.4.2 Impacts on Protected Species

Sea Turtles

Alternative 4 would require gear modifications which are a combination of Alternatives 2 and 3. While impacts of Alternative 2 and 3 are described individually in Sections 9.2.2 and 9.3.2, respectively, there may be some synergistic or cumulative effects from Alternative 4. Gilman et al. (2007a) found major reductions in turtle hooking rates from both switching from 9/0 J-hooks to 18/0 circle hooks, and switching bait types from squid to fish. It is thought that green turtles tend to eat fish from the hook in small bites, thus avoiding ingesting the hook, as opposed to squid bait, which it is thought to be gulped down whole leading to more deep hooking. Moreover, juvenile green sea turtles are relatively small-sized with small jaws and may not be able to effectively bite through large fish bait. If large circle hooks can reduce sea turtle hooking, and the feeding habits of sea turtles may reduce the severity of hooking, then the useof large hooks and fish bait may reduce sea turtle interactions, (Watson et al. 2004, Kiyota et al. 2005). Of the eight turtles hooked in the mouth up, as noted in the 2010 BiOp, the hook sizes were equal between 14/0 and 15/0 sizes, indicating that 15/0 hooks can hook juvenile greens in the mouth. Based on this information if the American Samoa longline fishery switched from using 14/0 to 16/0 circle hooks on average, and continued using fish bait, there may be a slight reduction in turtle interactions, including hooking. Requiring a combination of larger hooks and increased minimum depth of fishing gear would be expected to result in fewer interactions with green sea turtles through reducing their catchability by increased hook size, and reducing their vulnerability by maintaining hooks below depths where green turtles are more commonly found in the water column.

Seabirds

From observed trips from 2006 through 2010, one seabird interaction (unidentified shearwater in 2007) was reported[32] by observers (Table 9). This is expected as typically longline-seabird interactions are minimal in tropical latitudes, being more or less restricted to higher sub-tropical and temperate latitudes (Molony 2005). It is difficult to accurately extrapolate across the entire fleet with five years of data from relatively low levels of observer coverage, four years of which reported zero interactions. This alternative would combine Alternative 2 and 3 by requiring the use 16/0 or larger circle hooks with no more than a 10 degree offset, and for those hooks be set at least 100 m deep with the largest practical whole fish bait covering the hook point . Since seabird interactions are already rare in the American Samoa longline fishery and because seabirds interact with longlines primarily by visual attraction to bait, impacts to seabirds are not expected to change under this alternative.

[32] Found on NMFS PIRO website at: http://www.fpir.noaa.gov/OBS/obs_qrtrly_annual_rprts.html

Marine Mammals

Interaction rates are not anticipated to be affected by Alternative 4. No large whale interactions have been observed in the American Samoa fishery, since the fishery has been regularly observed from 2006.

NMFS PIRO SFD determined in July 2008 that the proposed action, Alternative 2, would have no effect on blue, fin, or sei whales; and in August, 2008, PIRO PRD concurred that sperm and humpback whales, and loggerhead turtles are not likely to be adversely affected by Alternative 2. Alternative 3 is not anticipated to affect interaction rates with marine mammals. The fishery would continue to operate largely in the same manner and would be expected to continue to have rare interactions with some marine mammals. Table 9 lists the observed interactions for the past five years of the fishery, which included five marine mammal interactions. It is expected that Alternative 4 which combines Alternatives 2 and 3 would not affect marine mammals in any manner not previously considered or authorized by the commercial fishing incidental take authorization under section 118 of the MMPA.

9.4.3 Impacts on Marine Habitat

Alternative 4 would not be expected to result in any increased gear loss over existing conditions or any additional impacts to marine habitats. Longline fishing occurs in pelagic waters within the upper portion of the water column and is not known to have any documented impacts on habitat during fishing operations. Gear loss, however, does occur in longline fisheries and has the potential to impact reef or other habitats. The provision to replace hooks with larger sized ones would not be expected to increase the likelihood of gear loss and the extent of possible impacts on habitat is unknown. The provision to move hooks to be set deeper in the water column would not increase the likelihood of gear loss. Also, Federal fishery logbooks enable fishermen to report the number of hooks lost per fishing set.

All longliners occasionally lose hooks and other gear while fishing. Fishermen do try to recover all gear, and are normally successful as the floats used in the fishery are marked to be visible from distance, even at night. Based on unpublished data from NMFS PIFSC, an average of 38,426 hooks (range: 14,215-49,370) were lost annually between 2001 and 2009 within the action area (Figure 4), or an average of about 7.3 hooks per set. Lost hooks are unlikely to have a major impact to the physical marine environment, being composed of steel. Depending on quality, the hooks will corrode, although hooks on the deep sea bed in water just above freezing, will corrode more slowly, and stainless steel hooks will corrode at a slower rate than non-stainless steel hooks.

9.4.4 Impacts on Fishery Participants and Fishing Communities

Impacts of Alternative 4 which is a combination of Alternative 2 and 3 are individually described in Sections 9.2.4 and 9.3.4. Under Alternative 4, fishery participants would be required to deploy the mainline with at least 70 m of blank mainline from where each float to the adjacent hooks are attached. Participants would be required to use float lines at least 30 m in length (see Figure 2). If they were less than 30 m in length, time and expense would be incurred to comply with the requirement. From observer data the fleet's mean float line length is 26 m with a minimum of 18 m and a maximum of 36 m.

The main concern with requiring modified gear configuration is the potential for such modifications to reduce catches of albacore tuna, and therefore cause economic harm to fishery participants. Bigelow and Fletcher (2009) estimate a 5.1 percent reduction in albacore CPUE from removing the two hooks nearest the floats (i.e., the four assumed shallowest hooks), which is akin to the 70 m or greater blank mainline distance from floats to adjacent hooks. Analysis suggests that a 5.1 percent reduction in albacore CPUE could correspond to an economic loss generated from albacore alone of up to $94 per set, or $16,900 per year per vessel or an annual fleet-wide loss of $439,406 per year from the fishery, based on 2009 effort, landings, and revenue. In addition, this alternative has the potential to result in vessels catching fewer economically-viable non-target species, which may have economic and cultural significance to longline fishermen.

Indications are that any potential direct negative impacts to catch from gear modification may be mitigated by several factors. For example, albacore tuna, especially larger individuals, are known to be more plentiful in waters between 150-250 meters during the day – away from the deep daytime and shallow nighttime sonic scattering layers, at depths coinciding with the main biomass of their preferred prey, micronekton (Domokos et al. 2007). Therefore, requiring fishing for albacore to occur at greater depths may in fact result in slightly higher weight per fish. In addition, while Bigelow and Fletcher's analysis also showed potential increases in CPUE if participants lengthen the mainline and/or redistribute the hooks that would have been removed. Third, participants may choose to increase their fishing effort in order to maintain current catch numbers. Though some vessels do not have the equipment capacity to accommodate much additional mainline, it is anticipated that deeper fishing, some gear-based mitigation, and increased effort can result in landings similar to those observed currently. The combination of responses will be vessel-specific.

Also under Alternative 4, fishery participants not currently using size 16/0 circle hooks would be required to replace all of their size 13/0, 14/0, and 15/0 hooks with size 16/0 or larger circle hooks. Those fishery participants not currently using 16/0 hooks would therefore bear the economic burden of purchasing a new set of hooks as well as the incremental increase in replacement costs that comes with the use of larger and more expensive hooks as well as larger bait. Larger hooks are significantly more costly than smaller hooks with the size 16/0 hook costing more than double the cost of either 14/0 or 15/0 (see Table 19). The combined impact of the required gear changes under Alternative 4 would be greater than that of either Alternative 2 alone or Alternative 3 alone in terms of costs and potential increased time of fishing operations.

The requirement prohibiting fishery participants from possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip would preclude fishery participants from targeting swordfish. Swordfish landings amounted on average to about 34,000 lb annually between 2005 and 2009, or on a per trip average of about one or two swordfish. A trip limit of 10 swordfish should have no impacts to fishery participants.

9.4.5 Impacts on Biodiversity and Ecosystem Function

Alternative 4 is not expected to adversely impact biodiversity or ecosystem function. The longline fishery around American Samoa primarily targets albacore tuna to supply the cannery. The removal of top predators such as tunas likely has some ecosystem impacts, however, there is no indication of negative ecological impacts from this fishery. At this time the stock assessment of the South Pacific albacore stock indicate it to be sustainable, as described in Section 8.5.1. Deepening the hook depth, under Alternative 4 is expected to reduce the amount of fishing mortality on other top trophic level fishes, mainly epipelagic species found in the upper 100 m of the water column such as various billfishes and mahimahi, and some sharks. Because the use of a larger hook and fish bait would not substantially alter the fishery, this gear change is not expected to impact biodiversity or ecosystem function.

The American Samoa longline fishery purchases their frozen fish bait from U.S. and Japan suppliers, thus the longline fishery would have no impacts to coastal bait fish and nearshore ecosystem function.

9.4.6 Impacts on Enforcement and Administration

Impacts of Alternative 4 which is a combination of Alternative 2 and 3 are described in Sections 9.2.6 and 9.3.6. Implementation of Alternative 4 would result in a requirement to use 16/0 or larger circle hooks with no more than a 10 degree offset, as well as the largest practical whole fish bait with the hook point covered. Therefore, the enforcement agencies would be required to be informed of the modifications in such detail that they could enforce compliance. Hook size is enforceable because it can be easily measured and fish bait may be recognized as such. Also, under Alternative 4 gear modifications would be required and enforcement agencies would need to be informed of the modifications in such detail that they could recognize compliance (see Figure 2). The float line lengths could be measured; however, assessing the minimum distance to adjacent hooks from each float would be difficult even if enforcement boarded a vessel during setting or hauling operations.

Fishery observers may be able to collect data during setting operations if their current duties are modified and clear parameters are specified. Observers currently do not monitor vessel setting operations in American Samoa. If data collection is requested, the observer provider contract may need to be amended and funds added if additional duties are placed on observers. Further, as part of this action is to limit swordfish catches to 10 fish per trip, the enforcement of the swordfish limit could be monitored by at-sea boarding or vessel inspections when vessels return to port.

Implementation of management measures under this alternative would require the administrative burden of rulemaking and ensuring all participants were thoroughly informed. This may include translating the requirements into Samoan, and possibly other languages, and conducting outreach in American Samoa. The Council may take the lead on translating necessary documents. Meetings would likely be joint effort with NMFS. Outreach can be facilitated and conducted by the Council’s Island Coordinator in American Samoa.

9.4.7 Impacts on Public Health and Safety

Alternative 4, which combines the requirements of Alternatives 2 and 3, would not significantly change the general operations of the American Samoa longline fishery. This alternative would not cause vessels to travel farther or in adverse conditions, nor would it change current regulations, including those that pertain to safety-at-sea. This alternative's proposed gear modifications are not expected to increase risks to fishermen while setting or retrieving their gear, and the modifications would not result in impacts on public health and safety.

9.5 Reasons for Selecting the Preferred Alternative 2

The purpose of this amendment is to reduce interactions between the American Samoa longline fishery and Pacific green sea turtles and enable the American Samoa longline fishery to sustainably continue operations, while providing for the long-term survival, recovery, and sustainability of Pacific green sea turtle populations. Under Alternative 2, the hook depth of at least 100 m would be partially achieved by deploying hooks attached to the mainline at least 70 m on either side from float lines. This should increase the depth of the shallowest hooks, which combined with a requirement to use a float line of at least 30 m in length (Figure 2), along with other proposed specifications, is expected to reduce interactions with green sea turtles.

Requiring the minimum 30 m length float line will assist in getting the line deeper to get all hooks fishing at least 100 m deep to the maximum extent practical. Table 10 shows that the observed vessels had float lines ranging from 18 m to 36 m in length with an average length of 26 m. The minimum of 15 branch lines between floats requirement was included as an additional means to assist in keeping the gear at least 100 m deep. The requirement to have a minimum of 15 branch lines between floats is not expected to cause any changes to gear configurations as the observed mean number is about 32 with a range of 25-36 branch lines, and an average length of branch lines is 10.3 m. Also hooks between floats affects the depth which gear is set and this has been used as a proxy for depth of setting in analysis of regional observer data used in the albacore stock assessment (Bromhead et al. 2009). In addition, temperatures between 15° C and 19° C are preferred by albacore tuna, and are associated with the highest catch rates of albacore in the Samoan archipelago islands region (Domokos et al. 2007). Depths where average water temperatures range from 15° to 19° C are commonly found between 200 and 400 m around the Samoan archipelago. Therefore, fishing at 100 m and deeper is not expected to significantly impact albacore catch rates. It would likely result in fewer green sea turtle interactions. However, as supported by Bigelow and Fletcher (2009), albacore can be caught at shallower and deeper depths outside of the preferred depth range.

A study conducted in Hawaii on turtle dive-depth distribution (Polovina et al. 2002, 2003) revealed that loggerheads spend most of their time shallower than 100 m, and that, even though olive ridleys dove deeper than loggerheads, only about 10 percent of their time was spent deeper than 100 m. The report concluded that incidental catches (of turtles) should be substantially reduced with the elimination of shallow longline sets. However, when deep sets are being set or hauled, or when current shears prevent the gear from sinking to its expected depth, hooks will occupy relatively shallow depths and this could result in incidental turtle catches. It is assumed that similar conditions will apply to green turtles in American Samoa. Bigelow and Fletcher

(2009) show time depth profiles of the deepest hook on four longline sets, which may vary as much as 100 to 150 m during a set.

Alternative 2 applies to longliners in Class B, C, and D (vessels longer than 40 ft). The operations of a highliner in the American Samoa small-scale alia longline albacore fishery were evaluated by monitoring its fishing activity between October 2003 and September 2004. Although over 65,000 hooks were set during the study, no sea turtles, seabirds, or marine mammal interactions were reported. The contracted alia caught a total of 1,220 fish during the 159 sets and the top five species caught were in descending order, albacore tuna (595), yellowfin tuna (359), skipjack tuna (74), mahimahi (57), and wahoo (50). Only 27 bigeye tuna were caught during the project period.

All the observed sea turtle interactions and interaction rates referred to in this amendment refer to vessels in the C and D size classes (there are currently no class B vessels operating in the American Samoa longline fishery, and those that operated previously were large alia catamarans). No sea turtle interactions have ever been observed in the alia fishery due to the small size of these vessels and the inability of NMFS to deploy observers on these craft. There is a single logbook report of a leatherback turtle interaction with an alia, but none with green sea turtles (NMFS WPacFIN unpublished data). However, non-observed interactions in the fishery have been recorded in vessel logbooks over the course of the Federal logbook program (since 1996). These interactions cannot be independently verified and were not used in the 2010 BiOp (NMFS 2010c) in assessing the impact of longline fishery on turtle populations.

Public meetings were held in American Samoa and attended by some portion of the longline fishery participants. The meetings resulted in the fishing community endorsing Alternative 2 as a balance between burden to administration and fishing participants, and most likely to achieve success in reducing sea turtle interactions while not decreasing target catch rates of albacore. Having ‘buy in’ from the longline fishing community is important in terms of achieving success and compliance and it is prudent to utilize the valuable knowledge the actual fishermen possess on their gear and fishing techniques.

The Council has conferred with NMFS and the U.S. Coast Guard to regarding enforceability of the proposed gear modifications. This will be achieved through measurable requirements including a 30 m minimum float line length with a minimum of 15 branch lines between any two floats. In addition, a prohibition on possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip is able to be enforced dockside or at sea and can effectively eliminate shallow-setting as is intended by this alternative. Fishery observers may be able to collect data during setting operations if their current duties are modified and clear parameters are specified. Observers currently do not monitor vessel setting operations in American Samoa. If data collection is requested, the observer provider contract may need to be amended and funds added if additional duties are placed on observers. Further, as part of this action is to limit swordfish catches to 10 pieces per trip, the enforcement of the swordfish limit could be monitored by at-sea boarding or vessel inspections when returned to port.

In summary, the combination of the justifications described above are responsible for Alternative 2 being chosen as the Council’s preferred alternative to best meet the purpose and need through implementing management measures which would enable the American Samoa-based longline fishery to continue operations, while reducing impacts to Pacific green sea turtle stocks.

9.6 Other Impacts

9.6.1 Cumulative Impacts

Cumulative impacts must be considered pursuant to the Council of Environmental Quality (CEQ) regulations 40 CFR 1508.7 which define cumulative impacts as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.

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.

In 2010 based on action by the WCPFC, the Western Pacific Fishery Management Council recommended establishing a 2,000 mt bigeye tuna catch limit for the U.S. territories of American Samoa and Guam, and the Commonwealth of the Northern Mariana Islands through a draft amendment to the Pelagic Fisheries Ecosystem Plan. Language under WCPFC Conservation and Management Measure 2008-01 states that countries pursuing responsible fisheries development would have no limit to their bigeye tuna catch, or if already fishing for bigeye, a limit up to 2,000 mt would apply. The Council decided to take a precautionary approach in the draft amendment and has recommended establishing the 2,000 mt limit for each of the three territories. The proposed bigeye tuna limit of 2,000 mt would not interact with the proposed action of requiring gear modifications in the American Samoa longline fishery.

Under the same measure, the Council is proposing giving the three U.S. territories the authority to lease 750 mt of their 2,000 mt allocation of bigeye tuna through a domestic charter vessel fishing arrangement in order to obtain funds for fisheries development. The charter arrangement would not require all bigeye catch to be landed in the territory, but would require a minimum of three landings by the chartering party, contingent on suitable infrastructure to deal with the catch. This amendment is being considered primarily for the Hawaii-based longline fishery, which is subject to bigeye tuna catch limits in both the WCPO and Eastern Pacific Ocean (see section 8.5.4). If a longline vessel with a Hawaii limited entry permit was fishing on the high seas north of the Equator under such an arrangement, it would not be subject to the provisions of this amendment.

There are no Class B vessels (40.1-50 ft) operating in the American Samoa longline fishery and these six permits are available. Proposed changes recommended by the Council would increase accessibility for these permits. There may be interest by Hawaii fishermen to obtain an American Samoa longline permit, even though it must be attached to a fishing vessel, since dual permit holders operating primarily from Hawaii can have their high seas bigeye tuna catch assigned to American Samoa’s proposed 2,000 mt bigeye tuna catch limit (74 FR 63999; Dec. 7, 2009).

There may thus be interest in acquiring the Class B permits, either to land bigeye in Hawaii without it counting towards the 2009-2011 U.S./Hawaii annual catch limit of 3,763 mt, or because bigeye catches in American Samoa have recently been about 10-20 percent of the proposed 2,000 mt annual limit that would be established through the draft amendment and there is room for increased catches (WPRFMC 2010, and unpublished American Samoa 2009 Pelagics annual report module). Although any longline fishing vessel with a Class B permit would need to be 40.1 to 50 ft in length, there are conventional monohull vessels of this size class in the Hawaii fishery, and it is likely that similar sized vessels could operate in American Samoa.

Other Council actions with respect to pelagic fisheries management in American Samoa include an amendment to the Pelagics FEP, which would create 75 nm purse seine area closures around the islands of the American Samoa archipelago, and another amendment to prohibit the use of FAD sets by purse seiners in the U.S. EEZ waters of the western Pacific. Limitation of purse seine fishing in the U.S. EEZ around American Samoa may not substantially impact the longline fishery in terms of its main target catch, albacore, since the target of purse seining is skipjack tuna, and to a lesser extent, yellowfin tuna. The purse seine measures were proposed to prevent localized depletion of pelagic tuna stocks and gear conflict, and therefore reduce the potential for adverse impacts on other fishery participants, including the small vessel commercial and recreational troll fishery, which operates out of Tutuila and targets skipjack and yellowfin tuna and other pelagic species. As noted in section 9.2.4, skipjack tuna price fluctuations mean that at times its value equals or even exceeds that of albacore and thus there could be benefits to the longline fleet if purse seine fishing in the U.S. EEZ around American Samoa constricts. However, as noted in various sections of this amendment, the requirement to maintain all hooks 100 m or deeper will likely reduce the catch rates of skipjack tuna possibly negating any advantage to the longliners from purse seine fishery regulations.

At the 149th Council Meeting in October 2010, the Council voted to adjust the current 50 nm large pelagic fishing vessel prohibited areas around the American Samoa archipelago. The initial proposal called for adjustments to both the northern and southern prohibited areas, the northern segment being around Swains Island. However at its 150th meeting, the Council took final action, which would only modify the southern large vessel prohibited area to be congruent with the northern and eastern boundaries of the Rose Atoll Marine National Monument as shown in Figure 9. The reconfiguration of the southern boundaries also has the added advantage of slightly increasing of ocean available for fishermen by 326 square nm. The proposed gear modifications in this amendment are unlikely to affect decisions to be made regarding modification of the southern large vessel prohibited area, nor would the proposed large vessel prohibited areas change the impacts of the gear modification alternatives.

Efforts to reduce fisheries bycatch and improve survival and recovery have reduced green turtle interactions (NMFS and USFWS 2007). Internationally, the conservation and recovery of green turtles is facilitated by a number of regulatory mechanisms at international, regional, national and local levels, such as the FAO Technical Consultation on Sea Turtle-Fishery Interactions, the Inter-American Convention for the Protection and Conservation of Sea Turtles, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and others. As a result of these designations and agreements, many of the intentional impacts on sea turtles have been reduced: harvest of eggs and adults have been slowed at several nesting areas through nesting beach conservation efforts and an increasing number of community-based initiatives are in place to slow the take of turtles in foraging areas (Gilman et al. 2007b; NMFS and USFWS 2007).

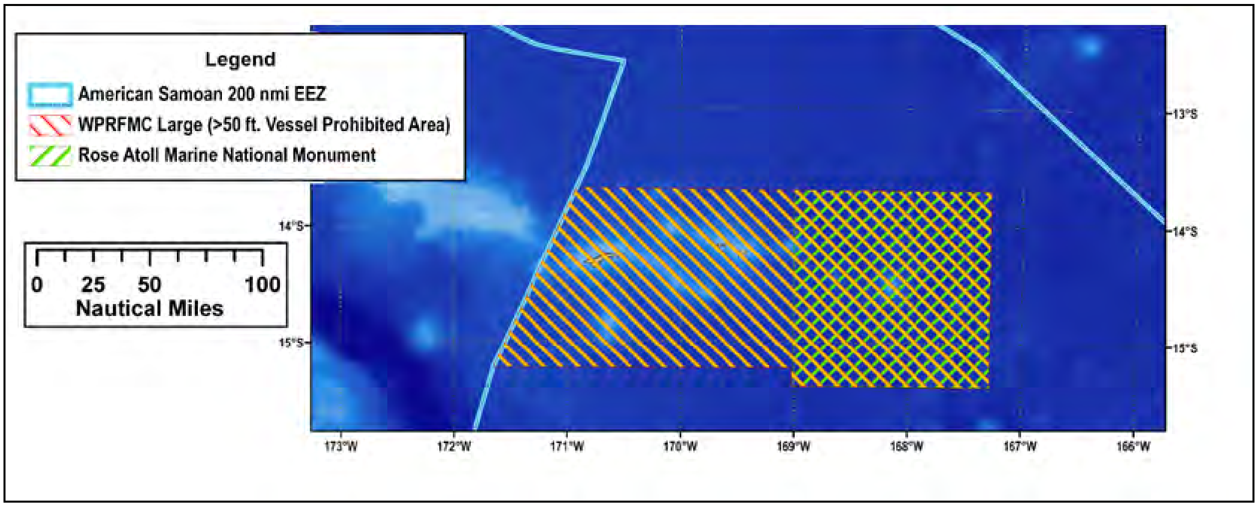

Figure 9. Proposed adjustments to the southern part of the large pelagic fishing vessel prohibited areas in the U.S. EEZ around American Samoa.

Source: NMFS PIFSC.

Note: The proposed change would align the boundaries of the Rose Atoll Marine National Monument.

The impacts of other activities unrelated to fishing operations would be expected to continue to impact green sea turtles throughout their global range. These may include: pollution from discharges and runoff, collisions with vessels, plastic ingestion, natural disasters such as the tsunami of September 2009, coastal development, other degradation to nesting beach areas from beach armoring and beachfront lighting, predation and poaching eggs and sea turtles, degradation of foraging areas, among others.

During the 4-year period from October 2004 to September 2008, the American Samoa DMWR recorded 15 green turtles stranded on Tutuila measuring 46-85 cm CCL, six of which were dead (NMFS 2010). Of the four green turtles that were necropsied, two had plastic and aluminum in their guts (Tagarino et al. 2008 *in* NMFS 2010). However, because DMWR's new turtle stranding program still has little data, and many turtles within the area that are dead or dying from the above human impacts do not strand in American Samoa, it is not possible to estimate the number of green turtle mortalities resulting from climate change, marine debris, harvest, and contaminants in the past few years in waters around American Samoa.

9.6.2 Climate Change Impacts

The global mean temperature has increased by 0.76° C over the last 150 years, and the linear trend of temperature 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). Observed changes in marine systems are associated with rising water temperatures, changes in ice cover, salinity, oxygen levels, circulation, and ocean acidity. Changes to marine systems include shifts in ranges; changes in algal, plankton, and fish abundance (IPCC 2007b); and damage to coral reefs (Scavia et al. 2002), and other impacts. A more complete summary of climate change and climate change impacts can be found online at http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1.

In general, large scale climate cycles can impact winds, currents, ocean mixing, temperature regimes, nutrient recharge, and affect the productivity of all trophic levels in the North Pacific Ocean (Polovina et al. 1994). These impacts are expressed as variability in stock size, recruitment, growth rates, or other factors. Pelagic fishes, as well as protected species that interact with the fisheries, are currently affected by these large-scale climate fluctuations and would continue to be affected in the same way under each of the alternatives.

Current and future impacts of climate change have been considered in view of the potential cumulative impacts on fishery target and non-target species and protected resources and are not anticipated to affect the Council's ability to achieve the management objectives of this proposed action. Fish stocks and sea turtle populations would continue to be monitored through logbook reports and observer coverage, as well as through international efforts to monitor populations. Any changes in the environment that affect population trends beyond what is currently known may cause the Council to make adjustments in fishery management in the future.

None of the alternatives would result in a change to the fishery that would contribute to climate change by changing the consumption of energy or release of greenhouse gases by the fishery participants.

9.6.2.1 Climate Change Impacts on Sea Turtles

The major ways climate change will affect sea turtle populations are: 1) changes in hatchling sex ratios as a species that exhibits temperature-dependent sex determination; 2) loss of nesting beach habitat due to sea level rise; 3) alterations to foraging habitats and prey resources; 4) changes in phenology and reproductive capacity that correlate with fluctuations in sea surface temperature (SST), and 5) potential changes in migratory pathways and range expansion.

While sex ratios vary naturally within and among seasons and nesting locations, several species already exhibit female bias throughout their major rookeries worldwide, in many cases producing anywhere from 60 – 99% females (Chan and Liew 1995; Godfrey et al. 1996; Marcovaldi et al. 1997; Binckley et al. 1998; Godfrey et al. 1999; Godley et al. 2001; Oz et al. 2004; Kaska et al. 2006). Monitoring data over a long enough timescale to discern climate change related trends in sex ratio have not been collected in the proposed action area. Sea level rose approximately 17 cm during the 20th century (Bindoff et al. 2007) and further increases are expected. There are several predictions for potential future sea turtle nesting habitat loss due to sea level rise (Fish et al. 2005; Baker et al. 2006; Fuentes et al. 2009); however, available data are insufficient to determine an existing correlation between past sea level rise and sea turtle population dynamics (Van Houtan 2010).

Global climate change-induced elevated temperatures, altered oceanic chemistry, and rising sea level may be contributing to changes to coral reef and seagrass ecosystems which provide resting and foraging habitat for green and hawksbill sea turtles, although it is difficult to distinguish impacts of climate-related stresses from other stresses that produce more prominent short term effects (Rosenzweig et al. 2007). 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 sea turtles (Solow et al. 2002; Chaloupka et al. 2008a), similar to what has been observed during El Niño events in the Pacific (Limpus and Nicholls 1994; Chaloupka 2001; Saba et al. 2007; Reina et al. 2008). These shifts in abundance of foraging resources are also directly linked to observed modifications in phenology for sea turtles such as longer remigration intervals and temporal shifts in nesting activity (Weishampel et al. 2004; Hawkes et al. 2007). However, at this time it is only possible to speculate as to the implications of such impacts, as findings raise numerous follow up questions (listed by Weishampel et al. 2004), including whether earlier nesting will affect overall fecundity, clutch size, incubation length, hatch success, hatchling survivorship, food availability for hatchlings, mating synchrony, and sex ratio. Changes in reproductive capacity and temporal shifts of nesting activity associated with changing environmental conditions have not been studied specifically in the proposed action area.

Additional potential effects of climate change on sea turtles include range expansion and changes in migration routes (Robinson et al. 2008). Leatherbacks have extended their range in the Atlantic north by 330 km in the last 17 years as warming has caused the northerly migration of the 15°C SST isotherm, the lower limit of thermal tolerance for leatherbacks (McMahon and Hays 2006). Scientific data on changes in migration routes of the four species that may be affected in the proposed action area are limited, and a similar study has not been done for these species. Therefore, it is not possible to say with any degree of certainty whether and how their migration routes and ranges have been or are currently affected.

Attempting to determine whether recent biological trends are causally related to climate change is complicated because non-climatic influences dominate local, short-term biological changes. However, the meta-analyses of 334 species and the global analyses of 1,570 species show highly significant, nonrandom patterns of change (in geographic range, phenology, and other biological factors) in accord with observed climate warming in the twentieth century. In other words, it appears that these trends are being influenced by climate change-related phenomena, rather than being explained by natural variability or other factors (Parmesan & Yohe 2003). The details support the probability that recently observed changes in sea turtle phenology, sex ratio, and foraging characteristics in studied populations may be influenced by climate change-related phenomena. However, the implications of these changes are not clear in terms of population level impacts, and data specific to the proposed action area are lacking. Therefore, any recent impacts from climate change in the proposed action area are not quantifiable or describable to a degree that could be meaningfully analyzed, but are believed to be insignificant at this time. The proposed action is designed to reduce impacts from the American Samoa longline fishery to green sea turtles and this will provide benefits even in light of other stressors.

9.6.3 Future Federal Actions

Other related Council actions expected to occur in the foreseeable future in fisheries occurring in waters around American Samoa include amendments to the Pelagics FEP including those to:

manage American Samoa longline vessels within the bigeye tuna catch limits for Pacific Islands Territories; modify the American Samoa longline limited entry permit system; and exclude purse seine vessels from operating within 75 nm around American Samoa. There are alternatives under consideration to combine vessel class sizes, however, none of the proposed actions in and of themselves would enable the longline fishery in American Samoa to expand beyond the maximum number of permits (60) delineated in the limited entry program. These actions may result in impacts to the human environment or to communities, which will be analyzed in the respective amendment documents.

In addition, there is a proposal to enlarge sanctuary waters around American Samoa through expansion of Fagatele Bay National Marine Sanctuary. These areas may add further protection to green sea turtles through restricting human activities. With regards to impacts to protected species, if needed, separate consultations pursuant to section 7 of the ESA will be conducted on these future management actions.

10.0 Consistency with the Magnuson-Stevens Act and Other Laws

10.1 Consistency with National Standards

Section 301 of the Magnuson-Stevens Act requires that regulations implementing any FMP or FMP amendment be consistent with the 10 national standards listed below.

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

Target and non-target species in the American Samoa longline fishery are neither overfished nor approaching an overfished condition. The preferred alternative is consistent with NS1 because it would not contribute to overfishing. It would reduce sea turtle bycatch in the American Samoa longline fishery so the fishery may continue to achieve the optimum yield of albacore tuna. See Sections 8.5 for further information on the status of the target stock and other tuna stocks.

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

The preferred alternative considered in this amendment is consistent with NS2 because the best available information, such as observer data, a TDR study, and fishery logbook data with other sources (NMFS 2010c), was used in developing and analyzing the alternatives. The recommendation to conduct further gear testing and sea turtle stock assessment work is seeking to add to the best available information such that it may also be used in future management decisions.

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

The preferred alternative considered in this amendment is consistent with NS3 in that it does not directly affect management of albacore tuna which is the target stock in this fishery. This action proposes to implement gear changes to reduce unwanted bycatch of protected species. This action does not interfere with the existing management measures, which manage the target stock. The target stock's range extends throughout the western and central Pacific, and thus, it is managed on a domestic and an international basis through participation in regional tuna fishery management organizations.

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

The preferred alternative considered in this amendment is consistent with NS4 because it does not discriminate between residents of different states, nor does it allocate or assign fishing privileges.

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

The preferred alternative considered in this amendment is consistent with NS5 in that it intends to consider efficiency in the fishery such that unintentional bycatch would be reduced by implementation of the least burdensome, most economical measures with minimal effect on the target species. The preferred alternative does not have economic allocation as its sole purpose.

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

The preferred alternative considered in this amendment is consistent with NS6 in that consideration was given to variations and contingencies in fishery resources and catches. This limited entry fishery is largely targeting the same resource; therefore, implementing measures to reduce bycatch would benefit all participants. The fishery is monitored and will continue, which would allow for responses to changes in the fishery, including future management actions.

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

The preferred alternative considered in this amendment is consistent with NS7 by proposing measures to best achieve the objective of reducing protected species bycatch through gear modifications which have been shown to be effective in other longline fisheries and which are relatively low cost. These measures would not duplicate any other existing management measures in this fishery.

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

The objective of this amendment is to maintain a viable longline fishery in American Samoa by proactively and cooperatively instituting measures to reduce green sea turtle bycatch, which occurs in the fishery. The longline fishery provides the people of American Samoa various economic benefits; ensuring that the continuity of fishery is therefore consistent with NS8. In particular, the preferred alternative is seen as having the best cost-benefit ratio of the all the alternatives to reduce and minimize unintended bycatch while maintaining a viable fishery to maximize benefits for the affected communities.

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

The preferred alternative considered in this amendment is consistent with NS9 because its objective is to effectively reduce incidental bycatch of sea turtles in the American Samoa longline fishery to maintain a viable longline fishery. It is likely that the management measures proposed in the preferred alternative would also reduce other epipelagic bycatch (e.g., marlins) in the longline fishery by keeping fishing gear below the upper 100 meters of the water column.

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

The preferred alternative considered in this amendment is consistent with NS10 because it would not pose safety risks to fishery participants in the American Samoa longline fishery. Safety of participants was given consideration in determining how to best meet the purpose and need while continuing the fishery safely.

10.2 National Environmental Policy Act

This amendment has been written and organized to meet the requirements of the National Environmental Policy Act and thus is a consolidated document including an Environmental Assessment, as described in NOAA Administrative Order 216-6, Section 603.a.2.

NEPA considers the effects of proposed Federal actions and alternatives on the environment and allows for involvement of interested and affected members of the public before a decision is made. The NMFS Regional Administrator will determine whether or not the action is significant causing the need for an Environmental Impact Statement to be prepared.

10.3 Executive Order 12866

To meet the requirements of Executive Order 12866 (E.O. 12866), NMFS requires that a Regulatory Impact Review (RIR) be prepared for all regulatory actions that are of public interest. This review provides an overview of the problem, policy objectives, and anticipated impacts of regulatory actions, and ensures that management alternatives are systematically and comprehensively evaluated such that the public welfare can be enhanced in the most efficient and cost effective way.

In accordance with E.O. 12866, the following is set forth: (1) This action is not expected to have an annual effect on the economy of more than $100 million or to adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety; or state, local or tribal governments or communities; (2) This action is not likely to create any serious inconsistencies or otherwise interfere with any actions taken or planned by another agency; (3) This action is not likely to materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights or obligations of recipients thereof; (4) This action is not likely to raise novel or policy issues arising out of legal mandates, or the principles set forth in the Executive Order. Based on the information contained in this Pelagics FEP amendment, the initial findings of this action are determined to not be significant under E.O. 12866.

10.4 Administrative Procedures Act

All federal rulemaking is governed under the provisions of the Administrative Procedures Act (APA) (5 U.S.C. Subchapter II) which establishes a “notice and comment” procedure to enable public participation in the rulemaking process. Under the APA, NMFS is required to publish notification of proposed rules in the Federal Register and to solicit, consider and respond to public comment on those rules before they are finalized. The APA also establishes a 30-day waiting period from the time of a final rule is published until the rule become effective, unless an exemption is applicable. This amendment complies with the provisions of the APA through the Council’s use of public meetings, requests for comments, and consideration of comments. To implement this amendment, NMFS will publish a proposed rule and request public comments.

10.5 Coastal Zone Management Act

The Coastal Zone Management Act requires a determination that a recommended management measure will have no effect on the land, water uses, or natural resources of the coastal zone, or is consistent to the maximum extent practicable with an affected state’s enforceable coastal zone management program. On April 13, 2010, NMFS sent a letter to the American Samoa Coastal Management Program informing them of their determination that the proposed action is consistent with the American Samoa Coastal Zone Management Program to the maximum extent possible.

10.6 Environmental Justice

On February 11, 1994, President William Clinton issued Executive Order 12898 (E.O. 12898), "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." E.O. 12898 provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." E.O. 12898 also provides for agencies to collect, maintain, and analyze information on patterns of subsistence consumption of fish, vegetation, or wildlife. That agency action may also affect subsistence patterns of consumption and indicate the potential for disproportionately high and adverse human health or environmental effects on low-income populations, and minority populations. A memorandum by President Clinton, which accompanied E.O. 12898, made it clear that environmental justice should be considered when conducting NEPA analyses by stating the following: "Each Federal agency should analyze the environmental effects, including human health, economic, and social effects of Federal actions, including effects on minority populations, low-income populations, and Indian tribes, when such analysis is required by NEPA[33].

Each alternative would require fishery participants with valid American Samoa longline limited entry permits to make some changes to their fishing gear. The proposed gear modifications would not result in large and adverse impacts to the environment and there were no environmental effects found that could result in disproportionately high and adverse effects to members of minority populations, low-income populations, or Indian tribes. The proposed action would not affect sustenance fishing by members of minority and low-income fishing.

10.7 Information Quality Act

The information in this document complies with the Information Quality Act and NOAA standards (NOAA Information Quality Guidelines, September 30, 2002) that recognize information quality is composed of three elements: utility, integrity, and objectivity. National Standard 2 of the Magnuson-Stevens Act states that an FMP's conservation and management measures shall be based upon the best scientific information available. In accordance with this national standard, the information product (amendment document and proposed rule) incorporates the best biological, social, and economic information available to date, including the most recent biological information on, and assessment of, the pelagic fishery resources and protected resources, and the most recent information available on fishing communities, including their dependence on pelagic longline fisheries, and up-to-date economic information (landings, revenues, etc.). The policy choices, i.e., proposed management measures, contained in the information product are supported by the available scientific information. The management measures of this Pelagics FEP Amendment are designed to meet the conservation goals and objectives of the Pelagics FEP and the Magnuson-Stevens Act. The data and analyses used to develop and analyze the measures contained in the information product are presented in this amendment. Furthermore, all reference materials utilized in the discussion and analyses are

[33] Memorandum from the president to the Heads of Departments and Agencies. Comprehensive Presidential Documents No. 279 (February 11, 1994).

properly referenced within the appropriate sections of the environmental assessment. The information product was prepared by Council and NMFS staff based on information provided by NMFS PIFSC, NMFS PIRO, and other sources. The information product was reviewed by PIRO and PIFSC staff, and NMFS Headquarters (including the Office of Sustainable Fisheries). Legal review was performed by NOAA General Counsel Pacific Islands and General Counsel for Enforcement and Litigation for consistency with applicable laws, including but not limited to the Magnuson-Stevens Act, National Environmental Policy Act, Administrative Procedure Act, Paperwork Reduction Act, Coastal Zone Management Act, Endangered Species Act, Marine Mammal Protection Act, and Executive Orders 13132 and 12866.

10.8 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act (PRA) is to minimize the paperwork burden on the public resulting from the collection of information by or for the Federal government. The PRA is intended to ensure the information collected under the proposed action is needed and is collected in an efficient manner (44 U.S.C. 3501(1)). None of the alternatives establish any new permitting or reporting requirements, and is therefore not subject to the provisions of the PRA.

10.9 Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) (5 U.S.C. 601 et seq.) requires government agencies to assess and present the impact of their regulatory actions on small entities including small businesses, small organizations, and small governmental jurisdictions. All vessels having the potential to participate in this fishery are considered to be small entities under the current Small Business Administration definition of small fish-harvesting businesses, that is, their gross receipts do not exceed $4.0 million. This action has been certified as not expected to have significant impacts to small entities. As a result, an initial regulatory flexibility analysis is not required and none has been prepared.

10.10 Endangered Species Act

Section 8.6 of this document describes the threatened and endangered species found in the action area of the American Samoa-based longline fishery. Under the ESA, NMFS may authorize the incidental take of listed species, including sea turtles, during the course of otherwise lawful longline fishing activity, through the preparation of a biological opinion (BiOp), provided that the take will not jeopardize the continued existence of the listed species. NMFS’ biological opinion on the Western Pacific Pelagics FMP which included the American Samoa-based pelagic longline fishery was completed in 2004 (NMFS 2004). The 2004 biological opinion concluded that continued operation of the American Samoa-based pelagic fisheries (troll, handline, pole and line, and longline) were not likely to jeopardize the continued existence of green, loggerhead, leatherback or olive ridley seas turtles. In addition, the opinion authorized the incidental take of 6 hardshell turtles, including one mortality; and take of one leatherback turtle with zero mortalities for those fisheries. Hardshell turtles are defined as including green, hawksbill, loggerhead, and olive ridley turtles. This amount of take was the annual number of sea turtles expected to be captured, injured, or killed in the pelagic fisheries based out of American Samoa.

As the expected take in terms of mortalities has been exceeded, NMFS PIRO prepared a new stand alone BiOp for the American Samoa longline fishery completed on September 16, 2010. The 2010 BiOp considers and analyzes the measures proposed in the Council's preferred alternative in this amendment, intended to reduce the potential for further interactions between longlines and sea turtles. The BiOp concluded that the annual numbers of interactions and mortalities expected to result from implementation of the proposed action for a 3-year period is incidental take of up to 45 green sea turtles over three years (average of 15 interactions per year with 41 mortalities). The occasional hooking and entanglement (no more than 1 every 3 years per species) of hawksbill, leatherback, and olive ridley turtles is also expected (NMFS 2010c). If the total number of authorized sea turtle interactions included in the incidental take statement (ITS) during any consecutive 3-year period is exceeded, re-initiation of consultation will be required (50 CFR 402.16). After implementation of the proposed action and the period of years 1 through 3 has ended, a new 3-year ITS period will begin with years 2 through 4, and so on.

Through the proposed FEP Amendment, and if approved by the Secretary, NMFS will implement measures recommended by the Council that will reduce sea turtle interactions. After gear modifications are made, the Council expects the operations of the American Samoa longline fishery will be consistent with the provisions of the BiOp and so, will not be likely to jeopardize the continued existence of any listed species or cause any adverse modification to their associated habitats.

10.11 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the take of marine mammals in the U.S. and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. The MMPA gives the Secretary of Commerce authority and duties for all cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals and sea lions, except walruses). The MMPA requires NMFS to prepare and periodically review stock assessments of marine mammal stocks.

Under section 118 of the MMPA, NMFS must publish, at least annually, a List of Fisheries that classifies U.S. commercial fisheries into one of three categories. These categories are based on the level of serious injury and mortality of marine mammals that occurs incidental to each fishery. Specifically, the MMPA mandates that each fishery be classified according to whether it has frequent, occasional, or a remote likelihood of or no known incidental mortality or serious injury of marine mammals. The American Samoa longline fishery is a Category II fishery (occasional serious injury and mortality) in the 2011 List of Fisheries (75 FR 68468; Nov. 8, 2010). This amendment makes no changes to allowable amount of fishing except to require deep-setting only in the American Samoa longline fishery. This proposed action is not expected to affect marine mammal interaction rates, therefore, it does not require a MMPA category re-designation or other action.

Vessel owners and crew that are engaged in Category II fisheries may incidentally take marine mammals after registering or receiving an Authorization Certificate under the MMPA, but they are required to: 1) report all incidental mortality and injury of marine mammals to NMFS, 2) immediately return to the sea with minimum of further injury any incidentally taken marine mammal, 3) allow vessel observers if requested by NMFS, and 4) comply with guidelines and prohibitions under the MMPA when deterring marine mammals from gear, catch, and private property (50 CFR 229.4, 229.6, 229.7). The MMPA registration process is integrated with existing state and Federal licensing, permitting, and registration programs. Therefore, individuals who have a state or Federal fishing permit or landing license, such as the American Samoa limited entry longline permit, are currently not required to register separately under the MMPA.

In addition, fishers participating in a Category I or II fishery are required to accommodate an observer onboard their vessel(s) upon request (50 CFR 229.7); and fishers participating in a Category I or II fishery are required to comply with any applicable take reduction plans. NMFS may develop and implement take reduction plans for any Category I or II fishery that interacts with a strategic stock.

See Sections 8.6.2 and 8.6.3 of this document for descriptions of marine mammals found around American Samoa. Section 9.0 provides an analysis of the anticipated impacts on these species under each of the alternatives considered by the Council. The Council expects that the alternatives would not adversely affect any marine mammal populations or habitat; however, at this time there are very little data on the few marine mammal interactions in this fishery from which to assess potential impacts (Table 9) and regarding marine mammal habitat in U.S. EEZ waters around American Samoa.

10.12 Executive Order 13132 – Federalism (E.O. 13132)

This action does not contain policies with federalism implications under E.O. 13132.

10.13 Essential Fish Habitat and Habitat Areas of Particular Concern

The proposed gear modification is a relatively minor change in the gear configuration that would disallow fishing from hooks between the surface and 100 m. The proposed measures would not result in increased gear loss, or large changes to fishery operations. Therefore, there would be no large or adverse effects of the proposal on essential fish habitat or habitat areas of particular concern for species managed under all the Western Pacific Fishery Ecosystem Plans. EFH and Habitat Areas of Particular Concern (HAPC) for these species groups has been defined as presented in
Table 21. The alternatives will not adversely affect EFH or HAPC for any managed species as they are not likely to lead to substantial physical, chemical, or biological alterations to the habitat, or result in loss of, or injury to, these species or their prey. The alternatives are not anticipated to cause damage to the ocean or coastal habitats. The alternative is expected to beneficially impact protected species while having no affects of any kind on habitat. The measures required in this amendment would have fishing gear in the water column fishing at depths deeper than 100 meters but this occurs in the pelagic habitat far from the bottom or any submarine features.

Table 21: EFH and HAPC for species managed under the Fishery Ecosystem Plans.

SPECIES GROUP	EFH (juveniles and adults)	EFH (eggs and larvae)	HAPC
Pelagics	Water column down to 1,000 m	Water column down to 200 m	Water column down to 1,000 m that lies above seamounts and banks
Bottomfish	Water column and bottom habitat down to 400 m	Water column down to 400 m	All escarpments and slopes between 40-280 m, and three known areas of juvenile opakapaka habitat
Seamount Groundfish	(Adults only): water column and bottom from 80 to 600 m, bounded by 29°-35°N and 171°E -179°W	(Including juveniles): epipelagic zone (0-200 nm) bounded by 29°-35°N and 171°E -179°W	Not identified
Precious Corals	Keahole, Makapuu, Kaena, Wespac, Brooks, and 180 Fathom gold/red coral beds, and Milolii, S. Kauai and Auau Channel black coral beds	Not applicable	Makapuu, Wespac, and Brooks Bank beds, and the Au`au Channel
Crustaceans	**Lobsters** Bottom habitat from shoreline to a depth of 100 m **Deepwater shrimp** The outer reef slopes at depths between 300-700 m	Water column down to 150 m Water column and associated outer reef slopes between 550 and 700 m	All banks with summits less than 30 m No HAPC designated for deepwater shrimp
Coral Reef Ecosystems	Water column and benthic substrate to a depth of 100 m	Water column and benthic substrate to a depth of 100 m	All Marine Protected Areas identified in FEPs, all PRIA, many specific areas of coral reef habitat (see FEPs)

Note: All areas are bounded by the shoreline, and the outward boundary of the EEZ, unless otherwise indicated.

11.0 Draft Proposed Regulations

1. In § 665.800, add the definitions of “Branch line” and “Float line” to read as follows:

Branch line (or *dropper line*) means a line with a hook that is attached to the mainline.

Float line means a line attached to a mainline used to buoy, or suspend, the mainline in the water column.

2. In § 665.800, in the definition of "Western Pacific pelagic management unit species," remove the entries for northern bluefin tuna and Indo-Pacific blue marlin, revise the scientific names for black marlin and striped marlin, and add new entries for Pacific bluefin tuna and Pacific blue marlin, to read as follows:

Western Pacific pelagic management unit species means the following species:

English common name	**Scientific name**
Pacific bluefin tuna	Thunnus orientalis
black marlin	Istiompax indica
striped marlin	Kajikia audax
Pacific blue marlin	Makaira nigricans

3. In § 665.802, add a new paragraph (n) to read as follows:

(n) Fail to comply with a term or condition governing longline gear configuration established in §665.819 if using a vessel registered for use with any valid longline permit issued pursuant to § 665.801 to fish for western Pacific pelagic MUS using longline gear south of the Equator.

4. In part 665, add a new § 665.819 to read as follows:

§ 665.819 American Samoa and south Pacific longline requirements.

When fishing south of the Equator for western Pacific pelagic MUS, owners and operators of vessels registered for use with any valid longline permit issued pursuant to § 665.801 must use longline gear that is configured according to the requirements in paragraphs (a) through (e) of this section.

(a) Each float line must be at least 30 m long.

(b) At least 15 branch lines must be attached to the mainline between any two float lines attached to the mainline.

(c) Each branch line must be at least 10 meters long.

(d) No branch line may be attached to the mainline closer than 70 meters to any float line.

(e) No more than 10 swordfish may be possessed or landed during a single fishing trip.

12.0 References

Ainley, D.G., T.C. Telfer, and M.H. Reynolds. 1997. Townsends' and Newell's shearwater (*Puffinus auricularis*). The Birds of North America, No. 297 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologist's Union. 18 pp.

Avise, J.C. and B.W. Bowen. 1994. Investigating Sea Turtle Migration Using DNA Markers. Current Opinion in Genetics and Development, 4 (1994): University of Georgia, Athens and University of Florida, Gainesville, USA. pp. 882-886.

Baker, C.S. 1985. The behavioral ecology and populations structure of the Humpback Whale (*Megaptera novaeangliae*) in the central and eastern Pacific. Dissertation for the University of Hawaii at Manoa.

Baker, C.S. and L.M. Herman. 1981. Migration and local movement of humpback whales through Hawaiian waters. Can. J. Zool. 59:460-469.

Baker, J.D., C.L. Littnan, D.W. Johnston. 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna in the Northwestern Hawaiian Islands. Endangered Species Research 4: 1-10.

Balazs, G.H. 1994. Homeward bound: satellite tracking of Hawaiian green turtles from nesting beaches to foraging pastures. p.205 *In:* 13th Ann. Symposium on Sea Turtle Biol. and Conserv., Feb. 23-27, 1993, Jekyll Island, GA.

Balazs, G.H. and D. Ellis. 1996. Satellite telemetry of migrant male and female green Turtles breeding in the Hawaiian Islands. p. 19 *In:* Abstr. 16th Ann. Symp. on Sea Turtle Conser. Biol. Feb.28-Mar.2, 1996; Hilton Head, S.C.

Balazs, G.H., P. Craig, B.R.Winton, and R.K Miya. 1994. Satellite telemetry of green turtles nesting at French Frigate Shoals, Hawaii, and Rose Atoll, American Samoa. *In*: Bjorndal, K.A., Bolten, A.B., Johnson, D.A. and Eliazar, P.J. (Eds), Proc. 14th Ann. Symp. on Sea Turtle Biology and Conservation. NOAA Tech Memo NMFS SEFSC-351, p. 184–187.

Balazs, G.H., P. Siu, and J. Landret. 1995. Ecological aspects of green turtles nesting at Scilli Atoll in French Polynesia. *In:* Twelfth Annual Sea Turtle Symposium. NOAA Technical memorandum NMFS-SEFSC-361; p. 7-10

Balazs G.H. and M. Chaloupka. 2004. Thirty-year recovery trend in the once depleted Hawaiian green sea turtle stock. Biological Conservation. 117: 491–498.

Bartram, P. and J. Kaneko, 2004. Catch to bycatch ratios: comparing Hawaii's longline fisheries with others. SOEST Publication 04-05. JIMAR Contribution 04-352. 40 pp.

Beverly, S. 2004. New deep setting longline technique for bycatch mitigation. Secretariat of the Pacific Community. Report Number R03/1398. August 2004. 30 pp.

Beverly, S., E. Robinson, and D. Itano, D. 2004. Trial setting of deep longline techniques to reduce bycatch and increase targeting of deep-swimming tunas. 17th Meeting of the Standing Committee on Tuna and Billfish, SCTB17, Majuro, Marshall Islands, 9-18 August 2004. FTWG-7a, 1-28.

Beverly, S. and L. Chapman. 2007. Interactions between sea turtles and pelagic longline fisheries. WCPFC-SC3-EB SWG/IP-01. Scientific Committee, Third Regular Session of the Western and Central Pacific Fisheries Commission meeting, August 13-25; Honolulu, Hawaii.

Beverly, S., D. Curran, M. Musyl, and B. Molony. 2009. Effects of eliminating shallow hooks from tuna longline sets on target and non-target species in the Hawaii-based pelagic tuna fishery. Fish. Res. 96: 281-288.

Beverly, S., D. Curran, and M. Musyl. 2009. Deep setting longlines to avoid bycatch. Status of Sea Turtle Bycatch Initiatives. Proceedings of the Fourth International Fishers Forum, Western Pacific regional Fisheries Management Council, Honolulu, Hawaii.

Beverly, S., D. Curran, C.R. Donovan, and S. Harley. 2011. Comparison of fishing efficiency of two sizes of circle hooks in the American Samoa-based longline fishery. Final Report, Western Pacific Regional Fishery Management Council, Honolulu, Hawaii. 17 pp.

Bigelow, K.A. and E. Fletcher. 2009. Gear depth in the American Samoa-based Longline Fishery and Mitigation to Minimize Turtle Interactions with Corresponding Effects on Fish Catches. NOAA Pacific Islands Fisheries Science Center Internal Report IR-09-008. Issued 4 March 2009. 22 pp.

Binckley, C.A., J.R. Spotila, K.S. Wilson, and F.V. Paladino. 1998. Sex determination and sex ratios of Pacific leatherback turtles, *Dermochelys coriacea*. Copeia 1998(2): 291-300.

Bindoff, N.L., J. Willebrand, V. Artale, A, Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley and A. Unnikrishnan, 2007: Observations: Oceanic Climate Change and Sea Level. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Bjorndal, K.A. 1997. Foraging ecology and nutrition of sea turtles. In P. L. Lutz and J. A. Musick (Eds.), The biology of sea turtles. Boca Raton, FL: CRC Press.

Bjorndal, K.A., A.B. Bolten, and M.Y. Chaloupka. 2000. Green turtle somatic growth model: Evidence for density dependence. Ecological Applications 10:269–282.

Bolten, A.B. and K.A. Bjorndal. 2002. Experiment to Evaluate Gear Modification on Rates of Sea Turtle Bycatch in the Swordfish Longline Fishery in the Azores. NOAA Award Number NA96FE0393. Final Project Report, March 2002. 14 pp.

BOH (Bank of Hawaii). 1997. American Samoa economic report. Bank of Hawaii, Honolulu.

Bromhead, D., S. Hoyle, A. Williams, S. Wang, and S. Chang. 2009. Factors influencing the size of albacore tuna sampled from the South Pacific albacore longline Fisheries. WCPFC Scientific Committee Fifth Regular Session, 10-21 August 2009, Port Vila, Vanuatu. WCPFC-SC5-2005/SA-IP-05.

Calambokidis J., E. Falcone, T. Quinn, A. Burdin, P. Clapham, J. Ford, C. Gabriele, R. DeLuc, D. Mattila, L. Rojas-Bracho, J. Straley, B. Taylor, J. Urban, D. Weller, B. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific (Final Report). Cascadia Research. Contract Report #50AB133F-03-RP-00078. 57 pp.

Carr, A. 1978. The ecology and migrations of sea turtles. The west Caribbean green turtle colony. Bull. Am. Mus. Nat. Hist. 162(1): 1-46.
Chaloupka, M., and C. Limpus. 2001. Trends in the abundance of sea turtles resident in southern Great Barrier Reef waters. Biological Conservation. 102: 235–249.

Chaloupka, M., P. Dutton, and H. Nakano. 2004. Status of sea turtle stocks in the Pacific. FAO Fisheries Report No. 738 Suppl., p.135-164.

Chaloupka, M., K.A. Bjorndal, G.H. Balazs, A.B. Bolten, L.M. Ehrhart, C.J. Limpus, H. Suganuma, S. Troeng, and M. Yamaguchi. 2008. Encouraging outlook for recovery of a once severely exploited marine mega-herbivore. Global Ecology and Biogeography 17: 297-304.

Chaloupka, M., N. Kamezaki, C. Limpus. 2008. Is climate change affecting the population dynamics of the endangered Pacific loggerhead sea turtle? Journal of Experimental Marine Biology and Ecology 356:136-143.

Chan, E.H., and H.C. Liew. 1995. Incubation temperatures and sex ratios in the Malaysian leatherback turtle *Dermochelys coriacea*. Biological Conservation 74: 169-174.

Chan, E., and H. Liew. 1996. Decline of the leatherback population in Terengganu, Malaysia, 1956–1995. Chelonian Conservation Biology 2(2): 196–203.

Chapman, L. 1998. The rapidly expanding and changing tuna longline fishery in Samoa. SPC Fisheries Newsletter #84 (January – March 1998). Secretariat of the Pacific Community, Noumea, New Caledonia. 10 pp.

Cliffton, K., D. Cornejo, and R. Felger. 1982. Sea turtles of the Pacific coast of Mexico. In K. Bjorndal (Ed.), Biology and conservation of sea turtles (pp. 199–209). Washington, DC: Smithsonian Institution Press.

Collette, B.B., J.R. McDowell, and J.E. Grave. 2006. Phylogeny of Recent Billfishes (Xiphioidei), Bulletin of Marine Science, 79(3): 455–468, 2006.

Cortez-Zaragosa, E., P. Dalzell, and D. Pauly. 1989. Hook selectivity of yellowfin tuna (Thunnus albacares) caught off la Union, Philippines. J. Appl. Ichthyol. 1: 12-17.

Craig, P., D. Parker, R. Brainard, M. Rice, and G. Balazs. 2004. Migrations of green turtles in the central South Pacific. Biological Conservation 116: 433-438.

Craig, P. (ed.). 2002. Natural history guide to American Samoa. National Park of American Samoan and Department of Marine and Wildlife Resources. 78 pp.

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

Department of Marine and Wildlife Resources (DMWR). 2001. Report on the NMFS logbook program for the American Samoa longline fishery, 1st, 2nd, 3rd and 4th quarters 2001. American Samoa Government.

Dobbs, K. 2001. Marine turtles in the Great Barrier Reef World Heritage Area: A compendium of information and basis for the development of policies and strategies for the conservation of marine turtles (1st ed.). Townsville, Queensland, Australia: Great Barrier Reef Park Authority.

Domokos, R., M. Seki, J. Polovina, and D. Hawn. 2007. Oceanographic investigation of the American Samoa albacore (*Thunnus alalunga*) habitat and longline fishing grounds. Fish. Oceanogr. 16:6, 555–572.

Dutton, P., B. Bowen, D. Owens, A. Barragán, and S. Davis. 1999. Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). Journal of Zoology 248:397–409.

Eckert, K.L. 1993. The biology and population status of marine turtles in the North Pacific Ocean (NOAA Tech. Memo, NOAA-TM-NMFS-SWFSC-186, 156 pp.). La Jolla, CA: National Marine Fisheries Service, Southwest Region.

Eckert, S.A. 1998. Perspectives on the use of satellite telemetry and other electronic technologies for the study of marine turtles, with reference to the first year-long tracking of leatherback sea turtles, p. 294. *In*: Proceedings of the Seventeenth 21 Annual Sea Turtle Symposium. S.P. Epperly and J. Braun (Eds.). NOAA Technical Memorandum NMFS-SEFC-415, Miami, FL.

Eckert, K.L. and S.A. Eckert. 1988. Pre-reproductive movements of leatherback turtles (*Dermochelys coriacea*) nesting in the Caribbean. Copeia 1988(2):400-406.

Edwards, M. and A.J. Richardson. 2004. Impact of climate change on marine pelagic phenology and trophic mismatch. Nature 430: 881-884.

Falanruw, M.V.C., M. McCoy, and Namlug. 1975. Occurrence of ridley sea turtles in the Western Caroline Islands. Micronesica (11)a: 151-152.

Fish, M.R., I.M. Cote, J.A. Gill, A.P. Jones, S. Renshoff, and A.R. Watkinson. 2005. Predicting the impact of sea –level rise on Caribbean sea turtle habitat. Conservation biology 19(2): 482-491.

Fitzsimmons, N.N., C. Moritz, and S.S. Moore. 1995. Conservation and dynamics of microsatellite loci over 300 million years of marine turtle evolution. Mol. Biol. Evol. 12:432-440.

Foreman, T. 1980. Synopsis of biological data on the albacore tuna, *Thunnus alalunga* (Bonnaterre, 1788), in the Pacific Ocean. *In:* W. Bayliff (Ed.) Synopses of biological data on eight species of Scombrids. Inter-American Tropical Tuna Commission: La Jolla, CA. 21-70. Special Report No. 2.

Forney K., J. Barlow, M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, J. Carretta. 2000. Draft U.S. Pacific Marine Mammal Stock Assessments: 2000. NMFS Southwest Fisheries Science Center: La Jolla.

Fuentes, M.M.P.B., C.J. Limpus, M. Hamann, and J. Dawson. 2009. Potential impacts of projected sea level rise on sea turtle rookeries. Aquatic Conservation Marine and Freshwater Ecosystems. DOI: 10.1002/aqc.

Gillett, R., M.A. McCoy, and D.G. Itano. 2002. Status of the United States Western Pacific tuna purse seine fleet and factors affecting its future. SOEST Publication 02-01, JIMAR Contribution 02-344. 64 pp.

Gilman, E. and D. Kobayashi. 2007. Sea turtle interactions in the Hawaii-based swordfish fishery first quarter 2007 and comparison to previous periods. Update to Gilman, E., D. Kobayashi, T. Swenarton, N. Brothers, P. Dalzell, and I. Kelly. 2007. Reducing sea turtle interactions in the Hawaii-based longline swordfish fishery. Biological Conservation 139:19-28.

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

Gilman, E., T. Moth-Poulsen, and G. Bianchi. 2007b. Review of measures taken by intergovernmental organizations to address sea turtle and seabird interactions in marine capture fisheries. FAO Fisheries Circular No. 1025. Food and Agricultural Organization of the United Nations, Rome.

Godfrey, M.H., R. Barret, and N. Mrosovsky. 1996. Estimating past and present sex ratios of sea turtles in Suriname. Canadian Journal of Zoology 74: 267-277.

Godfrey, M.H., A.F. D'Amato, M.A. Marcovaldi, and N. Mrosovsky. 1999. Pivotal temperature and predicted sex ratios for hatchling hawksbill turtles from Brazil. Canadian Journal of Zoology 77: 1465-1473.

Godley, B.J., A.C. Broderick, and N. Mrosovsky. 2001. Estimating hatchling sex ratios of loggerhead turtles in Cyprus from incubation durations. Marine Ecology Progress Series 210: 195-201.

Grant, G.S., P.W. Trail, and R.B. Clapp. 1994. First specimens of Sooty Shearwater, Newell's Shearwater, and White-faced Storm Petrel from American Samoa. Notornis: 41 215-217.

Grant, G.S., P. Craig, and G.H. Balazs. 1997. Notes on juvenile hawksbill and green turtles in American Samoa. Pacific Science 51(1): 48-53.

Hampton, W.J., A. Langley, P. Kleiber, and K. Hiramatsu. 2004. Stock assessment of bigeye tuna in the Western and Central Pacific Ocean. 17th Meeting of the Standing Committee on Tuna and Billfish, 9-18 August 2004, Majuro, Marshall Islands. Working Paper SA-2.

Hampton, J., P. Kleiber, A. Langley, Y. Takeuchi, and M. Ichinokawa. 2005. Stock assessment of yellowfin tuna in the western and central Pacific Ocean. 1st Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission. WCPFC-SC1, Noumea, New Caledonia, 8 – 19 August 2005. SA WP-1. 105 pp.

Harley, S., S. Hoyle, P. Williams, J. Hampton, and P. Kleiber. 2010. Stock Assessment of Bigeye Tuna in The Western and Central Pacific Ocean. Western and Central Pacific Fisheries Commission, Scientific Committee, Sixth Regular Session, 10-19 August 2010 Nuku'alofa, Tonga. WCPFC-SC6-2010/SA-WP-04. 98 pp.

Harrison, C. 1990. Seabirds of Hawaii: natural history and conservation. Cornell University Press, Ithaca, New York. 249 pp.

Harwood, John. 2001. Marine mammals and their environment in the twenty-first century. Journal of Mammology 82(3): 630-640.

Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2007. Investigating the potential impacts of climate change on a marine turtle population. Global Change Biology 13: 923-932.

Hays, G.C., A.J. Richardson, and C. Robinson. 2006. Climate change and marine plankton. Trends in Ecology and Evolution 20(6): 337-344.

Hill, P. and D. DeMaster. 1999. Alaska Marine Mammal Stock Assessments 1999. National Marine Mammal Laboratory, NMFS Alaska Fisheries Science Center. Seattle.

Hill P., D. DeMaster, and R. Small. 1997. Alaska Marine Mammal Stock Assessments, 1996. U.S. Pacific Marine Mammal Stock Assessments: 1996. U.S. Dept. of Commerce, NOAA, Tech. Memo., NMFS, NOAA-0TM-NMFS-AFSC-78. 149pp.

Hirth, H. 1997. Synopsis of Biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). U.S. Fish and Wildlife Service, Washington D.C. 120p.

Hodge R. and B. Wing. 2000. Occurrence of marine turtles in Alaska Waters: 1960-1998. Herpetological Review 31:148-151.

Horwood, J. 1987. The Sei Whale: Population Biology, Ecology and Management. Croom Helm. London.

Hoyle, S.D. and M.N. Maunder. 2005. Status of yellowfin tuna in the Eastern Pacific Ocean in 2004 and outlook for 2005. IATTC Stock Assessment Report 6. Inter-American Tropical Tuna Commission. La Jolla, California. 102 pp.

Hoyle, S., A. Langley, and J. Hampton. 2008. Stock assessment of albacore tuna in the South Pacific Ocean. WCPFC Scientific Committee Fourth Regular Session, 11-22 August, 2008, Port Moresby, Papua New Guinea. WCPFC-SC4-2008/SA-WP-8. 126 pp.

Hoyle, S. and N. Davies. 2009. WCPFC Scientific Committee Fifth Regular Session, 10-21 August, 2009, Port Vila, Vanuatu. WCPFC-SC5-2009/SA-WP-6. 133 pp.

Hoyle, S. P. Kleiber, N. Davies, S. Harley, and J. Hampton. 2010. Stock Assessment of Skipjack Tuna in the Western and Central Pacific Ocean. Western and Central Pacific Fishery Commission, Sixth Scientific Committee, Nuku'alofa, Tonga WCPFC-SC6-2010/SA-WP-10.

IPCC (Intergovernmental Panel on Climate Change). 2007: Summary for Policymakers. In: Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (Eds.). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA.

IPCC (Intergovernmental Panel on Climate Change). 2007b. Summary for Policy Makers. In: Solomon, S., D. Quin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M. Tignor, and H.L. Miller (Eds.), Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY, USA.

ISC (International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean). 2007. Annex 5: Report of the albacore working group workshop (November 28-December 5, 2006, Shimizu, Japan) in Report of the Seventh Meeting of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean, Plenary Session. Busan, S. Korea, July 25-30, 2007. 53 p.

Kaneko, J. and P. Bartram. 2005. Operational profile of a highliner in the American Samoa small-scale (alia) longline albacore fishery. SOEST Publication 05-03. JIMAR Contribution 05-357. 34 pp.

Kaska, Y., Ç. Ilgaz, A. Özdemir, E. Başkale, O. Türkozan, İ. Baran and M. Stachowitsch. 2006. Sex ratio estimations of loggerhead sea turtle hatchlings by histological examination and nest temperatures at Fethiye beach, Turkey. Naturwissenschaften 93(7): 338-343.

Kilarski, S., D. Klaus, J. Lipscomb, K. Matsoukas, R. Newton, and A. Nugent. 2006. Decision Support for Coral Reef Fisheries Management: Community Input as a Means of Informing Policy in American Samoa. A Group Project submitted in partial satisfaction of the requirements of the degree of Master's in Environmental Science and Management for the Donald Bren School of Environmental Management. University of California, Santa Barbara.

Kiyota, M., Yokota, K., Nobetsu, T., Minami, H., and Nakano, H. 2005. Assessment of mitigation measures to reduce interactions between sea turtles and longline fishery. Proc. 5th SEASTAR2000 Workshop, 24-29.

Landsberg, J.H., G.H. Balazs, K.A. Steidinger, D.G. Baden, T.M. Work, and D.J. Russell. 1999. The potential role of natural tumor promoters in marine turtle fibropapillomatosis. Journal of Aquatic Animal Health 11:199-210.

Langley, A. 2006. The South Pacific Albacore Fishery: A Summary of the Status of the Stock and Fishery Management Issues of Relevance to Pacific Island Countries and Territories. Technical Report 37. Noumea, New Caledonia: Secretariat of the Pacific Community. 26 pp.

Langley, A., M. Ogura, and J. Hampton. 2003. Stock assessment of skipjack tuna in the western and central Pacific Ocean. 16th Meeting of the Standing Committee on Tuna and Billfish. SCTB16 Working Paper, June 2003. 43 pp.

Langley, A., S. Harley, S. Hoyle, N. Davies, J. Hampton, and P. Kleiber. 2009. Stock assessment of yellowfin tuna in the western and central Pacific Ocean, WCPFC Scientific Committee Fifth Regular Session, 10-21 August 2009, Port Vila, Vanuatu, WCPFC-SC5-2005/SA-WP-03. 125 pp.

Laurs, R. and J. Wetherall. 1981. Growth rates of North Pacific albacore, *Thunnus alalunga*, based on tag returns. Fish. Bull. 79 (2): 293-302.

Levine, A. and S. Allen. 2009. American Samoa as a fishing community. U.S. Dept. of Commerce, NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-19, 74 pp.

Limpus, C.J. 1982. The status of Australian sea turtle populations. In K.A. Bjorndal (Ed.), Biology and conservation of sea turtles. Washington, DC: Smithsonian Institution Press.

Limpus, C. 1992. The hawksbill turtle, *Eretmochelys imbricata*, in Queensland: Population structure within a southern Great Barrier Reef feeding ground. Wildlife Research 19: 489–506.

Limpus, C.J. 2009. A Biological Review of Australian Marine Turtles: 2. Green Turtle *Chelonia mydas* (Linnaeus); 3. Hawksbill Turtle, *Eretmochelys imbricata* (Linnaeus).The State of Queensland, Environmental Protection Agency. September 2008.

Limpus, C.J. and M.Y. Chaloupka. 1997. Nonparametric regression modeling of green sea turtle growth rates (southern Great Barrier Reef). Marine Ecology Progress Series 149:23-34.

Limpus, C.J. and N. Nicholls, 1994. Progress report on the study of the interaction of the El Niño - Southern Oscillation on annual *Chelonia mydas* at the southern Great Barrier Reef rookeries. In: R. James, Editor, *Proceedings of the Marine Turtle Conservation Workshop*, Australian National Parks and Wildlife Service, Canberra (1994), pp. 73–78.

Limpus, C.J. and D. Reimer. 1994. The loggerhead turtle, *Caretta caretta*, in Queensland: A population in decline. *In* R. James (Compiler). Proceedings of the Australian Marine Turtle Conservation Workshop: November 14–17, 1990 Canberra, Australia: Australian Nature Conservation Agency.

Lopez-Mendilaharsu, M., S. Gardner, J. Seminoff, and R. Riosmena-Rodriguez. 2005. Identifying critical foraging habitats of the green turtle (*Chelonia mydas*) along the Pacific coast of the Baja California peninsula, Mexico. Aquatic Conservation: Marine and Freshwater Ecosystems, 15: 259-269.

Marcovaldi, M. and G. Marcovaldi. 1999. Marine Turtles of Brazil: the history and structure of Projeto TAMAR-IBAMA. Biological Conservation 91:35-41.

Marquez, M. 1990. Sea turtles of the world. An annotated and illustrated catalogue of sea turtle species known to date. FAO species Catalog. FAO Fisheries Synopsis 11 (125). 81pp.

Maunder, M.N. and S.D. Hoyle. 2005. Status of Bigeye Tuna in the Eastern Pacific Ocean in 2004 and Outlook for 2005. IATTC Working Group on Stock Assessment Document SAR-06-07B.

McKeown, A. 1977. Marine turtles of the Solomon Islands. Honiara: Solomon Islands: Ministry of Natural Resources, Fisheries Division.

McMahon, C.R., and G.C. Hayes. 2006. Thermal niche, large-scale movements and implications of climate change for a critically endangered marine vertebrate. Global Change Biology 12: 1330-1338.

Meylan, A. 1985. The role of sponge collagens in the diet of the Hawksbill turtle, *Eretmochelys imbricata*. In A. Bairati and R. Garrone, (Eds.), Biology of invertebrate and lower vertebrate collagens. New York: Plenum Press.

Meylan, A. 1988. Spongivory in hawksbill turtles: A diet of glass. Science 239: 393–395.

Meylan, A. 1999. International movements of immature and adult hawksbill turtles (*Eretmochelys imbricata*) in the Caribbean Region. Chelonian Conservation and Biology 3: 189-194.

NMFS (National Marine Fisheries Service). 1998. Biological Opinion on the fishery management plan for the pelagic fisheries of the Western Pacific Region: Hawaii Central North Pacific Longline Fishery. National Marine Fisheries Service, Southwest Region.

NMFS 2001. Final Environmental Impact Statement for the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region.

NMFS. 2003. American Samoa Pilot Observer Program Status Report. PIRO, NMFS. February 21, 2003.

NMFS. 2004. Endangered Species Act Section 7 Consultation Biological Opinion on Proposed Regulatory Amendments to the Fisheries Management Plan for Pelagic Fisheries of the Western Pacific Region, National Marine Fisheries Service, Issued February 23, 2004.

NMFS. 2005. Biological Opinion on Continued authorization of the Hawaii-based Pelagic, Deep-Set, Tuna Longline Fishery based on the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. Pacific Islands Region, 168 pp.

NMFS. 2006. The U.S. Western and Central Pacific Purse Seine Fishery as authorized by the South Pacific Tuna Act and the High Seas Fishing Compliance Act. Pacific Islands Region, 185 pp.

NMFS. 2008a. Biological Evaluation: Effects of continued operation of the American Samoa pelagic longline fishery on ESA-listed sea turtles and marine mammals (attachment to July 31,2008, memo requesting ESA consultation). NMFS Pacific Islands Regional Office, Honolulu.

NMFS. 2008b. Endangered Species Act Section 7 Consultation Biological Opinion on Management Modifications for the Hawaii-based Shallow-set Longline Swordfish Fishery—Implementation of Amendment 18 to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region. Issued October 15, 2008. Pacific Islands Regional Office. 91 pp.

NMFS. 2010. Endangered Species Act Section 7 Consultation Biological Opinion on FEMA funding, under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, for projects to repair infrastructure damage on Tutuila, American Samoa that resulted from the Presidentially-declared Earthquake, Tsunami, and Flooding disaster (FEMA-1859-DR-AS) of September 2009. I/PIR/2010/00153. Issued March 18, 2010. 32 pp.

NMFS. 2010b. Summary of Green Turtle Nesting in Oceania. National Marine Fisheries Service Pacific Islands Region, Honolulu, HI. Prepared by K. Maison, I. Kelly, and K. Frutchey. March 2010.

NMFS. 2010c. Endangered Species Act Section 7 Consultation Biological Opinion on Measures to Reduce Interactions Between green sea turtles and the American Samoa-based Longline Fishery-Implementation of an Amendment to the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region. September 16, 2010. 91 pp.

NMFS. 2010d. Social assessment for Amendment 5 to the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region: Measures to Reduce Interactions between the American Samoa Longline Fishery and Green Sea Turtles. National Marine Fisheries Service Pacific Islands Region, Honolulu, Division of Sustainable Fisheries, 10 pp.

NMFS and USFWS. 2007a. (National Marine Fisheries Service and U.S. Fish and Wildlife Service). Green Sea Turtle (*Chelonia mydas*). 5-Year Review: Summary and Evaluation. 105 p. Available at: http://www.nmfs.noaa.gov/pr/pdfs/species/greenturtle_5yearreview.pdf

NMFS and USFWS. 2007b. Olive Ridley Sea Turtle (*Lepidochelys olivacea*). 5-Year Review: Summary and Evaluation. 67 p. Available at: http://www.nmfs.noaa.gov/pr/pdfs/species/oliveridley_5yearreview.pdf

NMFS and USFWS. 1998a. (National Marine Fisheries Service and U.S. Fish and Wildlife Service) Recovery Plan for U.S. Pacific Populations of the green turtle (*Chelonia mydas*). National Marine Fisheries Service. Silver Spring, MD. 84 pp.

NMFS and USFWS. 1998b. Recovery Plan for U.S. Populations of the hawksbill turtle (*Eretmochelys imbricata*). National Marine Fisheries Service. Silver Spring, MD. 82 pp.

NMFS and USFWS. 1998c. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle (Dermochelys Coriacea). National Marine Fisheries Service: Silver Spring, MD

O'Malley, J.M. and S.G. Pooley. 2002. A description and economic analysis of large American Samoa longline vessels. SOEST (University of Hawaii) Report 02-345.

Oz, M., A. Erdogan, Y. Kaska, S. Dusen, A. Aslan, H. Sert, M. Yavuz, and M.R. Tunc. 2004. Nest temperatures and sex-ratio estimates of loggerhead turtles at Pantara beach on the southwestern coast of Turkey. Canadian Journal of Zoology 82(1): 94-101.

PIFSC (NMFS Pacific Islands Fisheries Science Center). 2008. PIFSC Report on the logbook program for the American Samoa longline fishery July-September 2008. PIFSC Data Report DR-08-012. Issued December 2008.

Parmesan, C. and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. Nature 421: 37-42.

Plotkin, P.T. 1994. The migratory and reproductive behavior of the olive ridley, *Lepidochelys olivacea* (Eschscholtz, 1829), in the Eastern Pacific Ocean. Ph.D. Thesis, Texas A&M Univ., College Station.

Polovina, J.J., G.H. Balazs, E.A. Howell, D.M. Parker, Michael P. Seki, and P.H. Dutton. 2003. Forage and migration habitat of loggerhead (*Caretta caretta*) and olive ridley (*Lepidochelys olivacea*) sea turtles in the central North Pacific Ocean. Fisheries Oceanography, 13 (1) 36–51.

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

Polovina, J., G. Mitchum, N. Graham, M. Craig, E. DeMartini, and E. Flint. 1994. Physical and biological consequences of a climate event in the Central North Pacific. Fisheries Oceanography. 3(1):15–21.

POP (Pacific Ocean Producers). 2011. POP Fishing and Marine. Honolulu, Hawaii. Price list, April 2011. http://pop-hawaii.com/fileadmin/pdf/Commercial_Pricelist.pdf

Pritchard, P.C.H. 1982a. Marine turtles of the South Pacific. Pages 253-262 In K.A. Bjorndal (ed.), Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, DC. 583 pp.

Pritchard, P.C.H. 1982b. Nesting of the leatherback turtle (*Dermochelys coriacea*) in Pacific Mexico, with a new estimate of the world population status. Copeia 1982:741-747.

Reeves R., S. Leatherwood, G. Stone, and L. Eldridge. 1999. Marine mammals in the area served by the South Pacific Regional Environment Programme (SPREP). South Pacific Regional Environment Programme: Apia, Samoa. 48 pp.

Reina, R.D., J.R. Spotila, F.V. Paladino, and A.E. Dunham. 2008. Changed reproductive schedule of eastern Pacific leatherback turtles *Dermochelys coriacea* following the 1997–98 El Niño to La Niña transition. Endangered Species Research, doi: 10.3354/esr00098; published online June 24, 2008.

Rice, D. 1989. Sperm whale *Physeter macrocephalus*. Academic Press. 442 pp.

Robinson, R.A. *et al*. 2008. Traveling through a warming world: climate change and migratory species. Endagered Species Research: published online June 17, 2008.

Rosenzweig, C., G. Casassa, D.J. Karoly, A. Imeson, C. Liu, A. Menzel, S. Rawlins, T.L. Root, B. Seguin, P. Tryjanowski, 2007: Assessment of observed changes and responses in natural and managed systems. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 79-131.

Saba, V., S. Pilar, R. Reina, J. Spotila, J. Musick, D. Evans, and F. Paladino. 2007. The effect of the El Niño Southern Oscillation on the reproductive frequency of eastern pacific leatherback turtle. J. Appl. Ecol. 44, 395–404.

Saito, S. 1973. Studies on fishing of albacore (*Thunnus alalunga* Bonnaterre) by experimental deep-sea tuna longline. Hokkaido Univ. Mem. Fac. Fish. 21(2):107-184.

Sarti L., S. Eckert, N. Garcia, and A. Barragan. 1996. Decline of the world's largest nesting assemblage of leatherback turtles. Marine Turtle Newsletter 74: 2–5.

Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeier, V. Burkett, D.R. Cayan, M. Fogarty, M.A. Harwell, R.W. Howarth, C. Mason, D.J. Reed, T.C. Royer, A.H. Sallenger, and J.G. Titus. 2002. Climate change impacts on U.S. coastal and marine ecosystems. Estuaries 25(2):149-164.

Schug, D. and A.Galea'i.1987. American Samoa: the tuna industry and the economy. *In* Tuna Issues and Perspectives in the Pacific Islands Region, East-West Center, Honolulu.

Secretariat of the Pacific Community (SPC). 2004. Western and Central Pacific Fisheries Commission Tuna Fishery Yearbook 2003. Oceanic Fisheries Programme. Noumea, New Caledonia.

Seminoff, J., T.T. Jones, and G.J. Marshall. 2006. Underwater behavior of Green Turtles monitored with video-time-depth recorders: what's missing from dive profiles? Marine Ecology Progress Series 322:269-280.

Seminoff, J. and T. Jones. 2006. Diel movements and activity ranges of green turtle (*Chelonia mydas*) at a temperate foraging area in the Gulf of California, Mexico. Herpetological Conservation and Biology 1(2): 81-86.

Seminoff, J. 2004. Marine Turtle Specialist Group Review. 2004 Global Assessment. Green turtle (*Chelonia mydas*). Marine Turtle Specialist Group, The World Conservation Union (IUCN) Species Survival Commission Red List Programme.

Seminoff, J. 2002. Global status of the green sea turtle (*Chelonia mydas)*: A summary of the 2001 status assessment for the IUCN Red List Programme. Pp: 197-211 *In*: I. Kinan (Ed.), Proc. Western Pacific Sea Turtle Cooperative Research and Management Workshop. February 5-8, 2002, Honolulu, Hawaii, USA. Western Pacific Regional Fishery Management Council: Honolulu, HI.

Seminoff, J.A., A.R.S. Hidalgo, T.W. Smith, and L.A. Yarnell. 2001. Diving patterns of green turtles (*Chelonia mydas agassizii*) in the Gulf of California. Proceedings of the Twenty-first Symposium on Sea Turtle Biology and Conservation. Philadelphia, PA.

Seminoff, J.A., A.R.S. Hidalgo, and W.J. Nichols. 2000. Movement and Home Range of the East- Pacific Green Turtle at a Gulf of California (Mexico) feeding Area. Proceedings of the Twentieth Symposium on Sea Turtle Biology and Conservation. Orlando, FL. 29 February – 4 March 2000.

Seminoff, J.A., W.J. Nichols, and A. Resendiz. 1997. Diet composition of the black sea turtle, (*Chelonia mydas agassizii*) in the central Gulf of California, Mexico. Proceedings of the 17th Annual Sea Turtle Symposium, 4-8 March 1997, Orlando, FL.

Severance, C. and R. Franco. 1989. Justification and design of limited entry alternatives for the offshore fisheries of American Samoa, and an examination of preferential fishing rights for native people of American Samoa within a limited entry context. Western Pacific Fishery Management Council, Honolulu.

Severance, C., R. Franco, M. Hamnett, C. Anderson, and F. Aitaoto. 1999. Effort comes from the cultural side: coordinated investigation of pelagic fishermen in American Samoa. Draft report for Pelagic Fisheries Research Program. JIMAR/SOEST, Univ. Hawaii - Manoa, Honolulu, HI.

Sokimi, W. and L. Chapman. 2000. Report of sea and fishing trials on board the Samoan Fisheries Division's New 12.2 m super alia, 26 April – 4 September 2000. Fisheries Development Section, Secretariat of the Pacific Community. 64 p.

Solow, A., Bjorndal, K., Bolten, A. 2002. Annual variation in nesting numbers of marine turtles: the effect of sea surface temperature on remigration intervals. Ecol. Lett. 5, 742–746.
Spear, L.B., D.G. Ainley, N. Nur, and S.N.G. Howell. 1995. Population Size and Factors Affecting At-Sea Distributions of Four Endangered Procellariids in the Tropical Pacific. The Condor 97 (3): 613-638.

Spotila J., A. Dunham, A. Leslie, A. Steyermark, P. Plotkin, and F. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: Are leatherback turtles going extinct? Chelonian Conservation Biology 2(2): 209–222.

Spotila, J.R., R.D. Reina, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. Nature 405: 529-530.

Starbird, C.H. and M.M. Suarez. 1994. Leatherback sea turtle nesting on the north Vogelkop coast of Irian Jaya and the discovery of a leatherback sea turtle fishery on Kei Kecil Island. Fourteenth Annual Symposium on Sea Turtle Biology and Conservation (p. 143). March 1–5, 1994, Hilton Head, South Carolina.

Stinson, M. 1984. Biology of sea turtles in San Diego Bay, California and the Northeastern Pacific Ocean. Master's Thesis, San Diego State University.

Swimmer, Y., R. Arauz, B. Higgins, L. McNaughton, M. McCracken, J. Ballestero and R. Brill. 2005. Food color and marine turtle feeding behavior: Can blue bait reduce turtle bycatch in commercial fisheries? Marine Ecology Progress Series. 295: 273-278.

Swimmer, Y., R. Arauz, J. Wang, J. Suter, M. Musyl, A. Bolanos, and A. Lopez. 2010. Comparing the effects of offset and non-offset circle hooks on catch rates of fish and sea turtles in a shallow-set longline fishery. Aquatic Conservation: Marine and Freshwater Ecosystems, 20: 445-451.

TEC, Inc. 2007. Review of fishery and seafood marketing development potentials for American Samoa. Prepared for the WPRFMC, Honolulu, HI.

TPC (Territorial Planning Commission) and Department of Commerce. 2000. American Samoa's comprehensive economic development strategy year 2000. American Samoa Government. 49 p.

Troeng, S. and E. Rankin. 2005. Long-term conservation efforts contribute to positive green turtle (*Chelonia mydas*) nesting trend at Tortuguero, Costa Rica. Biological Conservation 121: 111–116.

Tuato'o-Bartley N., T. Morrell, P. Craig. 1993. Status of sea turtles in American Samoa in 1991. Pacific Science 47 (3). 215-221.

USFWS (U.S. Fish and Wildlife Service). 1983. Hawaiian Dark-Rumped Petrel and Newell's Shearwater Recovery Plan. Portland, OR. pp.57

USCG (United States Coast Guard) and NMFS (National Marine Fisheries Service). 2010. Distant Water Tuna Fleet (aka U.S. Purse Seine Fleet) Annual report to Congress. April 30, 2010. 14 pp.

Utzurrum, R. 2002. Sea turtle conservation in American Samoa. P. 30-31 *In*: I. Kinan (Ed.). Proc. of the Western Pacific Sea Turtle Cooperative Research and Management Workshop, Feb. 5-8, 2002. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii.

Van Dam, R. and C. Diez. 1997. Diving behavior on immature hawksbill turtle (*Eretmochelys imbricata*) in a Caribbean reef habitat. Coral Reefs 16:133–138.

Van Houtan, K.S. 2010. Future climate impacts to marine turtle populations, with a focus on the North Pacific Ocean. NOAA Fisheries Internal Report. Marine Turtle Assessment Program, Pacific Islands Fisheries Science Center, Honolulu, HI.

Walther, G.R., E. Post, P. Convey, A. Menzel, C. Parmesan, T.J. Beebee, J.M. Fromentin, O. Hoegh-Guldberg, and F. Bairlein. 2002. Ecological responses to climate change. Nature 416: 389-395.

Warham, J. 1990. The shearwater, *Fenus puffinus*. *In:* The petrels: Their ecology and breeding system (pp. 157–170). San Diego, CA: Academic Press.

Watson, J, D. Foster, S. Epperly, and A. Shah. 2004. Experiments in the western Atlantic northeast distant waters to evaluate sea turtle mitigation measures in the pelagic longline fishery. Report on experiments conducted in 2001–2003. US National Marine Fisheries Service, Pascagoula, MS, USA.

Waugh, S., B. Lascelles, P. Taylor, I. May, M. Balman, and S. Cranwell. 2009. Appendix to EB-SWG-WP-6: Range distributions of seabirds at risk of interactions with longline fisheries in the western and central Pacific Ocean. WCPFC-SC5-2009/EB-WP-06-Appendix. WCPFC Scientific Committee Fifth Regular Session. 10-21 August 2009. 74 pp.

Weishampel, J. F., D. A. Bagley, and L. M. Ehrhart. 2004. Earlier nesting by loggerhead sea turtles following sea surface warming. Global Change Biology 10: 1424-1427.

WCPFC. 2010. Western and Central Pacific Fisheries Commission Tuna Fishery Yearbook 2009. Western and Central Pacific Fisheries Commission, Pohnpei, Federated States of Micronesia.

Werner, T., S. Kraus, A. Read, and E. Zollett. 2006. Fishing techniques to reduce the bycatch of threatened marine animals. Marine Technology Society Journal 40(3): 50-68.

Wetherall, J.A. 1993. Pelagic distribution and size composition of turtles in the Hawaii longline fishing area. *In*: G. H. Balazs and S. G. Pooley (Eds.). Research plan to assess marine turtle hooking mortality: Results of an expert workshop held in Honolulu, Hawaii, November 16–18, 1993. SWFSC Administrative Report H-93-18.

Witzell, W.N. 1984. The incidental capture of sea turtles in the Atlantic U.S. fishery conservation zone by the Japanese tuna longline fleet, 1978-81. Marine Fisheries Review 46(3): 56-58.

Williams, P. and P. Terawasi. 2009. Overview of tuna fisheries in the western and central Pacific Ocean, including economic conditions – 2008. 5th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission. WCPFC-SC1, Noumea, New Caledonia, 8 – 19 August 2005. WCPFC-SC5-2009/GN WP-1. 46 pp.

WPRFMC. 2003. Pelagic Fisheries Annual Report, 2002. Western Pacific Regional Fishery Management Council, Honolulu, Hawaii.

WPRFMC. 2006. Pelagic Fisheries of the Western Pacific Region 2005 Annual Report. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii.

WPRFMC. 2007. Pelagic Fisheries of the Western Pacific Region 2006 Annual Report. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii.

WPRFMC. 2009a. Amendment 18 to the Fishery Management Plan for Pelagic Fisheries of the Western Pacific Region Including a Final Supplemental Environmental Impact Statement. March 2009. 331 pp.

WPRFMC. 2009b. Pelagic Fisheries of the Western Pacific Region 2007 Annual Report. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii.

WPRFMC. 2010. Pelagic Fisheries of the Western Pacific Region 2008 Annual Report. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii.

Yokota, K., H. Minami, and T. Nobetsu. 2006. Research on mitigation of the interaction of sea turtle with pelagic longline fishery in the western North Pacific. Proc. 3rd Int. Symp. SEASTAR and Asian Bio-logging Science, 3-8.

Zug, G.R., G.H. Balazs, J.A. Wetherall, D.M. Parker and S.K. Murakawa. 2002. Age and growth of Hawaiian sea turtles (*Chelonia mydas*): an analysis based on skeletochronology. Fish. Bull. 100:117-127.

12.1 Personal Communications and Correspondence Cited

Bartram, Paul. Communication on project conducted in American Samoa where alia operations were observed.

Hamm, D. Electronic mail response from David Hamm, PIFSC to Paul Dalzell, WPRFMC staff. Sent October 1, 2008.

Ikehara, W. Electronic mail from Walter Ikehara, PIRO Permits Coordinator, received January 12, 2009.

Lutu-Sanchez, Christinna. American Samoa vessel owner, Pago Pago, American Samoa. E-mail to Paul Dalzell, WPRFMC staff.

NMFS PIRO, Protected Species Division. *Draft* report on Extrapolated Green Turtle Interactions in the American Samoa Longline Fishery, 2006-2007. May 2008.

Pooley, S. Letter from Samuel G. Pooley, Director of the NOAA Pacific Islands Fisheries Science Center, Honolulu, HI to Kitty Simonds, Executive Director of the Western Pacific Regional Fishery Management Council, Honolulu, HI. August 19, 2008.

Robinson, B. Letter from William L. Robinson, Regional Administrator of the NOAA Pacific Islands Regional Office, Honolulu, HI to Kitty Simonds, Executive Director of the Western Pacific Regional Fishery Management Council, Honolulu, HI. August 18, 2008.

Secretariat of the Pacific, Oceanic Fisheries Program (SPC-OFP), communication with Peter Sharples.

Sword, William. Personal communication with Will Sword, Western Pacific Fishery Management Council member from American Samoa.

13.0 Regulatory Impact Review

1. Introduction

This document is a regulatory impact review (RIR) prepared under Executive Order (E.O.) 12866, "Regulatory Planning and Review." The regulatory philosophy of E.O.12866 stresses that in deciding whether and how to regulate, agencies should assess all costs and benefits of all regulatory alternatives and choose those approaches that maximize the net benefits to the society. To comply with E.O. 12866, NMFS prepares an RIR for all regulatory actions that are of public interest. The RIR provides a review of the problems, policy objectives, and anticipated impacts of regulatory actions.

This RIR is for proposed Amendment 5 to the Fishery Ecosystem Plan for the Pelagic Fisheries of the Western Pacific Region (Pelagics FEP) developed by the Western Pacific Fishery Management Council (Council). The amendment includes an Environmental Assessment (EA) and proposed regulations.

2. Problems and Management Objective

Amendment 5 contains proposed management measures to reduce the number of interactions between the American Samoa longline fishery and green sea turtles, while allowing the American Samoa longline fishery to continue operations. Reducing the number of these interactions would enhance the survival, recovery, and sustainability of the Pacific green sea turtle population.

U.S. pelagic longline fisheries in the western Pacific accidentally catch small numbers of sea turtles while fishing. All species of sea turtles are listed under the Endangered Species Act (ESA) as threatened or endangered, and the ESA permits a limited take of sea turtles through an incidental take statement in a Biological Opinion. The previous Biological Opinion authorizing take in this fishery was issued in 2004, and in 2006, it was determined that number of green sea turtle takes in the American Samoa longline fishery exceeded the allowable take. As a result, NMFS requested that the Western Pacific Fishery Management Council develop a proposed action to reduce interactions in this fishery. NMFS subsequently issued a Biological Opinion, dated September 16, 2010, that revised the incidental take statement based on the fishery operating under the action proposed in Amendment 5.

A detailed description of the problem and the management objective are presented in Sections 3 and 4 of the amendment.

Bycatch of sea turtles is an example of an externality of fishing effort, where one's actions impose uncompensated costs on other parties, here through the accidental loss of sea turtles through ongoing fishing operations. In situ, sea turtles have numerous benefits, and their survival is considered a public good, since the preservation benefits are valued by the general population. These values include the value of knowing that the species continues to exist, now and for future generations. There could be recreation benefits gained from being able to view sea turtles in the wild.

3. Description of the Fisheries

American Samoa-based Longline Fishery

The following section briefly describes the American Samoa longline fishery; a detailed description can be found in Section 8 of the amendment. The American Samoa-based pelagic fisheries primarily comprise small and large-scale longlining, and pelagic trolling. Longlining has dominated the pelagic fisheries in American Samoa since the mid- to late 1990s and expanded rapidly in early 2000s when large-scale mono-hulled longline vessels joined the fleet.

In the 1990s, most participants in the small-scale domestic longline fishery operated alia – locally built fiberglass or aluminum catamaran 40 ft or shorter in overall length. The alia vessels deploy a short monofilament longline, with approximately 300-350 hooks per set, from a hand-powered reel. Alia fishermen usually make single day trips with a crew of three, targeting mainly albacore for the tuna cannery. In recent years, the alia longline fleet has greatly declined from 38 active vessels in 2000 to only one vessel active since 2008.

The composition of the American Samoa longline fleet began to change in the early 2000s with the influx of large (≥ 50 feet) conventional monohull longline vessels, including some vessels from Hawaii. These large monohull vessels are typically steel-hulled vessels of around 20-27 m operating hydraulically driven mainline reels holding 30-50 miles of monofilament, setting around 3,000 hooks per set with a crew of five to six. Most of these vessels are equipped with marine electronics for navigation, communication, and fish finding, and also have refrigeration systems to freeze albacore on board. Larger-scale vessels also experienced a gradual decline in recent years.

Table 1 lists the number of permitted and active vessels by size class in the American Samoa longline fishery between 2000 and 2009.

Table 1: Actual and Active Permits in American Samoa Longline Fishery, 2000-2009.

Year	Class A		Class B		Class C		Class D	
	≤ 40 feet		40.1 – 50 feet		50.1 – 70 feet		> 70 feet	
	Permitted	Active	Permitted	Active	Permitted	Active	Permitted	Active
2000	45	37	2	2	5	3	2	2
2001	61	37	6	6	11	9	23	18
2002	55	32	6	6	14	6	24	17
2003	31	17	5	4	15	9	23	22
2004	11	9	2	2	13	8	22	21
2005	8	5	3	2	11	9	20	18
2006	21	3	5	0	12	6	24	19
2007	19	2	6	0	11	5	26	22
2008	19	1	6	0	11	5	26	22
2009	12	1	0	0	12	5	26	20

Source: NMFS unpublished data[34].

[34] http://www.pifsc.noaa.gov/wpacfin/as/Pages/as_data_6.php Last updated June 30, 2010.

Note: 2006-2008 permitted vessels add up to 62. Double-counting can occur if permits are transferred to different owners or vessels during the year. The total number of available permits is 60.

More than 10.6 million lb of pelagic species were landed in American Samoa in 2009 from the longline and trolling fleets. Tuna species accounted for more than 95% of all landings with albacore comprising the vast majority of landings at nearly 85% of tuna landings and almost 81% of total pelagic landings. Albacore landings totaled over 8.6 million lb in 2009 which represents an increase of about 10% over the previous year.

Table **Error! Reference source not found.**2 contains the landings by American Samoa-based longline vessels from 2002-2009 and ex-vessel value of all landings. It also provides summary information by each year regarding number of active vessels, number of hooks set, number of trips, and number of sets.

Table 2: American Samoa Longline Fishery Landings and other Statistics, 2002-2009.

Item	2002	2003	2004	2005	2006	2007	2008	2009
Active Vessels	60	52	40	36	28	29	28	26
Hooks set (millions)	13.1	14.2	11.7	11.1	14.3	17.5	14.4	15
Trips	NA	650/282*	430/193*	223/179*	331	377	287	177
Sets Made	6,872	6,221	4,853	4,359	5,069	5,919	4,754	4,689
Total Landings (mt)	7,146	5,085	4,101	4,003	5,482	6,491	4,359	4,835
Bigeye Tuna Landings (mt)	198	253	228	133	201	231	124	159
Yellowfin Tuna Landings (mt)	487	517	891	526	501	638	345	394
Albacore Landings (mt)	5,946	3,931	2,483	2,916	4,177	5,188	3,540	3,903
Catch Composition (in percent)								
Albacore	83%	77	61	73	76	80	81	81
BET, YFT Tunas	10%	15	27	16	13	13	11	11
Miscellaneous	7%	8	12	11	11	7	8	8
Total Ex-vessel Value (adjusted) ($ millions)	$13.7	$10.3	$8.9	$8.7	$11.7	$14.1	$9.5	$10.4

Source: WPacFIN data, WPRFMC 2010, WPRFMC unpublished 2009 Pelagics Annual Report module.
Notes: *The first number is trips by alia and the second is by larger monohull vessels. After 2005, data confidentiality rules prevent disaggregating the trip types. BET, bigeye tuna; YFT, yellowfin tuna.

Table 3 provides information on 2009 landings and ex-vessel values for each species. Albacore is also the dominant species in terms of landing value. In 2009, albacore accounted for the largest proportion of value of fish landed by American Samoa-based longline vessels (83%), followed by yellowfin tuna (7.7%) and bigeye tuna (3.7%).

Table 3: American Samoa Longline Fishery Landings and Ex-vessel Value, 2009.

Species	Pounds	Value ($)	% Value
Skipjack tuna	341,829	206,410	2.0
Albacore	8,604,024	8,616,157	83.2
Yellowfin tuna	853,036	796,992	7.7
Kawakawa	0	0	0.0
Bigeye tuna	320,576	378,821	3.7
TUNAS SUBTOTALS	10,119,465	9,998,380	96.6
Mahimahi	24,417	57,271	0.6
Black marlin	187	168	0.0
Blue marlin	55,556	52,778	0.5
Striped marlin	1,785	1,964	0.0
Wahoo	299,404	181,105	1.7
All sharks	0	0	0.0
Swordfish	18,843	40,996	0.4
Sailfish	1,751	4,359	0.0
Spearfish	953	1,096	0.0
Moonfish	4,863	7,294	0.1
Oilfish	4,549	4,549	0.0
Pomfret	1,019	2,293	0.0
NON-TUNA PMUS SUBTOTALS	413,328	353,875	3.4
Barracuda (misc.)	192	516	0.0
Rainbow runner	48	128	0.0
Dogtooth tuna	0	0	0.0
Pelagic fish (misc.)	0	0	0.0
OTHER PELAGICS SUBTOTALS	241	644	0.0
TOTAL PELAGICS	**10,533,034**	**10,352,899**	**100**

Source: WPRFMC unpublished 2009 Pelagics Annual Report module.

Currently the fleet primarily targets albacore using deep-set longline gear since the sole albacore cannery on American Samoa is the main buyer of fish. Yellowfin, skipjack, and bigeye tunas and wahoo contribute the bulk of the non-albacore landings (18%). Much of the non-albacore catch is considered bycatch and therefore not retained. The tuna species are the only category of pelagic landings where multiple species have retention rates exceeding 80% with albacore (99.7% retained), yellowfin tuna (94.5%), and bigeye tuna (93.4%).

In the future, the fleet may diversify into other fish products in response to uncertainties about the long-term continuity of the Pago Pago-based fish processing industry (TEC, Inc. 2007); however, currently the fleet primarily targets albacore using deep-set longline gear and is the major species landed. Yellowfin, skipjack, and bigeye tunas and wahoo contribute the bulk of the non-albacore landings (18%).

4. Description of the Alternatives

All of the alternatives under consideration would apply to vessels longer than 40 ft (i.e., Class B, C, and D vessels) permitted for use in the American Samoa longline limited entry fishery. The no-action alternative, the preferred alternative (proposed action), and other reasonable alternatives that could be implemented to mitigate green sea turtle interactions are identified below.

Please see Section 7 of the amendment for more details on each of the alternatives that were analyzed and Section 9 for more specific details on the impacts of each of the alternatives on fishing participants and the region.

Alternative 1: No Action

Under the no-action alternative the American Samoa longline fishery would continue as is operating under the current regulations with no changes in gear requirements or fishing practices.

Alternative 2: 100 m Hook Depth Requirement (Preferred)

Under this alternative, participants in the American Samoa longline fishery with a Class B, C, or D permit (vessels longer than 40 ft) would be required to have their hooks set to fish at least 100 meters deep. This would be accomplished by requiring the section of blank mainline between the float and closest hooks to be increased to at least 70 m with a minimum of 15 branch lines as well as to use float lines that are at least 30 m in length to help ensure to the extent practicable that all hooks fish deeper than 100 m. Figure 1 depicts the requirements. Participants would also be prohibited from possessing or landing more than 10 swordfish (*Xiphias gladius*) at any time during a given trip in order to further discourage shallow-set fishing.

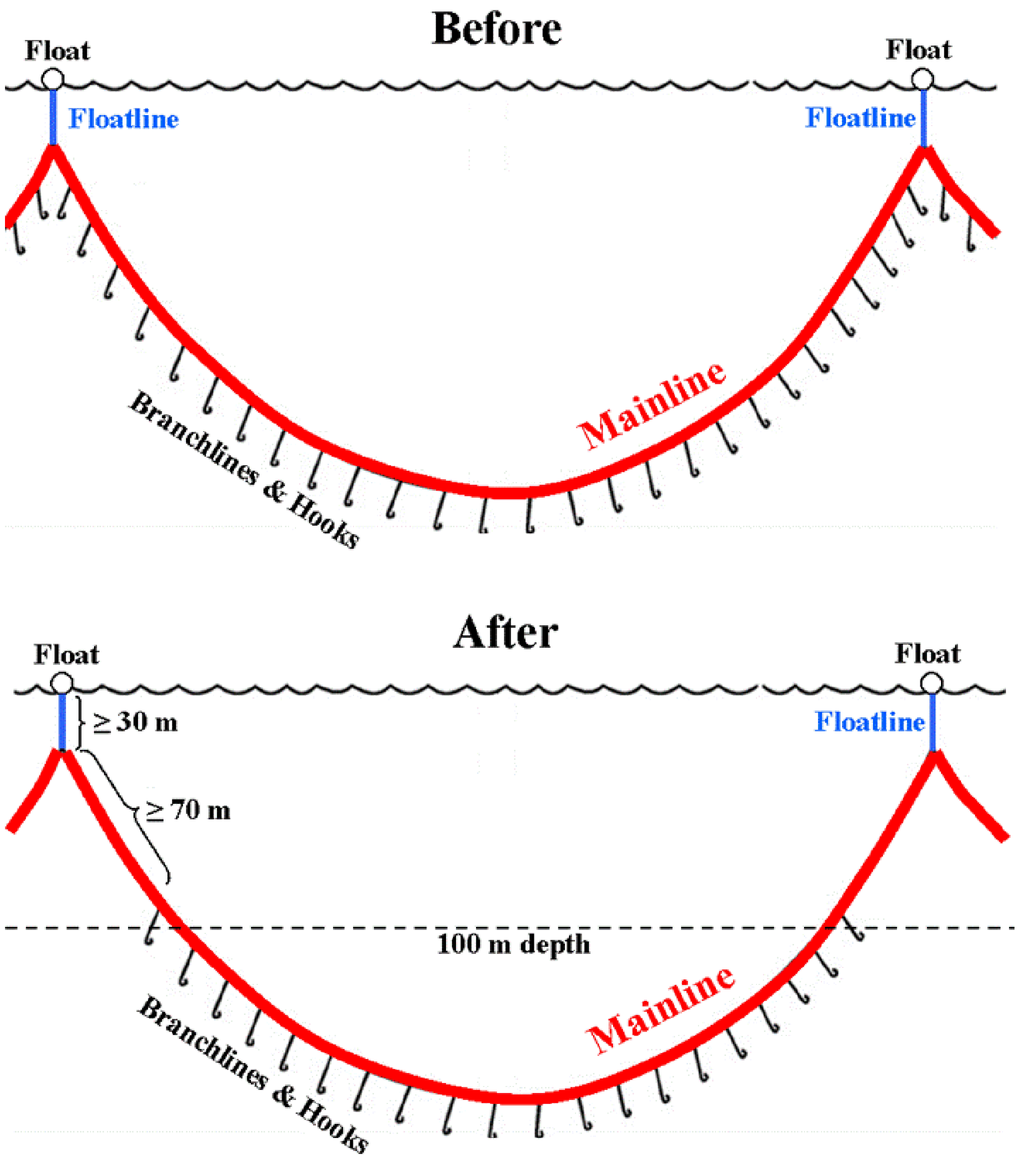

Figure 10: Gear Configuration Before and After Implementation of the Preferred Alternative.
Source: NMFS PIRO. Note: One option is presented here; fishermen may maintain the same distance of mainline between floats. There are many other gear configuration possibilities that would comply with the preferred alternative.

Alternative 3: Hook Size and Bait Size Requirements

Under this alternative, participants in the American Samoa longline fishery would be required to use size 16/0 or larger circle hooks with an offset of no more than 10 degrees, as well as the largest practical whole fish bait with the hook point covered.

Alternative 4: Combined Gear Restrictions

Alternative 4 combines the requirements considered under Alternatives 2 and 3. Under this alternative, participants in the American Samoa longline fishery would be required to use size 16/0 or larger circle hooks with an offset of no more than 10 degrees and the largest practical whole fish bait with the hook point covered. In addition, participants would be required to set hooks to fish at least 100 meters deep by increasing the distance of mainline from each float to adjacent branch lines to least 70 m away from any float line and associated float to help ensure that all hooks are deeper than 100 m. To achieve this, participants would also be required to utilize float lines at least 30 m in length with a minimum of 15 branch lines between any two floats. Fishermen would also be prohibited from possessing or landing more than 10 swordfish at any time during a given trip.

5. Analysis of Alternatives

This section describes potential economic effects of all alternatives that were considered and evaluates the impacts of each action alternative relative to the no-action alternative. The analysis considers four types of effects in particular: changes in net benefits to the nation; distributional changes in net benefits; changes in income and employment; and cumulative impacts of regulation.

5.1 Changes in Net Benefits

The analysis emphasizes changes in net benefits to the U.S. national accounts; changes in net benefits that occur to foreign interests are not relevant in the context of this RIR. Benefits accrued as surplus to consumers measure the difference between the amount consumers are willing to pay for products or services and the amount they actually pay. Benefits accrued as surplus to producers measure the difference between the amount producers actually received for providing products or services and the economic cost producers bear to do so. In the case of fish harvesting operations, producer surplus can be measured by the difference between gross revenues and operating costs. Benefits and costs in both the private and public sectors are important with respect to net benefits to the national account; effects in both sectors are accounted for in this analysis to the extent possible. Quantitative projection of changes in benefits and costs is provided where possible, but in some instances only qualitative assessment can be made.

Alternative 1: No Action

Alternative 1 is the no action alternative and is the least restrictive of all of the alternatives considered and analyzed. Under the no-action alternative, the American Samoa longline fishery would continue as is, operating under the current regulations with no changes in gear requirements. There would be no direct cost or benefit beyond the status quo associated with this alternative.

The fishery would likely continue to take sea turtles incidentally at levels exceeding the number permitted through the 2004 Biological Opinion. This alternative would, therefore, be inconsistent with the ESA and the Magnuson-Stevens Act, and it would not meet the objective of this action.

Alternative 2: 100 m Minimum Hook Depth Requirement (Preferred)

Alternative 2 requires certain gear configurations to ensure that all hooks are set at least 100 m deep. The benefits under this alternative include a significant reduction of sea turtle bycatch. Green sea turtle bycatch is expected to drop by at least 50 percent. The range of associated economic benefits from adopting additional measures to protect sea turtles include existence values, which are values placed on knowing that these species will continue to survive and bequest values, which are values placed on knowing that endangered marine turtles remain for future generations.

In order to achieve the goal of setting hooks at least 100 m deep, fishermen would be required to use float lines at least 30 m in length, as well as move or remove hooks on the mainline that are currently placed within 70 m to the float lines. Some fishermen are already meeting the 30 m float line requirement and recent observer data suggests that the average length of float line is about 26 m with a range of 18-36 m. Those that need to increase the length of float lines would spend about $0.40 per additional meter of float line plus minimal labor costs. The 70 m minimum distance of blank mainline could cause a loss in catch and landings. One recent study estimates the 70 m or greater blank mainline requirement, and a reduction in the total number of hooks deployed by the same distance of mainline may reduce target albacore catch by about 5.1 percent (Bigelow and Fletcher 2009). This reduction corresponds to an estimated average loss of albacore catch of $16,900 per vessel, based on the number of active vessels in 2009, landings, and revenue. The Bigelow and Fletcher (2009) study also showed that the act of lengthening the mainline and/or redistributing the removed hooks could increase CPUE and overall albacore landings, compared with status quo. Therefore, fishermen could adopt one or more mitigating measures to help offset the reduction in albacore catch caused by the increased depth requirement. These include redistributing some or all displaced hooks to locations either further along the mainline between the same set of floats or onto additional mainline. Fishermen would incur some additional costs to add mainline.

Using average longline gear configuration characteristics based on observer data, the removal of four hooks between floats results in a displacement of approximately 382 hooks. Redeploying these displaced hooks would require an additional 8,827.3 m of mainline (approx. 4.8 nm) of mainline. If the vessel is able to add additional mainline to the reel, and chose to do so, the retail cost for a 5-nm spool of 3.6 mm monofilament mainline is $1,383, and the cost for a 550-meter spool of 6.4 mm “tarred” float line is $214.95. Float line materials used in the fishery are variable and range from polypropylene rope to tarred rope, the latter of which is about twice as costly as polypropylene line. The cost used here is for tarred float line to give an upper bound for the likely costs of redistributing the hooks on the mainline. About 12 additional floats would be required to suspend the mainline, and cost about $480 (roughly $40 per float). Assuming this additional gear is used, the total cost per vessels would be about $2,115. This figure includes the estimated cost for snaps connecting the floats to the mainline and shipping to American Samoa from Hawaii (Sources: Pacific Fishing Supply, Pacific Ocean Producers, and VAK Fisheries, Honolulu, HI).

Albacore, especially larger individuals, are known to be more plentiful in waters around American Samoa between 150-250 meters during the day at depths coinciding with the main biomass of their preferred prey, micronekton (Domokos et al. 2007). Therefore, requiring fishing for albacore to occur at greater depths may in fact result in slightly higher pounds-per-fish yields. The requirement to increase the depth of the gear may slightly increase the albacore CPUE for those longline fishermen who are currently fishing at depths less than 100 m.

To offset reduced albacore catch that may be realized, fishermen also could increase the number of sets throughout the course of the year to make up for the loss in catch. Catch rates and market prices for albacore and other marketable non-target catch, as well as additional trip expenses, such as bait, fuel, and crew may influence the effort needed to compensate any revenue lost, therefore; the number of additional sets is not estimated here.

Catch of other fish species may drop by a greater amount, particularly those species more commonly found at shallower depths (Bigelow and Fletcher 2009). However, due to the current lack of sufficient local market, most species found at shallower depths are largely discarded at sea. In 2009, non-albacore landings were less than 20% of overall pelagic landings. Catch rates may go down, but landings and revenue for most non-albacore species may remain the same since they could be landed rather than discarded.

Two additional requirements under this alternative call for a minimum of 15 branch lines on the mainline between floats as well as a prohibition on landing or possessing more than 10 swordfish per trip. NMFS observer data indicates that longline fishermen operating in American Samoa already use more than 15 branch lines between floats and generally do not possess more than a few swordfish on board at any time, so the requirements on the number of branch lines on each mainline as well as the number of swordfish on board do not appear to be binding constraints and would not affect cost or benefits.

The methods used to meet the 100 m minimum depth requirement and their associated costs depends on individual fishermen's current fishing gear configuration and whether the fishermen adopts one or more of measures to mitigate the loss of albacore from removing the shallowest hooks. Fishermen who can use one of a variety of measures to offset the loss in albacore catch from the 70 m or greater blank mainline requirement would face some additional expense and time associated with those mitigating measures. Given that the expected loss in annual revenue per boat by removing the shallowest hooks appears to exceed the cost of mitigating measures, it seems likely that fishermen would adopt these mitigating measures, if they are able to do so. It is possible that some fishermen would see albacore landings increase relative to status quo, as a result of these mitigating measures, but as it is not possible to predict which fishermen or how many would adopt mitigating measures, or to what degree, and further it is not possible to predict which fishermen would increase overall landings. Please see Section 9.2.4 of the amendment for more details on the various costs of and potential gains in albacore landings from implementing these mitigative measures.

Nearly all of the albacore caught by American Samoa-based longline fleet are delivered to the tuna cannery in American Samoa, while other tuna and non-tuna species are sold in local markets and to restaurants. A tuna processing industry developed in American Samoa in the 1950s and 1960s with the establishment of two tuna cannery plants: Chicken of the Sea (recently shut down on September 30, 2009, and relocated to a facility in Georgia, USA) and StarKist. Alternative 2 is expected to have a negligible impact (either positively or negatively) on tuna supplied to the American Samoa cannery, as the cannery has many sources of tuna, including those landed by foreign fishermen. Hence there would be little disruption of supply to the cannery and virtually no change of canned tuna supply to the U.S. market.

Implementation of measures under Alternative 2 would result in administrative costs incurred by the federal government. The costs are associated with, among other things, promulgating and enforcing the rules, potentially translating materials into Samoan, and conducting outreach and education in American Samoa. Most of these administrative activities could utilize NMFS and the U.S. Coast Guard’s existing resources. Public burdens are not expected to be excessive.

Summary of the Effects on Net Benefits under Alternative 2:

Under Alternative 2, incidental interactions of green sea turtles in the American Samoa-based longline fishery are expected to decrease significantly, while total commercial pelagic landings are unlikely to be significantly affected. There may be a slight decrease in albacore landings unless longliners adopt mitigating measures that offset these decreases and possibly increase overall albacore landings. The cost of gear configurations required under this alternative is expected to be small and is likely to have little impact on the overall operating costs to fishermen. It is reasonable to conclude that this alternative would have little adverse effect on the U.S. longline fishery based in American Samoa, and hence negligible adverse effect on the U.S. fishery as a whole. With little expected change in tuna harvests provided to the tuna cannery in American Samoa, this alternative would result in a negligible change to canned tuna processing in American Samoa, so there would be negligible change in the availability of canned tuna products in the U.S. markets that came from the cannery in American Samoa. Hence, U.S. consumers would likely be unaffected by this alternative. Last but not least, the public cost associated with administration and enforcement under this alternative is expected to be minor; it would not be unduly burdensome for the relevant agencies.

The expected impacts described above cannot be fully quantified, so it is not possible to determine the net impacts to the nation with certainty. However, it is possible that the conservation benefits of this alternative associated with the increased likelihood of the survival and recovery of green sea turtle population would accumulate over time and is likely to be substantial.

Alternative 3: Hook Size and Bait Size Requirements

This alternative would require the use of size 16/0 or larger circle hooks with less than a 10 degree offset as well as the largest practical whole fish bait with the hook point covered. This alternative is being considered based on the fact that 12 of the 13 observed green sea turtle interactions in American Samoa-based longline fishery have occurred with smaller circle hooks size 13/0, 14/0, and 15/0, and eight of those 12 were hooked in the mouth using sardine bait (NMFS 2010). Requiring larger sized hooks and larger sized fish bait, therefore, might be effective in reducing green sea turtle bycatch. This alternative is expected to result in fewer turtles hooked in the mouth, which accounted for a majority of observed interactions. The benefits under this alternative include a reduction of sea turtle bycatch. The range of associated economic benefits from adopting additional measures to protect sea turtles include existence values, which are values placed on knowing that these species will continue to survive and bequest values, which are values placed on knowing that endangered marine turtles remain for future generations. It is not clear whether this alternative would be more protective and thus provide more non-market benefits than Alternative 2.

Alternative 3 would have negative impacts on American Samoa-based longline fishermen. Longline fishermen would need to replace smaller circle hooks with circle hooks sized 16/0 or greater and use larger bait that covers the hook point. The analysis in the amendment shows that the overall increase in annual costs to the typical fisherman who is currently using 14/0 hooks to be about $676 for hooks and up to $43,792 from switching from 40-60 gram bait to the largest bait, assuming 100-120 gram bait is used ($15,088 annual increase in moving to 60-80 gram bait and $28,888 annual increase in moving to 80-100 gram bait). This is substantially greater than costs associated with Alternative 2, even if the fishermen decide to take mitigating measures to offset loss in landings under Alternative 2. However, the Council did not specify which size of bait would be required under this alternative. Recent trials using 16/0 circle hooks in American Samoa indicate that catch rates of albacore would remain relatively unchanged compared with 14/0 circle hooks and 60-80 g bait.

Since albacore landings are expected to stay largely the same, there is no expected change in markets, including canned tuna market and industry. However, if the costs are so high that individual longline fishermen leave the industry this could lead to a drop in supply to the American Samoa tuna cannery and related industries and could potentially affect the price of canned tuna to U.S. consumers.

Alternative 3 would result in administrative costs incurred by the federal government similar to Alternative 2.

Summary of the Effects on Net Benefits under Alternative 3:

Alternative 3 is expected to decrease green sea turtle hooked in the American Samoa-based longline fishery but at the expense of the fleet in terms of increased operating costs. The impact on consumers and the canned tuna industry is expected to remain the same as status quo in the short term, but could generate a negative impact on American Samoa tuna cannery and industries that provide services to this cannery, if some longline fishermen cannot continue to fish because of the high cost of meeting gear requirements under this Alternative. The public burdens are expected to be similar to those under Alternative 2. It is not clear how the non-market benefits gained through implementing the hook and bait requirement under Alternative 3 compare relative to Alternative 2. Hence, it is not possible to determine the net impacts to the nation.

Alternative 4: Combined Gear Restrictions

This alternative includes all gear modifications that are required under Alternative 2 and 3. The interactions between green sea turtles and the American Samoa-based longline fishery are expected to decline substantially under Alternative 4. The effects on U.S. consumers and public burdens are expected to be the same as those under Alternative 2. However, this alternative would have the most adverse impact on participants in the American Samoa-based longline fishery compared to all other alternatives.

5.2 Distributional Changes in Net Benefits

None of the alternatives is expected to have any distributional effect among different fisheries because the proposed measures to reduce green sea turtle interactions would apply only to the American Samoa-based longline fishery. Fisheries involving other vessel types and in other areas would be unaffected.

5.3 Changes in Income and Employment

To the extent that alternatives 2 and 4 might cause a reduction in the amount of tuna caught relative to the no-action alternative, income of American Samoa-based longline harvesters would be negatively impacted. However, U.S. income and employment in forward and backward linkages of this fishery might not be affected accordingly due to the fact that part of the equipment, fuel, supplies, and provisioning services are supplied by foreign businesses. A large proportion of cannery workers are also foreign nationals coming from Western Samoa and Tonga (WPRFMC 2009).

5.4 Cumulative Impacts

None of the alternatives considered here are expected to result in cumulatively significant adverse impacts when considered in conjunction with other existing or future conservation and management measures that affect the American Samoa-based longline fishery. Currently, sea turtle mitigation regulations require vessel owners and operators to complete a NMFS Protected Species Workshop every year and have on board the vessel, a valid Protected Species Workshop certificate issued by NMFS or a legible copy of it. They are also required to carry and use specific equipment for handling and releasing turtles and to follow specific procedures if a sea turtle is hooked or entangled (50 CFR Part 665).

6. Determination of Significance Under Executive Order 12866

In accordance with E.O. 12866, NMFS has made the following determinations:

(1) This rule is not likely to have an annual effect on the economy of more than $100 million or adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.

(2) This rule is not likely to create any serious inconsistencies or otherwise interfere with any action taken or planned by another agency.

(3) This rule is not likely to materially alter the budgetary impact of entitlements, grants, user fees or loan programs or the rights or obligations of recipients thereof.
(4) This rule is not likely to raise novel or policy issues arising out of legal mandates, the president's priorities, or the principles set forth in E.O. 12866.

Based on these findings, this rule is determined to not be significant regulatory action for the purposes of E.O. 12866.

7. Impact on Small Entities

This section provides a description of the economic impacts of the proposed alternative on small entities as well as that of the alternatives that were considered in the amendment but not selected.

NMFS does not have revenue information on a per-vessel basis, but assumes that all American Samoa longline fishery permit holders to be small entities based on the SBA size standard for defining a small business entity in this industry with average annual receipts less than $4.0 million.

The reasons why the action is being considered, the objectives of, and the legal basis for the proposed action is addressed in Sections 3 and 4 of the amendment. NMFS does not believe that the proposed regulations would conflict with or duplicate other Federal regulations.

This rule would apply to vessels operating in the American Samoa longline fishery greater than 40 feet in length. Based on 2009 data, this would suggest that the affected vessels would be as follows: Class B (40.1-50 feet): 0 vessels permitted or active; Class C (50.1-70 feet): 5 active, 12 permitted; and Class D (>70 feet): 20 active, 26 permitted. This fishery targets albacore for the cannery in American Samoa. A detailed description on this fishery is provided in Section 8 of the amendment. This rule also applies to any Western Pacific longline fishing vessel, including vessels operating under Hawaii longline limited access and Western Pacific general longline permits when fishing south of the Equator. Since 2005, two or fewer Hawaii deep-set longline fishing vessels have fished south of the Equator comprising 0.05 percent or less of annual fishing effort by the Hawaii deep-set longline fleet. It does not appear that those with Western Pacific general longline permits that are based in the northern hemisphere, e.g. Guam, fish south of the Equator.

The preferred alternative requires specific gear configuration that would ensure that hooks are set at least 100 m in depth. The configuration includes lengthening the float line to 30 meters and leaving at least 70 m of mainline closest to each float line free of hooks. The preferred alternative also calls for a 15 branch line minimum on each mainline between two floats and requires that fishermen have 10 or fewer swordfish on board or landed per trip.

Some fishermen are already meeting the minimum 30 m float line length requirement and recent observer data suggests that the average length of float line is about 26 m with a range of 18-36 m. Those that need to increase the length of float lines would spend about $0.40 per additional meter of float line plus minimal labor costs. Requiring at least 70 m of blank mainline adjacent to each float could cause a loss in catch. One recent study estimates the 70 m or greater blank mainline requirement, and a reduction in the total number of hooks deployed by the same distance of mainline may reduce target albacore catch by about 5.1 percent (Bigelow and Fletcher 2009). This reduction corresponds to an estimated average loss of albacore catch of $16,900 per vessel, based on the number of active vessels in 2009, landings, and revenue. The Bigelow and Fletcher (2009) study also showed that the act of lengthening the mainline and/or redistributing the removed hooks could increase CPUE and overall albacore landings, compared with status quo. Therefore, fishermen could adopt one or more mitigating measures to help offset the reduction in albacore catch caused by reduction in hooks for the same length of mainline. These include redistributing some or all displaced hooks to locations either further along the mainline between the same set of floats or onto additional mainline. Fishermen would incur some additional costs to add mainline. Using average longline gear configuration characteristics based on observer data, the minimum 70 m distance of blank mainline requirement adjacent to floats would mimic the removal of four hooks between floats because more mainline would be used for the same number of hooks. The requirement could result in a displacement of approximately 382 hooks on an average 40 nm mainline. Redeploying these displaced hooks would require an additional 8,827.3 m (approx. 4.8 nm) of mainline. If the vessel is able to add additional mainline to the reel, and chose to do so, the retail cost for a 5-nm spool of 3.6 mm monofilament mainline is $1,383, and the cost for a 550-meter spool of 6.4 mm “tarred” float line is $214.95. Float line materials used in the fishery are variable and range from polypropylene rope to tarred rope, the latter of which is about twice as costly as polypropylene line. The cost used here is for tarred float line to give an upper bound for the likely costs of redistributing the hooks on the mainline. About 12 additional floats would be required to suspend the mainline, and cost about $480 (roughly $40 per float). Assuming this additional gear is used, the total cost per vessels would be about $2,115. This figure includes the estimated cost for snaps connecting the floats to the mainline and shipping to American Samoa from Hawaii (Sources: Pacific Fishing Supply, Pacific Ocean Producers, and VAK Fisheries, Honolulu, HI).

Two additional requirements under this alternative call for a minimum of 15 branch lines on the mainline between floats as well as a prohibition on landing or possessing more than 10 swordfish per trip. NMFS observer data indicates that longline fishermen operating in American Samoa already use more than 15 branch lines between floats and generally do not possess more than a few swordfish on board at any time, so the requirements on the number of branch lines on each mainline as well as the number of swordfish on board do not appear to be binding constraints and would not affect cost or benefits.

The methods used to comply with these requirements and their associated costs depends on individual fishermen’s current fishing gear configuration and whether the fishermen adopts one or more of measures to mitigate the loss of albacore from removing the shallowest hooks. Fishermen who can use one of a variety of measures to offset the potential loss in albacore catch would face some additional expense and time associated with those mitigating measures. Given that the expected loss in annual revenue per boat by removing the shallowest hooks appears to exceed the cost of mitigating measures, it seems likely that fishermen would adopt these mitigating measures, if they are able to do so. It is possible that some fishermen would see albacore landings increase relative to status quo, as a result of these mitigating measures, but as it is not possible to predict which fishermen or how many would adopt mitigating measures, or to what degree, and further it is not possible to predict which fishermen would increase overall landings. Fishermen who would not be able to adopt mitigating measures are likely to be more adversely affected by this rule.

Other alternatives that were considered, but not proposed, included 1) requiring participants of the American Samoa longline fishery to use size 16/0 or larger circle hooks with an offset of no more than 10 degrees, as well as the largest practical whole fish bait with the hook point covered and 2) a combination of the hook requirement and the preferred alternative. Both of the other alternatives would cause a greater hardship on participants of the American Samoa longline fishery relative to the preferred alternative.

NMFS has certified that this rule would not have a significant economic impact on a substantial number of small entities. While the required 70 m minimum of blank mainline adjacent to floats may reduce revenues from catches of target species by 5%, some fishermen have various options to offset those potential losses in landings or even increase albacore landings to levels that could even be higher than under status quo. These options were as described above; the expected costs of adopting those mitigating measures are lower than the expected loss in revenue without the adoption of those mitigating measures.

8. References

Bigelow, K.A. and E. Fletcher. 2009. Gear depth in the American Samoa-based Longline Fishery and Mitigation to Minimize Turtle Interactions with Corresponding Effects on Fish Catches. NOAA Pacific Islands Fisheries Science Center Internal Report IR-09-008. Issued 4 March 2009. 22 pp.

Domokas, R., M. Seki, J. Polovina, and D. Hawn. 2007. Oceanographic investigation of the American Samoa albacore (*Thunnus alalunga*) habitat and longline fishing grounds. Fish. Oceanogr. 16:6, 555–572.

National Marine Fisheries Service (NMFS). 2008. 2008 Annual Report to the Western and Central Pacific Fisheries Commission: United States of America. National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

NMFS. 2010. Endangered Species Act Section 7 Consultation Biological Opinion on Measures to Reduce Interactions Between green sea turtles and the American Samoa-based Longline Fishery-Implementation of an Amendment to the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region. September 16, 2010. 91 pp.

Western Pacific Regional Fishery Management Council (WPRFMC). 2009. Pelagic Fisheries of the Western Pacific Region 2007 Annual Report. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii.

WPRFMC. 2010. Pelagic Fisheries of the Western Pacific Region 2008 Annual Report. Western Pacific Regional Fishery Management Council. Honolulu, Hawaii.

WPRFMC. 2011. Draft Amendment to the Pacific Pelagic Fishery Ecosystem Plan: Measures to Reduce Interactions between Green Sea Turtles and the American Samoa-based Longline Fishery Including an Environmental Assessment. Honolulu: Western Pacific Regional Fishery Management Council. 124 pp.