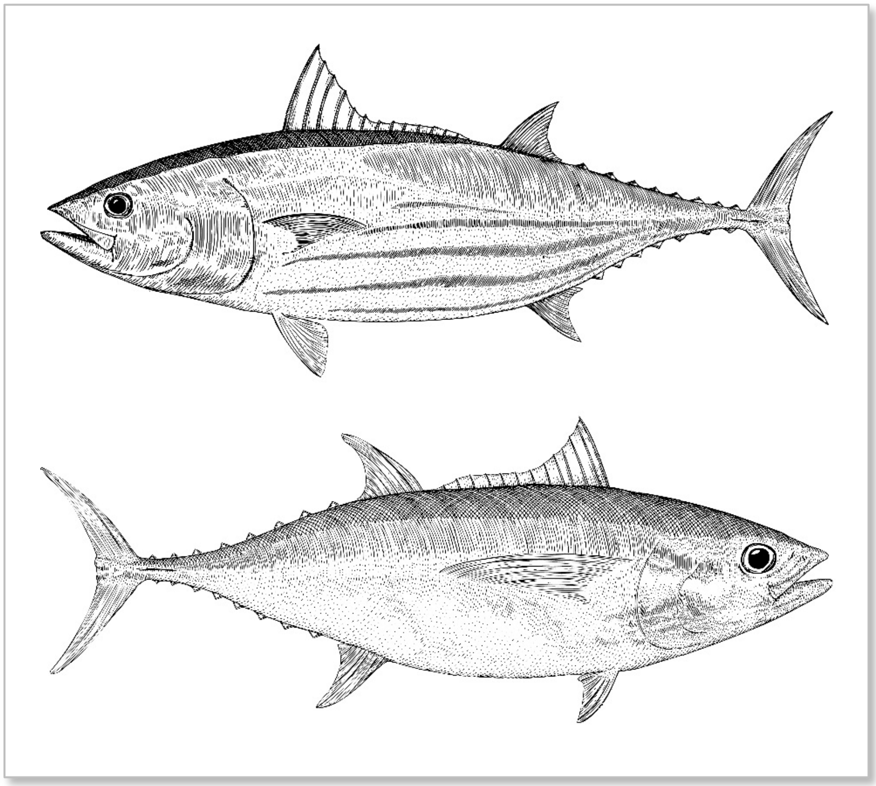
Stock Assessment and Fishery Evaluation Report
Pacific Island Pelagic Fisheries
2016



Western Pacific Regional Fishery Management Council
1164 Bishop St., Suite 1400
Honolulu, HI 96813
PHONE: (808) 522-8220
FAX: (808) 522-8226
www.wpcouncil.org

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A report of the Western Pacific Regional Fishery Management Council

Stock Assessment and Fishery Evaluation Report

Pacific Island Pelagic Fisheries

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Prepared by the Pelagics Plan Team and Council Staff

for the

Western Pacific Regional Fishery Management Council
1164 Bishop Street, Suite 1400, Honolulu, Hawai`i 96813

The Western Pacific Regional Fishery Management Council acknowledges the valuable contributions of the following Plan Team members for drafting sections of this report:

Hawaii Division of Aquatic Resources: Reginald Kokubun, Mike Fujimoto

American Samoa Department of Marine and Wildlife Resources: Tepora Toliniu Lavata'i

Guam Division of Aquatic and Wildlife Resources: Brent Tibbatts

CNMI Division of Fish and Wildlife: Michael Tenorio

NMFS Pacific Islands Fisheries Science Center: Keith Bigelow, Christofer Boggs, Russell Ito, Justin Hospital, Phoebe Woodworth-Jefcoats, T. Todd Jones, Annie Yau, Kimberly Lowe

NMFS Pacific Islands Regional Office: Melanie Brown, Tom Graham

Other: Paul Bartram

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GLOSSARY OF TERMS AND LIST OF ACRONYMS

Term	Definition
Alia	Samoan fishing catamaran, about 30 ft long, constructed of aluminum or wood with fiberglass. Used for various fisheries including trolling, longline, and bottomfishing
Bycatch	Fish caught in a fishery but discarded or released, except in a recreational fisheries catch and release program.
Commercial	Commercial fishing, where the catch is intended to be sold, bartered, or traded.
Guam	A U.S. territory in the Marianas Archipelago. South of and adjacent to the Commonwealth of Northern Marianas Islands.
Hawai`i	U.S. state. See MHI, NWHI. Composed of the islands, atolls and reefs of the Hawaiian Archipelago from Hawai`i to Kure Atoll, except the Midway Islands. Capitol - Honolulu.
Ika-shibi	Hawaiian term for night tuna handline fishing method. Fishing for tuna using baited handlines at night with a nightlight and chumming to attract squid and tuna.
Incidental Catch	Fish caught that are retained in whole or part, though not necessarily the targeted species. Examples include monchong, opah and sharks.
Interaction	Catch of protected species, which is required to be released. Examples: Hawaiian monk seals, marine turtles and albatrosses.
Logbook	Journal kept by fishing vessels for each fishing trip; records catch data, including bycatch and incidental catch. Required in the federally regulated longline and crustacean fisheries in the Hawaiian EEZ.
Longline	Fishing method utilizing a main line that exceeds 1 nm in length, is suspended horizontally in the water column either anchored, floating, or attached to a vessel, and from which branch or dropper lines with hooks are attached; except that, within the protected species zone, longline gear means a type of fishing gear consisting of a main line of any length that is suspended horizontally in the water column either anchored, floating, or attached to a vessel, and from which branch or dropper lines with hooks are attached.
Longliner	Fishing vessel specifically adapted to use the longline fishing method.

Term	Definition
Palu-ahi	Hawaiian term for day tuna handline fishing. Fishing for tuna using baited handlines and chumming with cut bait in a chum bag or wrapped around a stone. Also, drop-stone, make-dog, etc.
Pelagic	The pelagic habitat is the upper layer of the water column from the surface to the thermocline. The pelagic zone is separated into several subzones depending on water depth: epipelagic - ocean surface to 200 meters depth; mesopelagic – 200 to 1,000 meters depth; bathypelagic – 1,000 to 4,000 meters depth; and abyssopelagic – 4,000 to 6,000 meters depth. The pelagic species include all commercially targeted highly migratory species such as tuna, billfish and some incidental-catch species such as sharks, as well as coastal pelagic species such as akule and opelu.
Pole-and-Line	Fishing for tuna using poles and fixed leaders with barbless lures and chumming with live baitfish. Poles can be operated manually or mechanically. Also, fishing vessels called baitboats or aku-boats (Hawai`i).
Protected	Refers to species which are protected by federal legislation such as the Endangered Species Act, Marine Mammal Protection Act, and Migratory Bird Treaty Act. Examples: Black-footed and Laysan albatrosses, marine turtles, dolphins.
Purse seine	Fishing for tuna by surrounding schools of fish with a very large net and trapping them by closing the bottom of the net.
Recreational	Recreational fishing for sport or pleasure, where the catch is not sold, bartered or traded.
Sanctuary	Protected area. Commercial/recreational fishing may be restricted.
Secretary	When capitalized and used in reference to fisheries within the U.S. EEZs, it refers to the U. S. Secretary of Commerce.
Small pelagics	Species such as akule (big-eye scad - Selar spp.) And opelu (mackerel scad - Decapterus spp). These fish occur mainly in shallow inshore waters but may also be found in deeper offshore waters. Not part of the PMUS.
Trolling	Fishing by towing lines with lures or live-bait from a moving vessel.

Acronym	Meaning
ACE	Accumulated Cyclone Energy
ACL	Annual catch limit
AS	American Samoa. Includes the islands of Tutuila, Manua, Rose and Swains Atolls.
ASG	American Samoa Government
AVHRR	Advanced Very High Resolution Radiometer
BiOp	Biological Opinion
BOEM	Bureau of Ocean Energy Management
BSIA	Best Scientific Information Available
CFR	Code of Federal Regulations
CML	Commercial Marine License data
CNMI	Commonwealth of the Northern Mariana Islands. Also, Northern Mariana Islands, Northern Marianas, and NMI. Includes the islands of Saipan, Tinian, Rota, and many others in the Marianas Archipelago.
CO_2	Carbon Dioxide
COS	Chicken-of-the-Sea
CPI	Consumer price index
CPUE	Catch-Per-Unit-Effort. A standard fisheries index usually expressed as numbers of fish caught per unit of gear per unit of time, e.g., number of fish per hook per line-hour or number of fish per 1,000 hooks.
DAWR	Division of Aquatic & Wildlife Resources, Territory of Guam.
DFW	Division of Fish & Wildlife, Northern Mariana Islands.
DMWR	Department of Marine & Wildlife Resources, American Samoa.
DOC	Department of Commerce. In this annual report, it refers to the American Samoa Government.
DOD	Department of Defense

Acronym	Meaning
DPS	Distinct population segment
EEZ	Exclusive Economic Zone, refers to the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the Sea as extending out 200 nautical miles from shore. Within the U.S., the EEZ is typically between three and 200 nautical miles from shore.
EFH	Essential fish habitat
EIS	Environmental impact statement
EPO	East Pacific Ocean
ENSO	El Nino–Southern Oscillation Index
ESA	Endangered Species Act. An Act of Congress passed in 1966 that establishes a federal program to protect species of animals whose survival is threatened by habitat destruction, overutilization, disease, etc.
FAD	Fish Aggregating Device; a raft or pontoon, usually tethered, and under which, pelagic fish will concentrate.
FEP	Fisheries Ecosystem Plan
FMP	Fishery Management Plan.
ft	Feet
GAC	Global area coverage
GRT	Gross registered tonnes
HAPC	Habitat Areas of Particular Concern
HDAR	Hawai`i Division of Aquatic Resources. Also, DAR.
HMRFS	Hawai`i Marine Recreational Fishing Survey
ISC	International Scientific Committee
ITS	Incidental Take Statement
JIMAR	Joint Institute for Marine and Atmospheric Research, University of Hawai`i.

Acronym	Meaning
IATTC	Inter-American Tropical Tuna Commission.
Km^2	Square kilometers
LAA	Likely to adversely affect
lbs	Pounds
LOC	Letter of Concurrence
LOF	List of Fisheries
LVPA	Large Vessel Protected Area
m	Meter
M&SI	Mortality and serious injury
MSA	Magnuson-Stevens Fishery Conservation and Management Act of 1996. Sustainable Fisheries Act.
ME	McCracken estimates
MFMT	maximum fishing mortality threshold
MHI	Main Hawaiian Islands (comprising the islands of Hawai`i, Mau'i, Lana'i, Moloka'i, Kaho'olawe, O'ahu, Kauai', Ni'ihau and Ka'ula).
MITT	Mariana Islands Training and Testing
MMA	Marine managed area
MMPA	Marine Mammal Protection Act
MPA	Marine Protected Area
MPCC Committee	Marine Planning and Climate Change Committee
MRFSS	Marine Recreational Fishing Statistical Survey
MSST	Minimum stock size threshold
MSY	Maximum Sustainable Yield.
mt	Metric tons

Acronym	Meaning
MUS	Management Unit Species
NCADAC	National Climate Assessment and Development Advisory Committee
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NLAA	Not likely to adversely affect
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce. Also NOAA Fisheries.
nmi	Nautical miles
NOAA	National Oceanic and Atmospheric Administration, U.S. Department of Commerce.
NESDIS	National Environmental Satellite, Data, and Information Service
NWHI	Northwestern Hawaiian Islands. All islands in the Hawaiian Archipelago, other than the Main Hawaiian Islands (MHI)
NWR	National Wildlife Refuge
NS2	National Standard 2
OFP-SPC	Oceanic Fisheries Program of the Secretariat of the Pacific Community.
ONI	Oceanic Niño Index
OR&R	NOAA's Office of Response and Restoration
OSDPD	Office of Satellite Data Processing and Distribution
OY	Optimum Yield
PBR	Potential Biological Removal
PDO	Pacific Decadal Oscillation
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Islands Regional Office, National Marine Fisheries Service. Also, NMFS PIRO.

Acronym	Meaning
PFRP	Pacific Pelagic Fisheries Research Program, JIMAR, University of Hawai`i
PMUS	Pacific Pelagic Management Unit Species. Also, PPMUS. Species managed under the Pelagic FEP
POES	Polar Operational Environmental Satellites
PPGFA	Pago Pago Game Fishing Association
ppm	parts per million
RPB	Regional Planning Body
PRIA	Pacific Remote Island Area
ROD	Record of Decision
SAFE	Stock Assessment and Fishery Evaluation
SAR	Stock Assessment Report
SB	Spawning biomass
SC	Standing Committee of the Western and Central Pacific Fisheries Commission
SDC	Status Determination Criteria
SPC	Secretariat of the Pacific Community. A technical assistance organization comprising the independent island states of the tropical Pacific Ocean, dependent territories and the metropolitan countries of Australia, New Zealand, USA, and France.
SPR	Spawning Potential Ratio. A term for a method to measure the effects of fishing pressure on a stock by expressing the spawning potential of the fished biomass as a percentage of the unfished virgin spawning biomass. Stocks are deemed to be overfished when the SPR<20%.
SSC	Scientific & Statistical Committee, an advisory body to the Council comprising experts in fisheries, marine biology, oceanography, etc.
SST	Sea Surface Temperature
STF	Subtropical Font

Acronym	Meaning
TZCF	Transition Zone Chlorophyll Front
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish & Wildlife Service, Department of Interior. Also, FWS.
WCNPO	Western and Central North Pacific
WCP–CA	Western and Central Pacific Fisheries Commission Convention Area
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	western and central Pacific Ocean
WPacFIN	Western Pacific Fishery Information Network, NMFS
WPRFMC	Also, the Council. Western Pacific Regional Fishery Management Council. One of eight nationwide fishery management bodies created by the Magnuson Fisheries Conservation and Management Act of 1976 to develop and manage domestic fisheries in the U.S. EEZ. Composed of American Samoa, Guam, Hawai`i, and Commonwealth of Northern Mariana Islands.

EXECUTIVE SUMMARY

The Western Pacific Regional Fishery Management Council (Council) manages the pelagic resources covered under the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSA) and that occur in the United States (U.S.) Exclusive Economic Zone (EEZ) around American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, Hawai`i, and the U.S. possessions in the Western Pacific Region (Johnston Atoll, Kingman Reef and Palmyra, Jarvis, Howland, Baker, Midway, and Wake Islands). The Council developed and the National Oceanic and Atmospheric Administration’s (NOAA) National Marine Fisheries Service (NMFS) implemented the Fishery Management Plan (FMP, now Fishery Ecosystem Plan [FEP]) for Pelagic Fisheries of the Western Pacific Region in 1987. Since this time, the Council has generated an Annual Report that provides fishery performance data, including but not limited to landings, value of the fishery, and catch rates, for each of the areas the Council manages.

This 2016 Stock Assessment and Fisheries Evaluation (SAFE) Report for Pacific Pelagic Fisheries of the Western Pacific Region is the second for this fishery. In July 2013, NMFS issued a final rule (78 FR 43066) that revised National Standard 2 (NS2) guidelines and clarify the content and purpose of the SAFE Report to manage fisheries using of the best scientific available information (see Title 50 Code of Federal Regulations [CFR] Part 600.315). In 2015, the Council, in partnership with NMFS Pacific Islands Fisheries Science Center, local fishery resource management agencies, and the NMFS Pacific Islands Regional Office (PIRO), agreed to revise and expand the contents of future annual reports to include the range of ecosystem elements, including protected species interactions, oceanographic parameters, essential fish habitat review, and marine planning activities. SAFE reports provide regional fishery management councils and NMFS with information for determining the annual catch limits for each stock in the fishery, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, implementing required essential fish habitat (EFH) provisions, and assessing the relative success of existing relevant state and Federal fishery management programs. The SAFE report is intended to serve as a source document for developing FMPs (or FEPs) and amendments, and other analytical documents needed for management decisions.

This year marks the second report that combines the requirements of reporting for the FEP with those required under the national SAFE report guidelines. Table ES-1 was developed from a review of NS2 guidelines and the 2013 revisions from the Final Rule for Provisions on Scientific Information for NS2 (78 FR 43066). This is the first year in which this report includse a Data Integration chapter that intends to analyze fishery performance data against ecosystem parameters to improve ecosystem-based fishery management.

Table ES-1. Fulfillment of National Standard 2 Requirements within this Report

Requirement	Data Needs	Citation for Additional Guidance	Section
Condition of stocks and stock complexes			
Description of the Status Determination Criteria (SDC)	maximum fishing mortality threshold (MFMT), OFL, and minimum stock size threshold (MSST)	600.310(e)(2)	2.6.5.1
Information on Overfishing Level (OFL)	Data collection, estimation methods, and consideration of uncertainty	600.310(f)(2)	2.6.6
Information determining Annual Catch Limits (ACL)	Needed for each stock to document significant trends or changes in the resource or marine ecosystem	600.310(f)(5)	2.6.6
Information on Optimum Yield (OY)	The harvest level for a species that achieves the greatest overall benefits, including economic, social, and biological considerations	600.310	N/A[1]
Information on Acceptable Biological Catch	Most recent stock assessment	600.310(c) 600.310(f)(2)	2.6.7
Fishing mortality	Sources of fishing mortality (both landed and discarded), including commercial and recreational catch and bycatch in other fisheries	600.310(i)	Ch. 2
Bycatch by fishery	Including target and non-target species		Ch. 2
Rebuilding overfished stocks	Best Scientific Information Available (BSIA)[2] on biological condition of stocks		N/A
Condition of ecosystems	BSIA to assess success of FEP		Ch. 4
Condition of EFH	Report on Review of available information; full review every 5 years	600.815(a)(10)	3.4
Socioeconomic conditions of fishery	BSIA to assess success of FEP		3.1
Socioeconomic conditions of fishing communities	BSIA to assess success of FEP		3.1
Socioeconomic conditions of processing industry	BSIA to assess success of FEP		N/A
Safety at sea by fishery	BSIA to assess success of FEP		NA
Information/data gaps	Explanation of data gaps and emphasis on future scientific work to address gaps		NA

N/A Not Applicable

[1] A numeric OY is not currently used to manage pelagic fisheries in the Pacific Islands Region.

[2] The National Standard 2 Guidelines define BSIA as: "Relevance, inclusiveness, objectivity, transparency, timeliness, verification, validation, and peer review of fishery management information as appropriate. The revised NS2 guidelines do not prescribe a static definition of BSIA because science is a dynamic process involving continuous improvements." (78 Federal Register 43067)

SUMMARY OF SAFE STOCK ASSESSMENT REQUIREMENTS

It is important to note that all fish managed under the Pelagic FEP are also managed under the international agreements governing the Western and Central Pacific Fisheries Commission (WCPFC) and/or the Inter-American Tropical Tuna Commission (IATTC) to which the U.S. is a party. Both the WCPFC and IATTC have adopted criteria for overfishing and overfished for certain species that differ from those under the Pacific Pelagic FEP. For the purposes of stock status determinations, NMFS will determine stock status of Pelagic MUS using the Status Determination Criteria (SDC) described in the Pelagic FEP.

For all pelagic management unit species (MUS), the Council adopted a maximum sustainable yield (MSY) control rule (see Figure 125). The Council has also adopted a warning reference point, B_{FLAG}, set equal to B_{MSY} to provide a trigger for consideration of management action before a stock's biomass reaches the MSST. A stock is approaching an overfished condition when there is more than a 50 percent chance that the biomass will decline below the MSST within two years.

For pelagic species in the Pacific Island Region, most stock assessments are conducted by several international organizations. In the Eastern Pacific Ocean (EPO), IATTC staff conduct stock assessments for EPO bigeye, yellowfin, striped marlin, and swordfish. IATTC also includes a review of a range of indicators for stock status of EPO skipjack.

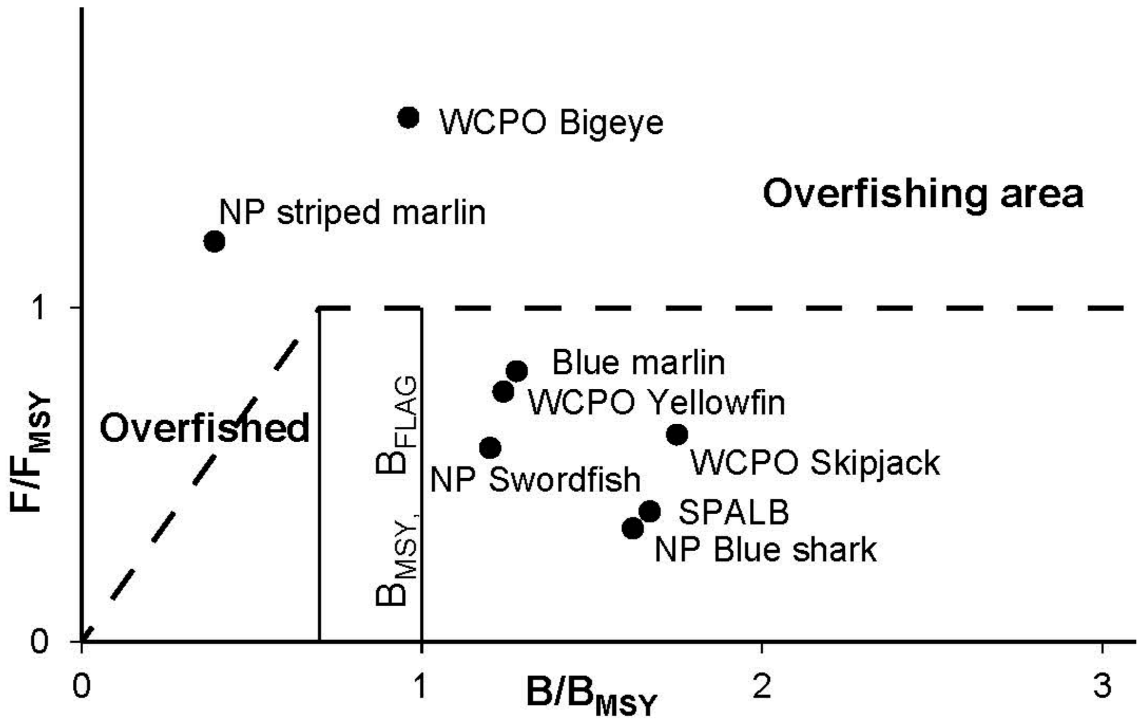
In the Western Central Pacific Ocean (WCPO), the Secretariat of the Pacific Community Oceanic Fisheries Program conducts stock assessments on tropical tunas, as well as for South Pacific albacore, southwest Pacific swordfish and striped marlin. In the North Pacific Ocean, the International Scientific Committee (ISC) for Tuna and Tuna-like Species in the North Pacific Ocean conducts similar stock assessments. In 2016, stock assessments were completed for the WCPO skipjack (McKechnie et al 2016), Pacific bluefin (ISC 2016a), southwestern blue shark (Takeuchi et al 2016) and Pacific blue marlin (ISC 2016b). Details of the WCPO stock assessments can be found in Section 2.6.

Table 43 in Section 2.6.7 provides an overview of stock status in relation to overfishing and overfished reference points for 12 species managed under this Pacific Pelagic Fishery Ecosystem Plan (Pelagic FEP).

Figure ES-1 provides the current stock status for all species in the Pelagic FEP for which stock assessments have been completed.

Stock assessments in 2017 will include WCPO bigeye and yellowfin tunas, Southwest Pacific swordfish, Pacific bige-eye thresher, North Pacific blueshark, EPO bigeye and yellowfin tunas and a review of indicators of EPO skipjack tuna.

Figure ES-1. Specification of fishing mortality and biomass reference points in the Pelagic FEP and current stock status in the WCPO and EPO.



SUMMARY OF FISHERY DATA IN THE PACIFIC ISLAND REGION

The table below provides a summary of the total pelagic landings during 2016 in the Western Pacific and the percentage change between 2015 and 2016.

Species	American Samoa		Guam		CNMI		Hawai`i	
	Pounds	% change	Pounds	% change	Pounds	% change	Pounds	% change
Swordfish	14,762	-10.58%	0	0.00%	0	0.00%	2,418,000	-38.79%
Blue marlin	71,432	8.83%	44,237	15.21%	0	0.00%	1,556,000	-15.94%
Striped marlin	3,990	-87.94%	0	0.00%	0	0.00%	892,000	-24.66%
Other billfish*	27,497	72.28%	0	0.00%	0	0.00%	842,000	22.21%
Mahimahi	10,981	-15.96%	174,458	9.13%	79,656	-11.48%	1,216,000	-22.94%
Wahoo	122,257	-36.29%	33,609	6.40%	4,968	14.17%	1,208,000	-1.24%
Opah (moonfish)	4,396	13.49%	0	0.00%	0	0.00%	2,164,000	-23.01%
Sharks (whole wt)	1,690	-21.89%	0	0.00%	0	0.00%	168,000	10.71%
Albacore	3,215,860	-8.11%	0	0.00%	0	0.00%	604,000	-12.42%
Bigeye tuna	218,022	30.71%	0	0.00%	0	0.00%	18,731,000	-6.82%
Bluefin tuna	0	0.00%	0	0.00%	0	0.00%	1,000	100.00%
Skipjack tuna	128,047	-93.20%	437,476	-36.81%	191,108	-50.27%	791,000	8.72%
Yellowfin tuna	514,491	-54.82%	127,520	13.38%	19,609	19.63%	4,954,000	17.88%
Other pelagics**	10,028	83.73%	18,765	68.27%	2,139	100.00%	1,602,000	-16.42%
Total	4,343,453	-14.08%	836,065	-12.74%	307,901	-28.61%	37,146,000	-7.14%

Note: Total Pelagic Landings based on commercial reports or creel surveys; % change based on 2014 landings.

*Other billfish include: black marlin, spearfish, and sailfish

**Other pelagics include: kawakawa, unknown tunas, pelagic fishes (dogtooth tuna, rainbow runner, barracudas), oilfish, and pomfret. Of these, only oilfish and pomfret are Pelagic MUS. While other tables in Chapter 2 excluded or separated out non-MUS, data could not accurately provide individual landings data for these species presented in this total landings table.

AMERICAN SAMOA

Pago Pago Harbor on the island of Tutuila is a regional base for the trans-shipment and processing of tuna taken by domestic fleets from other South Pacific nations, the distant-waters longline fleets, and purse seine fleets. As NMFS Pacific Island Region does not directly manage these fisheries, data on the purse seine and non-U.S. vessel landings are not included in this report.

Participation. The largest fishery in American Samoa directly managed as part of this FEP is the American Samoa longline fishery. The majority of these vessels are greater than 50 ft, are required to fish beyond 50 nautical miles (nmi) from shore, and sell the majority of their catch, primarily albacore, to the Pago Pago canneries. In 2016, there were 20 active longline vessels, with 15 vessels greater than 70 ft, three vessels between 50 and 70 ft and two vessels shorter than 40 ft. Smaller longline vessels (locally built, twin-hulled vessels about 30 ft long, powered by 40HP gasoline outboard engines) can fish within 50 nmi from shore, but due to the low participation, these data are confidential and are reported only as combined with the large vessel fishery. Troll and handline fishing is the next largest fishery with 12 boats that landed pelagic species in 2016. Recreational fisheries in American Samoa are rare.

Landings. The estimated annual pelagic landings have varied widely, from 1 to 15 million lbs since 1998. The 2016 landings were approximately 4.3 million pounds, which contributes to the declining trend since peak landings in 2007 (Figure 4). Pelagic landings consist mainly of five tuna species – albacore, yellowfin, skipjack, mackerel and bigeye – which when combined with other tuna species made up 94% of the total landings. Albacore made up 79% of the tuna species. Wahoo, blue marlin and black marlin made up most of the non-tuna species landings.

Bycatch. There was no recorded bycatch for the troll fishery in 2016 (Table 15). In the longline fishery, less than 1% of the tuna bycatch was released. Albacore and skipjack were the most released bycatch tuna species, while sharks and oilfish had the highest numbers of non-tuna released fish, accounting for 92% release of non-tuna species. In total, only 10% of all pelagic species caught were released. Fish are released for various reasons including quality, handling and storage difficulties, and marketing problems. Investigation into the reasons for releasing pelagic species are recommended because of the high release rate for many non-tuna Pacific Pelagic Management Unit Species (PMUS) and releases of some tuna.

Effort. There are currently 20 vessels known to be fishing in the waters of American Samoa according to federal logbooks collected. The 20 vessels that fished in 2016 made 213 trips (average 11 trips/vessel), deployed 2,420 sets, (121 sets/vessel) using 6.8 million hooks (Table 8). The troll and handline fishery conducted 190 trips that landed pelagic species.

Catch Rate. The total pelagic catch rate by all longline vessels decreased by 1.5 fish/1,000 Hooks in 2016. The tuna catch rate also decreased by 1.4 fish/1,000 Hooks in 2016. Non-tuna and other pelagic species all showed relatively constant catch rates from 2009 to 2016. The longline catch rate for tuna species have fluctuated during the past ten years. Albacore, the species targeted by longline boats, have decreased this year (12.4 fish/1,000 Hooks). Troll trips have increased by 12% from 2015 and troll hours have decreased by 15%, while the average catch per troll hour for all pelagic species have still increased.

Fish Size. Average weight-per-fish from the cannery samples for all tuna species are currently unknown (Table 6), since the sampling program that supported this information for the longline fishery was discontinued in 2015. Albacore weight ranged from 38-39 lbs. before 2016. There has been a slight variation for yellowfin and bigeye tunas in the past four years. For yellowfin, weight varied from 50-60 lbs and for bigeye tuna, it varied from 45-54 lbs. Mean weight for mahimahi and wahoo decreased slightly.

Revenues. Commercial landings of tuna species continue to decline, with the 2016 landings the lowest in the past ten years (Figure 5). Tunas accounted for 96% of total pelagic landings with an estimated adjusted revenue of $4.7 million in 2015, and an accumulated average $1.10 price per pound. Albacore accounted for 79% of the revenue, with an estimated price of $1.28 per pound. See Human Dimensions (section 3.1) for a full accounting of the socio-economic data for all American Samoa fisheries.

Protected Species Interactions. Protected species interactions are monitored in the American Samoa longline fishery with a mandatory observer coverage at approximately 20% of all trips. Mitigation measures have been implemented to reduce green turtle interactions in this fishery. Sea turtle interaction levels in 2016 remained below the Incidental Take Statements (ITSs) specified in the 2015 Biological Opinion. Observed marine mammal interactions with the American Samoa longline fishery are relatively infrequent, usually no more than two of all species combined in any given year. This report also includes observed interactions with seabird and the ESA-listed Indo-west Pacific distinct population segment (DPS) of scalloped hammerhead, both of which have infrequent interactions in the American Samoa longline fishery.

CNMI

The CNMI's pelagic fisheries occur primarily from the island of Farallon de Medinilla south to the Island of Rota.

Participation. The number of boats involved in CNMI's pelagic fishery has been steadily decreasing since 2001, when there were 113 fishermen reporting commercial pelagic landings. In 2016, only 63 fishermen reported landings, a significant increase from 12 in 2015.

Landings. Skipjack tuna is the principal species landed, comprising over 62% of the entire pelagic landings in 2016 based on creel survey data. Skipjack landings declined more than 34% (191,108 lbs) and total landings declined 25% (307,907 lbs.) over 2015. Landings of mahimahi and yellowfin tuna ranked second and third, respectively, by weight of landings during 2016. Creel data estimated 79,656 lbs of mahimahi, a 10% decrease from 2015. There was 19,609 lbs of yellowfin landed in 2016, a 20% increase from the 2015 landings.

Bycatch. Bycatch is not a significant issue in the CNMI, as fishermen retain their catch regardless of species, size or condition. Based on creel survey interviews, no fish were caught as bycatch in the trolling fisheries in the years 2007-2016.

Effort. In 2016 number of trips based on commercial data receipts increased by 14% over the 2015 value. Total hours trolling was similarly higher in 2016, with 19,260 hours (increase of 37% from 2015). Average trip length has remained steady, averaging between 5.1 and 5.5 hours per trip since 2008.

Catch Rate. In 2016, trolling catch rates decreased to 15.9 lbs. per trolling hour, a level similar to 2014 levels after a significant increase in 2015. The skipjack catch rate, the primary target species in CNMI, decreased to 9.9 lbs. per hour fished. This catch rate is the lowest since the reimplementation of the creel survey in 2000. Yellowfin catch rate in 2016 was near the long-term average at 1.00 lbs per hour, while the mahimahi catch rate decreased 34% in 2016.

Revenue. Commercial revenues, based on the commercial receipts, at $195,155, were near an all-time low in 2016, although as noted, not all 2016 receipts have been entered into the database. Average price per pound for all pelagics, tuna and non-tuna pelagics, were all lower than the long-term average. The average price for all pelagics was $2.10 driven by the low ($2.08) price for skipjack.

Protected Species Interactions. There have not been any reported or observed interactions with protected species in the CNMI fisheries.

GUAM

Guam's pelagic fishery consists of small, primarily recreational, trolling boats that fish within the local waters of Guam's EEZ or the adjacent EEZ of the Northern Mariana Islands.

Participation. The number of boats involved in Guam's pelagic fishery gradually increased from 193 in 1983 to a high of 496 in 2013. There were 408 boats involved in Guam's pelagic fishery in 2016, an increase of 9.7% from 2015. The majority of the fishing boats are less than 10 m (33 ft) in length and are usually owner-operated by fishermen who earn a living outside of fishing. Most fishermen sell a portion of their catch and it is difficult to make a distinction between recreational, subsistence, and commercial fishers. A small (~5%), but economically significant, segment of the pelagic group is made up of marina-berthed charter boats that are operated primarily by full-time captains and crews. Data and graphs for non-charters, charters, and bycatch are represented in this report.

Landings and Bycatch. The estimated annual pelagic landings have varied widely, ranging between 383,000 and 958,000 lbs in the 34-year time series. The average total catch has shown a slowly increasing trend over the reporting period. The 2016 total expanded pelagic landings were 836,065 lbs, a decrease of 11.8 % when compared with 2015. Tuna PMUS decreased 20.8%, while non-tuna PMUS increased 11.2%. Landings consisted primarily of five major species: mahimahi, wahoo, bonita or skipjack tuna, yellowfin tuna, and Pacific blue marlin, with skipjack comprising over 52% of total landings. Other minor species caught include rainbow runner, barracudas, and pomfrets. Sharks were also caught during 2016, with sharks noted in specific fishermen interviews conducted in 2016 regarding shark encounters (see bycatch below). However, these species were not encountered during offshore creel surveys and were not available for expansion for this year's report. Sharks are often discarded as bycatch. In addition to the above pelagic species, approximately half a dozen other species were landed incidentally this year.

There are wide year-to-year fluctuations in the estimated landings of the five major pelagic species. Landings for four of the five common species increased from 2015 levels: Yellowfin tuna increased 15.4%. Yellowfin catch was the highest since 1999. Skipjack decreased 26.9%, blue marlin increased 17.9%, mahimahi catch, which accounts for the largest percentage of non-tuna PMUS landed on Guam, increased 10%, while wahoo increased by 6.8%. Both mahimahi and wahoo catches fluctuate erratically from year to year, although both appear to be experiencing a long-term downward trend.

Effort. The number of trolling trips increased by 21.6%, but hours spent trolling decreased by 1%. There were 21 separate events covering 111 high surf advisory days in 2016, a decrease from 122 in 2015. 21 high surf advisory days occurred during August, normally a month of relatively calm waters. From 1982-2015, DAWR surveys recorded more than 2,930 trolling and bottom fishing trips to these southern banks, an average of more than 83 trips per year. The number of notices to mariners regarding closures at the W-517 restricted airspace in 2016 was 64, equaling 123 closure days, up from 109 in 2015.

Catch Rate. Trolling catch rates in 2016 (lbs per hour fished) showed a slight decrease from 2015. Total CPUE decreased 13%. Yellowfin, marlin, and mahimahi CPUE increased, while skipjack tuna CPUEs decreased and wahoo remained unchanged. The fluctuations in CPUE are probably due to variability in the year-to-year abundance and availability of the stocks.

Revenue. Commercial revenues decreased in 2016, with total adjusted revenues decreasing 15.6%. Adjusted revenue per trolling trip decreased 18.5% for all pelagics, with a decrease of 49.4% for tuna PMUS, and an increase of 21.3% for non-tuna PMUS. Commercial landings have shown a decreasing trend over the past twenty years. A majority of troll fishermen do not rely on the catch or selling of fish as their primary source of income. Previously, Guam law required the government of Guam to provide locally caught fish to food services in government agencies, such as Department of Education and Department of Corrections. In 2002, the government of Guam began implementing cost-saving measures, including privatization of food services. The requirement that locally-caught fish be used for food services, while still a part of private contracts, is not being enforced. This has allowed private contractors to import cheaper foreign fish, and reduced the sales of vendors selling locally caught fish. This represented a substantial portion of sales of locally caught pelagic fish. The decrease in commercial sales seen following 2002 may be, in part, due to this change.

Bycatch. There is very low bycatch in the charter fishery. In 2016, there were 6 reported bycatch in 346 fish caught, for a 1.7% rate. Bycatch occasionally occurs in the troll fishery including sharks, shark-bitten and undersized fish. There was no reported bycatch in the troll fishery in 2016.

In 2016, fishers were asked if they experienced a shark interaction. There were a total of 887 interviews for boat based fishing in 2016, with 300 of these inappropriate for determining shark interaction. Of the remaining 587 interviews, 235 reported interactions with sharks, 352 reported no interactions with sharks, a 40% positive rate for interviews where fishers were asked about shark interactions.

Protected Species Interactions. There have not been any reported or observed interactions with protected species in the Guam fisheries.

HAWAI`I

Compared to the other regions, Hawai`i has a diverse fishery sector which includes deep-set and shallow-set longline, Main Hawaiian Islands (MHI) troll and handline, offshore handline, and the aku boat (pole and line) fisheries. The Hawai`i longline fishery is by far the most important economically, accounting in 2015 for about 89% percent of the estimated ex-vessel value of the total commercial fish landings in the State. The MHI troll was the second largest fishery in Hawai`i. The shallow-set longline, MHI handline, aku boat, offshore handline fisheries and other gear types made up the remainder.

Participation. A total of 3,669 fishermen were licensed in 2016, including 2,030 (55%) who indicated that their primary fishing method and gear were intended to catch pelagic fish. Most licenses that indicated pelagic fishing as their primary method were issued to trollers (47%) and longline fishermen (38%). The remainder was issued to ika shibi and palu ahi (handline) (15%).

Landings. Hawai`i commercial fisheries landed 37,146,000 pounds of pelagic species in 2016, a decrease of 7% from the previous year. Although each fishery targets or intends to catch a particular pelagic species, a variety of other species were also caught. The deep-set longline fishery targeted bigeye and yellowfin tuna. This was the largest of all pelagic fisheries and its total catch comprised 85% (31,547,000 pounds) of all pelagic fisheries. The shallow-set longline fishery targeted swordfish and its catch was 1,854,000 pounds, or 5% of the total catch. The main Hawai'i Islands troll fishery targeted tunas, marlins and other PMUS caught 2,535,000 pounds or 7% of the total. MHI handline fishery targeted yellowfin tuna while the and offshore handline fishery targeted bigeye tuna. The MHI handline fishery accounted for 773,000 pounds (2% of the total). The offshore handline fishery was responsible for 366,000 pounds or 1% of the total catch.

The largest component of the pelagic catch was tunas, which comprised 68% of the total in 2016. Bigeye tuna alone accounted for 75% of the tunas and 50% of all pelagic catch. Billfish catch made up 15% of the total catch in 2016. Swordfish was the largest of these, at 42% of the billfish and 7% of the total catch. Catches of other PMUS represented 17% of the total catch in 2016 with moonfish being the largest component at 34% of the other PMUS and 6% of the total catch.

Bycatch. A total of 104,461 fish were released by the deep-set longline fishery in 2016. Sharks accounted for 85% of the deep-set longline bycatch. With the exception for mako shark, there is almost no demand for sharks in Hawaii. Of all shark species combined, 99% of the deep-set longline shark catch was released. Conversely, bycatch rate for the deep-set longline fishery was only 3% for targeted and incidentally caught pelagic species in 2016. A total of 13,053 fish were released by the shallow-set longline fishery in 2016. Sharks accounted for 91% of the shallow-set longline bycatch. With the exception for mako shark, there is almost no demand for sharks in Hawaii. Of all shark species combined, 99% of the shallow-set longline shark catch was released. Conversely, bycatch rate for the shallow-set longline fishery was 9% for targeted and incidentally caught pelagic species in 2016. Since shallow-set longline trips are often longer than deep-set trips, the higher release rate by the shallow-set sector is to conserve space for swordfish and forego keeping other pelagic species due to their short shelf life.

Effort. There were 142 active Hawai`i-permitted deep-set longline vessels in 2016, one less vessel than the previous year, with 140 or more deep-set vessels in the past three years. The number of deep-set trips (1,479) and sets (19,378) were the highest effort over the past ten years. The number of hooks set by this fishery reached a record 51.1 million hooks in 2016. The Hawai`i-permitted shallow-set longline fishery operates mainly in the first half of the year. In 2016, 13 vessels completed 46 trips and made 727 sets, which was the lowest participation and effort for this segment of the fishery over the past ten years. The number of hooks set by this fishery also decreased to 800,000 in 2016. The number of days fished by MHI troll fishers has been dropping since a peak in 2012, with 1,401 fishers logging 21,956 days fished around the MHI in 2016. There were 417 MHI handline fishers that fished 3,796 days in 2016, both well below their long-term averages. At 6 fishers and 175 days fished in 2016, the offshore handline fishery had its lowest effort since 2008.

Catch Rate. The deep-set longline fishery targets bigeye tuna and this species had higher CPUE (4.3 fish per 1,000 hooks) compared to yellowfin tuna (0.9) and albacore (0.2). CPUE of billfish for the deep-set fishery is similar to that of albacore (0.1 - 0.5 fish per 1,000 hooks), while the

CPUE for blue shark, a bycatch species, is second only to bigeye at 1.4 fish per 1,000 hooks. The Hawai`i-permitted shallow-set longline fishery targets swordfish and achieved a CPUE of 12.4 fish per 1,000 hooks. However, blue shark is a bycatch of this fishery but had the highest CPUE of any species at 13.8 fish per 1,000 hooks in 2016 Mahimahi, bigeye and mako shark CPUE was above 1.0 fish per 1,000 hooks, while all other species were less than 1.0 fish per 1,000 hooks. The 2016 MHI troll fishery CPUE for tuna and marlins were above the long-term average while CPUE for mahimahi and ono declined from their respective peaks in 2014. MHI handline CPUE for yellowfin tuna peaked in 2015 and dropped to its long-term average in 2016. Albacore and bigeye tuna CPUE was substantially lower compared to yellowfin tuna and have shown no clear trend in recent years. CPUE of the offshore handline fishery has been steady for the past nine years, with bigeye catch rates six times higher than that of yellowfin (1,774 and 294 lbs per trip, respectively) in 2016.

Fish Size. The average weight for all species of the deep-set longline fishery in 2016 was close to their respective long-term weights. Bigeye tuna caught in the deep-set fishery was 84 lbs in 206, 2% greater than the long-term average. Yellowfin tuna average weight in the deep-set fishery was 73 lbs, slightly below the long-term average. 2016 saw record high mean weights for albacore, spearfish and moonfish and record low weights for bigeye tuna, ono, and pomfret by the shallow-set longline fishery in 2016. The shallow-set average weight of swordfish in 2016 was 179 lbs or 8% lower than the long-term average. In general, the average weight of fish caught by the shallow-set longline fishery is higher than fish caught by the deep-set longline fishery. The average weight for most species caught by the troll and handline fisheries were close to their long-term average in 2016 except for bigeye tuna, blue marlin and mahimahi which were at or below previous record lows.

Revenue. The total revenue from Hawaii's pelagic fisheries was $112.8 million in 2016, an increase of 4% from the previous year. The deep-set longline fishery reached a record high $99.1 million in 2016. This fishery represented 88% of the total revenue for pelagic fish in Hawaii. The shallow-set longline fishery decreased to $2.5 million and accounted for 2% of the revenue. The MHI troll revenue was $7.5 million or 7% of the total in 2016 and was followed by the MHI handline fishery at $2.4 million (2%). The offshore handline fishery was worth $1.1 million in 2016. The trend for revenue from the deep-set longline, MHI troll and MHI handline fisheries was increasing while revenue of the shallow-set longline fishery was decreasing. There was substantial variation for revenue from the offshore handline fishery.

Protected Species Interactions. Protected species interactions are monitored in the Hawai`i-based longline fishery with a mandatory observer coverage at 100% for the shallow-set vessels and a minimum of 20% for the deep-set vessels. Both and the deep- and shallow-set fisheries are required to adhere to a suite of conservation measures aimed at reducing seabird, sea turtle and marine mammal interactions.

In 2016, there were 778 sets and 849,681 hooks observed in the shallow-set fishery. Since the most recent Biological Opinion for the shallow-set fishery in 2012 through the end of 2016, the fishery has not exceeded the two-year Incidental Take Statement (ITS) for any turtle species or for the humpback whale. Interactions of ESA-listed species remained under the Incidental Take Statements (ITS). The shallow-set fishery had an observed interaction with a Guadalupe fur seal in 2016, which was previously not known to interact with the fishery. Marine mammal interactions remain low in this fishery, with the level of mortality and serious injury well below the corresponding potential biological removal (PBR) determined in the marine mammal Stock Assessment Reports (SARs). Seabird interactions have remained relatively stable over time in this fishery, with a possible marginal increase in black-footed albatrosses after 2008.

Because the deep-set longline fishery operates under a 20% observer coverage requirement, an extrapolation is used to estimate total takes in the fishery. In 2016, there were 3,880 sets and 9,872,439 hooks observed in the deep-set fishery at 20.1% annual observer coverage. The ITSs for loggerhead and green turtles were exceeded during the fourth quarter of 2015 and the ITS for olive ridley turtle was exceed during the first quarter of 2016. Re-consultation for these species has been completed. No other ITSs were exceeded during 2016. Marine mammal interactions are generally rare in this fishery, with the level of mortality and serious injury for species other than false killer whales being well below the corresponding potential biological removal (PBR) determined in the marine mammal Stock Assessment Reports (SARs). The False Killer Whale Take Reduction Plan is currently in effect due to the M&SI for this species exceeding PBR. Interactions with black-footed albatrosses were substantially higher in 2015 and 2016 compared to previous years. Recent analysis of albatross interactions in the deep-set fishery suggest that the higher interactions observed in this fishery may be related to oceanographic factors.

CLIMATE CHANGE AND OCEAN INDICATORS

In an effort to improve ecosystem-based fishery management, the Council is utilizing a conceptual model that allows for the application of data from specific climate change indicators that may affect marine systems and ultimately the productivity or catchability of managed stocks. While the indicators that the Council monitors may change as the Council continues to improve ecosystem-based management, those described in this 2016 report provide a list of climate and oceanic indicators to track:

- Atmospheric Concentration of Carbon Dioxide
- Oceanic pH (at Station ALOHA)
- Oceanic Niño Index (ONI)
- Pacific Decadal Oscillation (PDO)
- Tropical Cyclones
- Sea Surface Temperature
- Ocean Color (Chlorophyll-a concentration)
- Oligotrophic Area (North Pacific)
- North Pacific Subtropical Front/Transition Zone Chlorophyll Front
- Fish Community Size Structure
- Bigeye Weight-Per-Unit-Effort
- Bigeye Recruitment Index

Section 3.3 provides a description of each of these indicators, a 2016 snapshot of the current conditions, and a rationale for how these data may progress ecosystem-based fishery management. Please see Chapter 4 to provide information on the analyses of chosen indicators of and fishery data within the context of related decision-making.

ESSENTIAL FISH HABITAT

NS2 requires that the Council review and revise EFH provisions periodically and report on this review as part of the annual SAFE report, with a complete review conducted as recommended by the Secretary at least once every five years. The pelagics biological components of the EFH section in the pelagic FEP are scheduled for review beginning in July of 2018, though ongoing Council actions may affect this schedule. The non-fishing impacts and cumulative impacts components were reviewed in 2016 through 2017.

MARINE PLANNING

The Council recently approved a new FEP objective to “consider the implications of spatial management arrangements in Council decision-making”. To monitor implementation of this objective, this 2016 SAFE report includes the Council’s spatially-based fishing restrictions or marine managed areas, the goals associated with those, and the most recent evaluation.

In addition, to meet EFH and National Environmental Policy Act (NEPA) mandates, this SAFE report tracks activities that occur in the ocean that are of interest to the Council and incidents that may contribute to cumulative impact. This includes monitoring fishing and non-fishing activities and facilities, including aquaculture facilities, alternative energy facilities, and military training and testing activities. Information on these activities is provided in Section 3.5.

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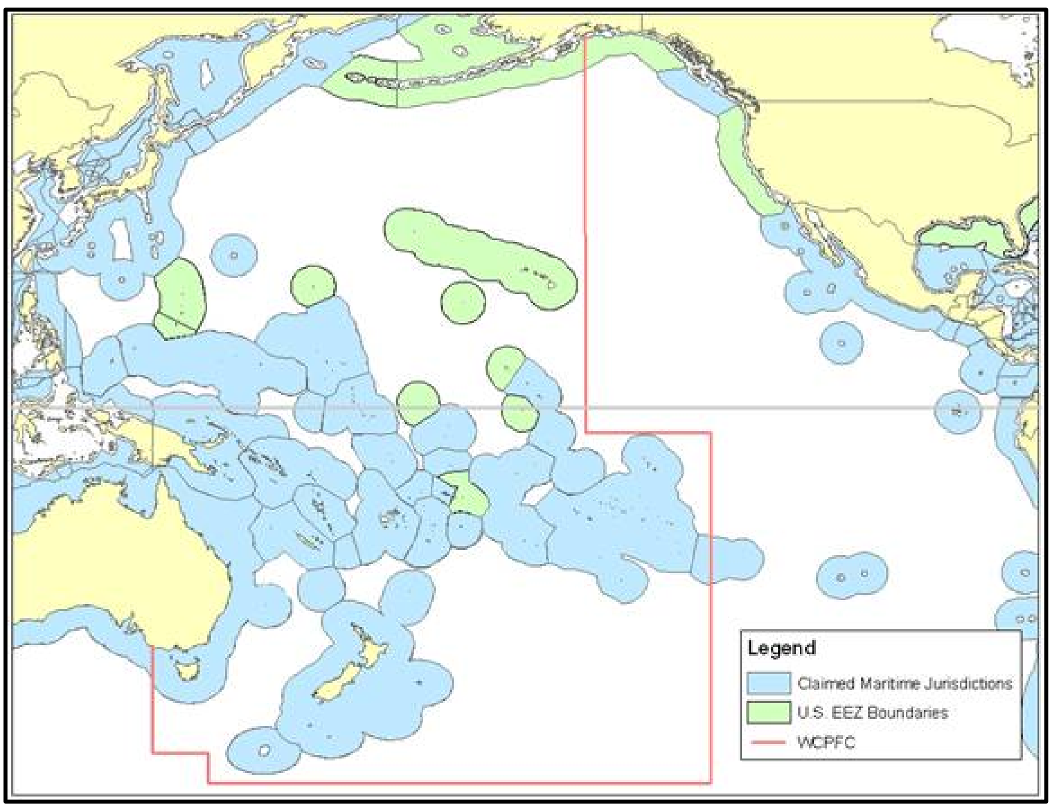
1 INTRODUCTION

The Fishery Management Plan (FMP) for Pelagic Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) on 23 March 1987. The Western Pacific Regional Fishery Management Council (WPRFMC or Council) developed the FMP to manage the pelagic resources that are covered by the Magnuson Fishery Conservation and Management Act of 1976 (MSA) and that occur in the U.S. Exclusive Economic Zone (EEZ) around American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, Hawai`i, and the U.S. possessions in the Western Pacific Region (Johnston Atoll, Kingman Reef and Palmyra, Jarvis, Howland, Baker, Midway, and Wake Islands). In 2010, the Council and NMFS implemented the Fishery Ecosystem Plan (FEP) for the Pacific Pelagic Fisheries that manages the fisheries while integrating vital ecosystem elements important to decision-making, including social, cultural, and economic dimensions, protected species, habitat considerations, climate change effects, and the implications to fisheries from various spatial uses of the marine environment.

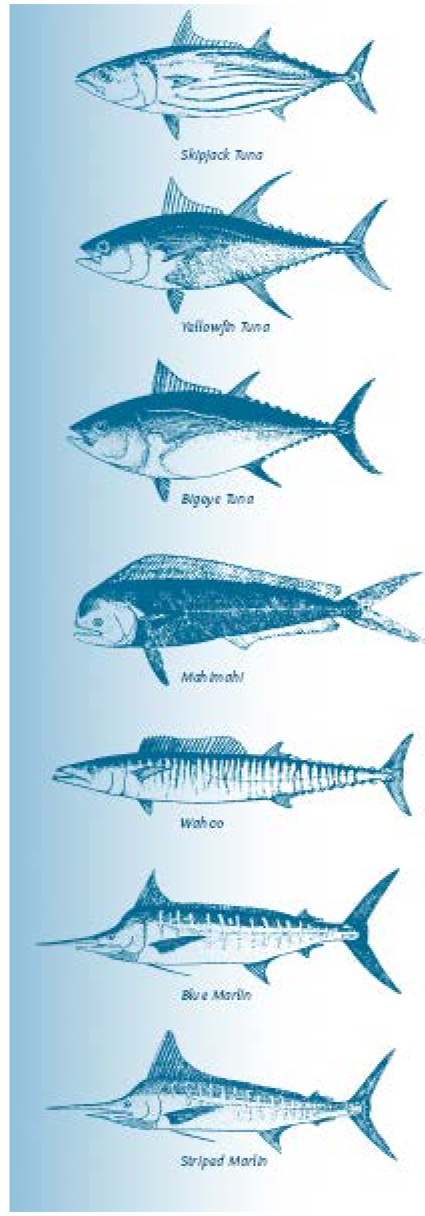
For more information regarding the plan's objectives, past amendments, and other information, refer to the Pelagic FEP found on Council website and regulations at 50 CFR 665.

Figure 1. Map of the Western Pacific Region



1.1 BACKGROUND TO THE SAFE REPORT

Following the Pelagic FEP requirements, the Council has been generating annual reports that assist the Council and NMFS in assessing the status of the stocks, fisheries, and effectiveness of the management regime. In July 2013, NMFS issued a final rule (78 FR 43066) that revised National Standard 2 (NS2) guidelines to manage fisheries using of the best scientific available information and clarify the content and purpose of the Stock Assessment and Fishery Evaluation (SAFE) Report. In 2015, the Council, in partnership with NMFS Pacific Islands Fisheries Science Center (PIFSC), local fishery resource management agencies, and the NMFS Pacific Islands Regional Office (PIRO), agreed to revise and expand the contents of future annual reports to include the range of ecosystem elements described above. This year marks the second iteration of the SAFE report that combines the requirements of reporting for the FEP with those required under NS2 guidelines.



1.2 PELAGIC MUS LIST

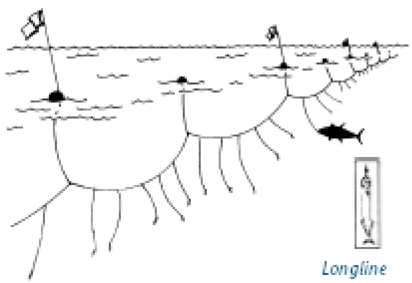
The Management Unit Species (MUS) managed under the Pelagic FEP in 2016 include large pelagic species such as tunas (tribe Thunnini), billfishes (Istiophoridae and Xiphiidae), and other harvested species with distribution straddling domestic and international waters. The MUS excludes some scombrids found predominantly near land, such as little bonitos (tribe Sardini, e.g., dogtooth tuna *Gymnosarda unicolor*). Although they are sometimes caught by the FEP-managed fisheries and reported herein, the MUS also excludes all jacks (Carangidae, e.g., rainbow runner *Elagatis bipinnulata*), all barracudas (Sphyraenidae) and all sharks except the following nine species: pelagic thresher shark (*Alopias pelagicus*), bigeye thresher shark (*Alopias superciliosus*), common thresher shark (*Alopias vulpinus*), silky shark (*Carcharhinus falciformis*), oceanic whitetip shark, (*Carcharhinus longimanus*), blue shark (*Prionace glauca*), shortfin mako shark (*Isurus oxyrinchus*), longfin mako shark (*Isurus paucus*), salmon shark (*Lamna ditropis*), and squid (family cephalopods) except those listed in Table 1. Although caught frequently, most shark MUS are discarded now that finning is illegal.

Table 1. Names of Pacific Pelagic Management Unit Species

English Common Name	Scientific Name	Samoan or AS local	Hawaiian or HI local	Chamorroan or Guam local	S. Carolinian or CNMI local	N. Carolinian or CNMI local
Mahimahi (dolphinfishes)	*Coryphaena* spp.	Masimasi	Mahimahi	Botague	Sopor	Habwur
Wahoo	*Acanthocybium solandri*	Paala	Ono	Toson	Ngaal	Ngaal
Indo-Pacific blue marlin Black marlin	*Makaira mazara:* *M. indica*	Sa'ula	A'u, Kajiki	Batto'	Taghalaar	Taghalaar
Striped marlin	*Tetrapturus audax*		Nairagi			
Shortbill spearfish	*T. angustirostris*	Sa'ula	Hebi	Spearfish		
Swordfish	*Xiphias gladius*	Sa'ula malie	A'u kū, Broadbill, Shutome	Swordfish	Taghalaar	Taghalaar
Sailfish	*Istiophorus platypterus*	Sa'ula	A'u lepe	Guihan layak	Taghalaar	Taghalaar
Pelagic thresher shark Bigeye thresher shark Common thresher shark Silky shark Oceanic whitetip shark Blue shark Shortfin mako shark Longfin mako shark Salmon shark	*Alopias pelagicus* *Alopias superciliosus* *Alopias vulpinus* *Carcharhinus falciformis* *Carcharhinus longimanus* *Prionace glauca* *Isurus oxyrinchus* *Isurus paucus* *Lamna ditropis*	Malie	Mano	Halu'u	Paaw	Paaw
Albacore	*Thunnus alalunga*	Apakoa	'Ahi palaha, Tombo	Albacore	Angaraap	Hangaraap
Bigeye tuna	*T. obesus*	Asiasi, To'uo	'Ahi po'onui, Mabachi	Bigeye tuna	Toghu, Sangir	Toghu, Sangir
Yellowfin tuna	*T. albacares*	Asiasi, To'uo	'Ahi shibi	'Ahi, Shibi	Yellowfin tuna	Toghu
Northern bluefin tuna	*T. thynnus*		Maguro			
Skipjack tuna	*Katsuwonus pelamis*	Atu, Faolua, Ga'oga	Aku	Bunita	Angaraap	Hangaraap
Kawakawa	*Euthynnus affinis*	Atualo, Kavalau	Kawakawa	Kawakawa	Asilay	Hailuway
Moonfish	*Lampris* spp	Koko	Opah		Ligehrigher	Ligehrigher
Oilfish family	Gempylidae	Palu talatala	Walu, Escolar		Tekiniipek	Tekiniipek
Pomfret	family Bramidae	Manifi moana	Monchong			
Other tuna relatives	*Auxis* spp, *Scomber* spp; *Allothunus* spp	(various)	Ke'o ke'o, saba (various)	(various)	(various)	(various)
Neon flying squid	Ommastrephes Bartamii		Squid, ika			
Diamondback squid	Thysanoteuthis rhombus		Squid, ika			
Purple flying squid	Sthenoteuthis oualaniensis		Squid, ika			

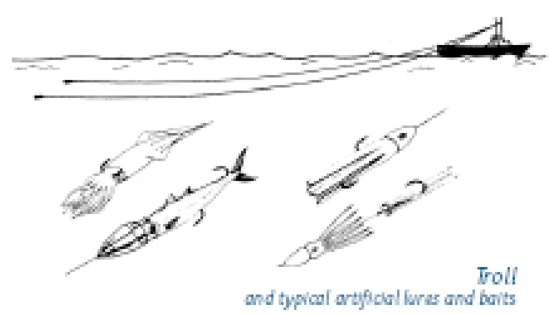
1.3 BRIEF LIST OF PELAGIC FISHERIES/GEAR TYPES MANAGED UNDER THE FEP

U.S. pelagic fisheries in the Western Pacific Region are, with the exception of purse seining, primarily variations of hook-and-line fishing. These include longlining, trolling, handlining, and pole-and-line fishing. The U.S. purse-seine fishery is managed under an international convention and is therefore not discussed in this report. In addition, while the U.S. fleet of albacore trollers, based at West Coast ports, occasionally operates in the Western Pacific, this fishery is not directly managed by the Western Pacific Fishery Management Council, and is also not described in this report.



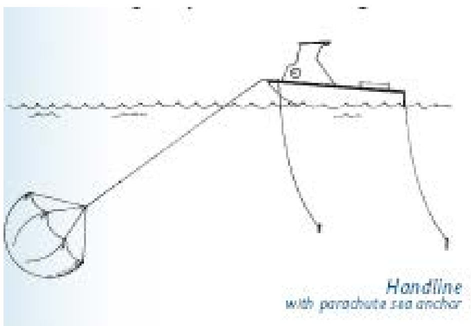
U.S. longline vessels in the Western Pacific Region are based primarily in Hawai`i and American Samoa, although Hawai`i-based vessels targeting swordfish and bigeye tuna have also fished seasonally out of California. The Hawai`i fishery, with 142 vessels, targets a range of species, with vessels setting shallow longlines to catch swordfish or fishing deep to maximize catches of bigeye tuna. Catches by the Hawai`i fleet also include yellowfin tuna, mahimahi, wahoo, blue and striped marlins, opah (moonfish) and monchong (pomfret). The Hawai`i fishery does not freeze its catch, which is sold to the fresh fish and sashimi markets in Hawai`i, Japan, and the U.S. mainland. The total catch in 2016 for the Hawai`i-based fleet was 37 million lbs, with 85% caught by the deep-set fishery.

The American Samoa fleet with 20 active vessels in 2016, down from a peak of 70 in 2001, fishes almost exclusively for albacore, which is landed to two tuna canneries in American Samoa. The estimated pelagic fishery landings in 2016 amounted to 4.3 million lbs. Pelagic landings consisted primarily of four tuna species: albacore, yellowfin, bigeye, and skipjack. The pelagic species wahoo, blue marlin, and mahimahi comprised most of the non-tuna landings.



Trolling and, to lesser extent, handline fishing for pelagics is the largest commercial fishery in terms of participation, although it catches annually a relatively modest volume of fish amounting to about 6.0 million lbs in 2015, with approximately 50% of the landings from the Hawai`i troll fishery. Part of this catch is made by charter or for-hire fishing vessels. In 2016, there were 949 troll licenses and 423 handline fishers in Hawai`i, 408 troll vessels in Guam, 63 fishermen reporting commercial pelagic landings in CNMI and 12 troll vessels in American Samoa. Troll and handline catches are dominated by yellowfin tuna in Hawai`i, by skipjack tuna in Guam, and skipjack and yellowfin tuna in American Samoa. Other commonly caught troll catches include mahimahi, wahoo, and blue marlin. About 80 percent of the troll and handline landings are made by Hawai`i vessels.

Troll fishing for pelagics is the commonest recreational fishery in the islands of the Western Pacific Region. The definition of recreational fishing, however, continues to be problematic in a region where many fishermen who are fishing primarily for recreation may sell their fish to cover their expenses. Hawaii's 2015 boat-based recreational fishery landings amounted to almost 16 million lbs, based on surveys of fishermen, with skipjack tuna are the most commonly recreationally caught pelagic fish by number, and yellowfin tuna dominating the catch in terms of weight. Recreational or non-commercial landings from boats in Guam were estimated at 712,351 lbs in 2015, with mahimahi, blue marlin and skipjack the principal species caught. Recreational landings in CNMI were estimated at 4,922 lbs. Recreational landings from boats in American Samoa were about 663 lbs in 2015.



In 2014, tuna fisheries in the Western Pacific Ocean as a whole catch about 2.9 million mt of fish, with U.S. fisheries in the Western Pacific Region catching about 8.6% (248,115 mt) of the total. Most of the catch is taken by fleets of high seas longliners and purse seiners from countries such as Japan, Taiwan, Korea. Small scale artisanal longlining is also conducted in Pacific Island countries like Samoa and in South America, where there are thousands of small scale longline vessels fishing in coastal waters.

Fishing has been a way of life for millennia across the Pacific Island Region. Each of the archipelagos within this region have a rich and fascinating history, where fishing maintains a critical part in the cultural identity and health of the people. Today, fishing is both a modern enterprise, sustaining an important industry and providing fresh seafood to all of the region's inhabitants, as well as an important pastime that maintains connections to the environment around us.

1.3.1 AMERICAN SAMOA

The islands of American Samoa are an area of modest productivity relative to areas to the north and west. The region is traversed by two main currents: the southern branch of the westward-flowing South Equatorial Current during June - October and the eastward-flowing South Equatorial Counter Current during November - April. Surface temperatures vary between 27°-29° C and are highest in the January - April period. The upper limit of the thermocline in ocean areas is relatively shallow (27° C isotherm at 100 m (approx. 328 ft) depth) but the thermocline itself is diffuse (lower boundary at 300 m (approx. 984 ft) depth).

1.3.1.1 TRADITIONAL AND HISTORICAL PELAGIC FISHERIES

The pelagic fishery in American Samoa is and has been an important component of the American Samoan domestic economy. American Samoan dependence on fishing undoubtedly goes back as far as the peopled history of the islands of the Samoan archipelago, about 3,500 years ago. 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 upon the culture of fishing. Centered around an extended family (`aiga) and allegiance to a hierarchy of chiefs (matai), this system is rooted in the economics and politics of communally-held village land. It has effectively resisted Euro-American colonial influence and has contributed to a contemporary cultural resiliency unique in the Pacific islands region.

American Samoa is a landing and canning port for the U.S. Purse seine fishery for skipjack and yellowfin tuna, with the largest catch of all U.S. pelagic fisheries in the region. The U.S. longline fishery for South Pacific albacore conducted primarily in the American Samoa EEZ comprises the second-largest of the U.S. longline fisheries in the FEP (after Hawai`i). The ecosystem based fishery management approach to regulation under the MSA has focused on the socioeconomics of allocating catch and access to EEZ areas by fleet sectors, and creating domestic regulations to monitor and mitigate longline fishery impacts to sea turtles and other protected species. American Samoa is a participating U.S. territory in the Western and Central Pacific Fisheries Commission (WCPFC) which status exempts it from certain WCPFC measures so as not to restrict responsible fishery development. The WCPFC establishes conservation and management measures that NMFS implements under its authorities, including the MSA.

Prior to 1995, the pelagic fishery was largely a troll fishery. Horizontal longlining was introduced to the Territory by Western Samoan fishermen in 1995. Local fishers have found longlining worthwhile as they land more lbs with less effort and use less gasoline for trips. Initially the vessels used in longlining were "alias," locally built, twin-hulled (wood with fiberglass or aluminum) vessels about 30 ft long, powered by 40HP gasoline outboard engines. Larger monohull vessels capable of longer multi-day trips began joining the longline fleet soon after the alias. The number of alias participating in the fishery decreased to below three by 1995 and due to confidentiality requirements cannot be directly reported. Landings from these vessels are added to the total landings. The number of commercial troll vessels has also declined.

Vessels longer than 50 ft are restricted from fishing within 50 nautical miles of Tutuila, Manu‘a, Swains Island and Rose Atoll (see Marine Planning Section for details). Albacore is the primary species caught longlining, with the bulk of the longline catch sold to the Pago Pago canneries. Remaining catch is sold to stores, restaurants and local residents or donated for customary trade or traditional functions. Pago Pago Harbor on the island of Tutuila is a regional base for the trans-shipment and processing of tuna taken by domestic fleets from other South Pacific nations, the distant-waters longline fleets, and purse seine fleets. Purse seine vessels land skipjack, yellowfin and other tunas, with little albacore.

1.3.1.2 CURRENT PELAGIC FISHERIES

Small-scale longline: This fishery is almost defunct with only two vessels still operating. Most participants in the small-scale domestic longline fishery were indigenous American Samoans with vessels under 50 ft in length, most of which are alia boats under 40 ft in length. The stimulus for American Samoa's commercial fishermen to shift from troll or handline gear to longline gear in the mid-1990s was the fishing success of 28-foot alia catamarans that engaged in longline fishing in the EEZ around Independent Samoa. Following this example, the fishermen in American Samoa deployed a short monofilament longline, with an average of 350 hooks per set, from a hand-powered reel (WPRFMC, 2000). An estimated 90 percent of the crews working in the American Samoa small-scale alia longline fleet were from Independent Samoa. Like the conventional monohull longline fishery (see below) the predominant catch from the small-scale fishery is albacore, which is marketed to the local tuna canneries.

Large-scale longline: American Samoa's domestic longline fishery expanded rapidly in 2001. Much of the recent (and anticipated future) growth is due to the entry of monohull vessels larger than 50 ft in length. The number of permitted longline vessels in this sector increased from seven in 2000 to 38 by 2003. Of these, five permits for vessels between 50.1 ft - 70 ft and five permits for vessels larger than 70 ft were believed to be held by indigenous American Samoans as of March 21, 2002. Economic barriers have prevented more substantial indigenous participation in the large-scale sector of the longline fishery. The lack of capital appears to be the primary constraint to substantial indigenous participation in this sector. In 2016, there were 20 active longline vessels.

While the smallest (less than or equal to 40 ft) vessels average 350 hooks per set, vessels over 50 ft can set 5-6 times more hooks and has a greater fishing range and capacity for storing fish (8-40 mt as compared to 0.5-2 mt on a small-scale vessel). Larger vessels are also outfitted with hydraulically-powered reels to set and haul mainline, and modern electronic equipment for navigation, communications and fish finding. Most are presently being operated to freeze albacore onboard, rather than to land chilled fish.

Troll and handline fishery: From October 1985 to the present, catch and effort data in American Samoa fisheries have been collected through a creel survey that includes subsistence and recreational fishing, as well as commercial fishing. However, differentiating commercial troll fishing activity from non-commercial activity can be difficult.

Recreational fishing: Recreational fishing underwent a renaissance in American Samoa with the establishment of the Pago Pago Game Fishing Association (PPGFA), founded in 2003 by a group of recreational anglers. 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 over the past 15 years, including the Steinlager I'a Lapo'a Game Fishing Tournament (a qualifying event for the International Game Fish Association's Offshore World Championship in Cabo San Lucas, Mexico). The recreational vessels use anchored FADs extensively, and on tournaments venture to the various outer banks which include the South Bank (35 miles), North East Bank (40 miles northeast), South East bank (37 miles southeast), 2% bank (40 miles), and East Bank (24 miles east).

There was no full-time regular charter fishery in American Samoa similar to those in Hawai`i or Guam. However, Pago Pago Marine Charters now operates a full-time charter fishery.

Estimates of the volume and value of recreational fishing in American Samoa are not precise. A volume approximation of boat based recreational fishing is generated in this annual report based on the annual sampling of catches, conducted by the American Samoa Department of Marine & Wildlife Resources (DMWR) and provided to WPacFIN. While boat-based recreational catches were as high as 46,462 lbs and averaged about 14,000 lbs in the last ten years, the 2016 recreational catch was 1,208 lbs.

While no permits have been issued to date, non-commercial fishing and recreational charter fishing is permitted within the Rose Atoll Marine National Monument. These permits are available only to a community resident of American Samoa or a charter business established legally under the laws of American Samoa.

1.3.2 GUAM

Generally, the major surface current affecting Guam is the North Equatorial Current, which flows westward through the islands. Sea surface temperatures off Guam vary between 80.9° – 84.9° Fahrenheit, depending on the season. The mixed layer extends to depths between 300 and 400 ft.

1.3.2.1 TRADITIONAL AND HISTORICAL PELAGIC FISHERIES

Fishing in Guam continues to be important not only in terms of contributing to the subsistence needs of the Chamorro people but also in terms of preserving their history and identity. Fishing assists in perpetuating traditional knowledge of marine resources and maritime heritage of the Chamorro culture.

1.3.2.2 CURRENT PELAGIC FISHERIES

Pelagic fishing vessels based on Guam are classified into two general groups: distant-water purse seiners and longliners that fish outside Guam's EEZ and transship through the island; and small, primarily recreational, trolling boats that are either towed to boat launch sites or berthed in marinas and fish only within local waters, either within Guam's EEZ or on some occasions in the adjacent EEZ of the Northern Mariana Islands. This annual report covers primarily the local, Guam-based, small-boat pelagic fishery.

Landings consisted primarily of five major species: mahimahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), and Pacific blue marlin (*Makaira mazara*). Other minor pelagic species caught include rainbow runner (*Elagatis bipinnulatus*), great barracuda (*Sphyraena barracuda*), kawakawa (*Euthynnus affinis*), dogtooth tuna (*Gymnosarda unicolor*), double-lined mackerel *(Grammatorcynus bilineatus*), oilfish (*Ruvettus pretiosus*), and three less common species of barracuda.

The number of boats involved in Guam's pelagic or open ocean fishery gradually increased from about 200 vessels in 1982. There were 408 boats active in Guam's domestic pelagic fishery in 2016. A majority of the fishing boats are less than 10 m (33 ft) in length and are usually owner-operated by fishermen who earn a living outside of fishing. Most fishermen sell a portion of their catch and it is difficult to make a distinction between recreational, subsistence, and commercial fishers. A small, but significant, segment of Guam's pelagic fishery is made up of marina-berthed charter boats that are operated primarily by full-time captains and crews.

1.3.3 HAWAI`I

The archipelago's position in the Pacific Ocean lies within the clockwise rotating North Pacific Subtropical Gyre, extending from the northern portion of the North Equatorial Current into the region south of the Subtropical High, where the water moves eastward in the North Pacific Current. At the pass between the Main Hawaiian Islands (MHI) and the Northwestern Hawaiian Islands (NWHI) there is often a westward flow from the region of Kauai along the lee side of the lower NWHI. This flow, the North Hawaiian Ridge Current, is extremely variable and can also be absent at times. The analysis of 10 years of shipboard acoustic Doppler current profiler data collected by the NOAA Ship Townsend Cromwell shows mean flow through the ridge between Oahu and Nihoa, and extending to a depth of 200 m.

Embedded in the mean east-to-west flow are an abundance of mesoscale eddies created from a mixture of wind, current, and sea floor interactions. The eddies, which can rotate either clockwise or counter clockwise, have important biological impacts. For example, eddies create vertical fluxes, with regions of divergence (upwelling) where the thermocline shoals and deep nutrients are pumped into surface waters enhancing phytoplankton production, and also regions of convergence (downwelling) where the thermocline deepens. Sea surface temperatures around the Hawaiian Archipelago experience seasonal variability, but generally vary between 18°-28° C (64°-82° F) with the colder waters occurring more often in the NWHI.

A significant source of inter-annual physical and biological variation around Hawai`i are El Niño and La Niña events. During an El Niño, the normal easterly trade winds weaken, resulting in a weakening of the westward equatorial surface current and a deepening of the thermocline in the central and eastern equatorial Pacific. Water in the central and eastern equatorial Pacific becomes warmer and more vertically stratified with a substantial drop in surface chlorophyll.

Physical and biological oceanographic changes have also been observed on decadal time scales. These low frequency changes, termed regime shifts, can impact the entire ocean ecosystem. Recent regime shifts in the North Pacific have occurred in 1976 and 1989, with both physical and biological (including fishery) impacts. In the late 1980's an ecosystem shift from high carrying capacity to low carrying capacity occurred in the NWHI. The shift was associated with the weakening of the Aleutian Low Pressure System (North Pacific) and the Subtropical Counter Current. The ecosystem effects of this shift were observed in lower nutrient and productivity levels and decreased abundance of numerous species in the NWHI including the spiny lobster, the Hawaiian monk seal, various reef fish, the red-footed booby, and the red-tailed tropic bird.

1.3.3.1 TRADITIONAL AND HISTORICAL PELAGIC FISHERIES

In old Hawai`i, fishing in nearshore waters (from the shoreline to the edges of the reefs and where there happens to be no reef, to a distance of mile from the beach) was regulated by the chiefs and closed seasons were determined by the life history of specific organisms. Areas known as nurseries were not used for fishing. This understanding of natural forces has been captured in the Hawaiian moon calendar, which incorporates the tides and seasons to explain the cycles of scarcity and abundance and provide guidance on what activities should occur at what times of the year. Deep sea fishing (beyond the reefs) was available and open to everyone and conducted based on annual/seasonal weather conditions. Those who fished in the deep ocean sought out these fishing grounds and kept them secret (Kahaulelio 2006). Fish caught in the deep sea included skipjack (aku), dolphinfish (mahimahi), billfish (a‘u), tuna (ahi) and other pelagic species.

1.3.3.2 CURRENT PELAGIC FISHERIES

Hawaii's pelagic fisheries, which include the longline, Main Hawai`ian Islands (MHI) troll and handline, offshore handline, and the aku boat (pole and line) fisheries, are the state's largest and most valuable fishery sector. The target species are tunas and billfish, but a variety of other species are also important. Collectively, these pelagic fisheries made approximately 37.1 million lbs of commercial landings with a total ex-vessel value of $112.8 million in 2016. The deep-set longline fishery was the largest of all commercial pelagic fisheries in Hawai`i and represented 85% of the total commercial pelagic catch and 88% of the ex-vessel revenue. The MHI troll was the second largest fishery in Hawai`i and accounted for 7% of the catch and revenue, respectively. The shallow-set longline, MHI handline, aku boat, offshore handline fisheries and other gear types made up the remainder.

The largest component of the pelagic catch was tunas, which comprised 68% of the total in 2016. Bigeye tuna alone accounted for 75% of the tunas and 50% of all pelagic catch. Billfish catch made up 15% of the total catch in 2016. Swordfish was the largest of these, at 42% of the billfish and 7% of the total catch. Catches of other PMUS represented 17% of the total catch in 2016 with moonfish being the largest component at 34% of the other PMUS and 6% of the total catch.

The Hawai`i longline fishery is by far the most important economically, accounting in 2016 for about 90% percent of the estimated ex-vessel value of the total commercial fish landings in the state. In 2013, it is estimated that the commercial seafood industry in Hawai`i generated sales impacts of $855 million and income impacts of $262 million while supporting approximately 11,000 full and part time jobs in the State of Hawai`i. The commercial harvest sector generated 3,800 jobs, $196 million in sales, $71 million in income, and $102 million in value added impacts (NMFS 2012[3]).

Recreational fisheries are also extremely important in the State of Hawai`i economically, socially, and culturally. The total estimated pelagic recreational fisheries production in 2016 was 6.6 million lbs. The number of small vessels in Hawai`i has declined to approximately 11,000 since a peak of over 16,000 vessels in 2008. Boat-based anglers took 231,551 fishing trips in 2016, with only 7,670 designated charter vessel trips. Although unsold or not entering the typical commercial channels for fish sales, the total estimated value of the recreational catch was approximately $20 million, based on an average of $3.00/lb from catch and value information provided by WPacFIN (https://www.pifsc.noaa.gov/wpacfin/hi/Data/Landings_Charts/hr3b.htm).

1.3.4 COMMONWEALTH OF THE NORTHERN MARIANAS ISLANDS

Generally, the major surface current affecting CNMI is the North Equatorial Current, which flows westward through the islands, however the Subtropical Counter Current affects the Northern Islands and generally flows in an easterly direction. Depending on the season, sea surface temperatures near the Northern Mariana Islands vary between 80.9° – 84.9° Fahrenheit. The mixed layer extends to between depths of 300-400 ft.

1.3.4.1 TRADITIONAL AND HISTORICAL PELAGIC FISHERIES

Fishery resources have played a central role in shaping the social, cultural and economic fabric of the CNMI. The aboriginal peoples indigenous to these islands relied on seafood as their principal source of protein and developed exceptional fishing skills. Later immigrants to the islands from East and Southeast Asia also possessed a strong fishing tradition. Under the MSA, the CNMI is defined as a fishing community.

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3 National Marine Fisheries Service. 2014. Fisheries Economics of the United States, 2012. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-137, 175p.

1.3.4.2 CURRENT PELAGIC FISHERIES

The CNMI’s pelagic fisheries occur primarily from the island of Farallon de Medinilla south to the island of Rota. Trolling is the primary fishing method utilized in the pelagic fishery. The pelagic fishing fleet consists primarily of vessels less than 24 foot in length, which usually have a limited 20-mile travel radius from Saipan.

The primary target and most marketable species for the pelagic fleet is skipjack tuna (62% of 2016 commercial landings). Schools of skipjack tuna have historically been common in near shore waters, providing an opportunity to catch numerous fish with a minimum of travel time and fuel costs. Skipjack is readily consumed by the local populace and restaurants, primarily as sashimi. Yellowfin tuna and mahimahi are also easily marketable species but are seasonal. During their seasonal runs, these fish are usually found close to shore and provide easy targets for the local fishermen.

Yellowfin tuna and mahimahi are also easily marketable species but are seasonal. During their runs, these fish are usually found close to shore and provide easy targets for the local fishermen. In addition to the economic advantages of being near shore and their relative ease of capture, these species are widely accepted by all ethnic groups which has kept market demand fairly high.

In late 2007, Crystal Seas became the first established longline fishing company in the CNMI to begin its operation out of the island of Rota. However, by 2009 Crystal Seas had become Pacific Seafood and relocated its operation to Saipan. In 2011, there were four licensed longline fishing vessels stationed in the CNMI. But these vessels did not do well, and found it very difficult to market their catch. By 2014, there were no active longliners in the CNMI, although a few of the original vessels were experimenting (unsuccessfully) with other types of fishing.

1.3.5 PACIFIC REMOTE ISLAND AREAS

Baker Island lies within the westward flowing South Equatorial Current. Baker Island also experiences an eastward flowing Equatorial Undercurrent that causes upwelling of nutrient and plankton rich waters on the west side of the island (Brainard *et. al* 2005). Sea surface temperatures of pelagic EEZ waters around Baker Island are often near 30° C. Although the depth of the mixed layer in the pelagic waters around Baker Island is seasonally variable, average mixed layer depth is around 100 m.

Howland Island lies within the margins of the eastward flowing North Equatorial Counter Current and the margins of the westward flowing South Equatorial Current. Sea surface temperatures of pelagic EEZ waters around Baker Island are often near 30° C. Although the depth of the mixed layer in the pelagic waters around Howland Island is seasonally variable, average mixed layer depth is around 70 m – 90 m.

Jarvis Island lies within the South Equatorial Current which runs in a westerly direction. Sea surface temperatures of pelagic EEZ waters around Jarvis Island are often 28°- 30° C. Although depth of the mixed layer in the pelagic waters around Jarvis Island is seasonally variable, average mixed layer depth is around 80 m.

Palmyra Atoll and Kingman Reef lie in the North Equatorial Counter-current, which flow in a west to east direction. Sea surface temperatures of pelagic EEZ waters around Palmyra Atoll are often 27°- 30° C. Although the depth of the mixed layer in the pelagic waters around Kingman Reef is seasonally variable, average mixed layer depth is around 80 m.

Sea surface temperatures of pelagic EEZ waters around Johnston Atoll are often 27°- 30° C. Although the depth of the mixed layer in the pelagic waters around Johnston Atoll is seasonally variable, average mixed layer depth is around 80 m.

Sea surface temperatures of pelagic EEZ waters around Wake Island are often 27°- 30° C. Although the depth of the mixed layer in the pelagic waters around Wake Atoll is seasonally variable, average mixed layer depth is around 80 m.

1.3.5.1 TRADITIONAL AND HISTORICAL PELAGIC FISHERIES

As many tropical pelagic species (e.g. skipjack tuna) are highly migratory, the fishing fleets targeting them often travel great distances. Although the EEZ waters around Johnston Atoll and Palmyra Atoll are over 750 nm and 1000 nm (respectively) away from Honolulu, the Hawai`i longline fleet does seasonally fish in those areas. For example, the EEZ around Palmyra is visited by Hawai`i-based longline vessels targeting yellowfin tuna, whereas at Johnston Atoll, albacore is often caught in greater numbers than yellowfin or bigyeye tuna. Similarly, the U.S. purse seine fleet also targets pelagic species (primarily skipjack tuna) in the EEZs around some Pacific Remote Island Areas (PRIAs), specifically, the equatorial areas of Howland, Baker, and Jarvis Islands. The combined amount of fish harvested from these areas from the U.S. purse seine on average is less than five percent of their total annual harvest.

1.3.5.2 CURRENT PELAGIC FISHERIES

The U.S. Fish & Wildlife Service (USFWS) prohibits fishing within the Howland Island, Jarvis Island, and Baker Island National Wildlife Refuge (NWR) boundaries. Currently, Jarvis Island, Howland Island and Baker Island are uninhabited. The USFWS manages Johnston Atoll as a National Wildlife Refuge, but does allow some recreational fishing within the Refuge boundary.

1.4 FMP/FEP AMENDMENTS AND NMFS ACTIONS IMPLEMENTED IN 2016

NMFS approved one amendment to the FEP in 2016, and implemented several management actions listed below. The first date listed is the effective date of the action followed by the Federal Register citation. The Federal Register notices for these actions are available from the NMFS Pacific Islands Regional Office website at http://www.fpir.noaa.gov/SFD/SFD_regs_1.html.

- January 29, 2016 (81 FR 5619, February 3, 2016). Final rule. Exemption for Large U.S. Longline Vessels To Fish in Portions of the American Samoa Large Vessel Prohibited Area. In this final rule, NMFS allows large federally permitted U.S. longline vessels to fish in certain areas of the Large Vessel Prohibited Area (LVPA). NMFS will continue to prohibit fishing in the LVPA by large purse seine vessels. The fishing requirements for the Rose Atoll Marine National Monument remain unchanged. The intent of the rule is to improve the viability of the American Samoa longline fishery and achieve optimum yield from the fishery while preventing overfishing, in accordance with National Standard 1.

- May 25, 2016 (81 FR 33147, May 25, 2016). Interim rule. NMFS established a limit for calendar year 2016 on fishing effort by U.S. purse seine vessels in the Effort Limit Area for Purse Seine, or ELAPS, which consists of the portion of the U.S. EEZ and high seas between the latitudes of 20° N. and 20° S. in the area of application of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. The limit is 1,828 fishing days. This action was necessary for the United States to implement provisions of a conservation and management measure adopted by the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WCPFC).

- July 25, 2016 (81 FR 41239, June 24, 2016). NMFS published a final rule with requirements for U.S. purse seine and longline vessels operating in the western and central Pacific Ocean (WCPO). This final rule, first, requires that U.S. purse seine vessels carry observers on fishing trips (effective date: July 25, 2016); second, establishes restrictions in 2016 and 2017 on the use of fish aggregating devices by U.S. purse seine vessels (effective July 1, 2016); and third, establishes limits in 2016 (3,554 mt) and 2017 (3,345 mt) on the amount of bigeye tuna that may be captured by U.S. longline vessels (effective date of the longline bigeye tuna limit: July 1, 2016).

- July 22, 2016 through December 31, 2016 (81 FR 45982, July 15, 2016). Temporary rule; fishery closure. NMFS temporarily closed the U.S. pelagic longline fishery for bigeye tuna in the western and central Pacific Ocean because the fishery had reached the 2016 catch limit. This action was necessary to ensure compliance with NMFS regulations that implement decisions of the WCPFC.
- July 25 through December 31, 2016 (81 FR 46614, July 18). Temporary rule; fishery closure. NMFS temporarily closed the U.S. pelagic longline fishery for bigeye tuna for vessels over 24 meters in overall length in the eastern Pacific Ocean because the 2016 catch limit of 500 metric tons was expected to be reached. This action was necessary to prevent the fishery from exceeding the applicable catch limit established by the Inter-American Tropical Tuna Commission in Resolution C-13-01 (Multiannual Program for the Conservation of Tuna in the Eastern Pacific Ocean During 2014-2016).

- September 2, 2016 through December 31, 2016 (81 FR 58410, August 25, 2016). Temporary rule; fishery closure. NMFS temporarily closed the Effort Limit Area for Purse Seine (ELAPS) to purse seine fishing for the remainder of 2016 because the 2016 ELAPS limit, which was established to implement a decision of the WCPFC, was expected to be reached.

- September 9, 2016 through December 31, 2016 (81 FR 63145, September 14, 2016). Final specifications; 2016 U.S. Territorial Longline Bigeye Tuna Catch Limits. In this final rule, NMFS specified a 2016 limit of 2,000 mt of longline-caught bigeye tuna for each U.S. participating territory (American Samoa, Guam, and the Northern Mariana Islands). NMFS allowed each territory to allocate up to 1,000 mt each year to U.S.

longline fishing vessels in a valid specified fishing agreement. As an accountability measure, NMFS monitored, attributed, and restricted (if necessary), catches of longline-caught bigeye tuna, including catches made under a specified fishing agreement. These catch limits and accountability measures support the long-term sustainability of fishery resources of the U.S. Pacific Islands and fisheries development in the U.S. territories. The deadline to submit a specified fishing agreement pursuant to 50 CFR 665.819(b)(3) for review was October 11, 2016.

- September 16, 2016 (81 FR 64356, September 20, 2016). Notice of a valid specified fishing agreement for the Commonwealth of the Northern Mariana Islands (CNMI). NMFS announced a valid specified fishing agreement that allocated up to 1,000 metric tons of the 2016 bigeye tuna limit for the CNMI to identified U.S. longline fishing vessels. The agreement supported the long-term sustainability of fishery resources of the U.S. Pacific Islands, and fisheries development in the CNMI.

- October 4, 2016 through December 31, 2016 (81 FR 69717, October 7, 2016). NMFS temporarily reopened the U.S. pelagic longline fishery for bigeye tuna for vessels over 24 meters in overall length in the eastern Pacific Ocean (EPO) because part of the 500 metric ton (mt) catch limit remained available after NMFS closed the fishery on July 25, 2016. This action allowed U.S. vessels to access the remainder of the catch limit, which was established by the Inter-American Tropical Tuna Commission (IATTC) in Resolution C–13–01.
- November 21, 2016 (81 FR 85162, November 25, 2016). Notice of a valid specified fishing agreement for Guam. NMFS announced a valid specified fishing agreement that allocated 1,000 mt of the 2016 bigeye tuna limit for the Territory of Guam to U.S. longline fishing vessels. The agreement supported the long-term sustainability of fishery resources of the U.S. Pacific Islands, and fisheries development in Guam. NMFS began attributing to Guam bigeye tuna caught by vessels identified in the agreement, starting on November 24, 2016.

- December 1, 2016 through December 31, 2016 (81 FR 83715, November 22, 2016). Temporary rule; fishery closure. NMFS closed the U.S. pelagic longline fishery for bigeye tuna in the western and central Pacific Ocean because the fishery would reach the 2016 allocation limit for the CNMI. This action was necessary to comply with regulations managing this fish stock. This closure did not apply to any vessel included in a valid agreement with another territory.

1.5 TOTAL PELAGIC LANDINGS IN WPR FOR ALL FISHERIES

A summary of the total pelagic landings during 2016 in the Western Pacific and the percentage change between 2015 and 2016 is shown in Table 2.

Table 2. Total pelagic landings in the Western Pacific Region in 2016

Species	American Samoa		Guam		CNMI		Hawai`i	
	Pounds	% change	Pounds	% change	Pounds	% change	Pounds	% change
Swordfish	14,762	-10.58%	0	0.00%	0	0.00%	2,418,000	-38.79%
Blue marlin	71,432	8.83%	44,237	15.21%	0	0.00%	1,556,000	-15.94%
Striped marlin	3,990	-87.94%	0	0.00%	0	0.00%	892,000	-24.66%
Other billfish*	27,497	72.28%	0	0.00%	0	0.00%	842,000	22.21%
Mahimahi	10,981	-15.96%	174,458	9.13%	79,656	-11.48%	1,216,000	-22.94%
Wahoo	122,257	-36.29%	33,609	6.40%	4,968	14.17%	1,208,000	-1.24%
Opah (moonfish)	4,396	13.49%	0	0.00%	0	0.00%	2,164,000	-23.01%
Sharks (whole wt)	1,690	-21.89%	0	0.00%	0	0.00%	168,000	10.71%
Albacore	3,215,860	-8.11%	0	0.00%	0	0.00%	604,000	-12.42%
Bigeye tuna	218,022	30.71%	0	0.00%	0	0.00%	18,731,000	-6.82%
Bluefin tuna	0	0.00%	0	0.00%	0	0.00%	1,000	100.00%
Skipjack tuna	128,047	-93.20%	437,476	-36.81%	191,108	-50.27%	791,000	8.72%
Yellowfin tuna	514,491	-54.82%	127,520	13.38%	19,609	19.63%	4,954,000	17.88%
Other pelagics**	10,028	83.73%	18,765	68.27%	2,139	100.00%	1,602,000	-16.42%
Total	4,343,453	-14.08%	836,065	-12.74%	307,901	-28.61%	37,146,000	-7.14%

Note: Total Pelagic Landings based on commercial reports or creel surveys; % change based on 2014 landings.

*Other billfish include: black marlin, spearfish, and sailfish

**Other pelagics include: kawakawa, unknown tunas, pelagic fishes (dogtooth tuna, rainbow runner, barracudas), oilfish, and pomfret. Of these, only kawakawa, unknown tunas, oilfish and pomfret are Pelagic MUS. While other tables in Chapter 2 excluded or separated out non-MUS, data could not accurately provide individual landings data for these species presented in this total landings table.

1.6 COUNCIL RECOMMENDATIONS

The following region-wide recommendations were adopted by the 2017 Pelagic Plan Team.

Data Time Series

1. For the 2016 SAFE report, the Pelagic Plan Team should use the entire time series but move to the 10 year fishery data time series for the 2017 report for consistency between fishery chapters.

Essential Fish Habitat

2. The Pelagic Plan Team recommends that Council staff explore a minimum depth for the definition of pelagic EFH that excludes depths seldom occupied by PMUS.

Socio Economics and Human Dimensions

3. The Pelagic Plan Team recommends the incorporation of the following items into the Socio-Economics module of the 2017 SAFE report

- Community Content
- Fishery Participant Descriptions/and or Demographics
- Costs of Fishing
- Economic Performance Metrics
- 2016 publication list

American Samoa Large Vessel Prohibited Area Recommendation

4. The Pelagic Plan Team should investigate commercial versus non-commercial catch in the American Samoa small boat fishery and seek further review and clarification from WPacFIN and DMWR.

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2 DATA MODULES

2.1 AMERICAN SAMOA

2.1.1 DATA SOURCES

This report contains the most recently available information on American Samoa's pelagic fisheries, as compiled from data generated by the Department of Marine and Wildlife Resources (DMWR) through a program established in conjunction with the Western Pacific Fishery Information Network (WPacFIN) and supported in part through funding from the Interjurisdictional Fisheries Act (IFA). Purse seine and non-U.S. vessel landings are not included in this module, but are discussed in general in the international module (Section 2.6).

Prior to 1985, only commercial landings were monitored. From October 1985 to the present, data have been collected through the Tutuila and Manu'a boat-based creel survey to include subsistence, recreational, as well as commercial fishing. Total number of sampling days, interviews, and observed trips are used to estimate annual catch, effort, bycatch, and other fishery metrics in this section. The number of days sampled decreased 11% from 2015 to 2016 (from 219 to 196 days, see Table A-1). However, this was still a more than adequate representation of the fishing year (>53% of days were sampled). The survey sampled approximately 67% of the total estimated trolling trips and interviewed nearly 53% of the fishermen. Surveyors have noted that fishermen may not accurately report the number of fish released at sea, although the troll fishery in American Samoa has never been known to release fish.

In September 1990, a Commercial Purchase System (receipt book) was instituted requiring all businesses that buy fish commercially in American Samoa, with an exception for the canneries, to submit a copy of their purchase receipts to the DMWR. In January 1996, NMFS implemented a federal longline logbook system. All longline fishermen are required to obtain a federal permit and to submit logs containing detailed data on each of their sets and the resulting catch, including the number of hooks set and number of fish released as bycatch. Confidentiality requirements prohibit providing a breakdown of the catch or effort from alia and monohull longline vessels in recent years. Changes to the data collection and analysis methodology have occurred periodically and are described in previous annual reports. No changes to the data collection or analysis were made in 2016, except that the number of vendors participating in the Commercial Purchase System has increased.

Participation (number of boats) is determined through both logbook entries and creel interviews. Effort (number of trips, hooks) is determined by direct reporting for longline trips, but is indirectly calculated for trolling trips, based on total pounds landed (reported), and average hourly catch rate and duration for trip (creel interviews). Since 2009 (the year of the tsunami), only the longline logbook database has been useful in determining the number of active boats. Prior to that, DMWR's boat-based creel survey data were also used to assess whether or not longline vessels were active. This helped include information from alia longline vessels that did not frequent the canneries, and was designed to exclude alias that exclusively conducted bottomfishing and/or trolling.

DMWR implemented a fuel subsidy program during 2015-2017, when DMWR began meeting fishers at a designated time and location for mandatory surveys in order to receive fuel subsidies. This extended the creel survey schedule into the evenings and detracted from the random sampling design at other times of the day. The fuel was dispensed to vessel owners, many of whom rent their vessels to fishermen. The new program caused changed in fishing behavior affecting catch estimated to a certain extent. Generally, more fuel was used and there were longer and more frequent trips, but otherwise, CPUE and species composition were not affected. The increase in the amount of trolling trips, and in trip length, may have affected the relative amount of pelagic species in the catch.

Average weight (pounds) per fish is calculated directly from creel-weighed fish sampled over the year. In the past, cannery fish weight was determined based on a length to weight conversion from cannery sampling data, since longline boats have been landing their catches gilled and gutted since 1999. However, the cannery sampling program was discontinued in 2015, so those average weight data are no longer available.

Because there are no cannery sampling data available for 2016, WPacFIN had to use proxies in order to estimate the weight and value of fish landings for the longline fishery in American Samoa.

For estimated weights, the current summaries are based on the best available average weight data for 2016, which is from DMWR's boat-based creel surveys. It should be noted that the weight of fish from the small boats is somewhat smaller than fish caught on the larger ocean going vessels, contributing to a somewhat lower weight estimate for the fishery during 2016. Over the course of 2016, PIFSC FRMD's International Fisheries Program (IFP) began estimating the average weight of fish kept for the longline fishery from observer data. This alternative source provides trip-level average weights for vessels with observers. These weights will be more representative of the longline fishery, but they will not be available for trips that do not carry observers. The protocol for handling unobserved trips is being developed by IFP, which will provide the data for this report in 2017. At the date of this report, that information is not available. It will be provided in the 2016 RFMO report for US Pacific longline fisheries.

Another item lost with the discontinuation of the (PIRO) longline cannery sampling program in Pago Pago was data on the proportion of longline fish (by species) sold to the cannery, vs. local market and village/take home (given, not sold). While the cannery buys a much higher volume of fish, their prices are low. The lesser amount of fish sold to the markets and local restaurants garners a higher price. Another portion of the catch is given away or taken home. In the absence of a cannery sampling program in 2016, WPacFIN was had to apply a number of estimates. For the top five cannery species (albacore, skipjack, yellowfin and big eye tuna and wahoo) the assumption of 100% sold to the cannery was applied. For other species also previously sampled at the cannery (e.g. mahimahi), for which a large percentage is not sold, proxy values from previous years were applied. The net result of using lower average weights (from boat-based creel) and lower percentages sold to the market (or sold period) is likely to be responsible in part for a decrease in estimated weight and value of the catch sold.

Total landings data cover all fish caught and brought back to shore, whether it enters the commercial market or not. Commercial landings cover the portion of the total landings that was sold both to the canneries and other smaller local business. The difference between total landings and commercial landings is the recreational/subsistence component of the fishery.

This module was prepared by DMWR and WPacFIN, and was reviewed by the Pelagics Plan Team, Scientific and Statistical Committee, and the Council.

2.1.2 SUMMARY OF AMERICAN SAMOAN PELAGIC FISHERY

Landings. The estimated annual pelagic landings have varied widely, from 1 to 15 million lbs since 1998. The 2016 landings were approximately 4.3 million pounds, which contributes to the declining trend since peak landings in 2007 (Figure 4). Pelagic landings consist mainly of four tuna species – albacore, yellowfin, skipjack, and bigeye – which when combined with other tuna species made up 94% of the total landings. Albacore made up 79% of the tuna species. Wahoo, blue marlin and black marlin made up most of the non-tuna species landings.

Longline Effort. There were 20 vessels known to be fishing in the waters of American Samoa in 2016 according to the PIRO Sustainable Fisheries Division permit program. The following number of vessels were active in each class: 15 Class D vessels (> 70 foot), 3 Class C (50 - 60 foot), 0 Class B vessels (40 - 50 foot) and 2 Class A (< 40 foot). The number of active longline boats increased from 18 in 2015 to 20 in 2016. The 20 vessels that fished in 2016 made 213 trips (average 11 trips/vessel), deployed 2,420 sets, (121 sets/vessel) using 6.8 million hooks (Table 8).

Longline Catch-Per-Unit-Effort (CPUE). The total pelagic catch rate by all longline vessels decreased by 1.5 fish/1,000 Hooks in 2016. The tuna catch rate also decreased by 1.4 fish/1,000 Hooks in 2016. Non-tuna and other pelagic species all showed relatively constant catch rates from 2009 to 2016. The longline catch rate for tuna species have fluctuated during the past ten years. Albacore, the species targeted by longline boats, have decreased this year (12.4 fish/1,000 Hooks).

Lbs-Per-Hour Trolling. Trolling catch rate increased steeply from 2010 to 2011 and increased slightly to its long-term peak in 2012. The catch rate continued to decrease every year until 2015. Troll trips have increased by 12% from 2015 and troll hours have decreased by 15%, while the average catch per troll hour for all pelagic species have still increased (Figure 21). The catch rate for blue marlin has decreased whereas catch rates for skipjack and yellowfin have increased (Figure 23 and Figure 22). Numbers for wahoo catches from trolling fishing activities are unknown for 2016, because there were a very small number of trolling interviews, allowing one interview with an unusually high catch rate to unduly inflated the expansion estimate. Rather than to report this known-unrepresentative result, wahoo landings from trolling are not provided here for the small boat fishery.

Fish Size. Since the cannery sampling program was discontinued in 2016, average weight-per-fish is not reported for 2016 (Table 6). Average albacore weights ranged from 38-39 lbs. in 2015. There has been a slight variation for yellowfin and bigeye tunas in the last five years of data collection. For yellowfin, weight varied from 50-60 lbs and for bigeye tuna, it varied from 45-54 lbs. Mean weight for mahimahi and wahoo decreased slightly toward the end of the time series.

Revenues. Commercial landings of tuna species continue to decline, with the 2016 landings the lowest in the past ten years (Figure 5). Tunas accounted for 96% of total pelagic landings with an estimated adjusted revenue of $4.7 million in 2015, and an accumulated average $1.10 price per pound. Albacore accounted for 79% of the revenue, with an estimated price of $1.28 per pound. See Human Dimensions (Section 3.1) for a full accounting of the socio-economic data for all American Samoa fisheries.

Bycatch. There was no recorded bycatch for the troll fishery in 2016 (Table 15). In the longline fishery, less than 1% of the tuna bycatch was released. Albacore and skipjack were the most released bycatch tuna species, while sharks and oilfish had the highest numbers of non-tuna released fish, accounting for 92% release of non-tuna species. In total, only 10% of all pelagic species caught were released. Fish are released for various reasons including quality, handling and storage difficulties, and marketing problems. Investigation into the reasons for releasing pelagic species are recommended because of the high release rate for many non-tuna Pacific Pelagic Management Unit Species (PMUS) and releases of some tuna.

2.1.3 PLAN TEAM RECOMMENDATIONS

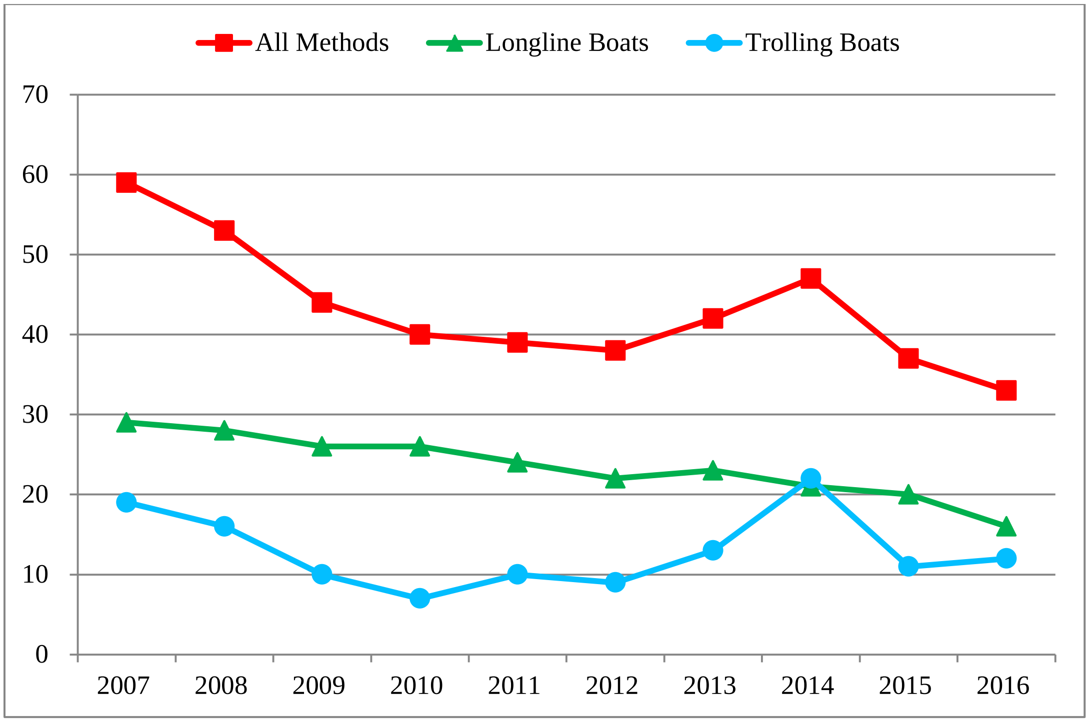
In addition to Action Items to Pelagic Plan Team members on improvements to modules, the following recommendation was forwarded to the Council:

American Samoa Large Vessel Prohibited Area Recommendation

The Pelagic Plan Team should investigate commercial versus non-commercial catch in the American Samoa small boat fishery and seek further review and clarification from WPacFIN and DMWR.

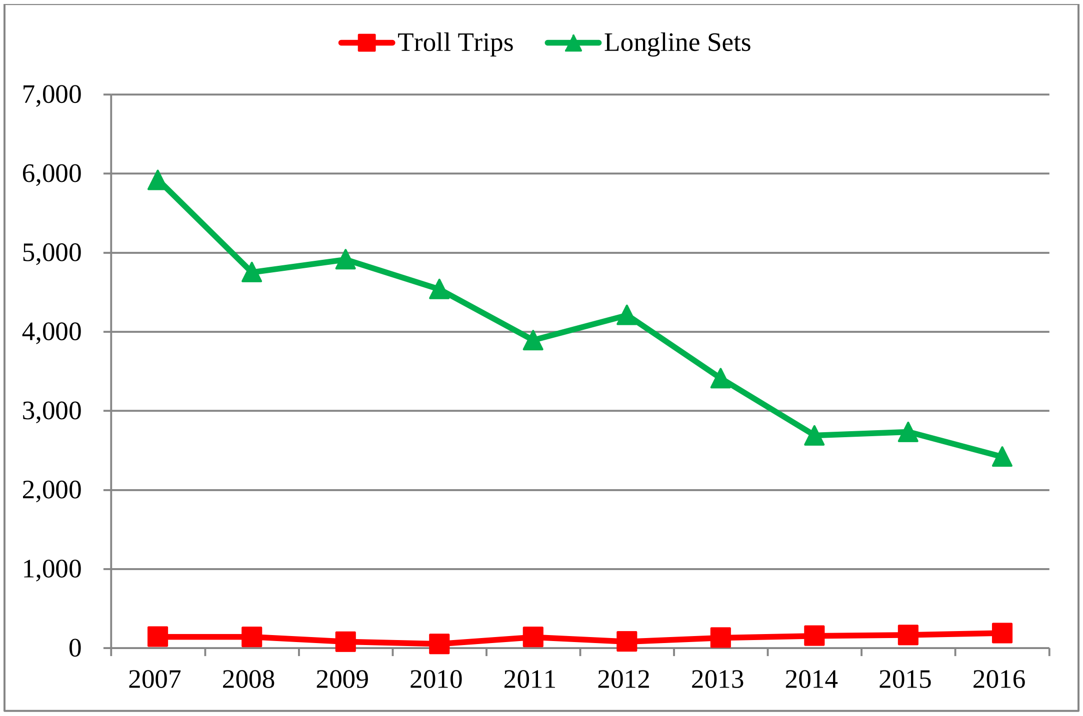
2.1.4 OVERVIEW OF PARTICIPATION ‑ ALL FISHERIES

Figure 2. Number of American Samoa boats landing any pelagic species by longlining, trolling and all methods



Supporting data shown in Table A-2.

Figure 3. Number of American Samoa fishing trips or sets for all pelagic species by method



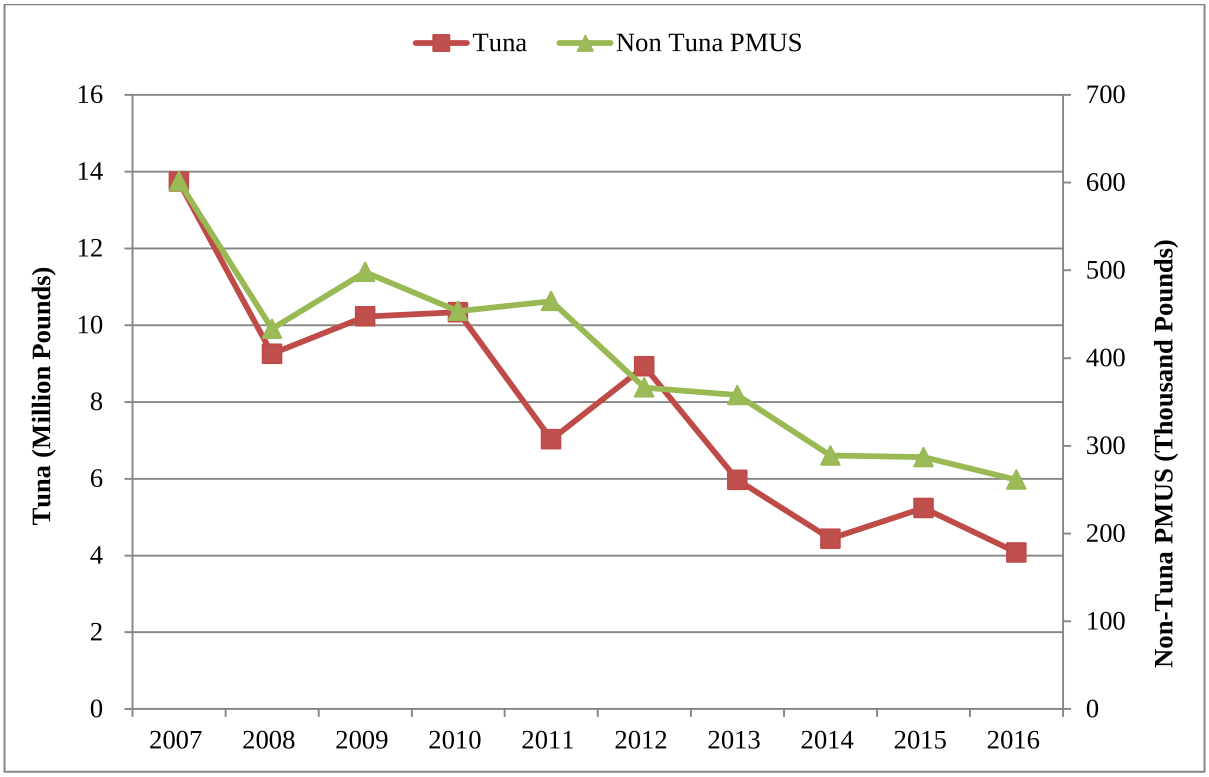
Supporting data shown in Table A-3.

2.1.5 OVERVIEW OF LANDINGS – ALL FISHERIES

Table 3. American Samoa 2016 estimated total landings of pelagic species by gear type.

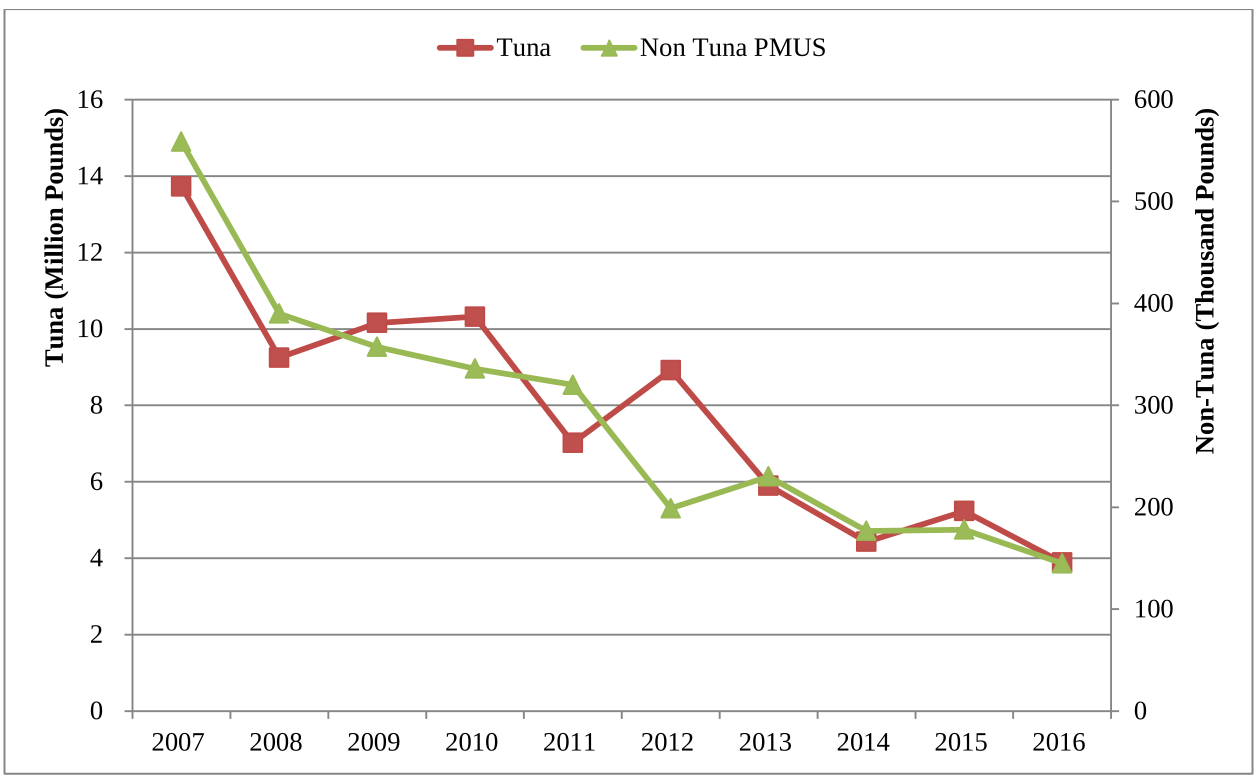
Species	Longline Pounds	Troll Pounds	Other Pounds	Total Pounds
Skipjack tuna	118,188	9,817	41	128,047
Albacore tuna	3,215,860	0	0	3,215,860
Yellowfin tuna	504,787	9,492	212	514,491
Kawakawa	0	117	5	122
Bigeye tuna	215,237	2,785	0	218,022
Bluefin tuna	0	0	0	0
Tunas (unknown)	36	0	0	36
Tuna PMUS Total	4,054,108	22,211	258	4,076,578
Mahimahi	9,284	1,428	269	10,981
Black marlin	18,903	0	0	18,903
Blue marlin	70,955	476	0	71,432
Striped marlin	3,990	0	0	3,990
Wahoo	108,846	13,097	314	122,257
Sharks (unknown coastal)	1,690	0	0	1,690
Swordfish	14,762	0	0	14,762
Sailfish	4,822	0	0	4,822
Spearfish	3,772	0	0	3,772
Moonfish	4,396	0	0	4,396
Oilfish	3,401	91	0	3,492
Pomfret	783	0	16	799
Non-Tuna PMUS Total	245,604	15,092	599	261,296
Barracudas	1,176	69	354	1,599
Great barracuda	0	0	0	0
Small barracudas	0	0	0	0
Rainbow runner	18	540	280	838
Dogtooth tuna	0	1,271	1,342	2,613
Pelagic fishes (unknown)	529	0	0	529
Non-PMUS Pelagics Total	1,723	1,880	1,976	5,579
Total Pelagics	4,301,435	39,183	2,833	4,343,453

Figure 4. American Samoa annual estimated total landings of Tuna and Non-Tuna PMUS



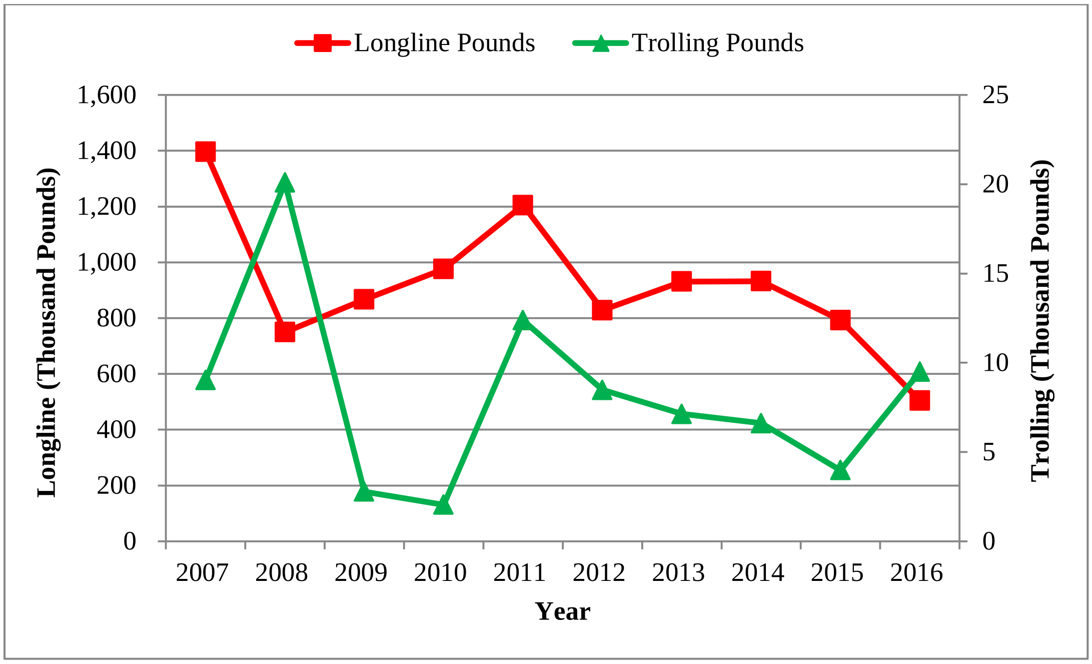
Supporting data shown in Table A-4.

Figure 5. American Samoa annual commercial landings of Tunas and Non-Tuna PMUS



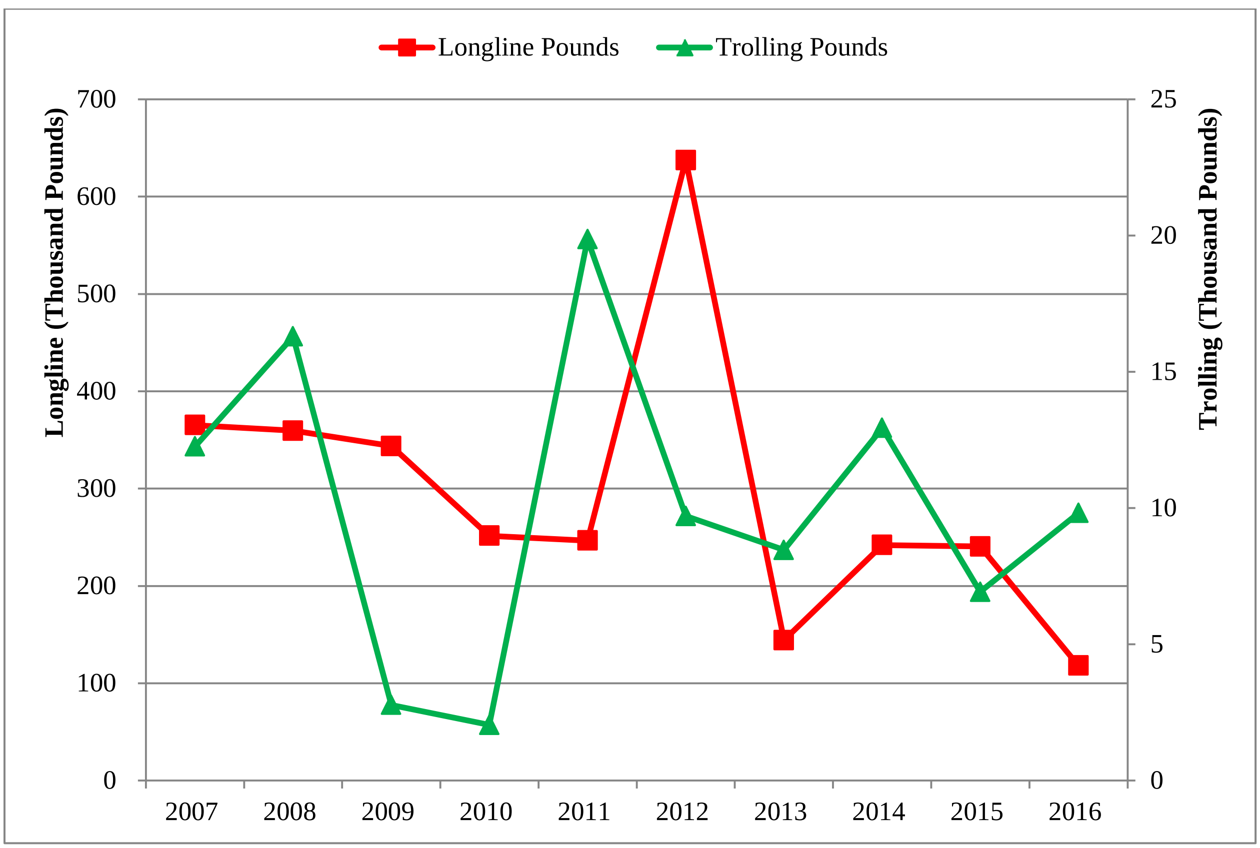
Supporting data shown in Table A-5.

Figure 6. American Samoa annual estimated total landings of Yellowfin Tuna by gear



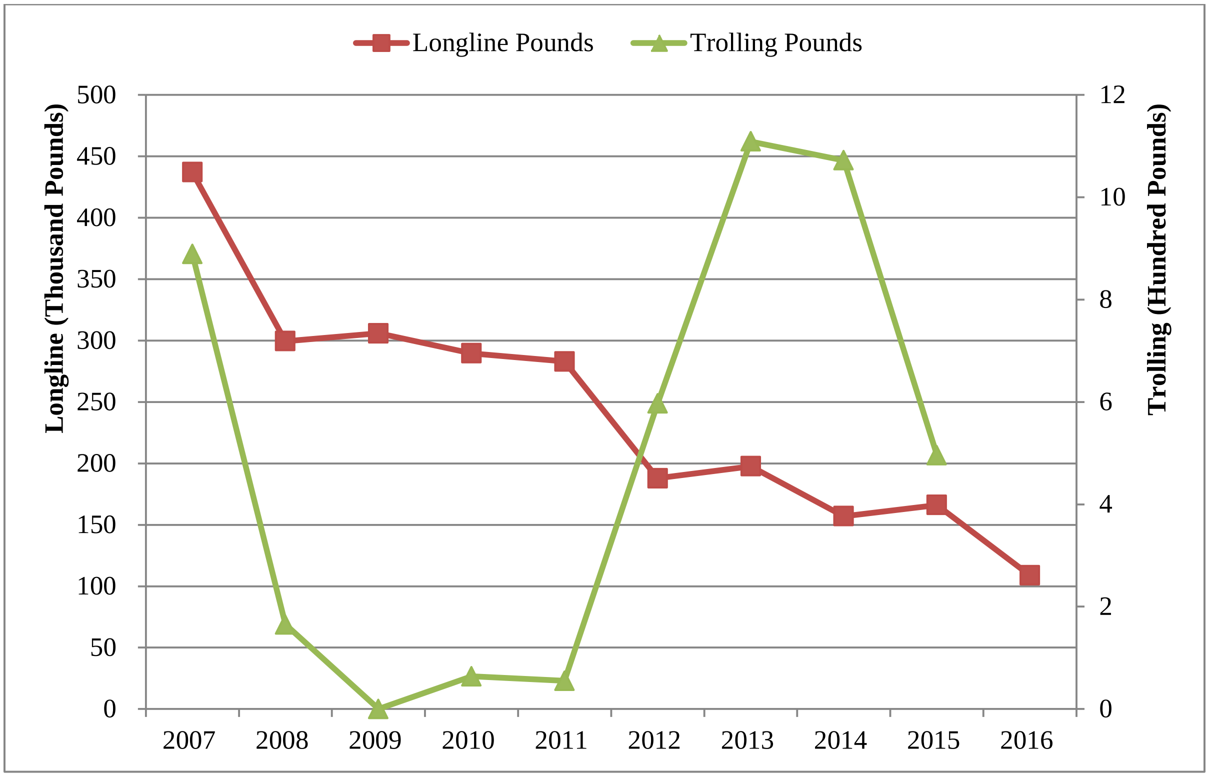
Supporting data shown in Table A-6.

Figure 7. American Samoa annual estimated total landings of Skipjack Tuna by gear



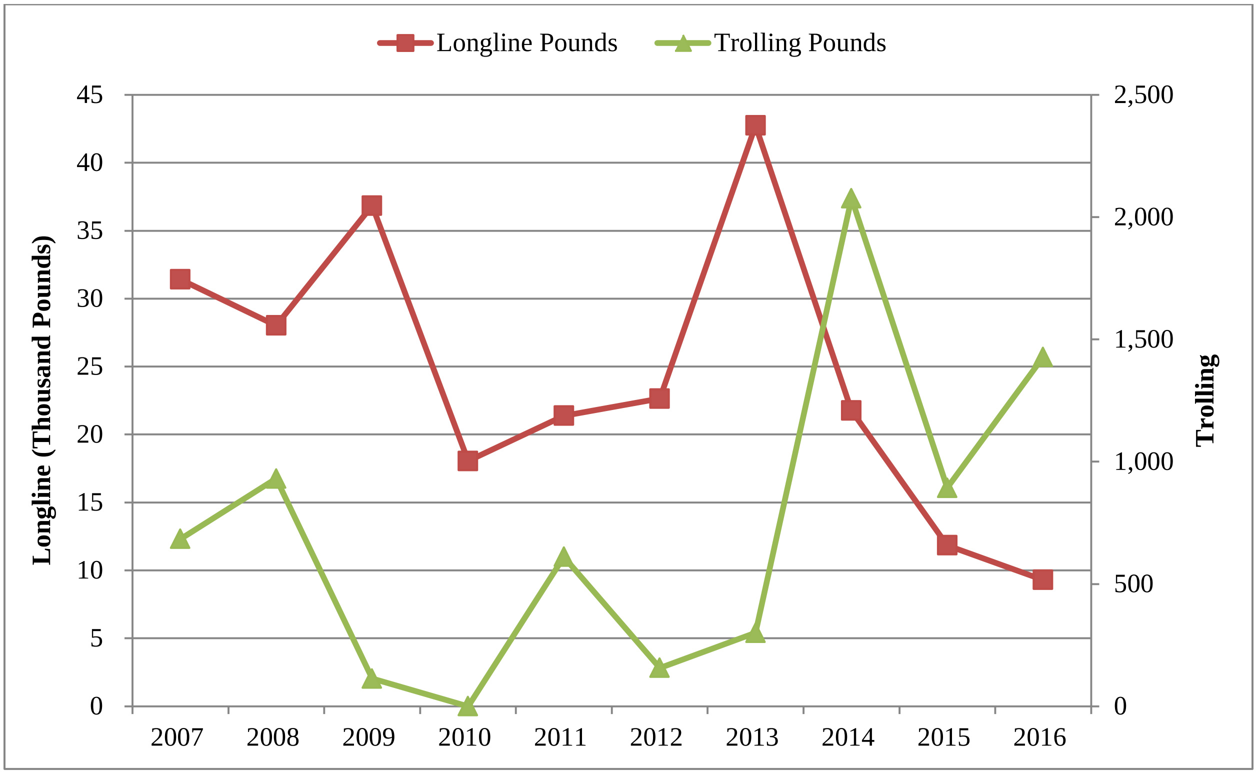
Supporting data shown in Table A-7.

Figure 8. American Samoa annual estimated total landings of Wahoo by gear



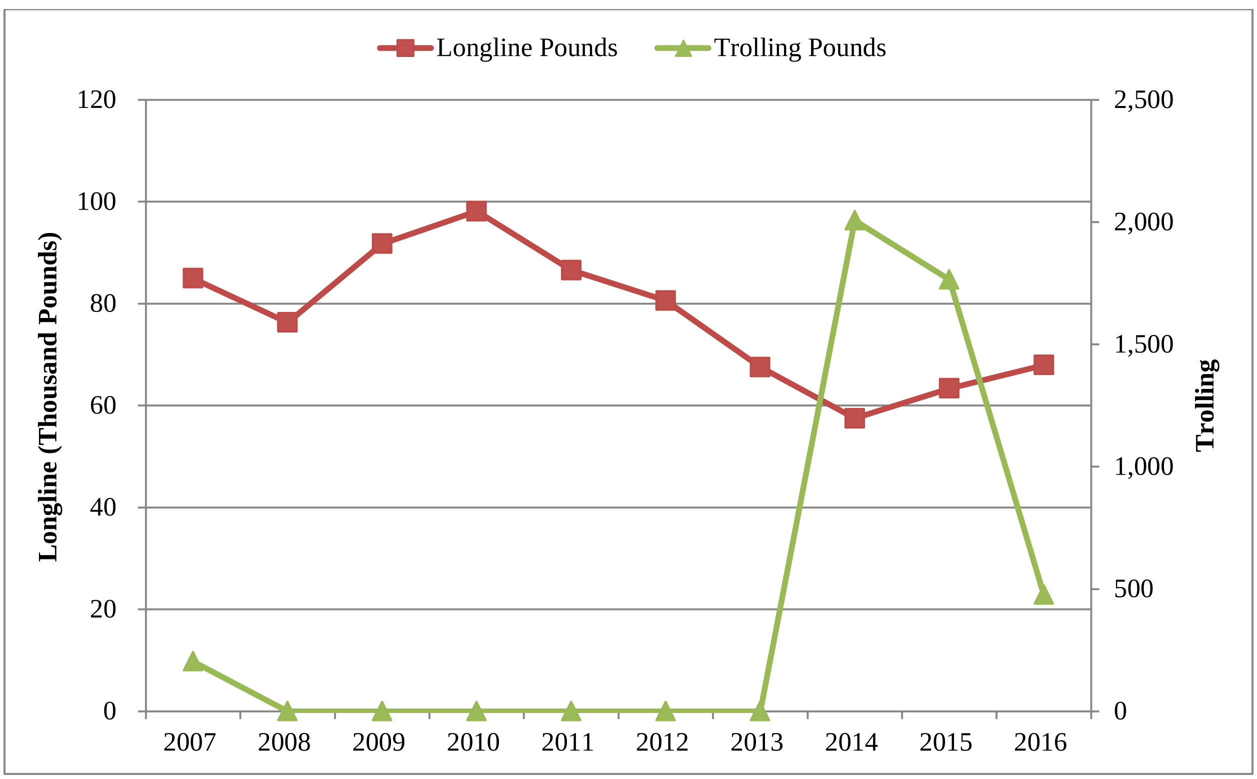
An unrepresentative amount of wahoo were caught on one day in the troll fishery in 2016. The data point has been removed from the chart to avoid misinterpretation of trends, but can be found in the supporting data shown in Table A-8.

Figure 9. American Samoa annual estimated total landings of Mahimahi by gear



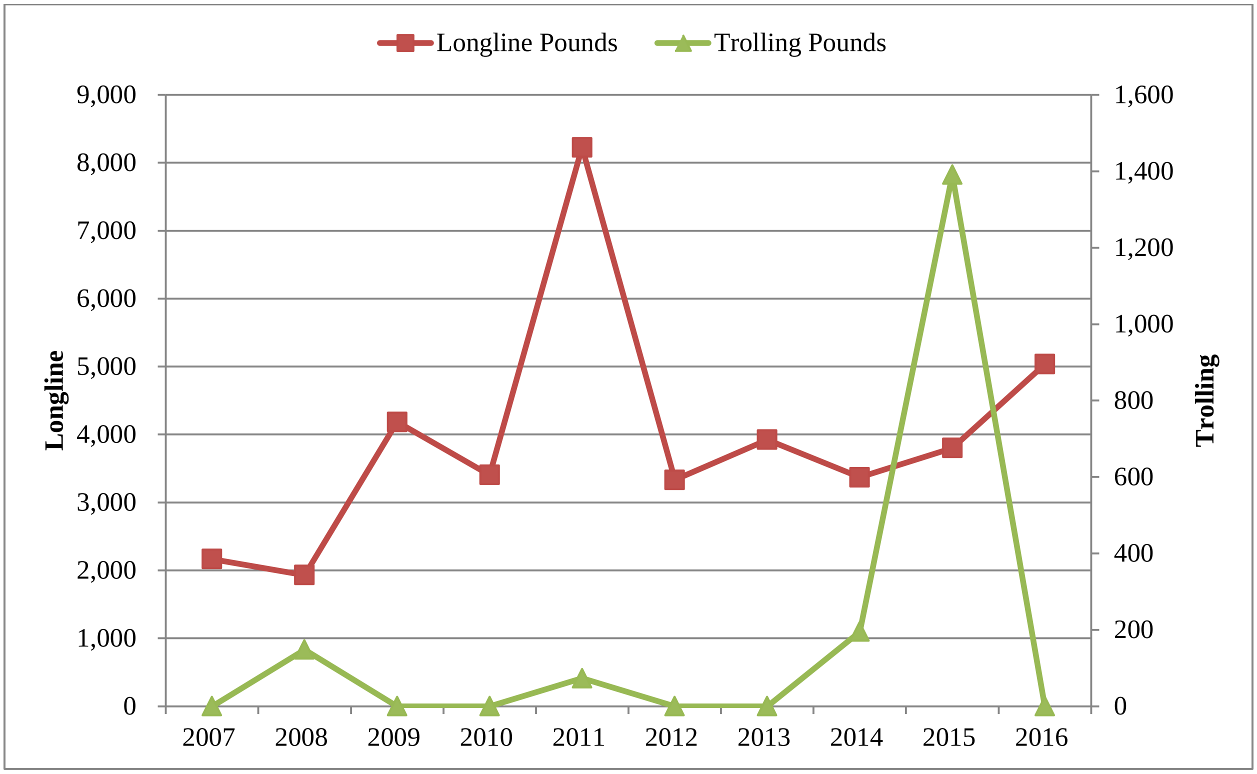
Supporting data shown in Table A-9.

Figure 10. American Samoa annual estimated total landings of Blue Marlin by gear



Supporting data shown in Table A-10.

Figure 11. American Samoa annual estimated total landings of Sailfish by gear



Supporting data shown in Table A-11.

2.1.6 WEIGHT-PER-FISH – ALL FISHERIES

Figure 12. Average Albacore Weight-per-fish

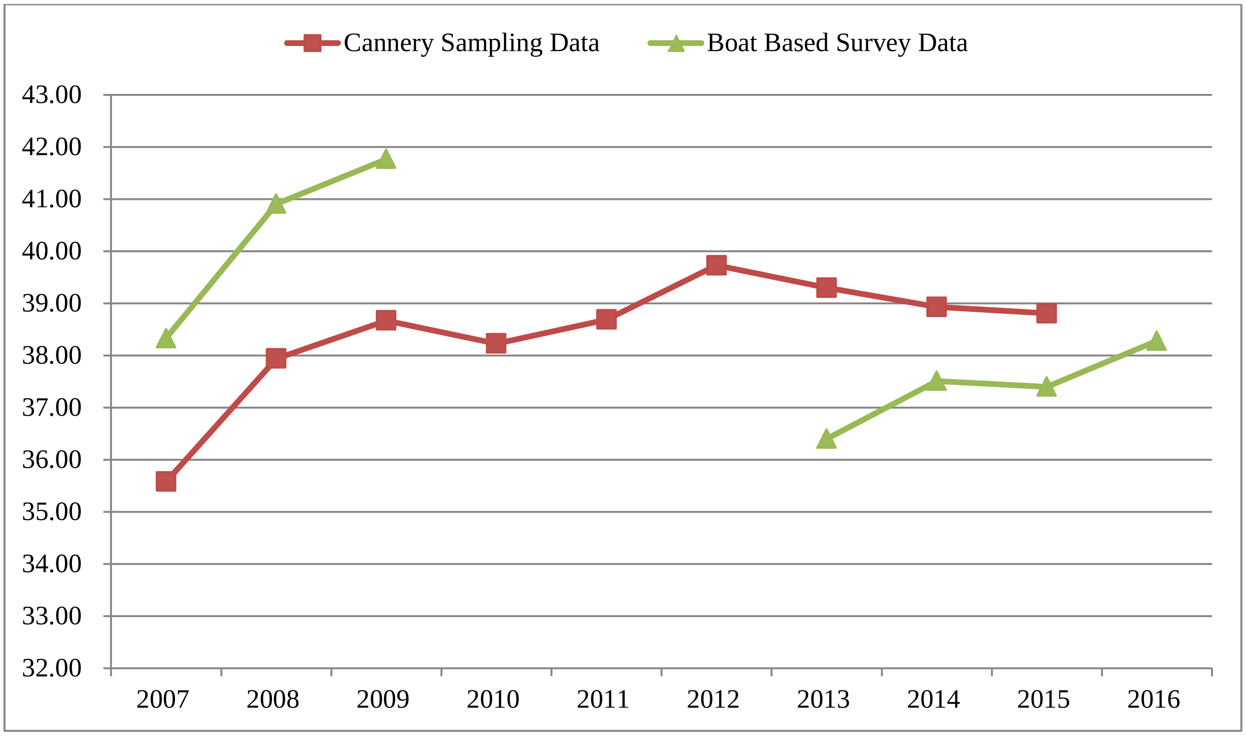


Figure 13. Average Cannery Sampled Weight-per-fish for Other Tunas and Wahoo

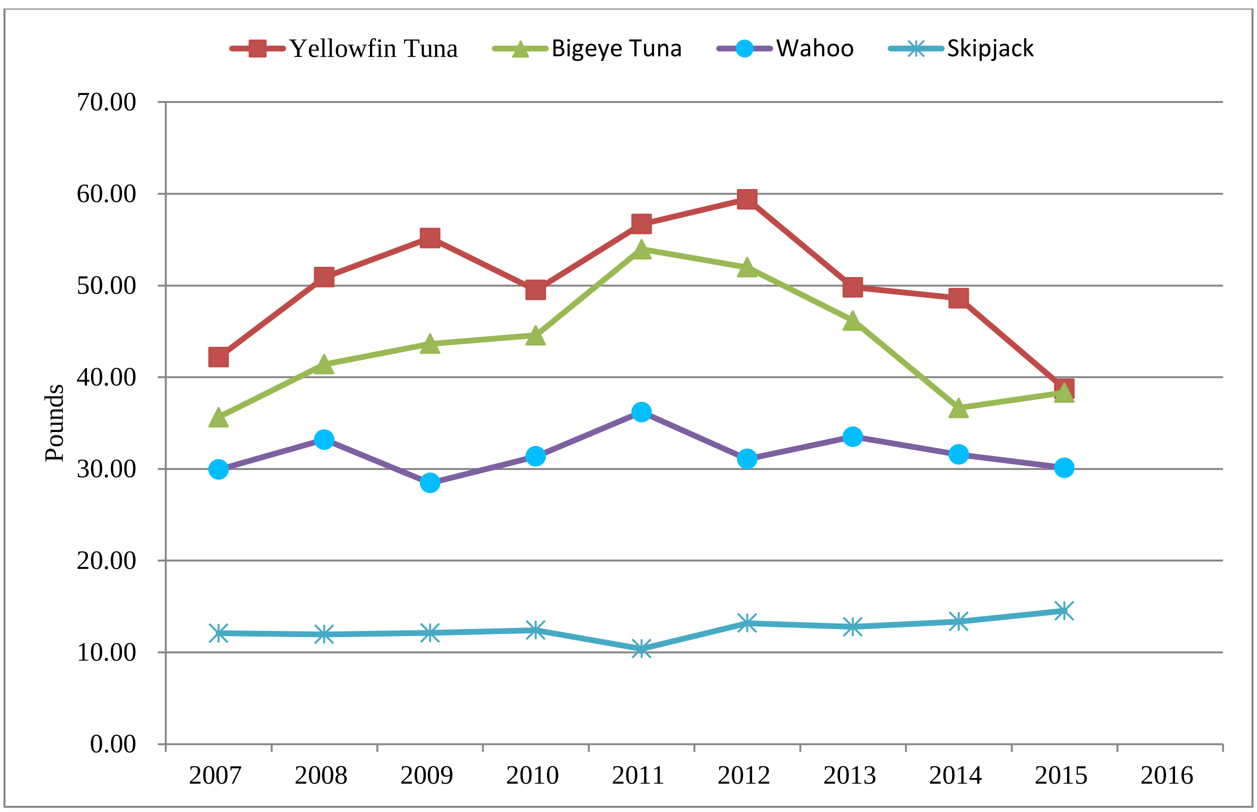


Table 4. Cannery Sampled Average Weight-per-fish (1998-2003)

Species	1998	1999	2000	2001	2002	2003
Skipjack tuna	-	-	-	16.8	11.3	9.9
Albacore tuna	41.0	47.2	40.7	39.8	39.1	37.8
Yellowfin tuna	-	-	-	57.0	62.4	44.3
Bigeye tuna	-	-	-	40.7	46.8	37.4
Mahimahi	-	-	-	16.2	13.5	20.7
Wahoo	-	-	-	30.6	30.7	30.0
Sailfish	-	-	-	-	27.4	-
Moonfish	-	-	-	147.6	117.6	-
Pomfret	-	-	-	5.1	6.2	-
Rainbow runner	-	-	-	-	9.4	-

Table 5. Cannery Sampled Average Weight-per-fish (2004-2009)

Species	2004	2005	2006	2007	2008	2009
Skipjack tuna	13.6	13.1	12.3	12.1	12.0	12.1
Albacore tuna	36.5	33.2	34.8	35.6	37.9	38.7
Yellowfin tuna	52.1	40.1	52.1	42.2	50.9	55.2
Bigeye tuna	35.9	31.6	35.5	35.6	41.4	43.7
Mahimahi	13.0	17.2	13.4	13.5	19.1	15.1
Blue marlin	-	45.8	-	-	-	-
Wahoo	27.4	31.7	31.9	29.9	33.2	28.5
Swordfish	72.3	-	90.3	-	-	-
Sailfish	-	22.9	21.7	-	-	-
Moonfish	-	95.5	34.7	-	-	-
Pomfret	-	7.8	-	5.4	-	-
Rainbow runner	10.8	-	-	-	-	-

Table 6. Cannery Sampled Average Weight-per-fish (2010-2016)

Species	2010	2011	2012	2013	2014	2015	2016
Skipjack tuna	12.4	10.4	13.2	12.8	13.4	14.5	NA
Albacore tuna	38.2	38.7	39.7	39.3	38.9	38.8	NA
Yellowfin tuna	49.5	56.7	59.4	49.8	48.6	38.7	NA
Bigeye tuna	44.6	54.0	52.0	46.2	36.6	38.3	NA
Mahimahi	23.7	21.6	22.8	22.4	14.1	-	NA
Blue marlin	-	48.9	-	-	-	-	NA
Wahoo	31.4	36.2	31.1	33.5	31.6	30.1	NA

Note: Tables 4, 5, and 6, NA indicates “not available” while – denotes that the species were not sampled at the cannery in that year.

2.1.7 AMERICAN SAMOA LONGLINE PARTICIPATION, EFFORT, LANDINGS, BYCATCH, AND CPUE

Table 7. Number of permitted and active longline fishing vessels by size class

	Class A <=40 ft.		Class B <= 50 ft.		Class C <=70 ft.		Class D > 70 ft.	
Year	Permits	Active	Permits	Active	Permits	Active	Permits	Active
2007	17	2	5	0	12	5	26	22
2008	16	1	5	0	12	5	27	22
2009	16	1	5	1	12	5	27	20
2010	16	1	5	0	12	5	27	20
2011	16	1	5	0	12	5	27	18
2012	5	1	5	0	11	9	25	23
2013	5	1	5	0	11	7	26	14
2014	14	2	5	0	12	7	26	13
2015	7	1	3	0	12	6	27	12
2016	7	2	4	0	12	3	27	15

Note: These data are used for Figure 14 that follows.

Figure 14. Number of active longline fishing vessels in size classes
A (< 40 ft), B(40-50 feet), C(51-70 feet) and D (> 70 ft)

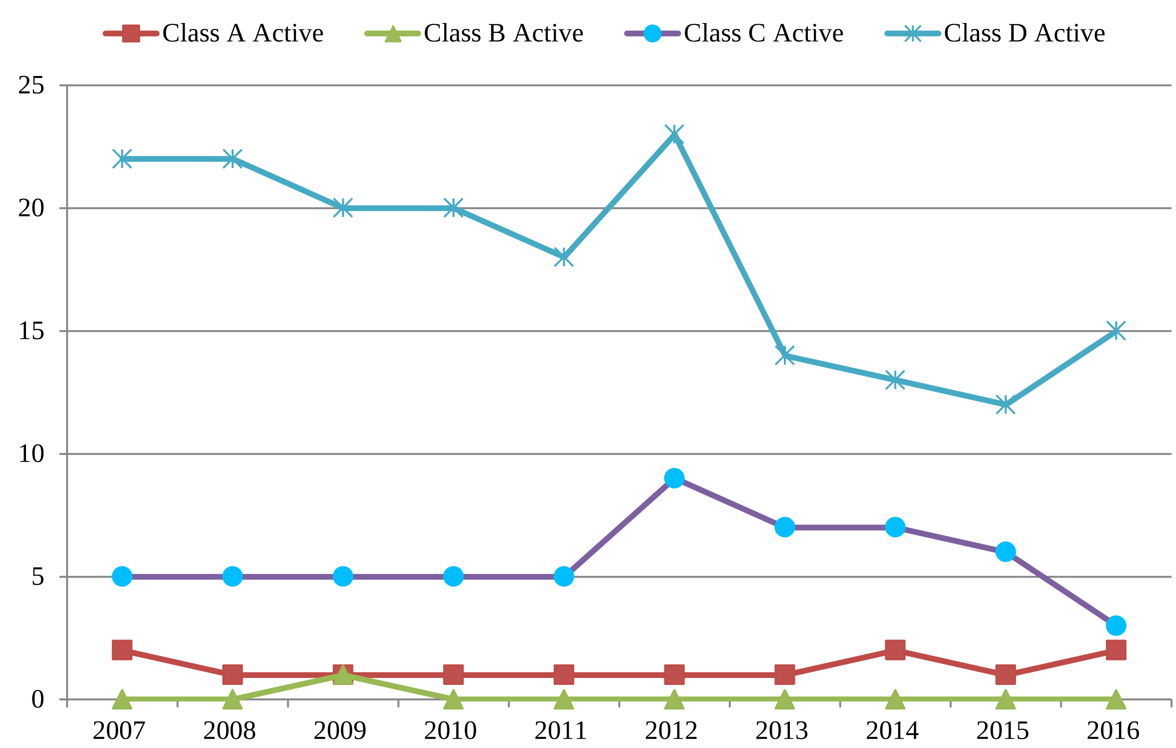
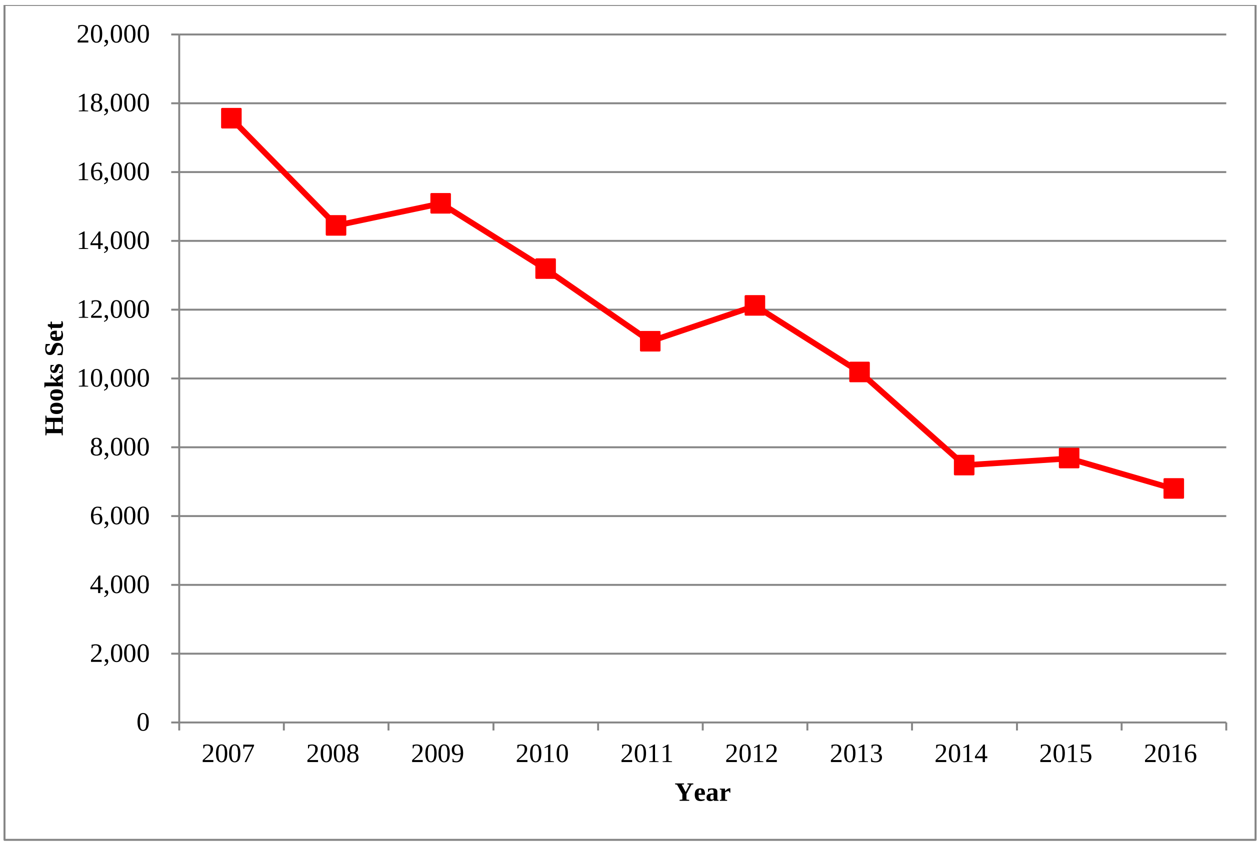


Table 8. Longline Effort by American Samoan Vessels during 2016

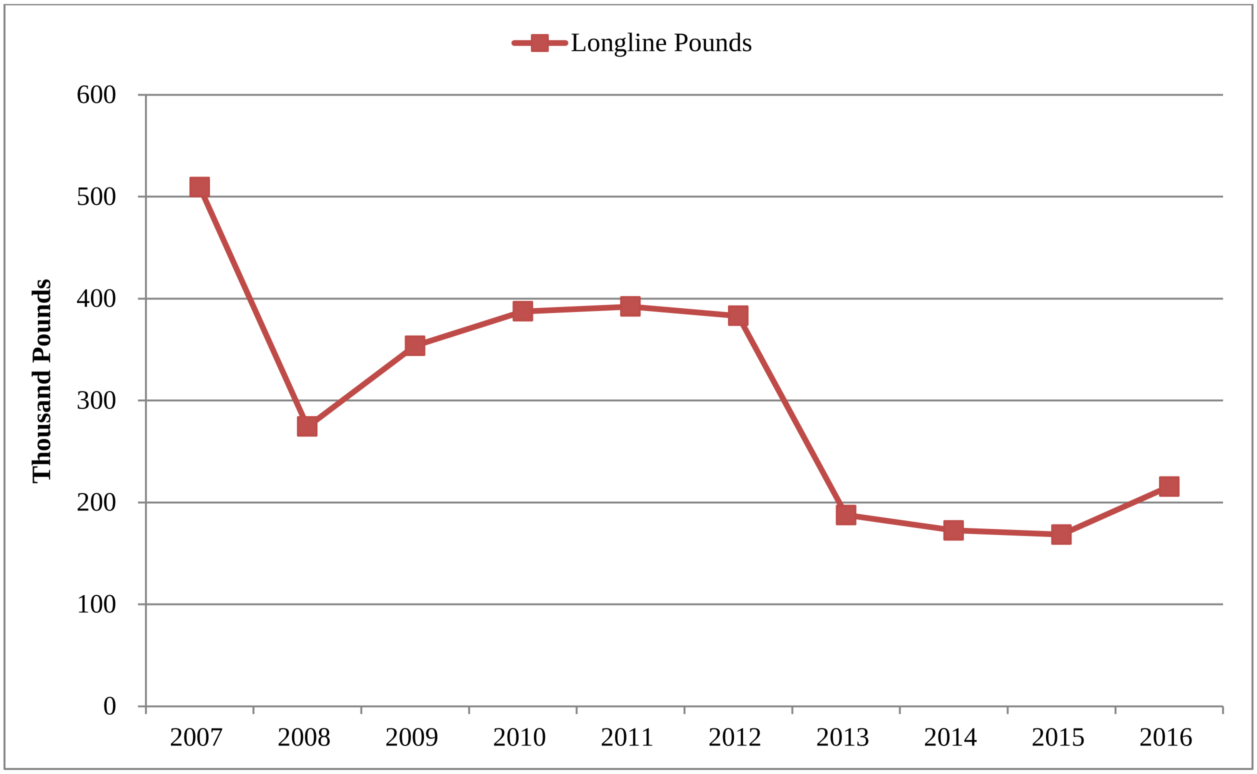
Effort	All Vessels
Boats	20
Trips	213
Sets	2,420
1000 Hooks	6,792
Lightsticks	576

Figure 15. Thousands of American Samoa longline hooks set (Federal Logbook Data)



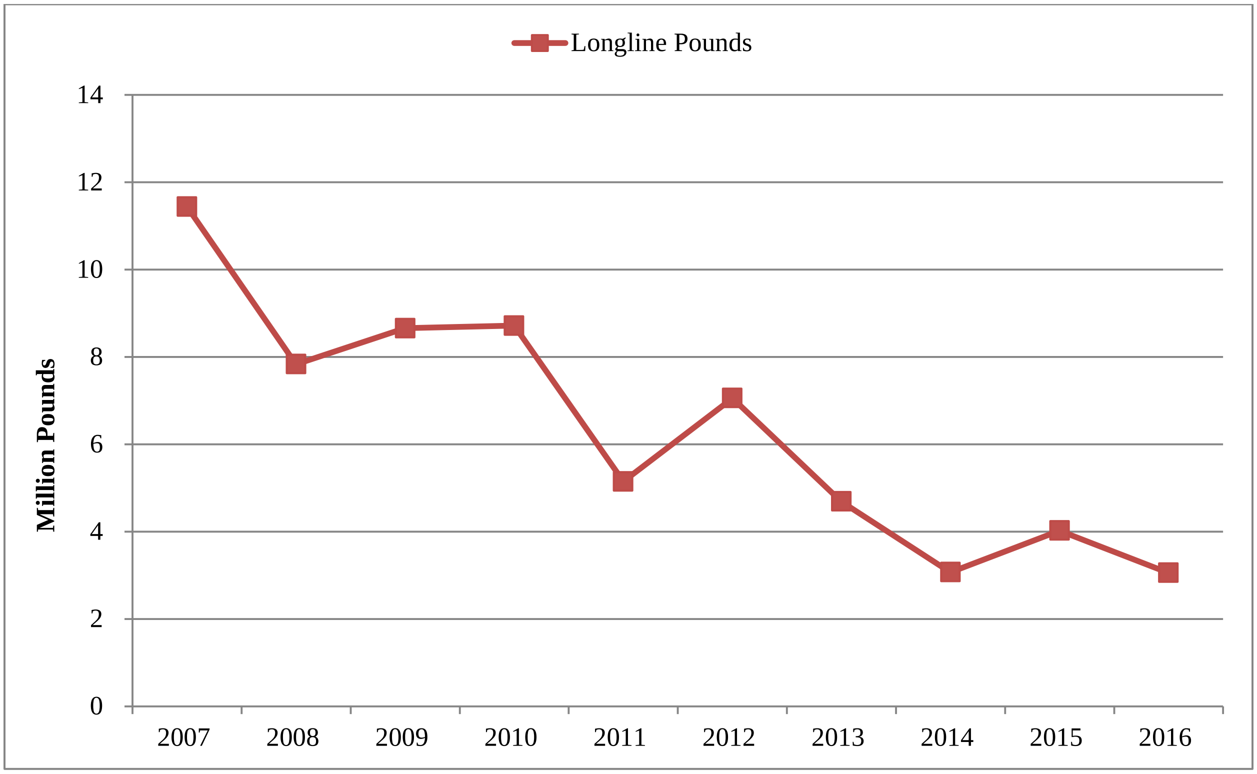
Supporting data shown in Table A-12.

Figure 16. American Samoa annual estimated total landings of Bigeye Tuna by longlining



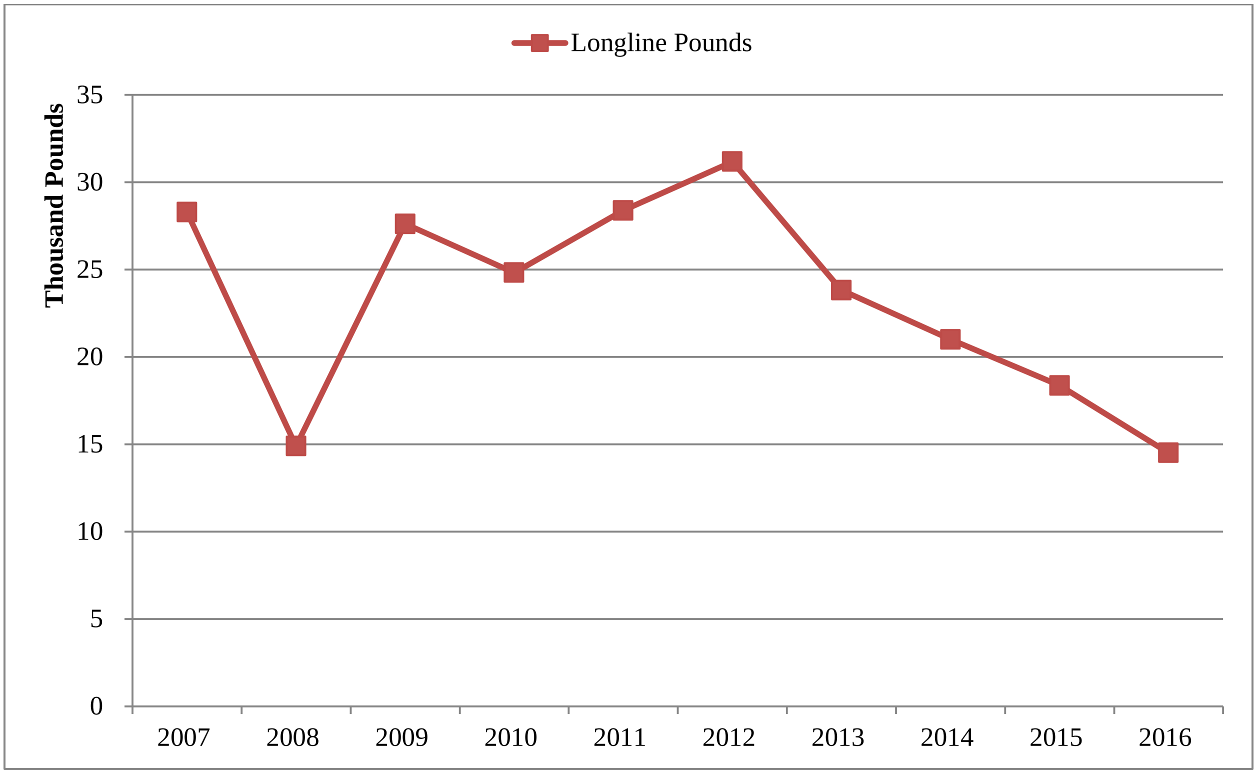
Supporting data shown in Table A-13.

Figure 17. American Samoa annual estimated total landings of Albacore by longlining



Supporting data shown in Table A-14.

Figure 18. American Samoa annual estimated total landings of Swordfish by longlining

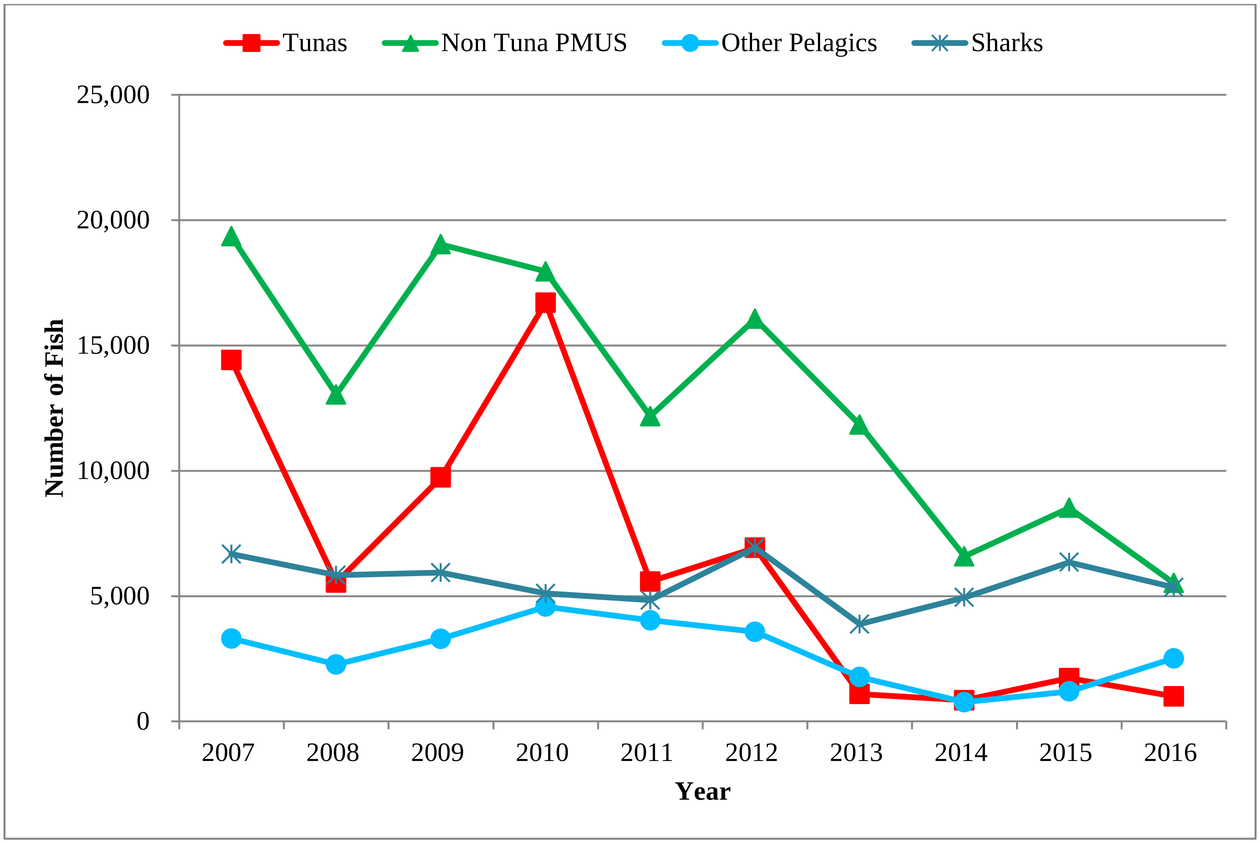


Supporting data shown in Table A-15.

Table 9. Number of fish kept, released and percent released for all American Samoa longline vessels during 2016

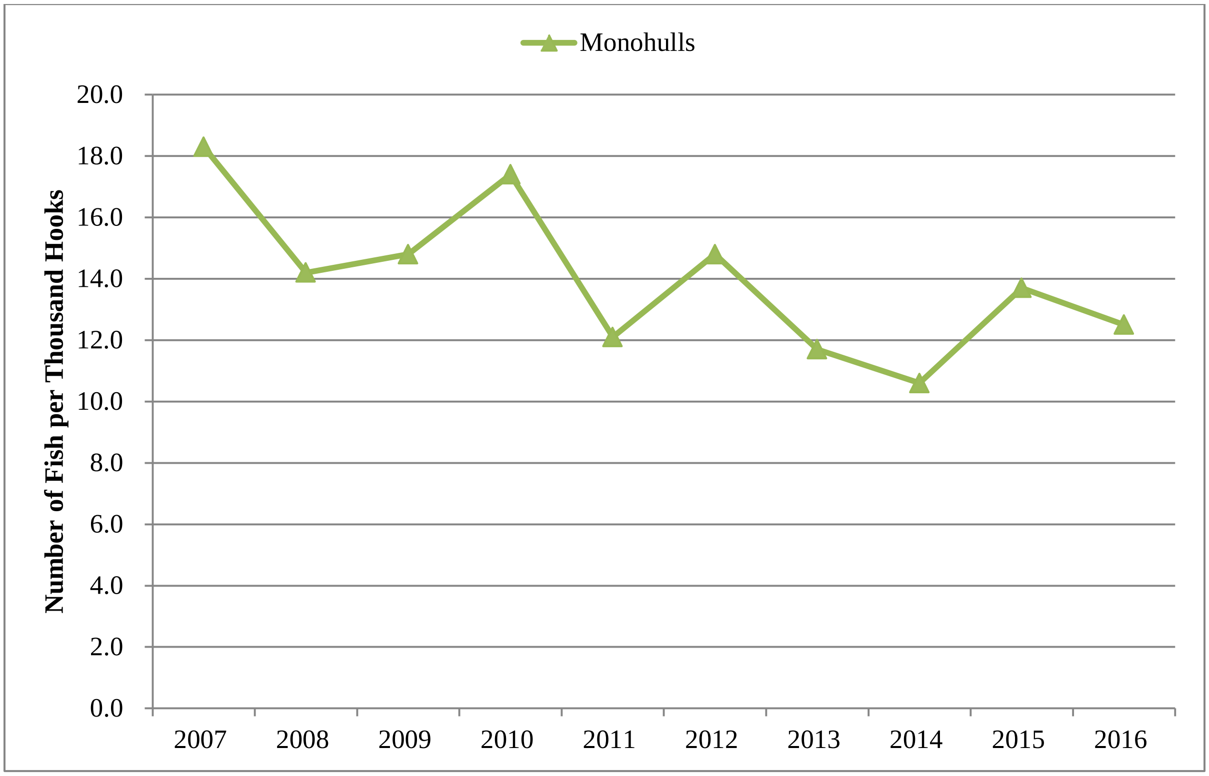
Species	Number Kept	Number Released	Total Caught	Percent Released
Skipjack tuna	14,145	277	14,422	1.9
Albacore tuna	83,759	518	84,277	0.6
Yellowfin tuna	18,610	171	18,781	0.9
Kawakawa	0	0	0	N/A
Bigeye tuna	3,284	31	3,315	0.9
Tunas (unknown)	2	0	2	N/A
Tuna PMUS Total	**119,800**	**997**	**120,797**	**0.8**
Mahimahi	419	22	441	5.0
Black marlin	0	0	0	N/A
Blue marlin	527	59	586	10.1
Striped marlin	58	11	69	15.9
Wahoo	4,881	108	4,989	2.2
Sharks (unknown coastal)	26	5,345	5,371	99.5
Swordfish	118	18	136	13.2
Sailfish	72	88	160	55.0
Spearfish	85	176	261	67.4
Moonfish	92	56	148	37.8
Oilfish	194	4,615	4,809	96.0
Pomfret	92	370	462	80.1
Non-Tuna PMUS Total	**6,564**	**10,868**	**17,432**	**62.3**
Barracudas	113	16	129	12.4
Rainbow runner	3	0	3	N/A
Dogtooth tuna	0	0	0	N/A
Pelagic fishes (unknown)	11	2,501	2,512	99.6
Non-PMUS Pelagics Total	**127**	**2,517**	**2,644**	**95.2**
Total Pelagics	**126,491**	**14,382**	**140,873**	**10.2**

Figure 19. Number of Fish Released by American Samoa Longline Vessels



Supporting data shown in Table A-16.

Figure 20. American Samoa Albacore catch per 1,000 Hooks by Monohull Vessels from Longline Logbook Data



Note: There were fewer than three alias reporting in the years shown, so alia are not included in this figure. Supporting data shown in Table A-17.

Table 10. American Samoa Catch/1,000 Hooks for alia vessels from 1996 to 1998

Species	Alias 1996	Alias 1997	Alias 1998
Skipjack tuna	0.1	1.2	3.7
Albacore tuna	40.6	32.8	26.6
Yellowfin tuna	6.5	2.7	2.2
Bigeye tuna	1.3	0.3	0.3
Tuna PMUS Total	48.5	37.0	32.8
Mahimahi	2.3	2.2	1.7
Blue marlin	0.9	0.7	0.5
Wahoo	0.8	0.9	2.2
Sharks (unknown coastal)	0.7	0.1	0.1
Swordfish	0.0	0.1	0.0
Sailfish	0.2	0.2	0.1
Non-Tuna PMUS Total	4.9	4.4	4.7
Pelagic fishes (unknown)	0.0	0.0	0.2
Non-PMUS Pelagic Total	0.0	0.0	0.2
Total Pelagics	53.4	41.4	37.7

Table 11. American Samoa Catch/1,000 Hooks for two types of longline vessels from 1999 to 2002

Species	1999		2000		2001		2002	
	Alias	**Monohulls**	**Alias**	**Monohulls**	**Alias**	**Monohulls**	**Alias**	**Monohulls**
Skipjack tuna	5.0	4.5	2.0	1.7	3.1	2.1	6.0	4.9
Albacore tuna	18.8	14.8	19.8	28.0	27.3	32.9	17.2	25.8
Yellowfin tuna	6.7	2.1	6.2	3.1	3.3	1.4	7.1	1.3
Bigeye tuna	0.7	0.5	0.4	1.0	0.6	1.0	0.6	0.9
Tuna PMUS Total	**31.2**	**21.9**	**28.4**	**33.8**	**34.3**	**37.4**	**30.9**	**32.9**
Mahimahi	2.2	0.3	1.7	0.4	3.4	0.5	4.0	0.6
Black marlin	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Blue marlin	0.5	0.1	0.5	0.2	0.4	0.2	0.2	0.3
Striped marlin	0.0	0.2	0.1	0.3	0.0	0.1	0.1	0.0
Wahoo	2.1	1.2	1.2	1.0	1.5	0.6	2.7	1.0
Sharks (unknown coastal)	0.1	1.2	0.0	0.7	0.0	0.7	0.0	0.8
Swordfish	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0
Sailfish	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0
Spearfish	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Moonfish	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Oilfish	0.0	0.6	0.0	0.1	0.0	0.2	0.0	0.5
Pomfret	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.1
Non-Tuna PMUS Total	**5.2**	**4.3**	**3.7**	**3.2**	**5.6**	**2.5**	**7.3**	**3.4**
Barracudas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Non-PMUS Pelagic Tot	**0.3**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.4**
Total Pelagics	**36.7**	**26.4**	**32.1**	**37.0**	**39.9**	**39.9**	**38.2**	**36.7**

Table 12. American Samoa Catch/1,000 Hooks for two types of longline vessels from 2003 to 2005

	2003		2004		2005	
Species	**Alias**	**Monohulls**	**Alias**	**Monohulls**	**Alias**	**Monohulls**
Skipjack tuna	4.7	2.9	3.0	3.9	1.0	2.7
Albacore tuna	17.3	16.4	13.7	12.9	10.3	17.4
Yellowfin tuna	5.9	2.0	8.8	3.2	7.0	2.6
Bigeye tuna	1.6	1.1	0.8	1.3	1.0	0.9
Tuna PMUS Total	**29.5**	**22.4**	**26.3**	**21.3**	**19.3**	**23.6**
Mahimahi	2.2	0.4	2.1	0.2	2.0	0.3
Blue marlin	0.2	0.2	0.1	0.2	0.2	0.2
Striped marlin	0.0	0.0	0.1	0.0	0.1	0.0
Wahoo	1.8	1.1	3.0	1.6	2.3	1.4
Sharks (unknown coastal)	0.3	0.8	0.1	0.9	0.0	0.7
Swordfish	0.1	0.0	0.1	0.0	0.1	0.0
Sailfish	0.1	0.0	0.0	0.1	0.1	0.1
Spearfish	0.1	0.0	0.0	0.1	0.0	0.0
Moonfish	0.1	0.1	0.1	0.1	0.1	0.1
Oilfish	0.3	0.5	0.0	0.7	0.0	0.3
Pomfret	0.1	0.1	0.0	0.1	0.0	0.1
Non-Tuna PMUS Total	**5.3**	**3.2**	**5.6**	**4.0**	**4.9**	**3.2**
Pelagic fishes (unknown)	0.2	0.2	0.0	0.1	0.0	0.1
Non-PMUS Pelagic Total	**0.2**	**0.2**	**0.0**	**0.1**	**0.0**	**0.1**
Total Pelagics	**35.0**	**25.8**	**31.9**	**25.4**	**24.2**	**26.9**

Table 13. American Samoa Catch/1,000 Hooks for all vessels from 2006 to 2011

Species	2006	2007	2008	2009	2010	2011
	All Vessels	All Vessels	All Vessels	All Vessels	All Vessels	All Vessels
Skipjack tuna	3.2	2.3	2.4	2.3	2.4	2.5
Albacore tuna	18.4	18.3	14.2	14.8	17.4	12.1
Yellowfin tuna	1.6	1.9	1.0	1.1	1.8	2.0
Bigeye tuna	0.9	0.9	0.5	0.6	0.8	0.7
Tuna PMUS Total	**24.1**	**23.4**	**18.1**	**18.8**	**22.4**	**17.3**
Mahimahi	0.4	0.1	0.1	0.2	0.1	0.1
Blue marlin	0.2	0.2	0.2	0.2	0.2	0.2
Wahoo	1.5	1.0	0.7	1.0	1.0	0.9
Sharks (unknown coastal)	0.5	0.4	0.4	0.4	0.4	0.4
Swordfish	0.1	0.0	0.0	0.0	0.0	0.0
Sailfish	0.1	0.0	0.0	0.0	0.0	0.0
Spearfish	0.1	0.0	0.1	0.1	0.1	0.1
Oilfish	0.5	0.5	0.4	0.5	0.6	0.6
Pomfret	0.0	0.1	0.1	0.1	0.1	0.1
Non-Tuna PMUS Total	**3.4**	**2.3**	**2.0**	**2.5**	**2.5**	**2.4**
Pelagic fishes (unknown)	0.0	0.2	0.1	0.2	0.3	0.3
Non-PMUS Pelagic Total	**0.0**	**0.2**	**0.1**	**0.2**	**0.3**	**0.3**
Total Pelagics	**27.5**	**25.9**	**20.2**	**21.5**	**25.2**	**20.0**

Table 14. American Samoa Catch/1,000 Hooks for all types of longline vessels from 2012 to 2016

Species	2012	2013	2014	2015	2016
	All Vessels	All Vessels	All Vessels	All Vessels	All Vessels
Skipjack tuna	4.3	1.1	2.5	2.2	2.1
Albacore tuna	14.8	11.7	10.5	13.6	12.4
Yellowfin tuna	1.2	1.9	2.5	2.8	2.8
Bigeye tuna	0.6	0.4	0.6	0.6	0.5
Tuna PMUS Total	**20.9**	**15.1**	**16.1**	**19.2**	**17.8**
Mahimahi	0.1	0.2	0.2	0.1	0.1
Blue marlin	0.1	0.1	0.1	0.1	0.1
Wahoo	0.7	0.7	0.7	0.7	0.7
Sharks (unknown coastal)	0.6	0.4	0.7	0.8	0.8
Spearfish	0.1	0.1	0.1	0.1	0.0
Moonfish	0.1	0.0	0.0	0.0	0.0
Oilfish	0.8	0.7	0.6	0.9	0.7
Pomfret	0.1	0.1	0.1	0.1	0.1
Non-Tuna PMUS Total	**2.6**	**2.3**	**2.5**	**2.8**	**2.5**
Pelagic fishes (unknown)	0.3	0.2	0.1	0.2	0.4
Non-PMUS Pelagic Total	**0.3**	**0.2**	**0.1**	**0.2**	**0.4**
Total Pelagics	**23.8**	**17.6**	**18.7**	**22.2**	**20.7**

2.1.8 AMERICAN SAMOA TROLLING BYCATCH AND CPUE

Data for participation, effort, landings and revenue are found in this modules overview sections. Due to the relatively small size of the troll fishery, tables and figures generally combined troll data with the longline data.

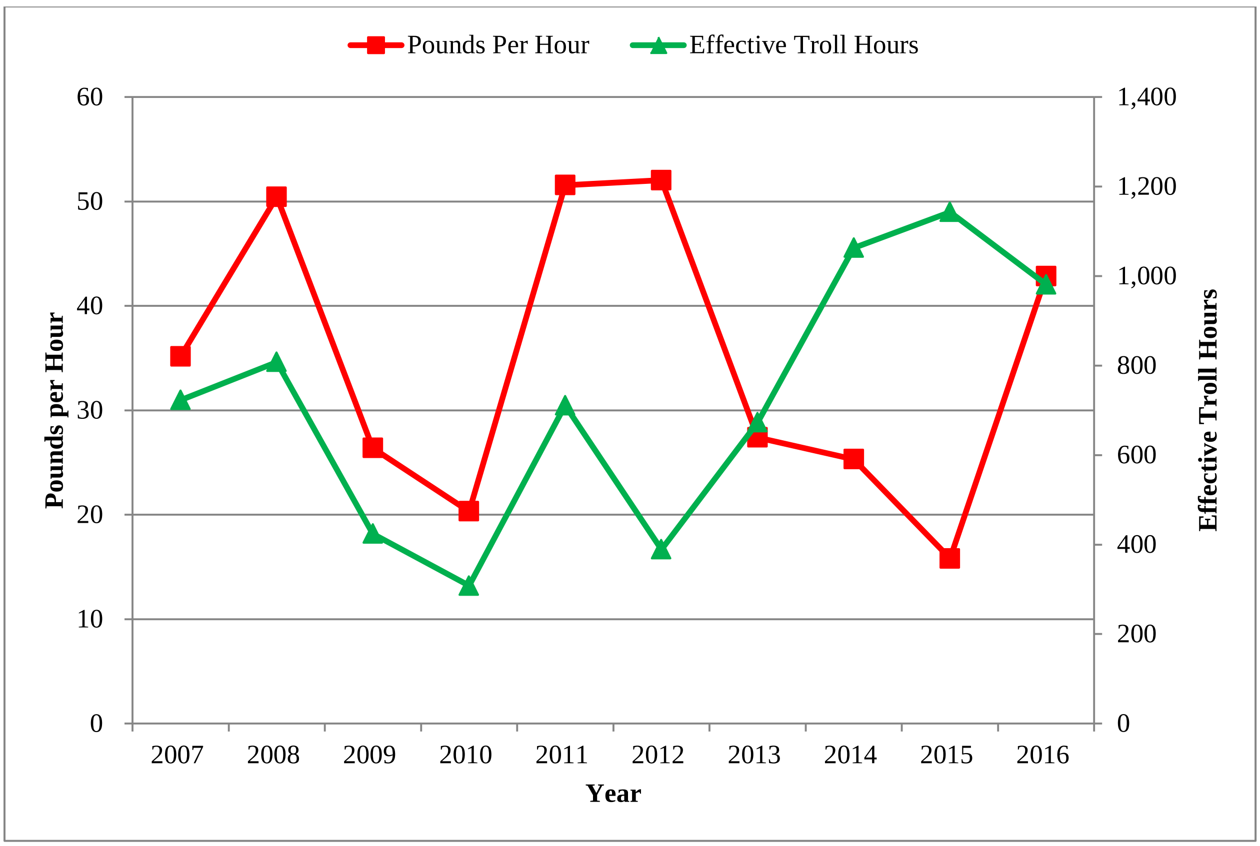
Table 15. American Samoa 2016 Trolling Bycatch Summary (Released Fish)

Species	Released			Total Bycatch	Total Catch	%BC	Interviews		
	Alive	Injured	Unknown				With Bycatch	All	%BC
All Species (Comparison)	0	0	0	0	1,376	N/A	0	46	N/A

Note:

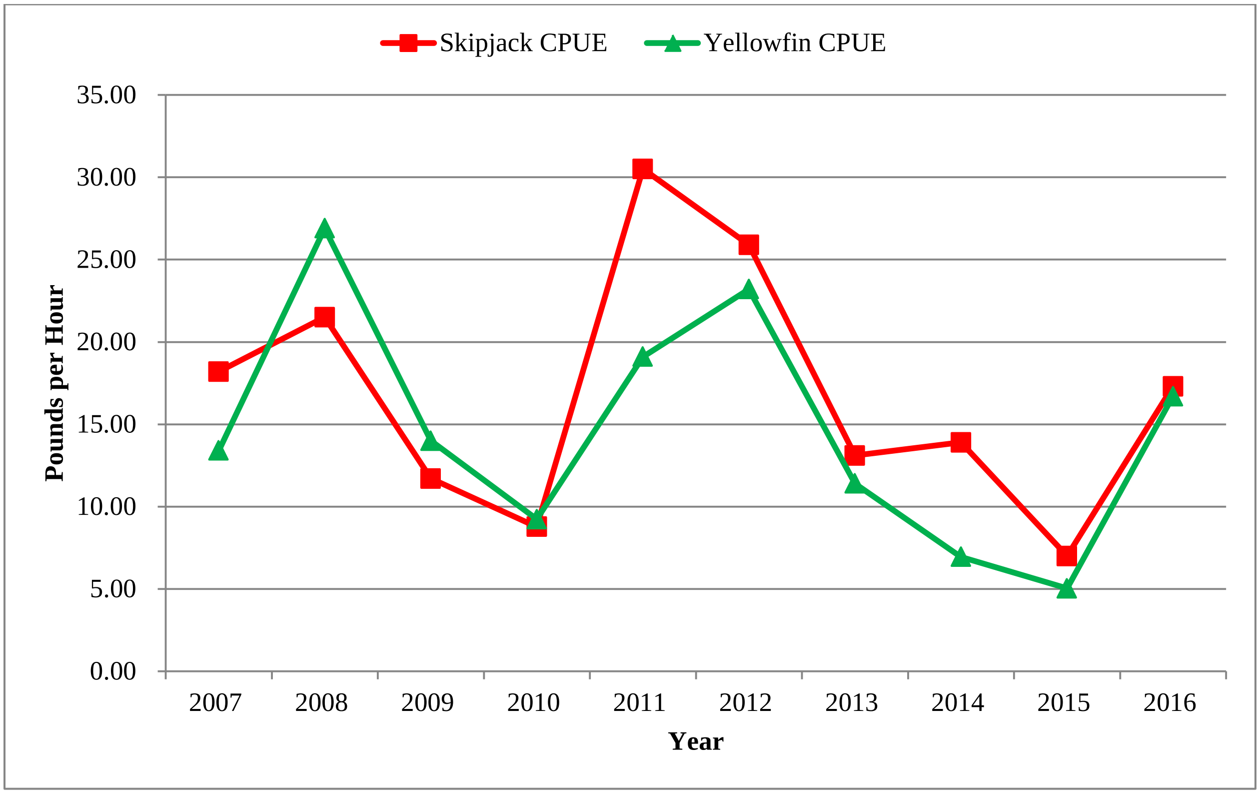
1. "Catch" is the total number of fish counted and estimated in interviews (Tutuila & Manu'a islands) for trolling method.
2. Bycatch information is calculated from raw interview data and represents the % of fish caught or % of interviews (trolling trips) with bycatch.
3. Abbreviations: Dead Inj; released dead or injured; Unk: Released unknown condition; With BC: Number of fisherman interviewed during creel survey who reported bycatch.

Figure 21. American Samoa pelagic catch per hour of trolling and number of trolling hours



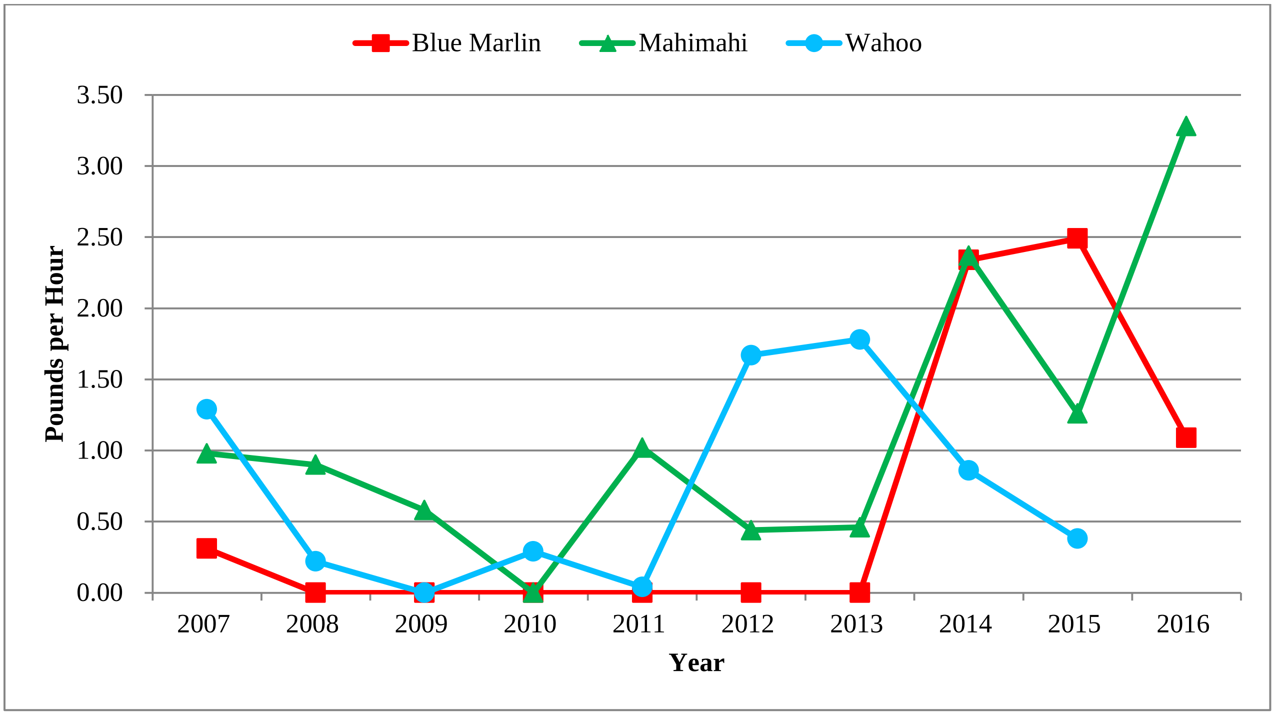
Supporting data shown in Table A-18.

Figure 22. American Samoa trolling catch rates for Skipjack and Yellowfin Tuna



Supporting data shown in Table A-19.

Figure 23. American Samoa trolling catch rates for Blue Marlin, Mahimahi, and Wahoo (creel survey)



Supporting data shown in Table A-20.

2.2 COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

2.2.1 DATA SOURCES

This fishery is characterized by the CNMI Department of Lands and Natural Resources, Division of Fish and Wildlife (DFW), using data from its Commercial Receipt Invoice Database and the Boat-based Creel Survey. The commercial purchase data collection system is dependent upon first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. DFW staff routinely distributes and collects invoice books from participating local fish purchasers on Saipan. This is a voluntary data collection program that includes purchasers at fish markets, stores, restaurants and hotels, as well as roadside vendors ("fish-mobiles").

Currently, DFW's Commercial Purchase Data Collection System and the boat-based Creel Survey are documenting landings only on the island of Saipan. Although the Saipan Commercial Purchase Data Collection System has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be used. It is believed that the 2015 Commercial Purchase Data includes about 50-60% of commercial landings for pelagic species on Saipan, based on the following estimates. In addition to unreported fish sales by official vendors (10-20%), there is also a subsistence fishery on Saipan, which profits by selling a small portion of the catch to cover fishing expenses. Some fishermen sell their catch by going door to door. This commercial catch comprises about 30% of unreported commercial landings, since it is not sold to fish purchasers participating in the invoice book program. Combined with the 10-20% of data from official commercial fish purchasers (fish vendors) that DFW is unable to capture for a variety of reasons (no forms returned, vendors missed, nonparticipation), an estimated 40-50% of total commercial sales are not included in the Commercial Purchase Data reported here for Saipan.

In addition to Commercial Purchase data, the boat-based creel survey has been continuously implemented since April 2000. Creel data only analyzes fishing activity on the island of Saipan, as there are no boat-based creel survey programs for Tinian and Rota. One of DFW's goals is to expand the data collection program to the islands of Tinian and Rota, however securing long term funding is challenging. Pilot boat-based creel surveys are currently being conducted on Tinian and Rota, although these data are incomplete and not included in this analysis. The creel survey targets both charter and non-charter vessels. DFW staff conducted 80 survey days in 2016 (see Table A-21). Due to fewer total trips in 2016 than previous years, staff conducted only 91 interviews, which was the lowest number since the survey began in 2000. Between 2013 and 2015, DFW staff intercepted fewer than 3 charter vessels for interviews. Four were intercepted in 2016. Due to confidentiality requirements, the data cannot be reported for the years 2013 through 2015, and are combined with the non-charter data, where appropriate. A 365-day annual expansion is run for each calendar year of DFW boat-based creel survey data to produce catch and effort estimates for the pelagic fishery, while avoiding over-estimating landings due to seasonal runs of pelagic species.

This report does not include any data from longline vessels.

Effort (number of fishermen) is determined by tallying unique fishermen as recorded on the Commercial Receipt Invoice, while number of trips is assumed to equal the number of invoices submitted, assuming that all sales from a single trip are made on a single day. Percent species composition is calculated by weight for the sampled catch (raw interview data) for each method and applied to the pounds landed to produce catch estimates by species for the expansion period. CPUE data are calculated from the total annual landings of each fishery, divided by the total number of hours spent fishing (gear in use), or by trip assuming that a trip is one day in length. Bycatch data are not expanded to the level of estimated annual trips, and are reported as a direct summary of raw interview data. Some tables include landings of non-PMUS that may not be included in other tables in this report. This artifact of the reporting method results in a slight difference in the total landings and other values within a single table and between tables in this section.

2.2.2 SUMMARY OF CNMI PELAGIC FISHERIES

The number of interviews conducted for the creel surveys slightly decreased in 2016 compared to the previous year. Landings and effort data are adjusted for the creel data, while no adjustment was made for the commercial receipt data. As such, the landings and effort creel data are more accurate estimates than the commercial receipt data.

Landings. Skipjack tuna is the principal species landed, comprising 62% of the entire pelagic landings in 2016 based on creel survey data. Skipjack landings declined more than 33% (191,108 lbs) and total landings declined 25% (307,901 lbs) from 2015 landings.

Landings of mahimahi and yellowfin tuna ranked second and third, respectively, by weight of landings during 2016. Creel data estimated 79,656 lbs of mahimahi, a 10% decrease from 2015. There was 19,609 lbs of yellowfin landed in 2016, a 20% increase from the 2015 landings.

Skipjack tuna are easily caught in near shore waters throughout the year. Mahimahi is seasonal with peak catch usually from February through April. Yellowfin tuna season usually runs from April to September.

Effort. The number of boats involved in CNMI's pelagic fishery has been steadily decreasing since 2001, when there were 113 fishermen reporting commercial pelagic landings. In 2016, only 63 fishermen reported landings, a significant increase from 12 in 2015. The number of trips, based on both the commercial data receipts and the creel survey, has also steadily declined since the late 1990s, dropping to a 33-year low in 2015 with only 352 trips recorded in the database and only 2,640 estimated from the creel survey. In 2015, this represented only 25% and 60% effort of the time-series average for commercial receipt and creel survey data, respectively. In 2016 number of trips based on commercial data receipts increased by 14% over the 2015 value. Total hours trolling was similarly higher in 2016, with 19,260 hours (increase of 37% from 2015). Average trip length has remained steady, averaging between 5.1 and 5.5 hours per trip since 2008. As noted above, charter fishing is a very small overall component of the trolling fishery, and due to confidentiality, cannot be reported independently.

CPUE. In 2016, trolling catch rates decreased to 15.9 lbs. per trolling hour, a level similar to 2014 levels after a significant increase in 2015. The skipjack catch rate, the primary target species in CNMI, decreased to 9.9 lbs. per hour fished. This catch rate is the lowest since the reimplementation of the creel survey in 2000. Yellowfin catch rate in 2016 was near the long-term average at 1.00 lbs per hour, while the mahimahi catch rate decreased 34% in 2016, down from a peak in 2015.

Revenues. Commercial revenues, based on the commercial receipts, at $195,155, were near an all-time low in 2016, although as noted, not all 2016 receipts have been entered into the database. Average price per pound for all pelagics, tuna and non-tuna pelagics, were all lower than the long-term average. The average price for all pelagics was $2.10 driven by the low ($2.08) price for skipjack.

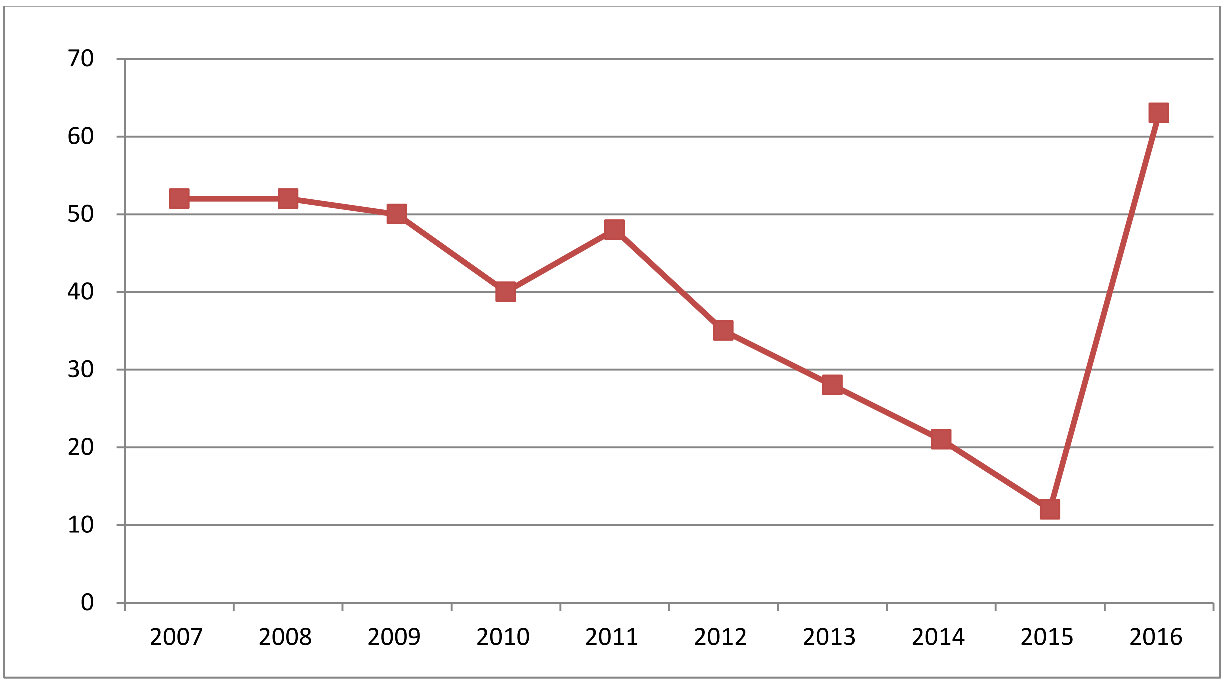
Bycatch. Bycatch is not a significant issue in the CNMI, as fishermen retain their catch regardless of species, size or condition. Based on creel survey interviews, no fish were caught as bycatch in the trolling fisheries in the years 2007-2016.

2.2.3 PLAN TEAM RECOMMENDATIONS

The CNMI has no recommendations in 2016 to be forwarded to the Council.

2.2.4 OVERVIEW OF PARTICIPATION AND EFFORT – NON-CHARTER AND CHARTER

Figure 24. Number of CNMI Fishermen (Boats) Making Commercial Pelagic Landings



Note: Due to data reporting methods, the number of fishermen may include duplicate counts. Supporting data shown in Table A-22.

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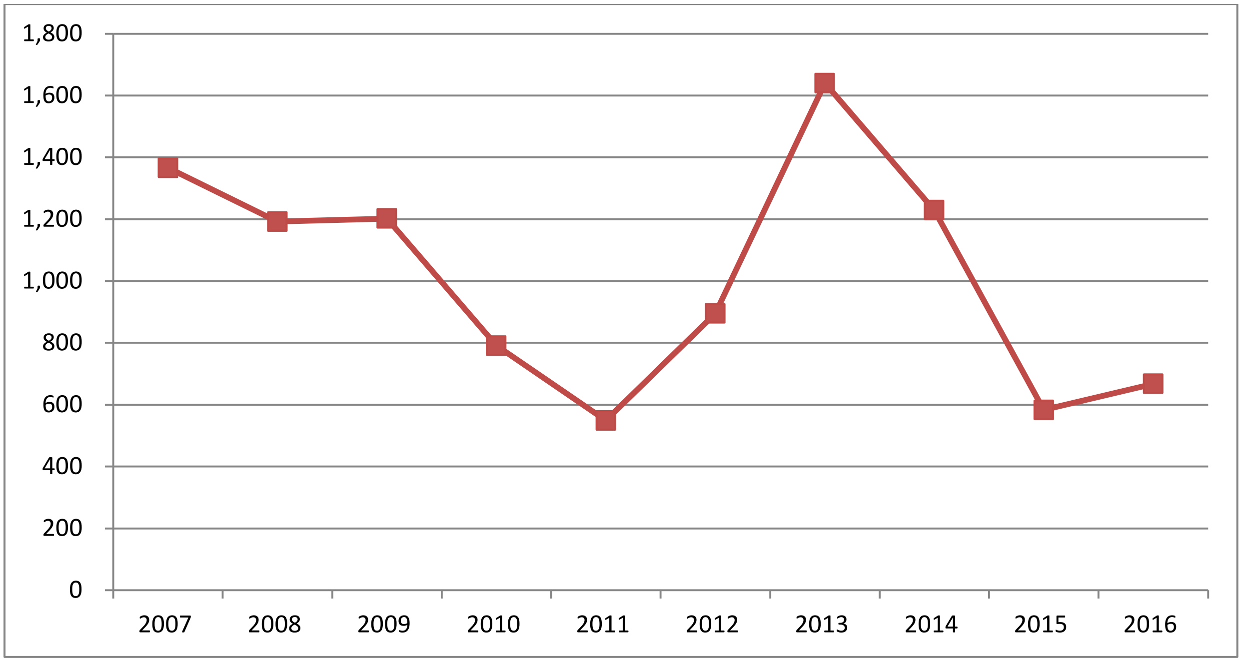
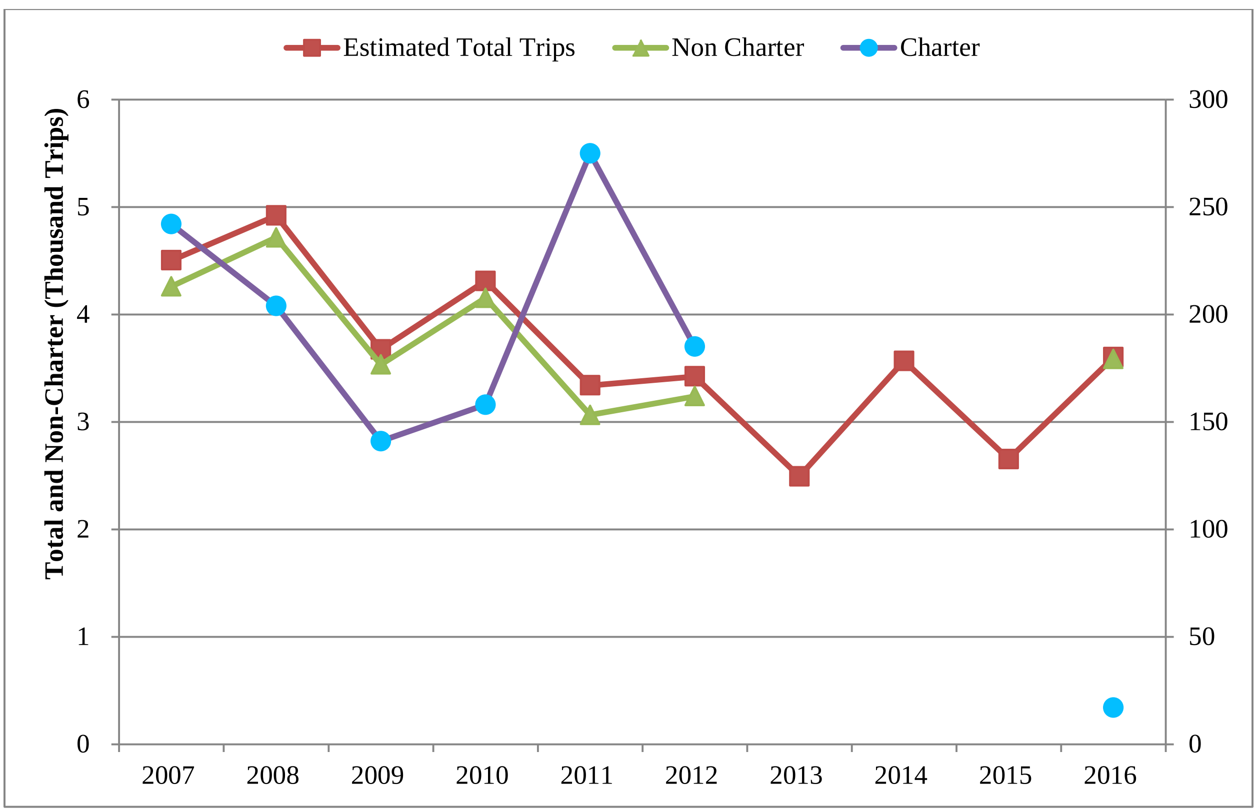
Figure 25. CNMI Numbers of Trips Catching Any Pelagic Fish from Commercial Receipt Invoices



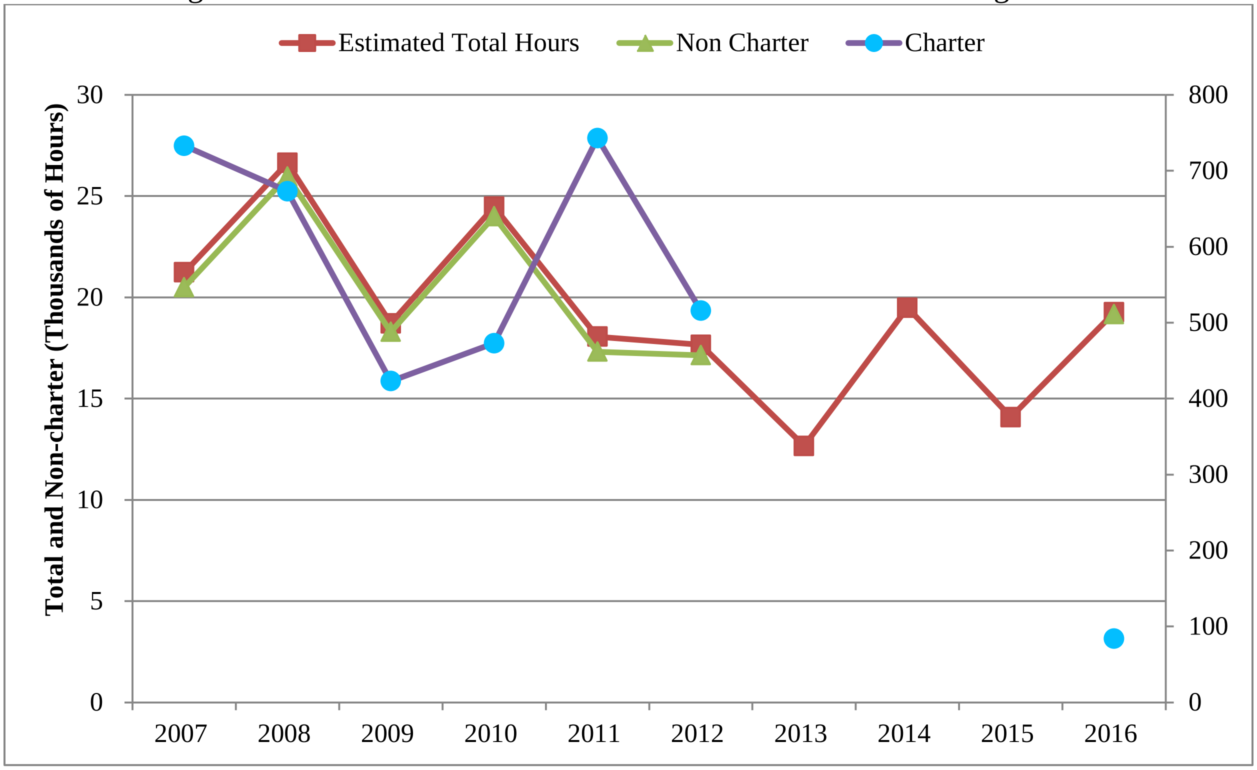
Supporting data shown in Table A-23.

Figure 26. CNMI Boat-based Creel Estimated Number of Trolling Trips



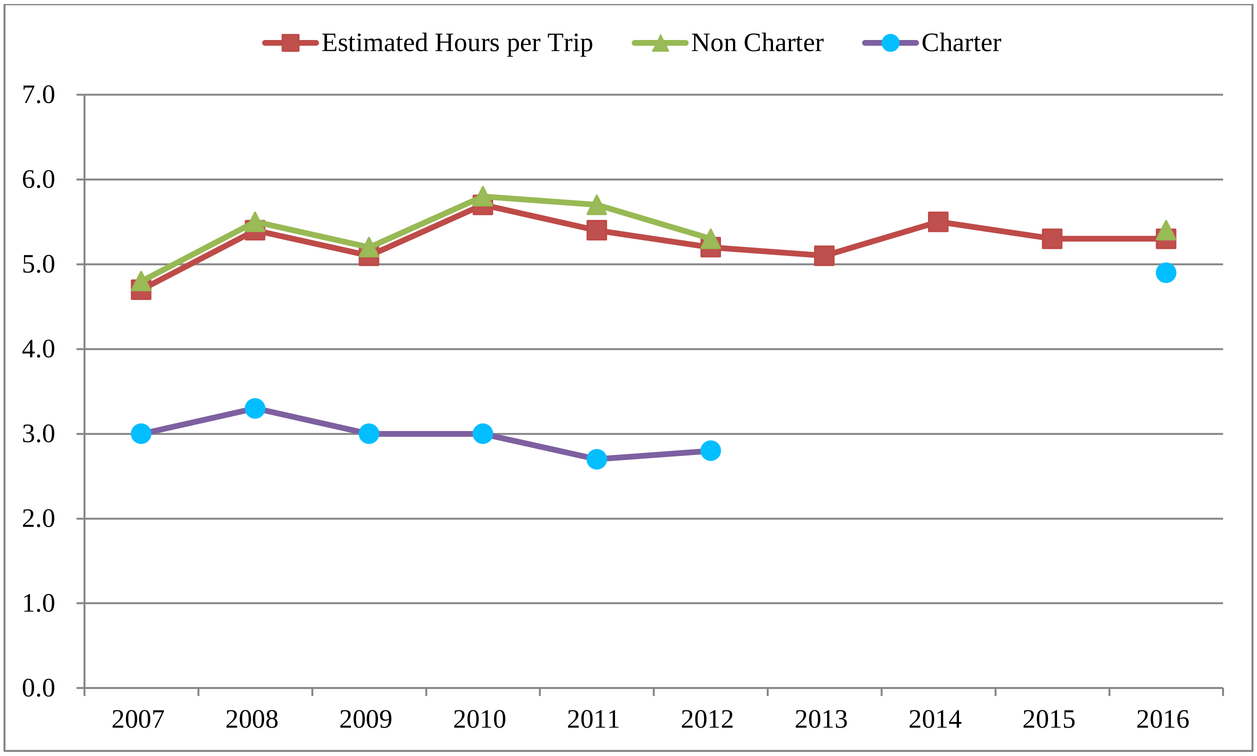
Supporting data shown in Table A-24.

Figure 27. CNMI Boat-based Creel Estimated Number of Trolling Hours



Supporting data shown in Table A-25.

Figure 28. CNMI Boat-Based Creel Average Trip Length – Hours per Trip



Supporting data shown in Table A-26.

2.2.5 OVERVIEW OF LANDINGS ‑ NON CHARTER AND CHARTER

Table 16. CNMI 2016 Creel Survey – Pelagic Species Composition

Species	Total Landing (Lbs)
Skipjack Tuna	191,108
Yellowfin Tuna	19,609
Kawakawa	2,139
Tuna PMUS	212,856
Mahimahi	79,656
Wahoo	4,968
Blue Marlin	0
Sailfish	0
Shortbill Spearfish	0
Non-tuna PMUS	84,662
Total Pelagics	307,901

Note: Total pelagic landings is greater than the sum of the individual species due to an artifact in reporting process, where the difference accounts for non-PMUS reported as part of the creel survey.

Table 17. CNMI 2016 Commercial Pelagic Landings, Revenues and Price

Species	Pounds	Value	Average Price
SKIPJACK TUNA	76,476.7	158,896.1	2.08
YELLOWFIN TUNA	8,474.8	19,068.5	2.25
SABA (KAWAKAWA)	939.0	1,910.0	2.03
TUNA PMUS TOTALS AND AVERAGE PRICE	85,890.5	179,874.6	2.09
MAHIMAHI	2,932.5	6,427.0	2.19
WAHOO	720.0	1,529.5	2.12
BLUE MARLIN	1,004.4	2,005.6	2.00
SICKLE POMFRET (W/WOMAN)	382.5	872.4	2.28
NON-TUNA PMUS TOTALS AND AVERAGE PRICE	5,039.4	10,834.5	2.15
DOGTOOTH TUNA	694.0	1,446.0	2.08
RAINBOW RUNNER	1,079.0	2,504.4	2.32
BARRACUDA	12.0	0.0	N/A
TROLL FISH (MISC.)	191.9	495.8	2.58
NON-PMUS PELAGIC TOTALS AND AVERAGE PRICE	1,976.9	4,446.2	2.25
PELAGIC TOTALS AND AVERAGE PRICE	92,906.8	195,155.3	2.10

Note: Total pelagic landings is greater than the sum of the individual species due to an artifact in reporting process, where the difference accounts for non-PMUS reported as part of the creel survey.

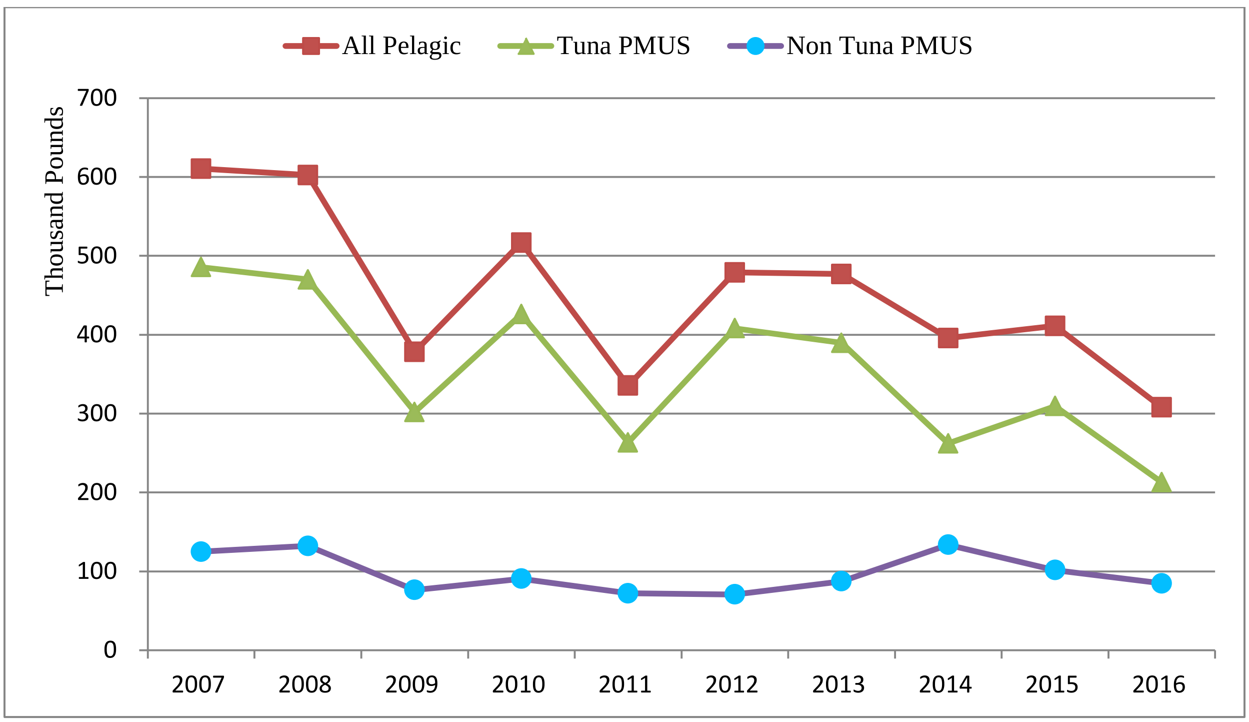
Table 18. Offshore Daytime Creel Survey Bycatch Summary, 2007-2016

Number Caught						Trip		
Species	Released	Dead/ Injured	Both	All	BC%	With BC	All	BC%
All Species Comparison	0	0	0	30,769	0	0	1280	0.

Note:

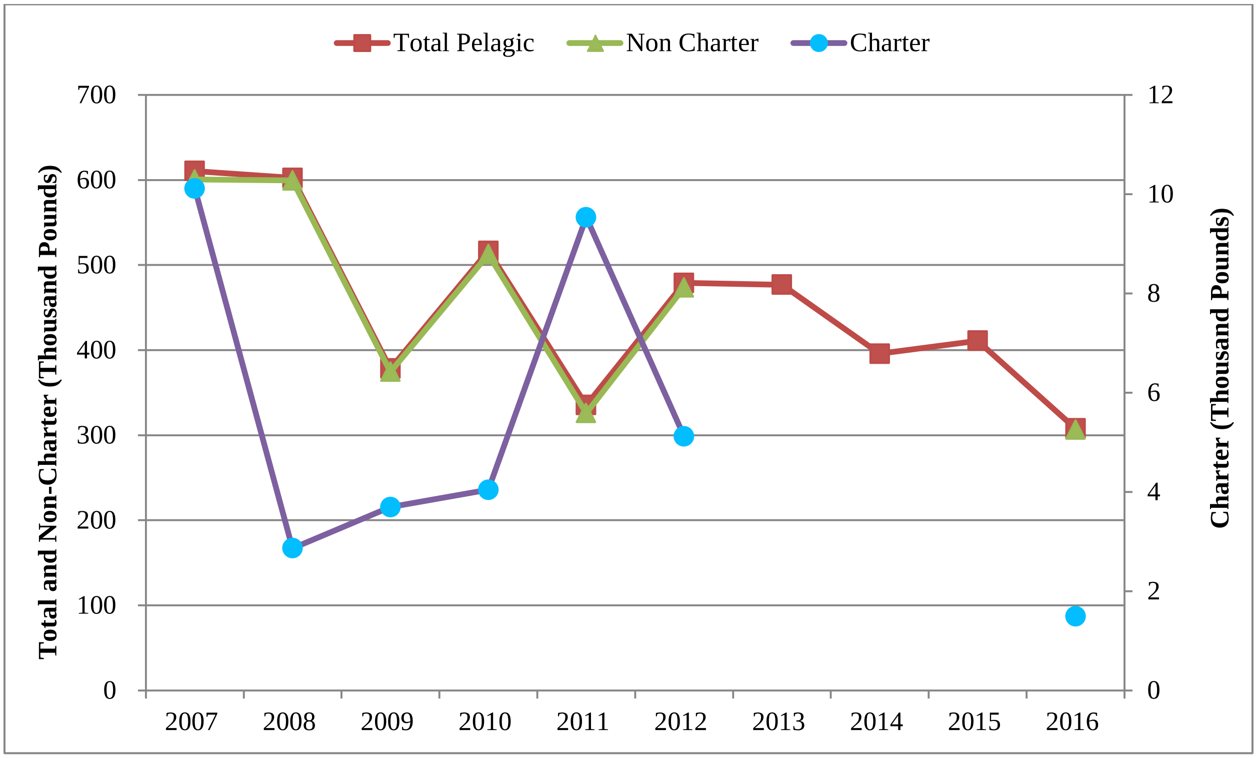
1. "Catch" is the total number of fish counted and estimated in interviews for trolling method.
2. Bycatch information is calculated from raw interview data and represents the % of fish caught or % of interviews (trolling trips) with bycatch.
3. Abbreviations: Dead Inj; released dead or injured; Unk: Released unknown condition; With BC: Number of fisherman interviewed during creel survey who reported bycatch.

Figure 29. CNMI Annual Estimated Total Landings: All Pelagics, Tunas PMUS, and Non-Tuna PMUS



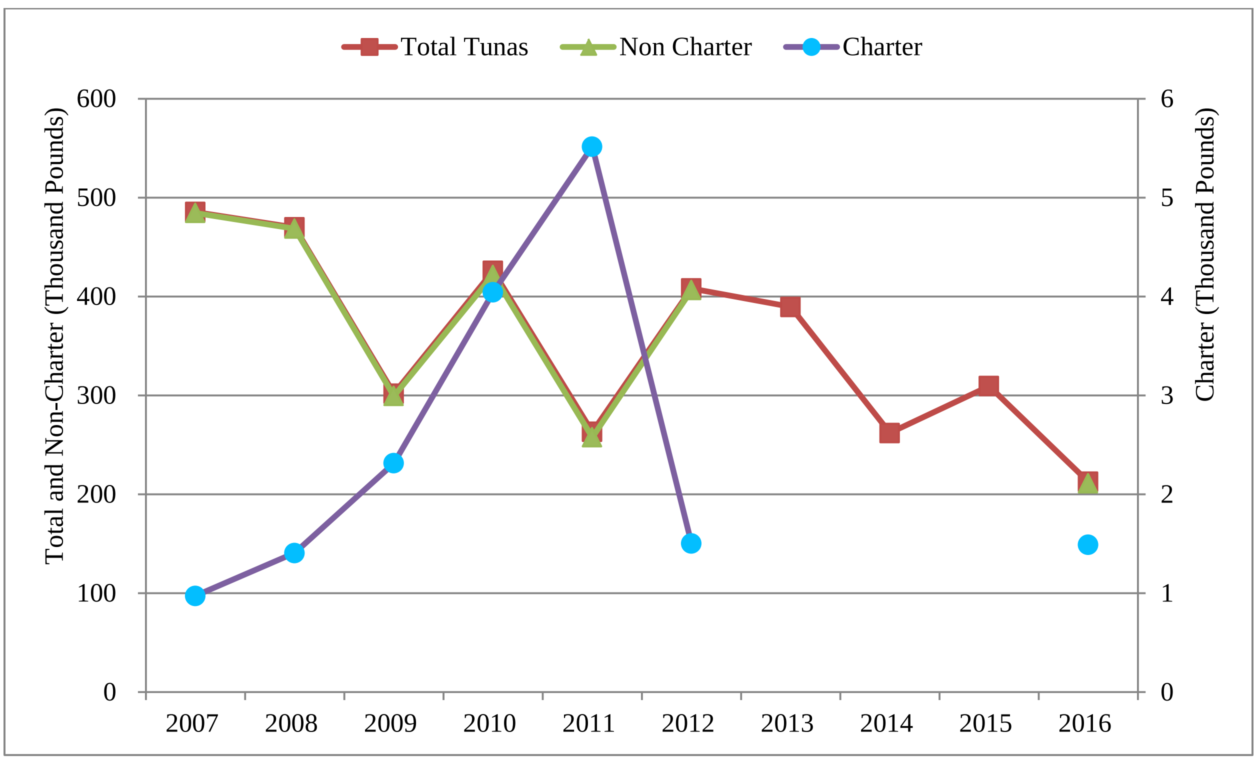
Supporting data shown in Table A-27.

Figure 30. CNMI Annual Estimated Total Pelagic Landings: Total, Non-Charter, and Charter



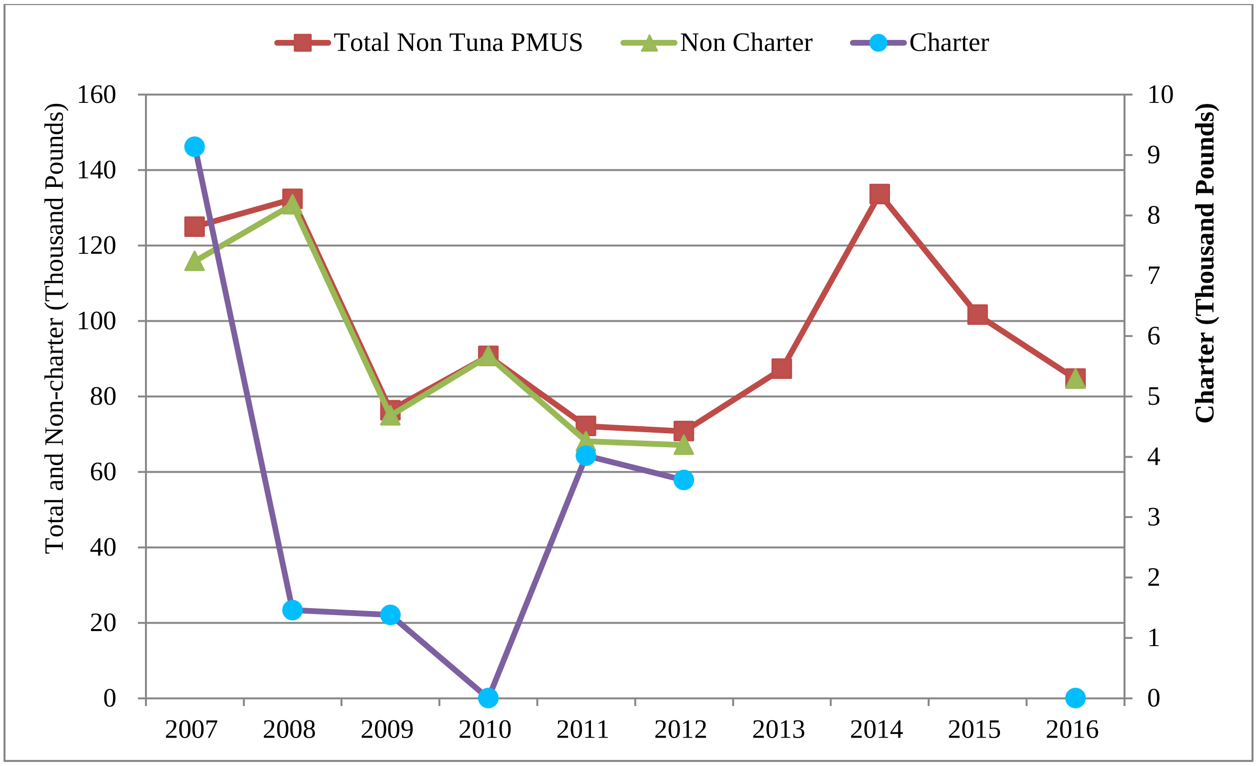
Supporting data shown in Table A-28.

Figure 31. CNMI Annual Estimated Total Tuna PMUS Landings: Total, Non-Charter, and Charter



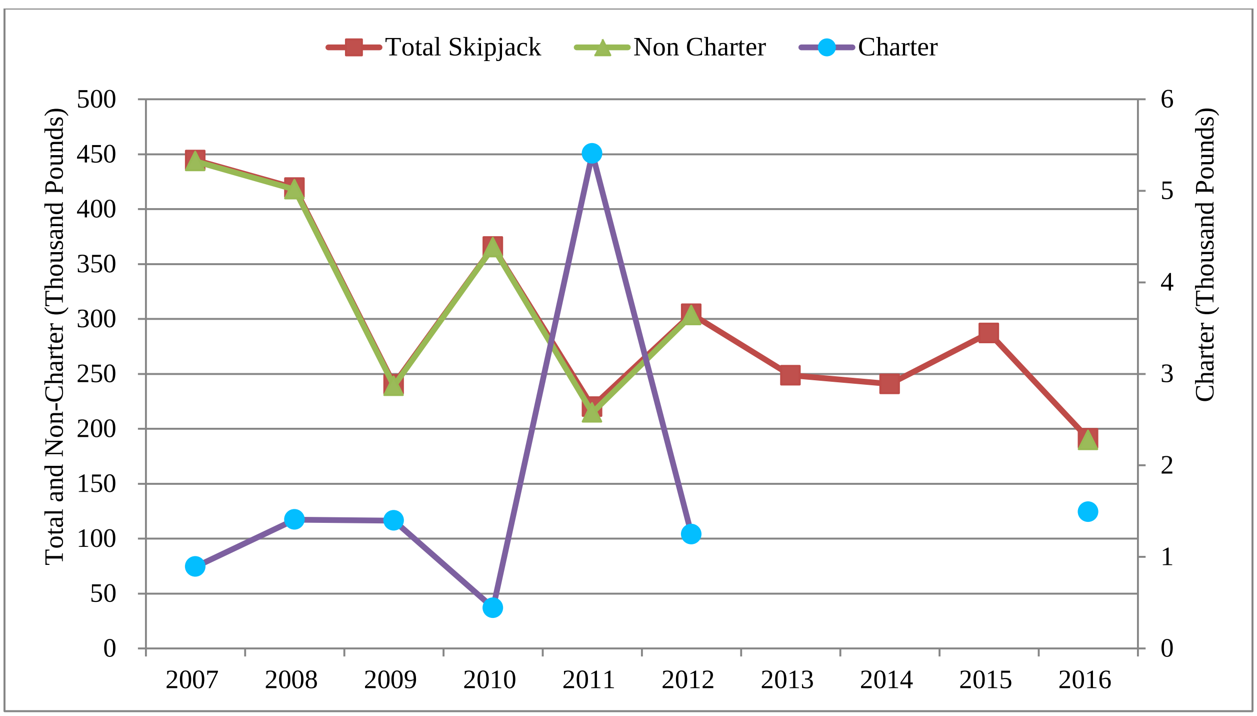
Supporting data shown in Table A-29.

Figure 32. CNMI Annual Estimated Total Non-Tuna PMUS Landings: Total, Non-Charter, and Charter



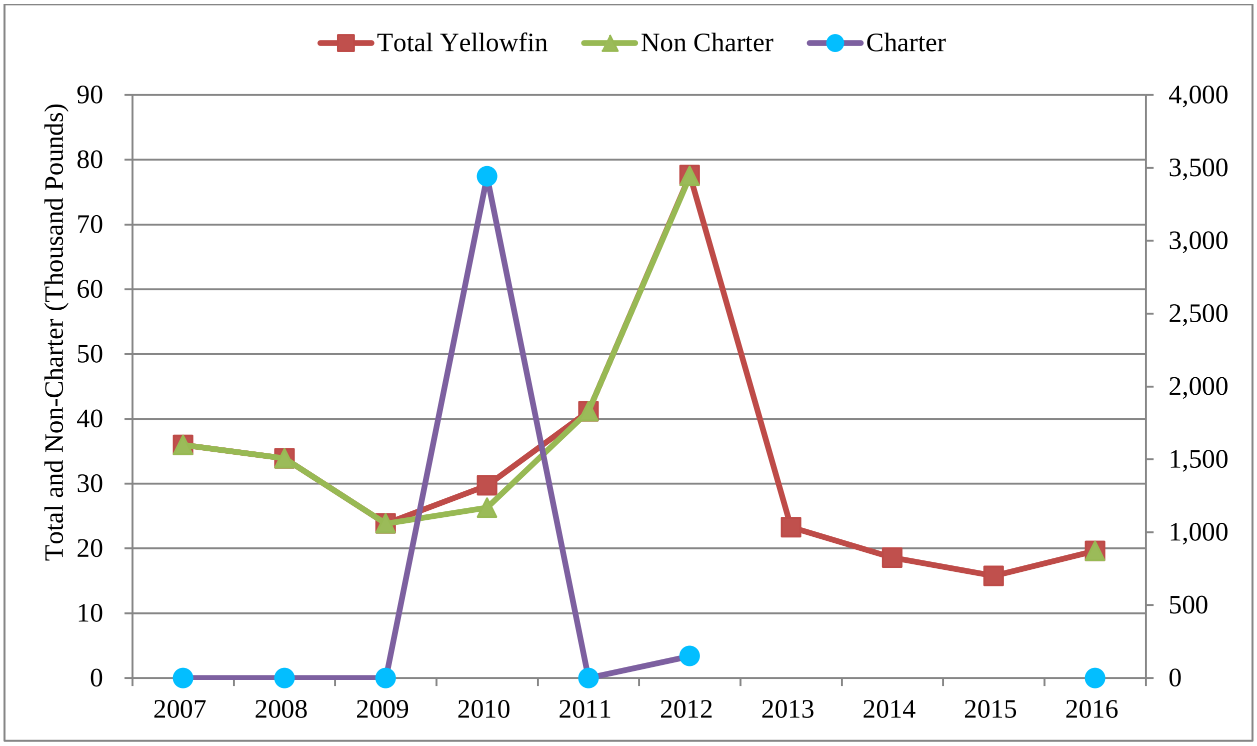
Supporting data shown in Table A-30.

Figure 33. CNMI Annual Estimated Total Skipjack Landings: Total, Non-Charter, and Charter



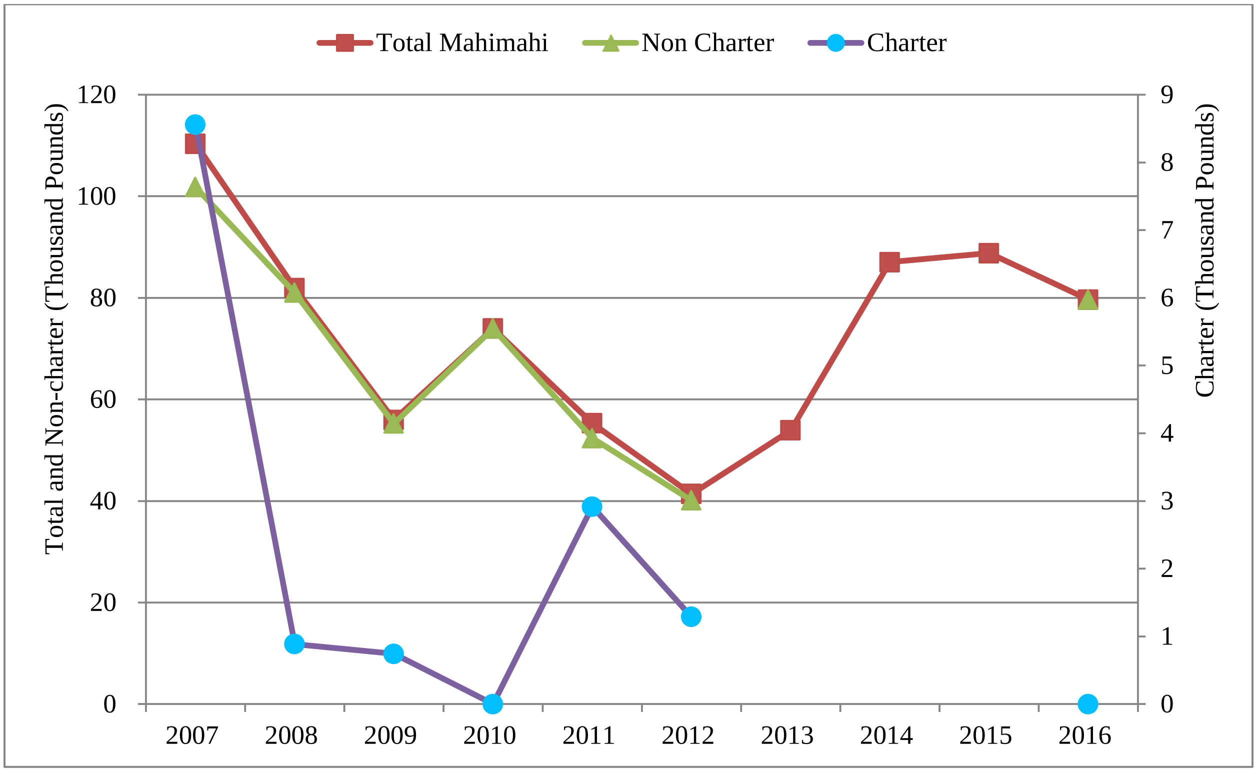
Supporting data shown in Table A-31.

Figure 34. CNMI Annual Estimated Total Yellowfin Landings: Total, Non-Charter, and Charter



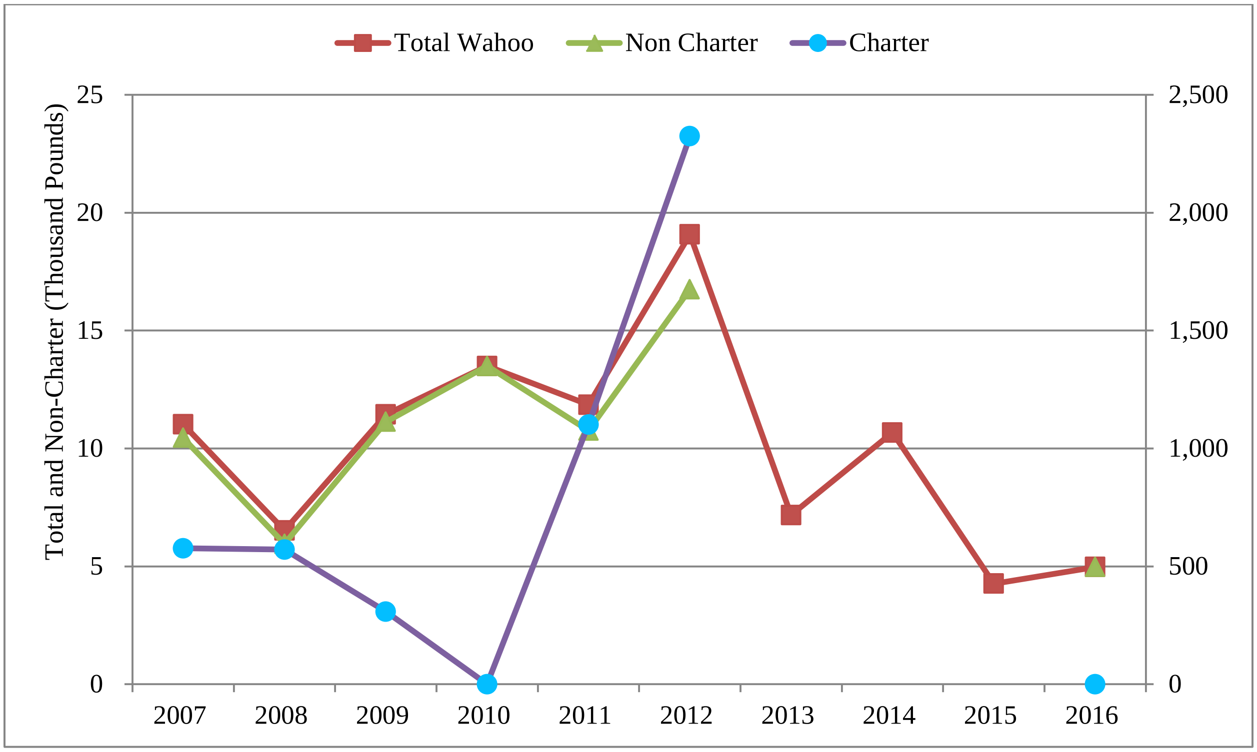
Supporting data shown in Table A-32.

Figure 35. CNMI Annual Estimated Total Mahimahi Landings: Total, Non-Charter, and Charter



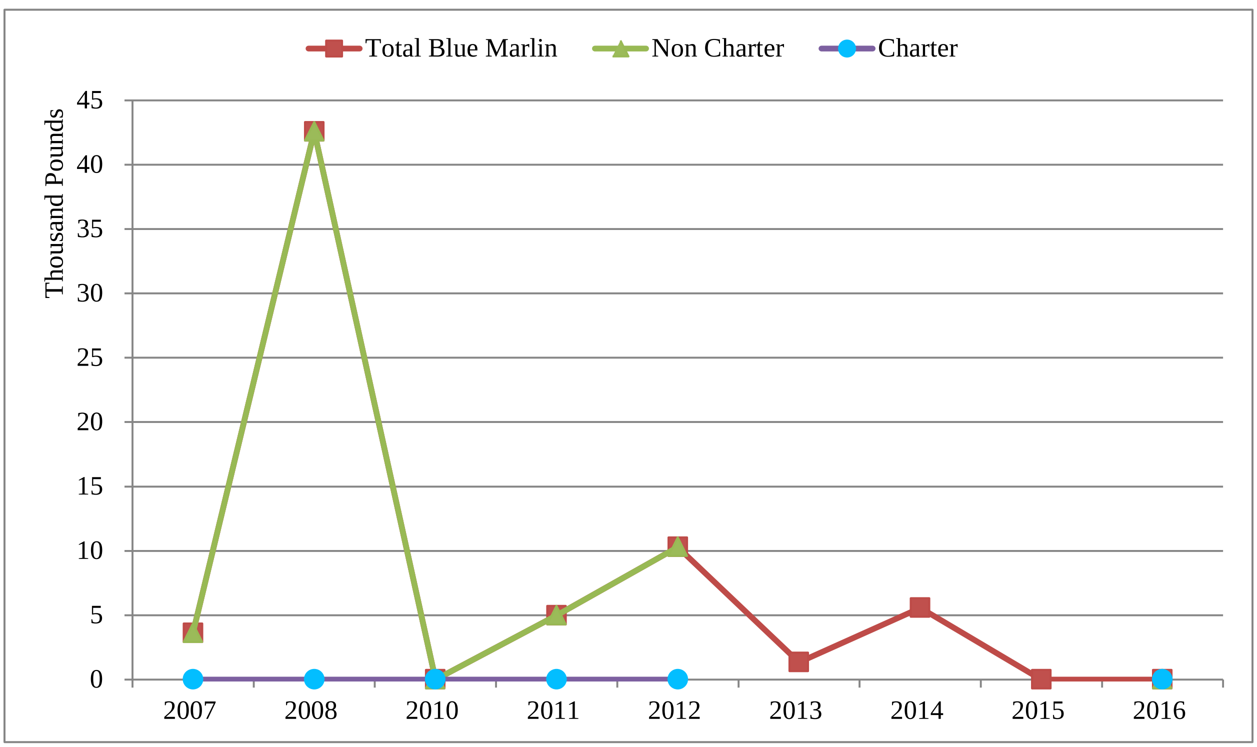
Supporting data shown in Table A-33.

Figure 36. CNMI Annual Estimated Total Wahoo Landings: Total, Non-Charter, and Charter



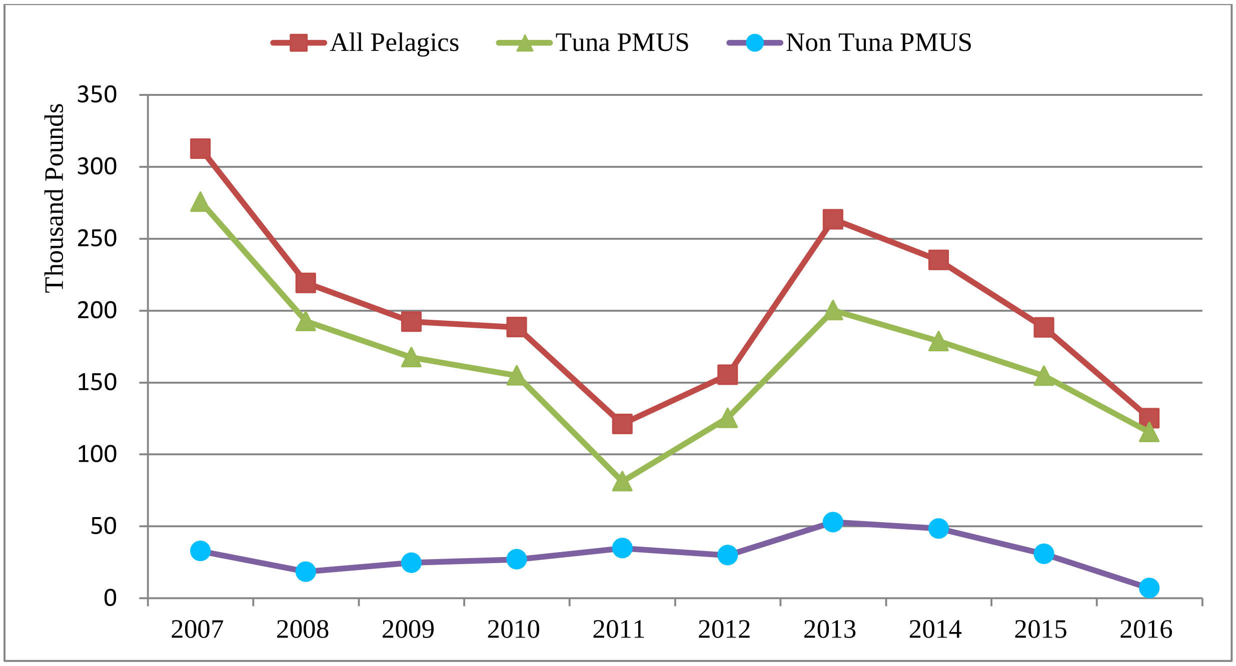
Supporting data shown in Table A-34.

Figure 37. CNMI Annual Estimated Total Blue Marlin Landings: Total, Non-Charter, and Charter



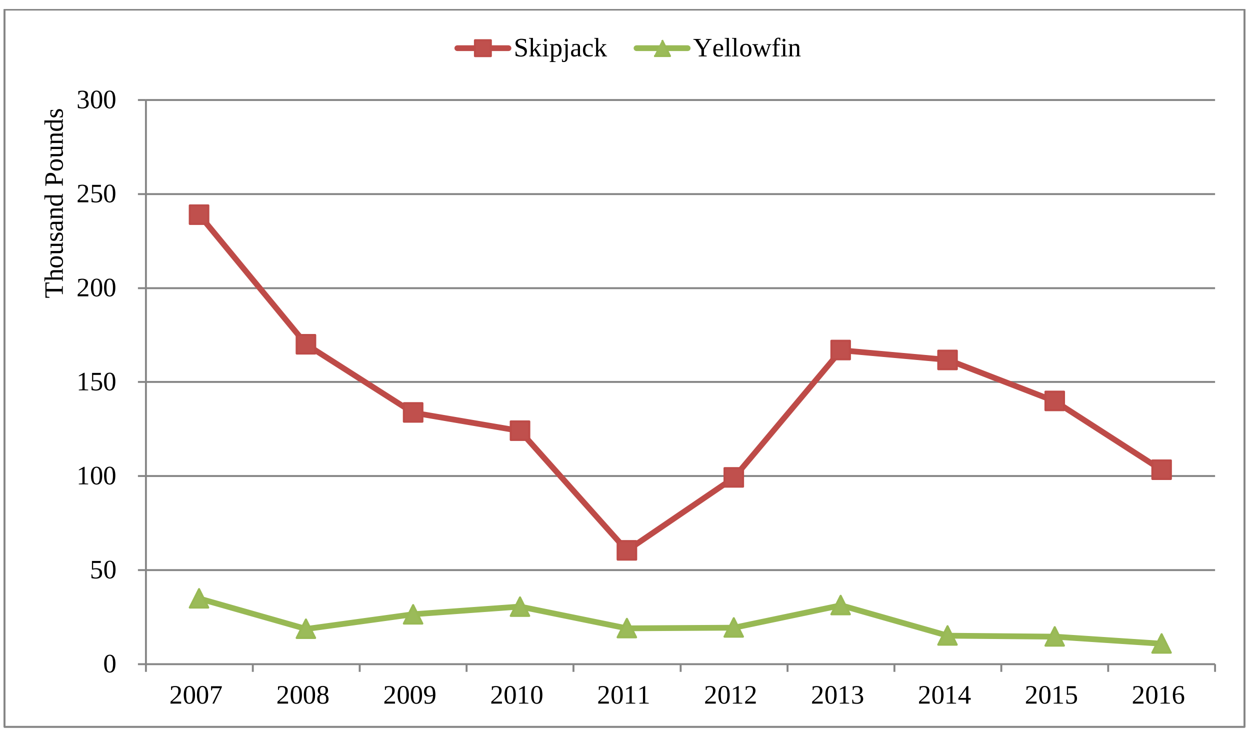
Supporting data shown in Table A-35.

Figure 38. CNMI Annual Commercial Landings: All Pelagics, Tuna PMUS, and Non-Tuna PMUS



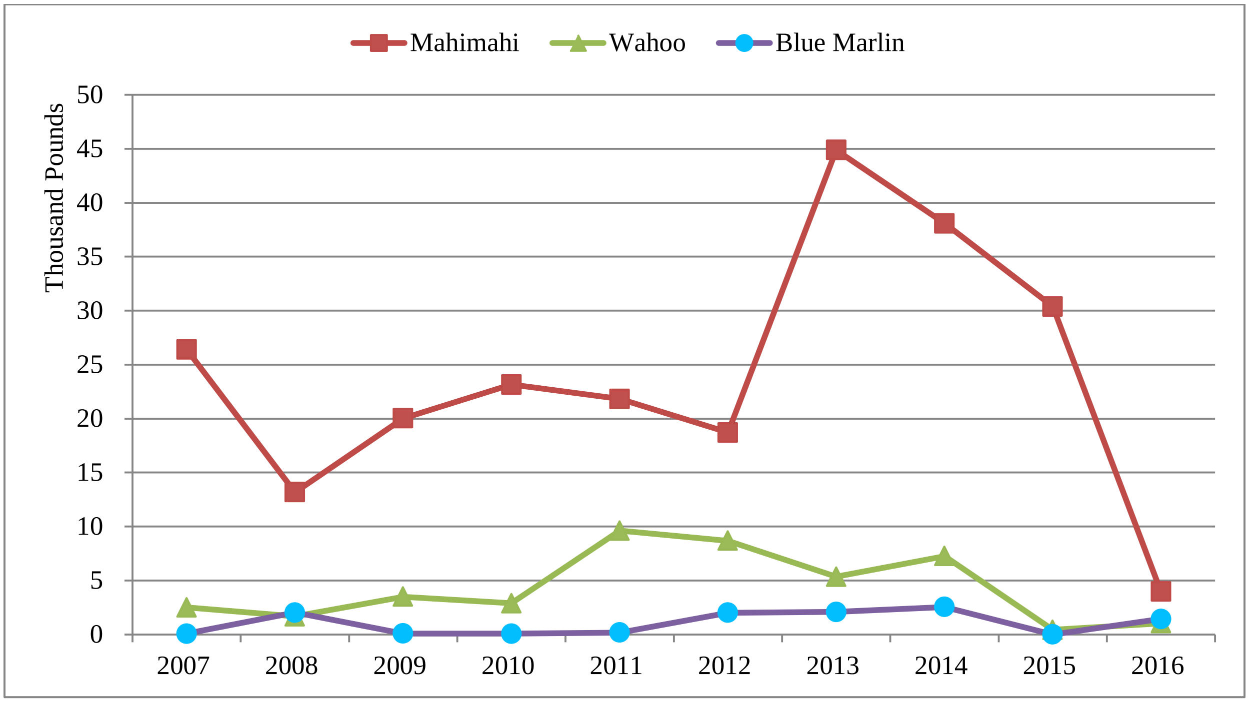
Supporting data shown in Table A-36.

Figure 39. CNMI Annual Commercial Landings: Skipjack and Yellowfin



Supporting data shown in Table A-37.

Figure 40. CNMI Annual Commercial Landings: Mahimahi, Wahoo, and Blue Marlin

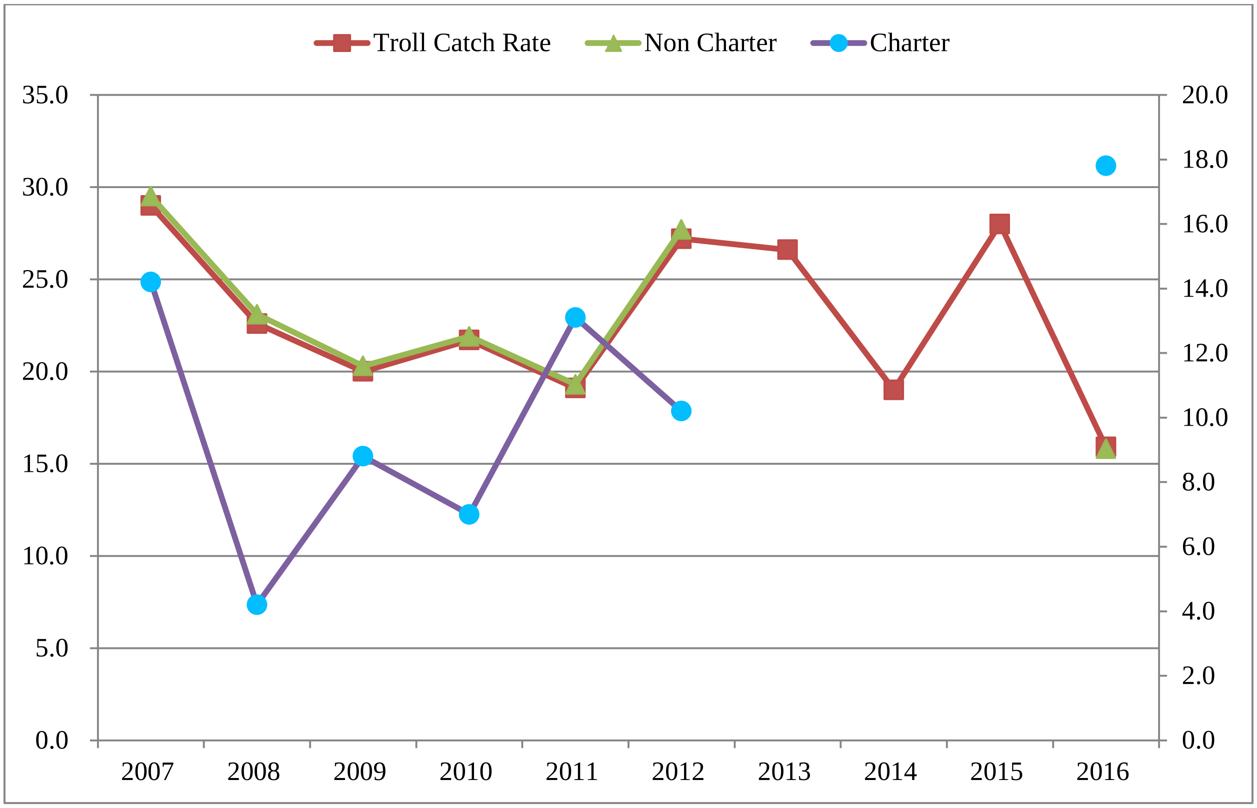


Supporting data shown in Table A-38.

2.2.6 OVERVIEW OF CATCH PER UNIT EFFORT – ALL FISHERIES

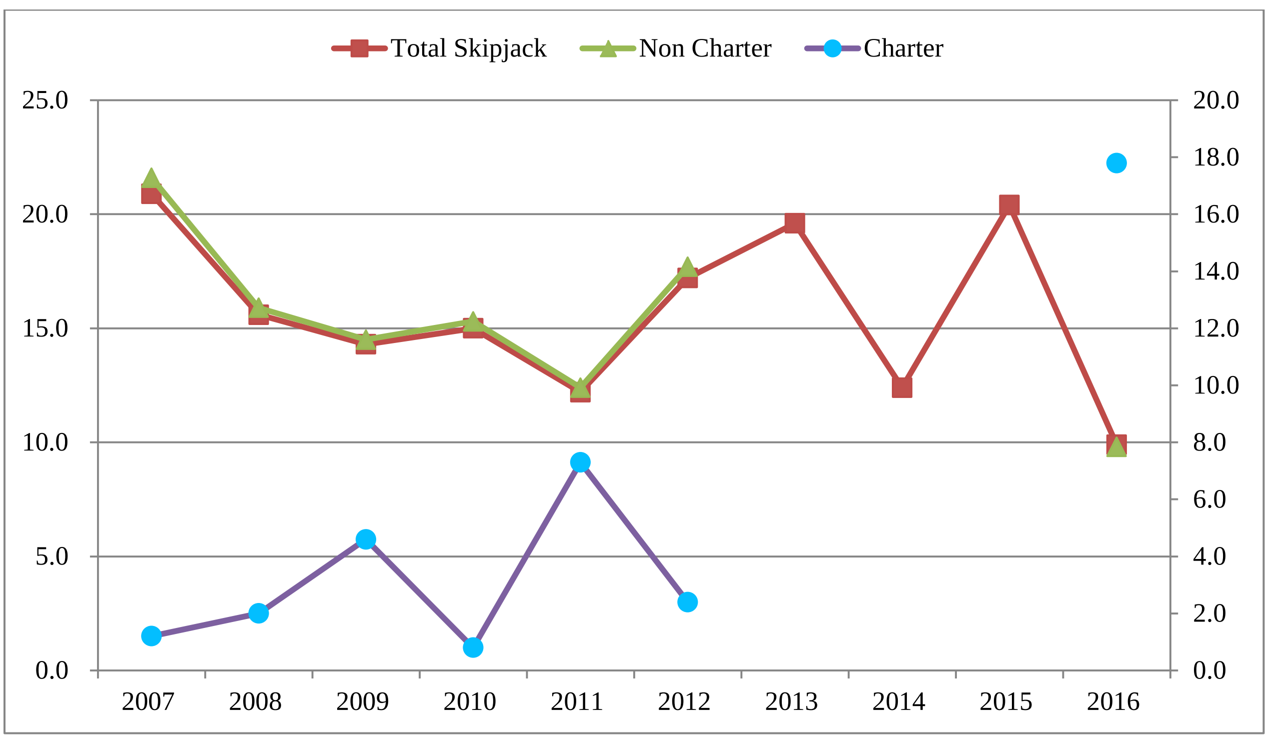
This section provides catch rates for the five main species landed by trolling. Lbs per hour trolled are determined from creel survey interviews and include charter and non-charter sectors, while lbs per trip are determined from commercial invoice receipts.

Figure 41. CNMI Boat-based Creel Trolling Catch Rates (lbs per hour)



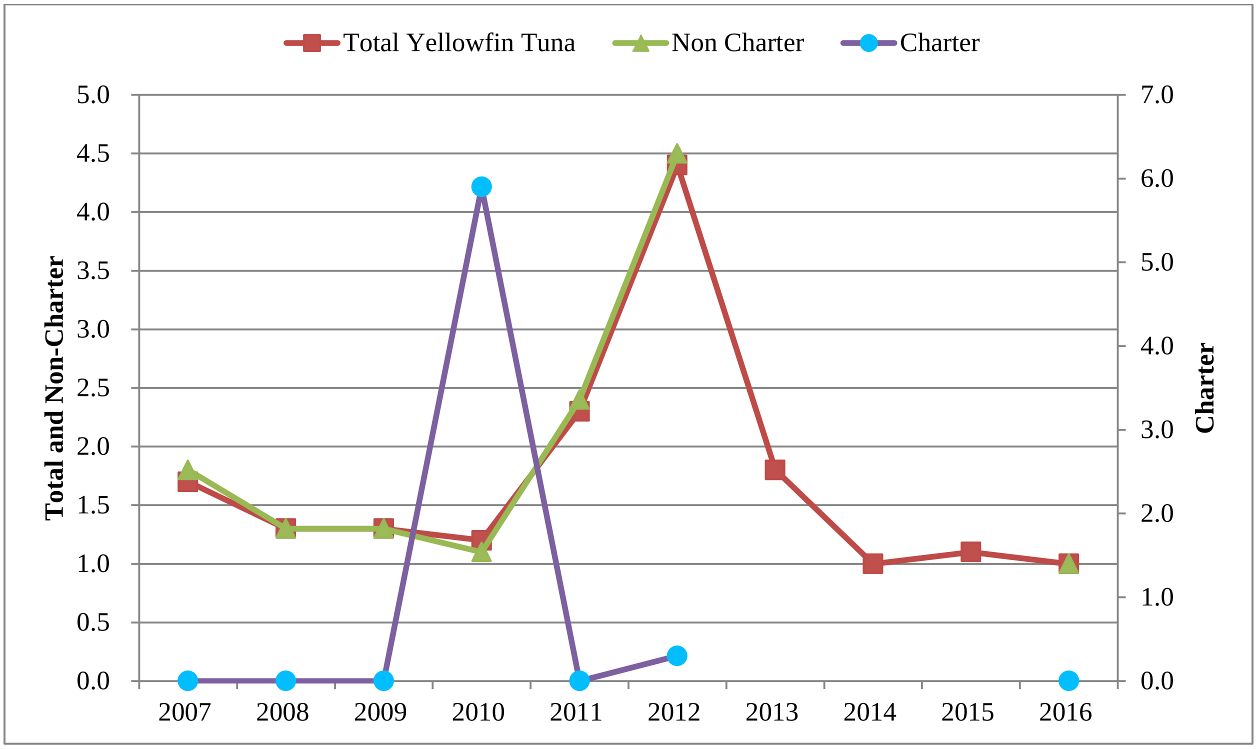
Supporting data shown in Table A-39.

Figure 42. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Skipjack



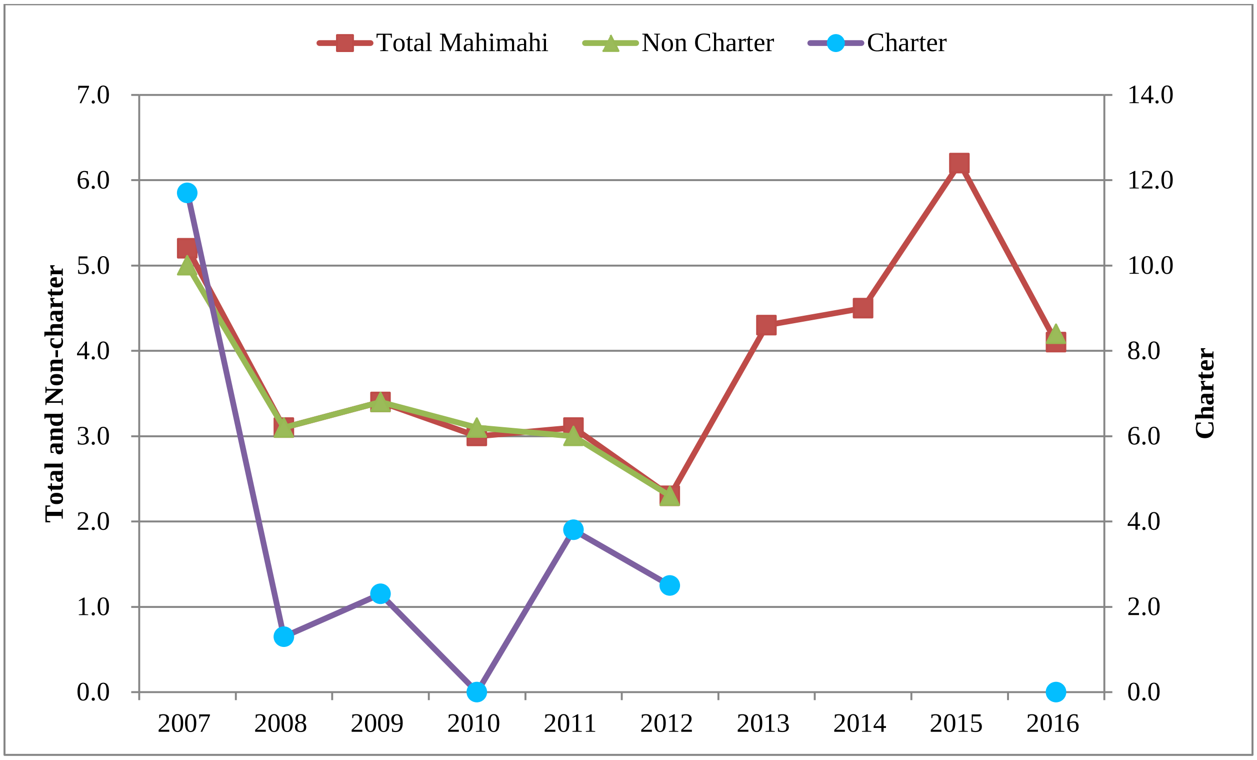
Supporting data shown in Table A-40.

Figure 43. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Yellowfin



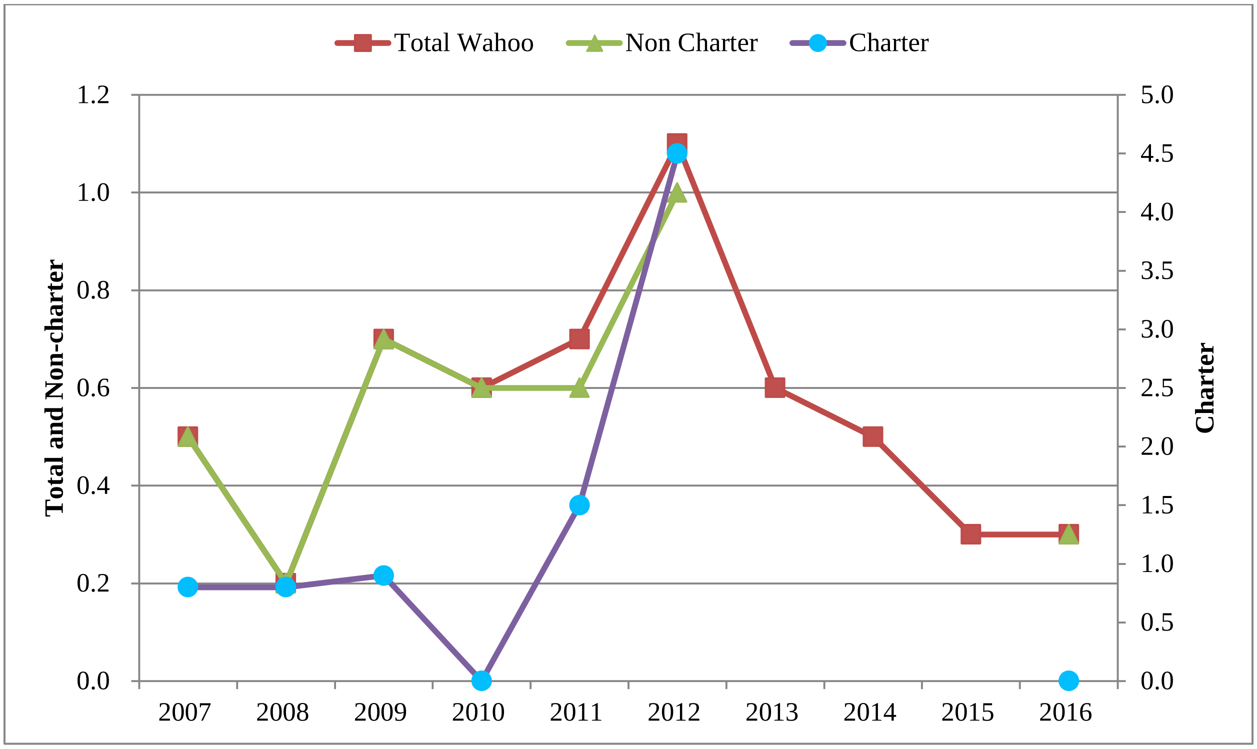
Supporting data shown in Table A-41.

Figure 44. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Mahimahi



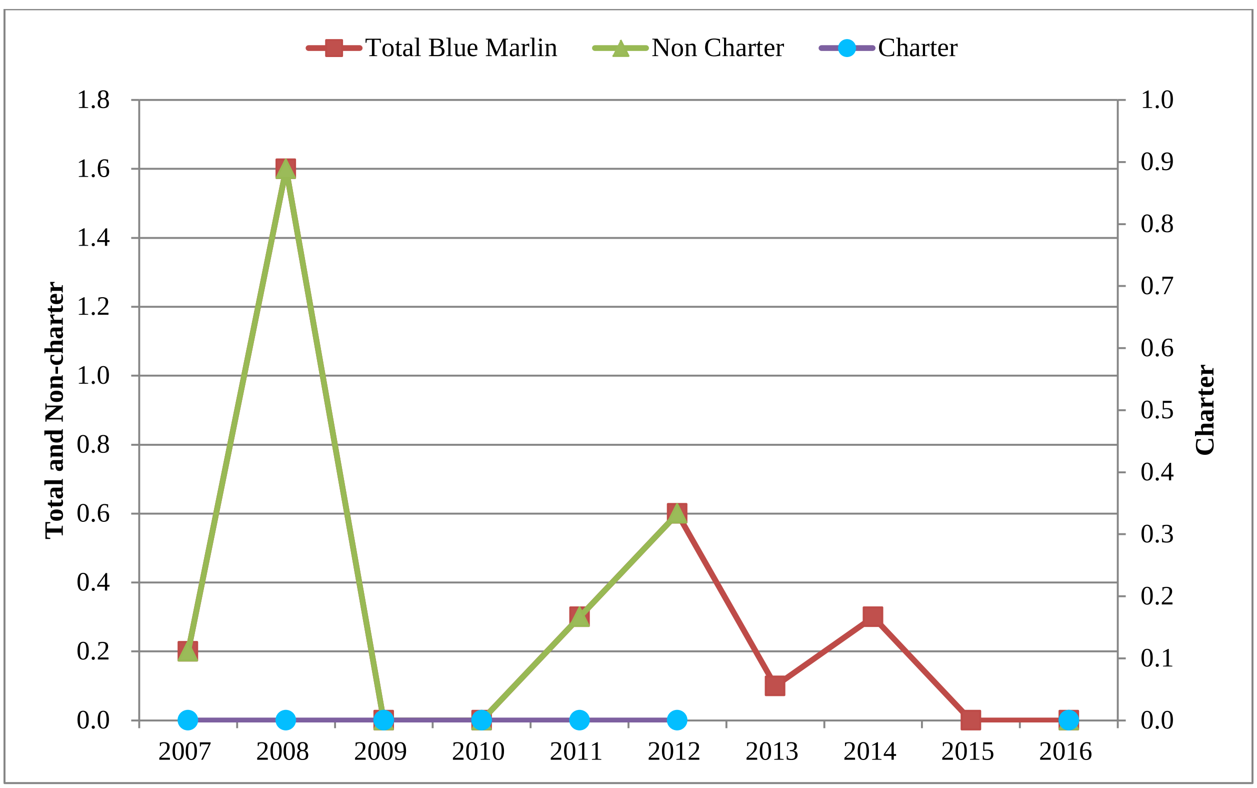
Supporting data shown in Table A-42.

Figure 45. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Wahoo



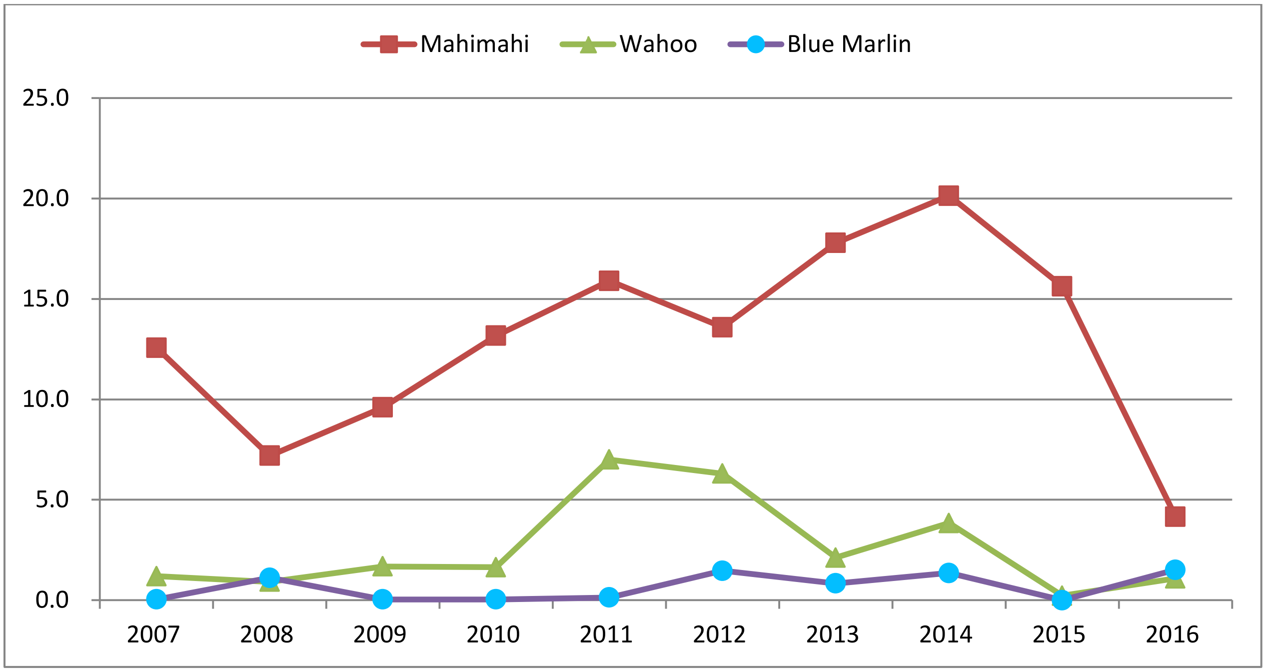
Supporting data shown in Table A-43.

Figure 46. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Blue Marlin



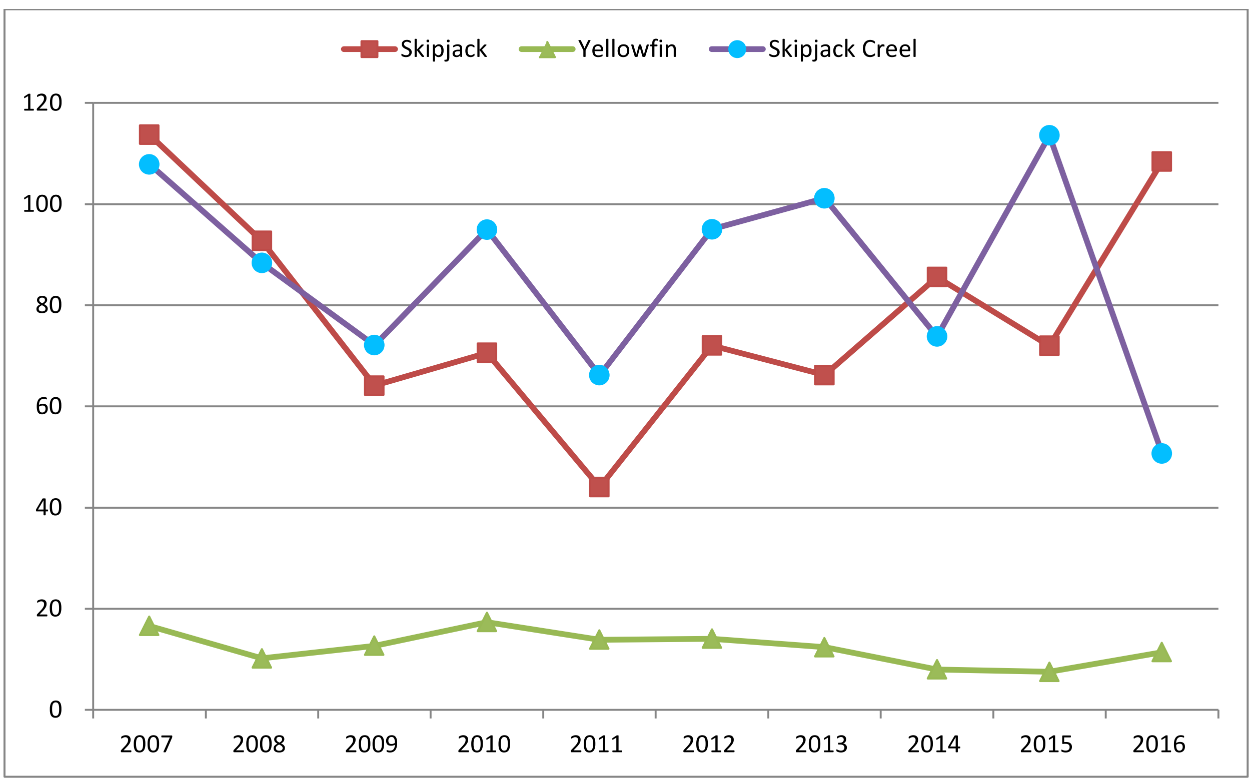
Supporting data shown in Table A-44.

Figure 47. CNMI Trolling Catch Rates of Skipjack and Yellowfin Tuna (lbs/trip)



Supporting data shown in Table A-45.

Figure 48. CNMI Trolling Catch Rate of Mahimahi, Wahoo, and Blue Marlin (lbs/trip)



Supporting data shown in Table A-46.

2.3 GUAM

2.3.1 DATA SOURCES

This report contains the most recently available information on Guam's pelagic fisheries, as compiled from data generated by the Division of Aquatic and Wildlife Resources (DAWR) through a program established in conjunction with WPacFIN and the WPRFMC. Data are gathered through the offshore creel survey data program. In the past 10 years, DAWR staff have logged between 90 and 97 survey days annually (see Table A-47). The number of trips logged in boat logs has varied from 498 to 1134 during that period, with the number of interviews slightly greater than half of that year's total trips. In 2016, DAWR logged 96 survey days, noting 1128 trips during that time, and conducted 715 interviews. Participation, total landings, effort, CPUE, and bycatch are generated from the creel survey. Using the DAWR computerized data expansion system files (with the assistance of NMFS to avoid over-estimating seasonal pelagic species), a 365-day quarterly expansion of survey data is run for each calendar year to produce catch and effort estimates for the pelagic fishery. Commercial landings, revenue, and price per pound data are obtained from the WPacFIN-sponsored commercial landings system through the commercial receipt book. Transshipment landings data are obtained from the Bureau of Statistics and Plans. Some tables include landings of several species of barracuda and the double-lined mackerel that may not be included in other tables in this report. This artifact of the reporting method results in a slight difference in the total landings and other values between tables.

The shortage of staff biologists has been significant in the past several years. DAWR staff biologists continue to oversee several projects simultaneously, while providing on-going training to ensure the high quality of data being collected by all staff. All fisheries staff are trained to identify the most commonly caught fish to the species level. New staff are mentored by biologists and senior technicians in the field before conducting creel surveys on their own.

Total commercial landings are estimated by summing the weight fields in the commercial landings database from the principal fish wholesalers on Guam, and then multiplying by an estimated percent coverage expansion factor. The annual expansion factor (described above) is subjectively created based on the available information in a given year including: an analysis of the "disposition of catch" data available from the DAWR offshore creel survey; an evaluation of the fishermen in the fishery and their entry/exit patterns; general "dock side" knowledge of the fishery and the status of the marketing conditions and structure; the overall number of records in the database; and a certain measure of best guesses.

2.3.2 SUMMARY OF GUAM PELAGIC FISHERIES

Landings. The estimated annual pelagic landings have varied widely, ranging between 383,000 and 958,000 lbs in the 34-year time series. The average total catch has shown a slowly increasing trend over the reporting period. The 2016 total expanded pelagic landings were 836,065 lbs, a decrease of 11.8 % when compared with 2015. Tuna PMUS decreased 20.8%, while non-tuna PMUS increased 11.2%. Landings consisted primarily of five major species: mahimahi, wahoo, bonita or skipjack tuna, yellowfin tuna, and Pacific blue marlin, with skipjack comprising over 52% of total landings. Other minor species caught include rainbow runner, barracudas, and pomfrets. Sharks were also caught during 2016, with sharks noted in specific fishermen interviews conducted in 2016 regarding shark encounters (see bycatch below). However, these species were not encountered during offshore creel surveys and were not available for expansion for this year’s report. Sharks are often discarded as bycatch. In addition to the above pelagic species, approximately half a dozen other species were landed incidentally this year.

There are wide year-to-year fluctuations in the estimated landings of the five major pelagic species. Landings for four of the five common species increased from 2015 levels: Yellowfin tuna increased 15.4%. Yellowfin catch was the highest since 1999. Skipjack decreased 26.9%, blue marlin increased 17.9%, mahimahi catch, which accounts for the largest percentage of non-tuna PMUS landed on Guam, increased 10%, while wahoo increased by 6.8%. Both mahimahi and wahoo catches fluctuate erratically from year to year, although both appear to be experiencing a long-term downward trend.

Transshipment Landings. Transshipment, the offloading or otherwise transferring MUS or products thereof to a receiving vessel, has had a mandatory data submission program since 1999. These vessels fish on the high sea outside Guam’s EEZ, but transship their catch through Guam. The amount of transshipped fish has ranged between 2,047 mt and 2,342 mt over the previous five years. In 2016, transshipments totaled 1,159 mt.

Effort. The number of boats involved in Guam’s pelagic fishery gradually increased from 193 in 1983 to a high of 496 in 2013. There were 408 boats involved in Guam’s pelagic fishery in 2016, an increase of 9.7% from 2015. The majority of the fishing boats are less than 10 m (33 ft) in length and are usually owner-operated by fishermen who earn a living outside of fishing. Most fishermen sell a portion of their catch and it is difficult to make a distinction between recreational, subsistence, and commercial fishers. A small (~5%), but economically significant, segment of the pelagic group is made up of marina-berthed charter boats that are operated primarily by full-time captains and crews. Data and graphs for non-charters, charters, and bycatch are represented in this report.

The number of trolling trips increased by 21.6%, and hours spent trolling remained steady, or decreased by only 1%. There were 21 separate events covering 111 high surf advisory days in 2015, a decrease from 122 in 2015. 21 high surf advisory days occurred during August, normally a month of relatively calm waters.

In early 2010, the U.S. military began exercises in an area south and southeast of Guam designated W-517. W-517 is a special use airspace (approximately 14,000 nm^2) that overlays deep open ocean approximately 50 miles south-southwest of Guam. Exercises in W-517 generally involve live fire and/or pyrotechnics. When W-517 is in use, a notice to mariners is issued, and vessels attempting to use the area are advised to be cautious of objects in the water and other small vessels. This discourages access to virtually all banks south of Guam, including Galvez, Santa Rosa, White Tuna, and other popular fishing areas. From 1982-2015, DAWR surveys recorded more than 2,930 trolling and bottom fishing trips to these southern banks, an average of more than 83 trips per year. The number of notices to mariners in 2016 was 64, equaling 123 closure days, up from 109 in 2015. This certainly impacted the number of fishing days south of Guam.

The small-boat bottomfish and trolling fishery in Guam relies on boat ramp access and FADs. Recent activities to support the Guam fishery follow.

On Guam, the makeshift ramp at Ylig Bay was eliminated in 2010. Widening of the main road on the southeast coast of Guam will cause removal of the ramp. In December 2006, a new launch ramp and facility was opened in Acfayan Bay, located in the village on Inarajan on the southeast coast of Guam. Monitoring of this ramp for pelagic fishing activity began at the start of 2007. In early 2007, this facility was damaged by heavy surf and has yet to be repaired. Monitoring of this ramp is currently on hold until the ramp is repaired. The current financial situation in Guam makes it unlikely this ramp will be repaired in the near future. DAWR staff are meeting with land owners and Department of Public Works officials to develop a new boat launching facility in Talofofo Bay on the east side of Guam, and land ownership may determine final placement.

CPUE. Trolling catch rates (lbs per hour fished) showed a decrease from 2015. Total CPUE decreased 13%. Yellowfin, marlin, and mahimahi CPUE increased, while skipjack tuna CPUEs decreased and wahoo remained unchanged. The fluctuations in CPUE are probably due to variability in the year-to-year abundance and availability of the stocks.

Revenues. Commercial revenues decreased in 2016, with total adjusted revenues decreasing 15.6%. Adjusted revenue per trolling trip decreased 18.5% for all pelagics, with a decrease of 49.4% for tuna PMUS, and an increase of 21.3% for non-tuna PMUS. Commercial landings have shown a decreasing trend over the past twenty years. A majority of troll fishermen do not rely on the catch or selling of fish as their primary source of income. Previously, Guam law required the government of Guam to provide locally caught fish to food services in government agencies, such as Department of Education and Department of Corrections. In 2002, the government of Guam began implementing cost-saving measures, including privatization of food services. The requirement that locally-caught fish be used for food services, while still a part of private contracts, is not being enforced. This has allowed private contractors to import cheaper foreign fish, and reduced the sales of vendors selling locally caught fish. This represented a substantial portion of sales of locally caught pelagic fish. The decrease in commercial sales seen following 2002 may be, in part, due to this change.

Bycatch. There is very low bycatch in the charter fishery. In 2016, there were 6 reported bycatch in 346 fish caught, for a 1.7% rate. Bycatch occasionally occurs in the troll fishery including sharks, shark-bitten and undersized fish. There was no reported bycatch in the troll fishery in 2016.

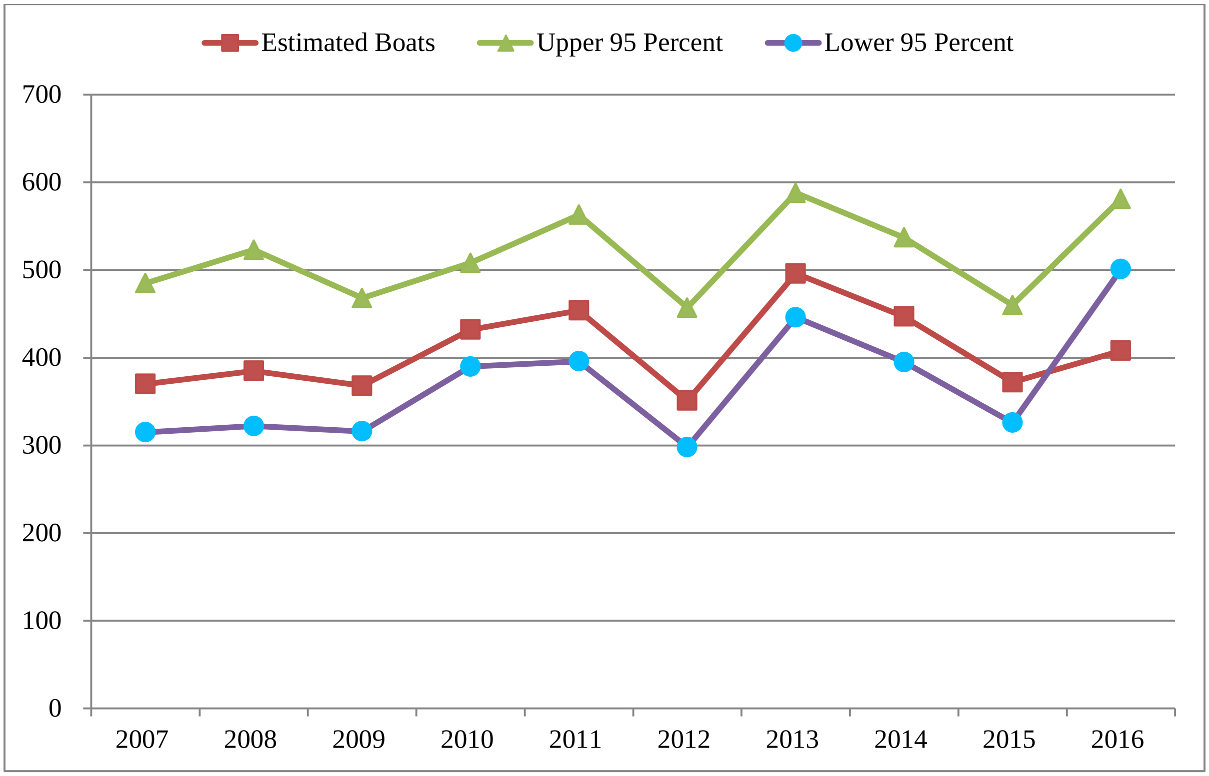
In 2016, fishers were asked if they experienced a shark interaction. There were a total of 887 interviews for boat based fishing in 2016, with 300 of these inappropriate for determining shark interaction. Of the remaining 587 interviews, 235 reported interactions with sharks, 352 reported no interactions with sharks, a 40% positive rate for interviews where fishers were asked about shark interactions.

2.3.3 PLAN TEAM RECOMMENDATIONS

There were no recommendations by the Pelagics Plan Team in 2016 to be forwarded to the Council, only Action Items to Pelagic Plan Team members on improvements to modules.

2.3.4 OVERVIEW OF PARTICIPATION - NON-CHARTER AND CHARTER FISHERIES

Figure 49. Guam Estimated Number of Trolling Boats



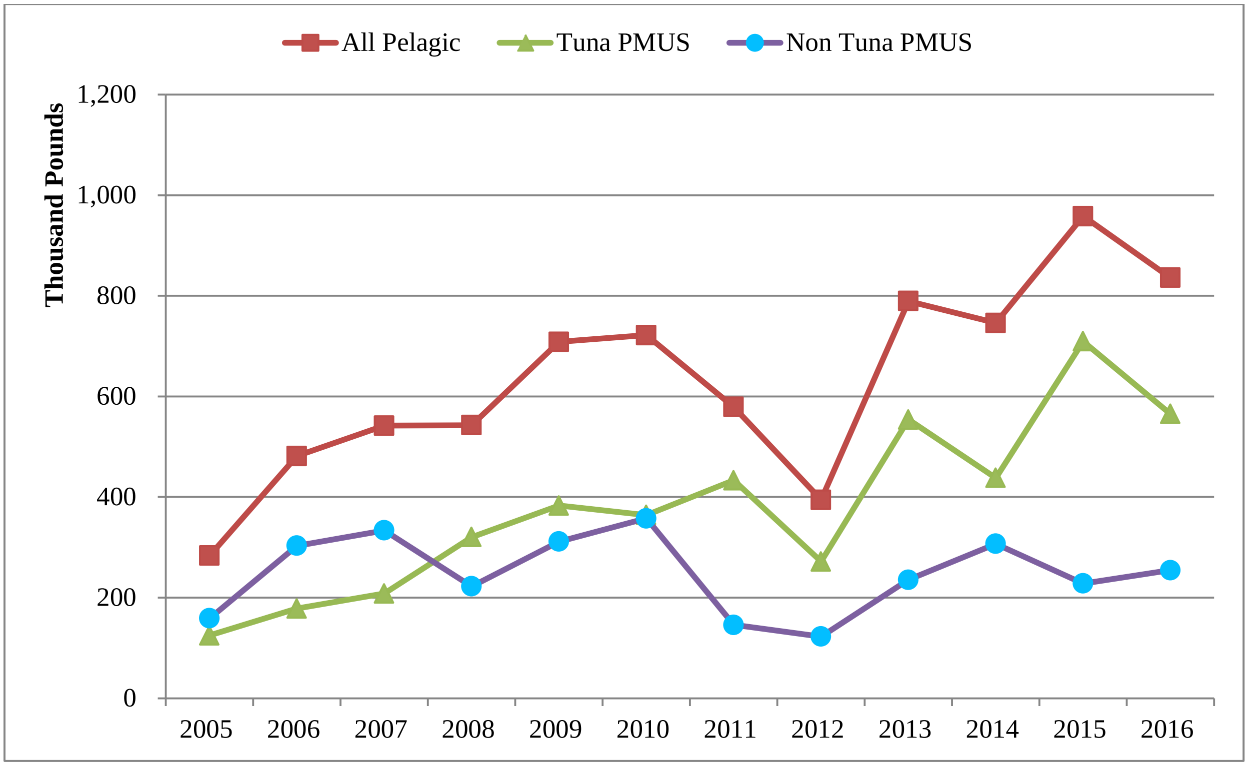
Supporting data shown in Table A-48.

2.3.5 OVERVIEW OF TOTAL AND REPORTED COMMERCIAL LANDINGS – NON-CHARTER AND CHARTER FISHERIES

Table 19. Guam 2016 estimated total landings, non-charter and charter

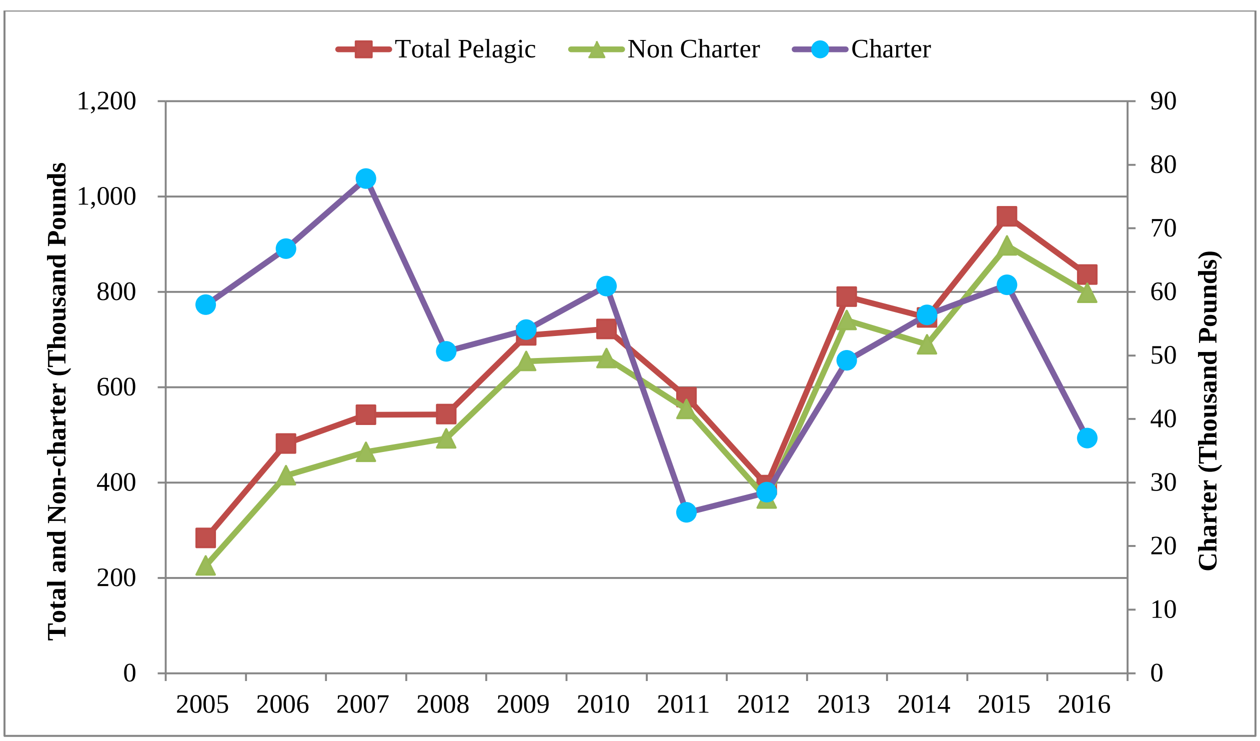
Species	Total Landings	Non Charter	Charter
Tuna PMUS			
Skipjack Tuna	437,476	432,534	4,942
Yellowfin Tuna	127,520	124,566	2,954
Kawakawa	77	0	77
Albacore	0	0	0
Bigeye Tuna	0	0	0
Other Tuna PMUS	0	0	0
Tuna PMUS Total	565,073	557,100	7,973
Non-Tuna PMUS			
Mahimahi	174,458	159,231	15,227
Wahoo	33,609	28,254	5,356
Blue Marlin	44,237	36,173	8,065
Black Marlin	0	0	0
Striped Marlin	0	0	0
Sailfish	0	0	0
Shortbill Spearfish	0	0	0
Swordfish	0	0	0
Oceanic Sharks	0	0	0
Pomfrets	1,520	1,520	0
Oilfish	878	878	0
Misc. Longline Fish	0	0	0
Non-Tuna PMUS Total	254,702	226,056	28,648
Non-PMUS Pelagics			
Dogtooth Tuna	0	0	0
Rainbow Runner	10,964	10,964	0
Barracudas	5,326	4,870	457
Double-lined Mackerel	0	0	0
Misc. Troll Fish	0	0	0
Non-PMUS Pelagics Total	16,290	15,834	457
Total Pelagics	836,065	798,990	37,078

Figure 50. Guam Annual Estimated Total Landings: All Pelagics, Tuna PMUS, and Non-Tuna PMUS



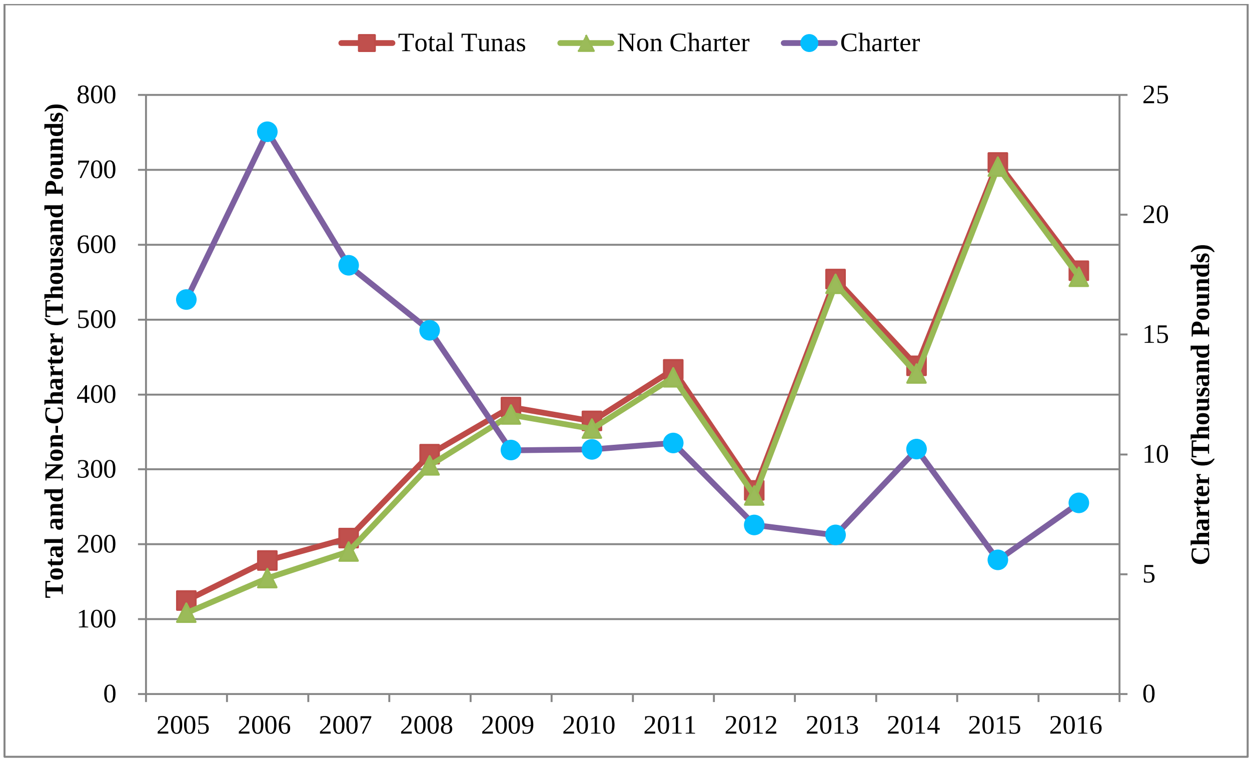
Supporting data shown in Table A-49.

Figure 51. Guam Annual Estimated Total Landings by Method



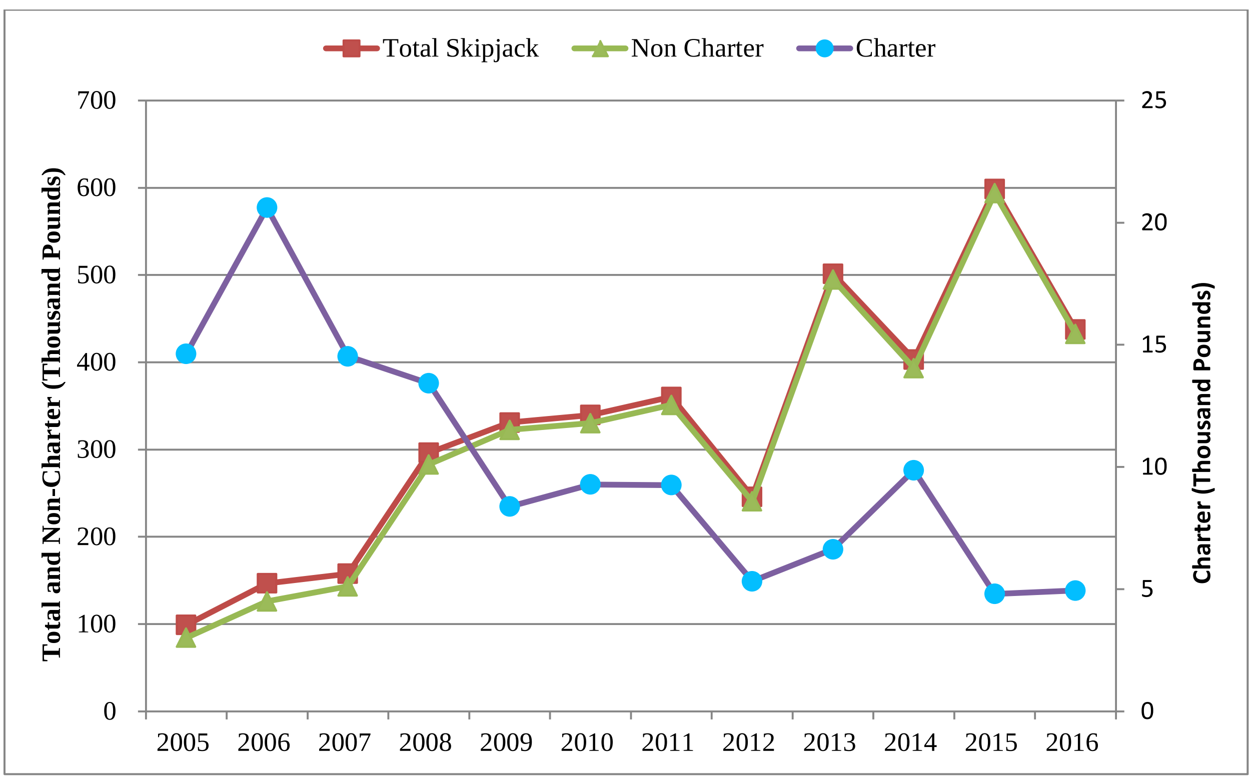
Supporting data shown in Table A-50.

Figure 52. Guam Annual Estimated Tuna PMUS Landings by Method



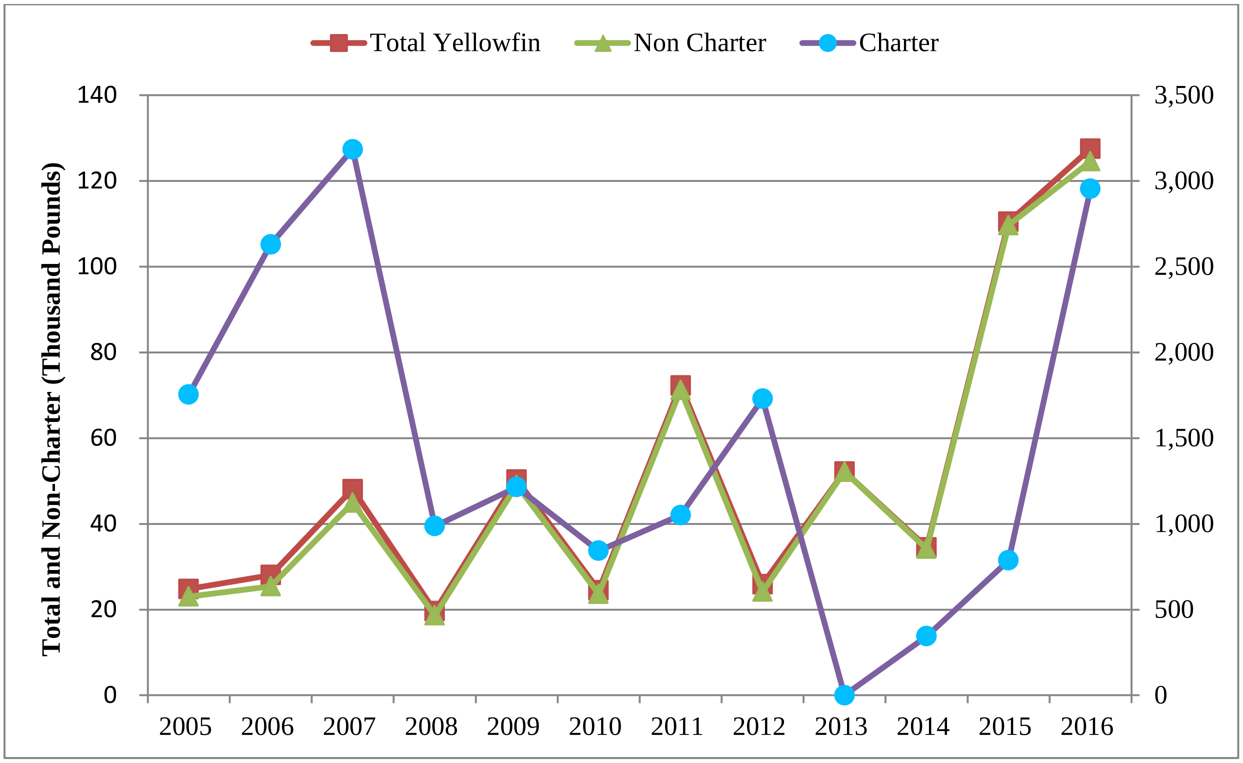
Supporting data shown in Table A-51.

Figure 53. Guam Annual Estimated Landings of Skipjack Tuna by Fishing by Method



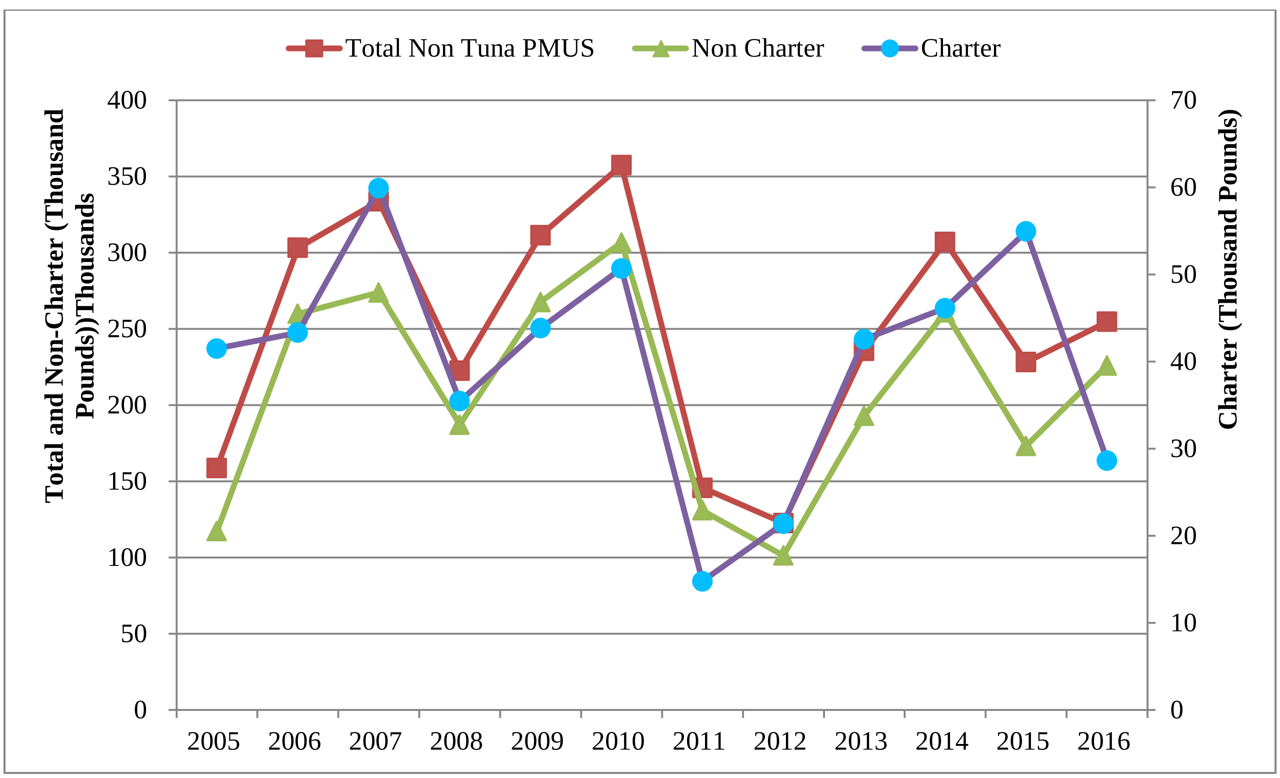
Supporting data shown in Table A-52.

Figure 54. Guam Annual Estimated Total Yellowfin Landings by Method



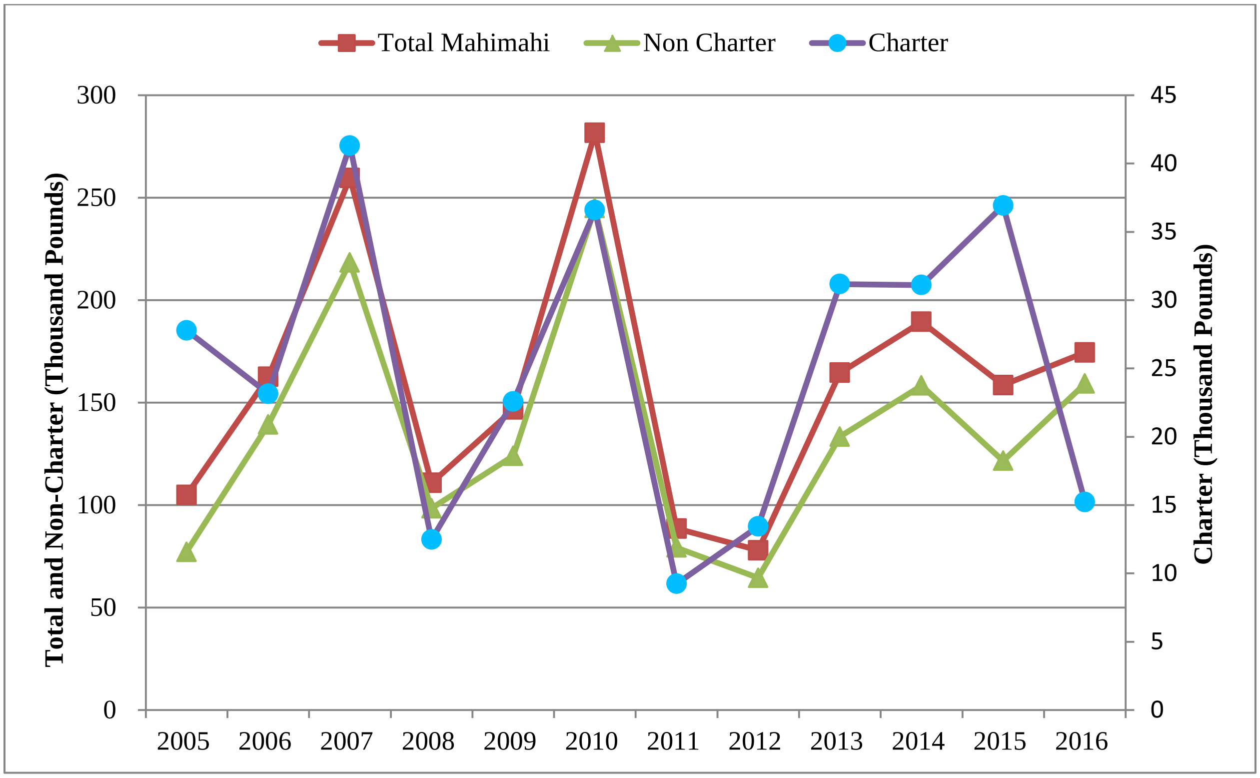
Supporting data shown in Table A-53 .

Figure 55. Guam Annual Estimated non-Tuna PMUS Landings by Method



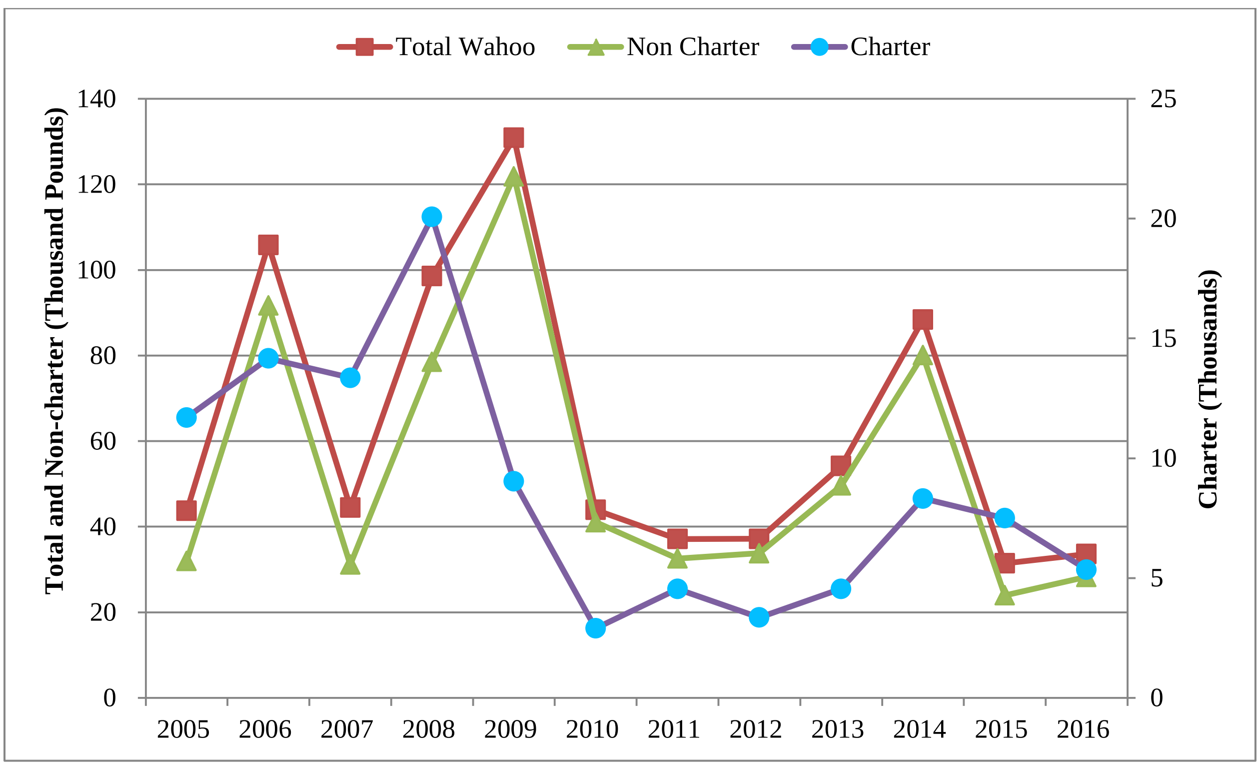
Supporting data shown in Table A-53.

Figure 56. Guam Annual Estimated Total Mahimahi Landings by Method



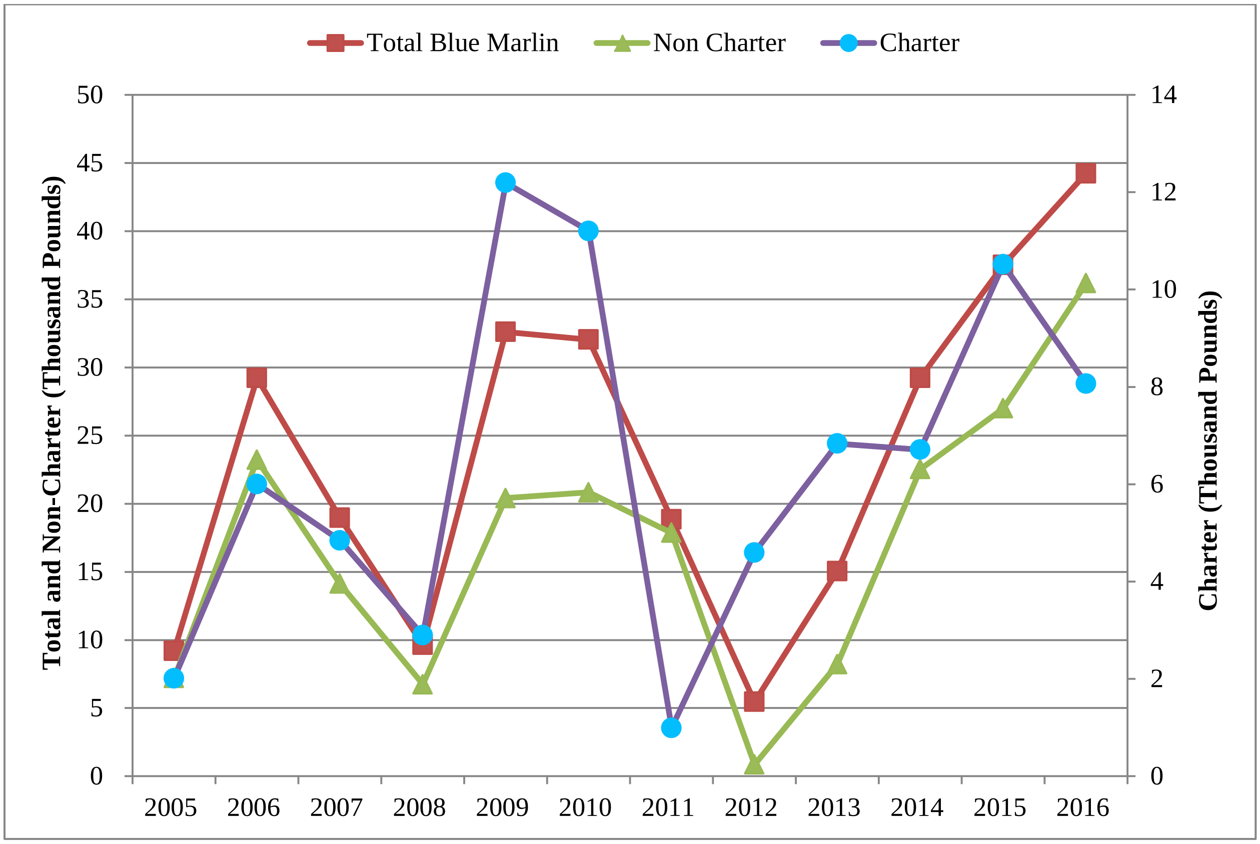
Supporting data shown in Table A-55.

Figure 57. Guam Annual Estimated Total Wahoo Landings by Method



Supporting data shown in Table A-56.

Figure 58. Guam Annual Estimated Total Blue Marlin Landings by Method



Supporting data shown in Table A-57.

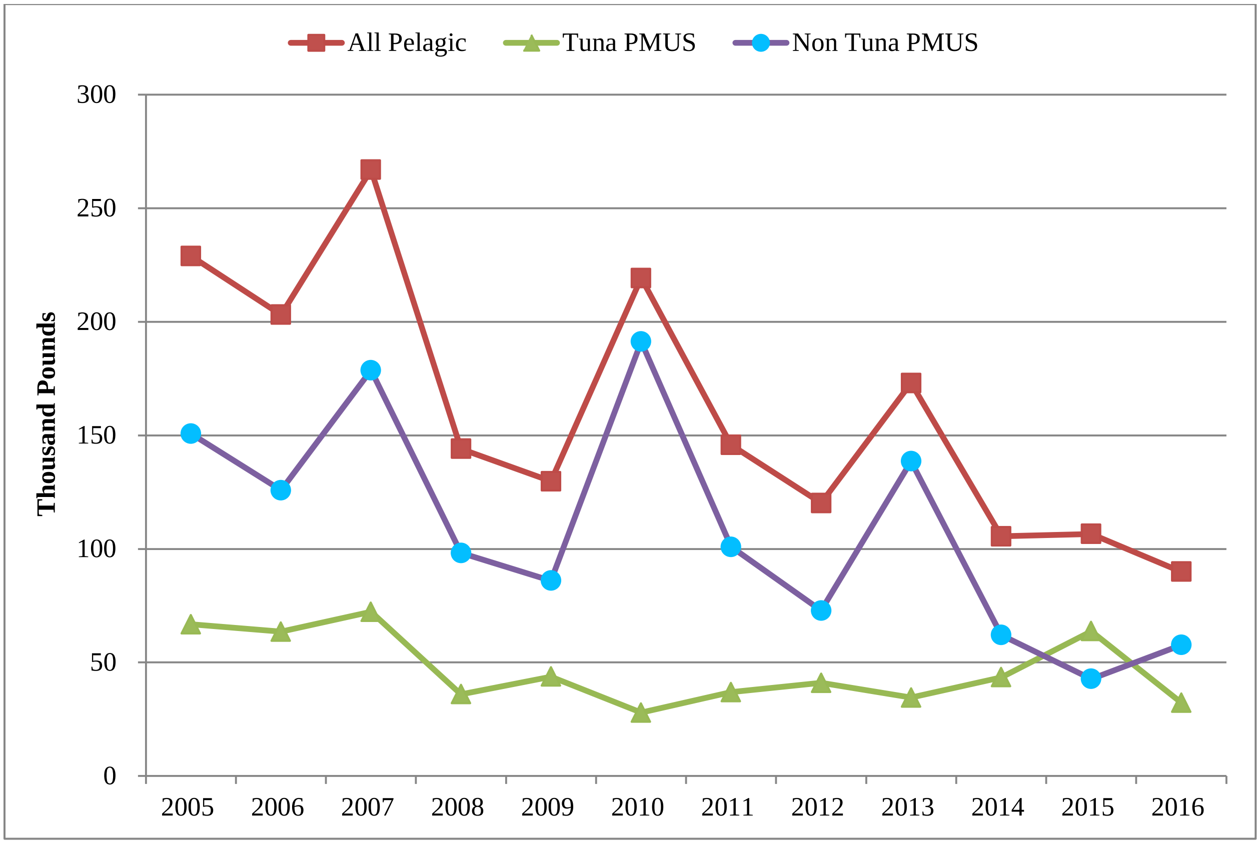
Table 20. Guam Bycatch Summary for Trolling Non-Charter and Charter Fisheries

Year	Species	Number Released	Percent Released*	Number Kept	Number Caught
Non-Charter Fisheries					
2007	*C. hippurus*	1	0.12	805	806
2007	*K. pelamis*	11	0.58	1,871	1,882
2007	*T. albacores*	10	2.73	356	366
2007	All	22	0.7	3,245	3,267
2008	No bycatch in 2008	0	0	3,490	3,490
2009	*M. mazara*	3	23.08	10	13
2009	All	3	0.1	6,072	6,075
2010	No bycatch in 2010	0	0	6,262	6,262
2011	*K. pelamis*	1	0.01	7,262	7263
2011	All	1	0	9,048	9,049

Year	Species	Number Released	Percent Released*	Number Kept	Number Caught
2012	No bycatch in 2012	0	0	4,102	4,102
2013	*E. bipinnulatas*	1	3.0	32	33
2013	*T.albacares*	6	1.6	373	379
2013	*K. pelamis*	21	0.4	5,474	5,495
2013	All	28	0.4	6,733	6,761
2014	*S. barracuda*	1	2.78	35	36
2014	*K. pelamis*	19	0.18	3,953	3,960
2014	*T. albacores*	1	0.36	274	275
2014	All	21	0.4	5,317	5,338
2015	No bycatch in 2015	0	0	6,801	6,801
2016	No bycatch in 2016	0	0	8,537	8,537
	Non-charter Total	75		59,607	59,682
Charter Fisheries					
2007	No bycatch in 2007	0	0	720	720
2008	*M. mazara*	1	20	4	5
2008	All	1	0.2	503	504
2009	No bycatch in 2009	0	0	469	469
2010	No bycatch in 2010	0	0	567	567
2011	No bycatch in 2011	0	0	379	379
2012	No bycatch in 2012	0	0	176	176
2013	No bycatch in 2013	0	0	257	257
2014	No bycatch in 2014	0	0	495	495
2015	No bycatch in 2015	0	0	444	444
2016	*C. hippurus*	3	2.38	123	126
2016	*K. pelamis*	3	2.94	107	110
2016	All	6	1.7	340	346
	Charter Total	7		4,350	4,357
	Grand Total	82		63,957	64,039

*"percent released" represents the number of pieces that were discarded compared to the total number of fish caught trolling. The bycatch information is from unexpanded data, taken only from actual interviews that reported bycatch.

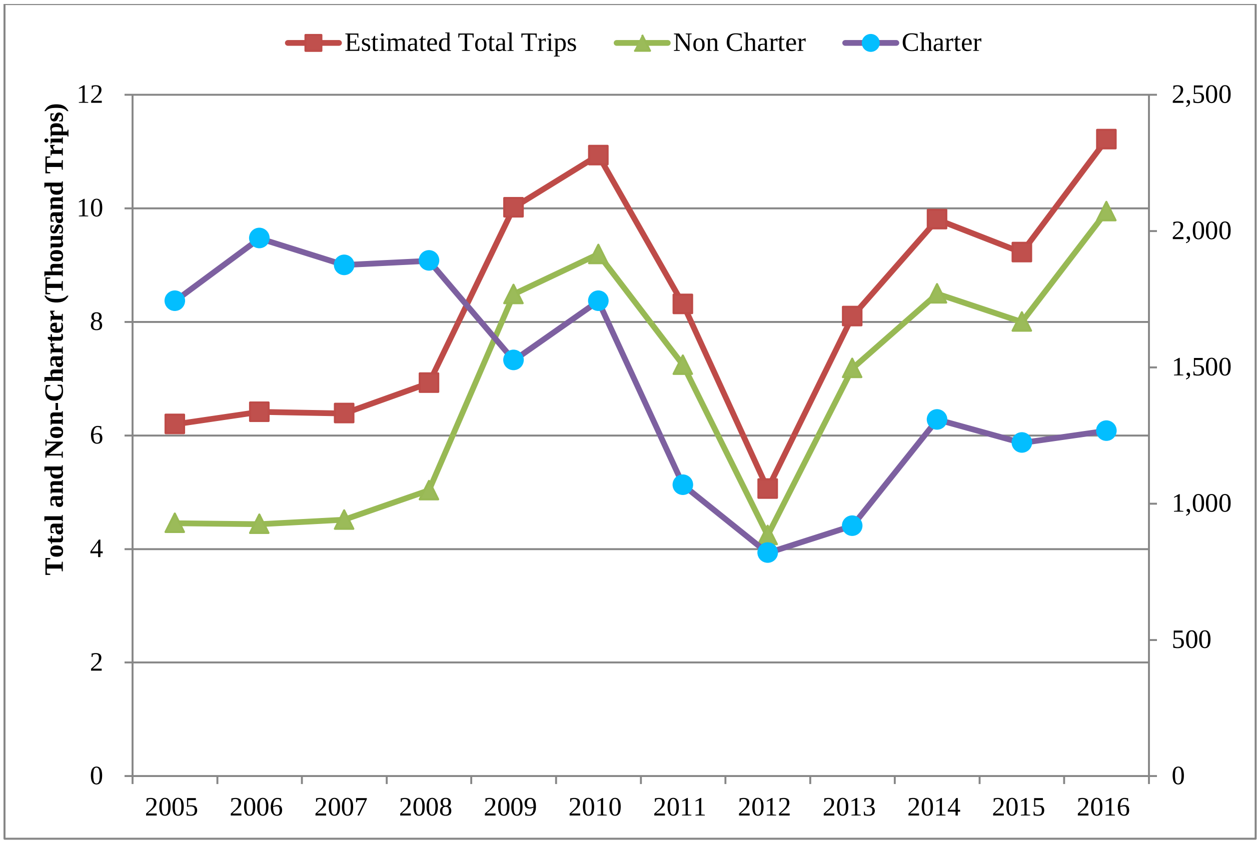
Figure 59. Guam Annual Estimated Commercial Landings: All Pelagics, Tuna PMUS, and Non-tuna PMUS



Supporting data shown in Table A-58.

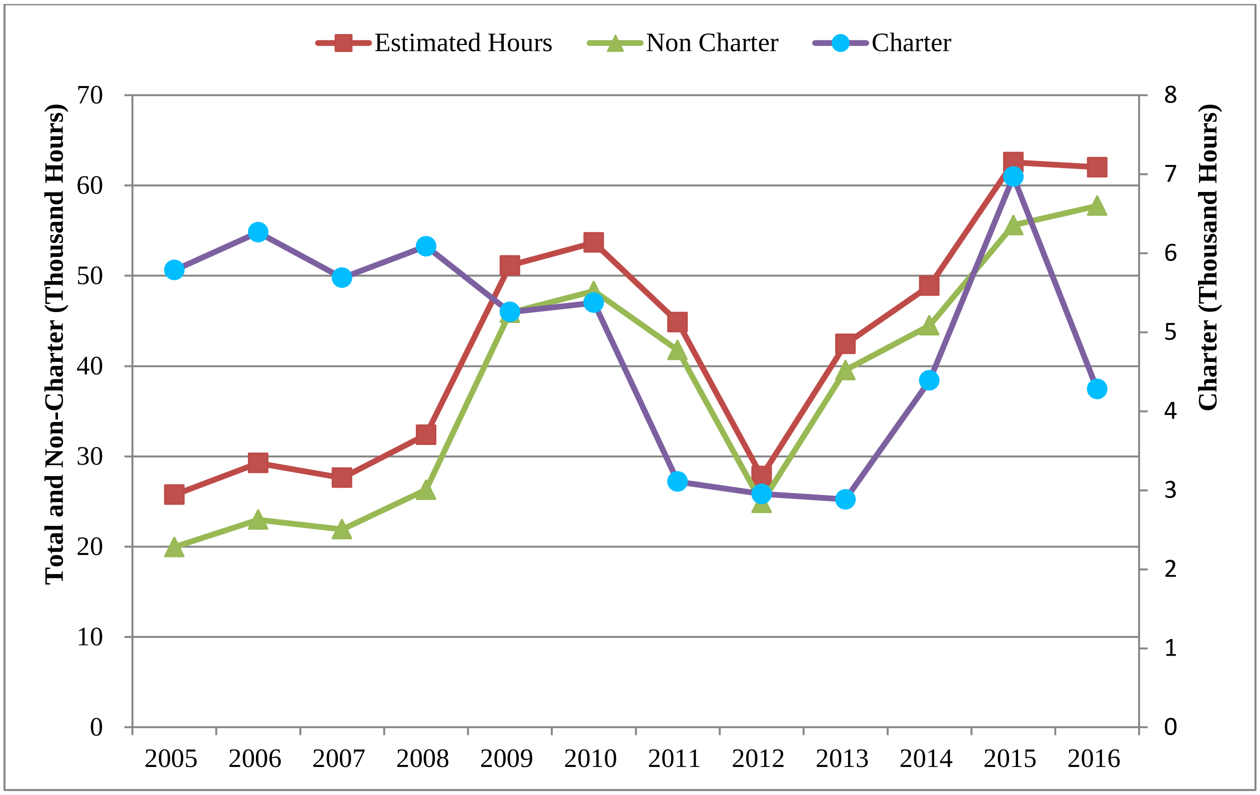
2.3.6 OVERVIEW OF EFFORT AND CPUE – NON-CHARTER AND CHARTER FISHERIES

Figure 60. Guam Estimated Number of Trolling Trips



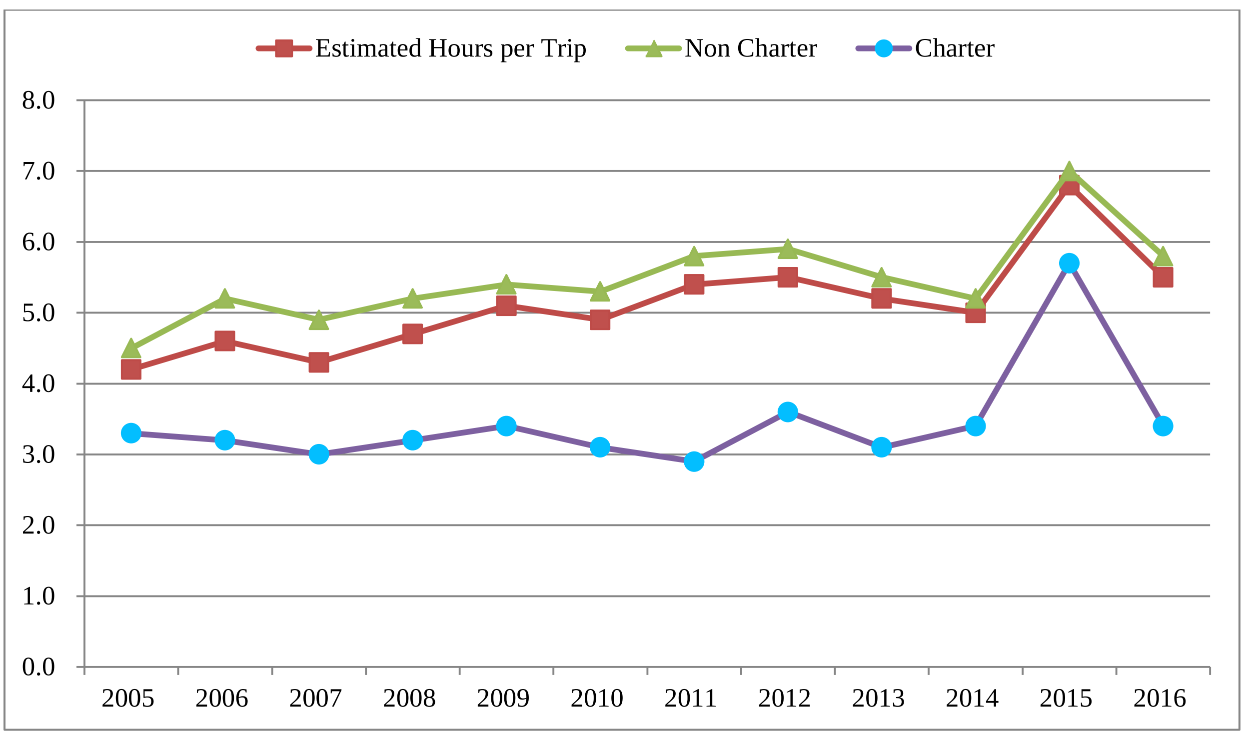
Supporting data shown in Table A-59.

Figure 61. Guam Estimated Number of Trolling Hours



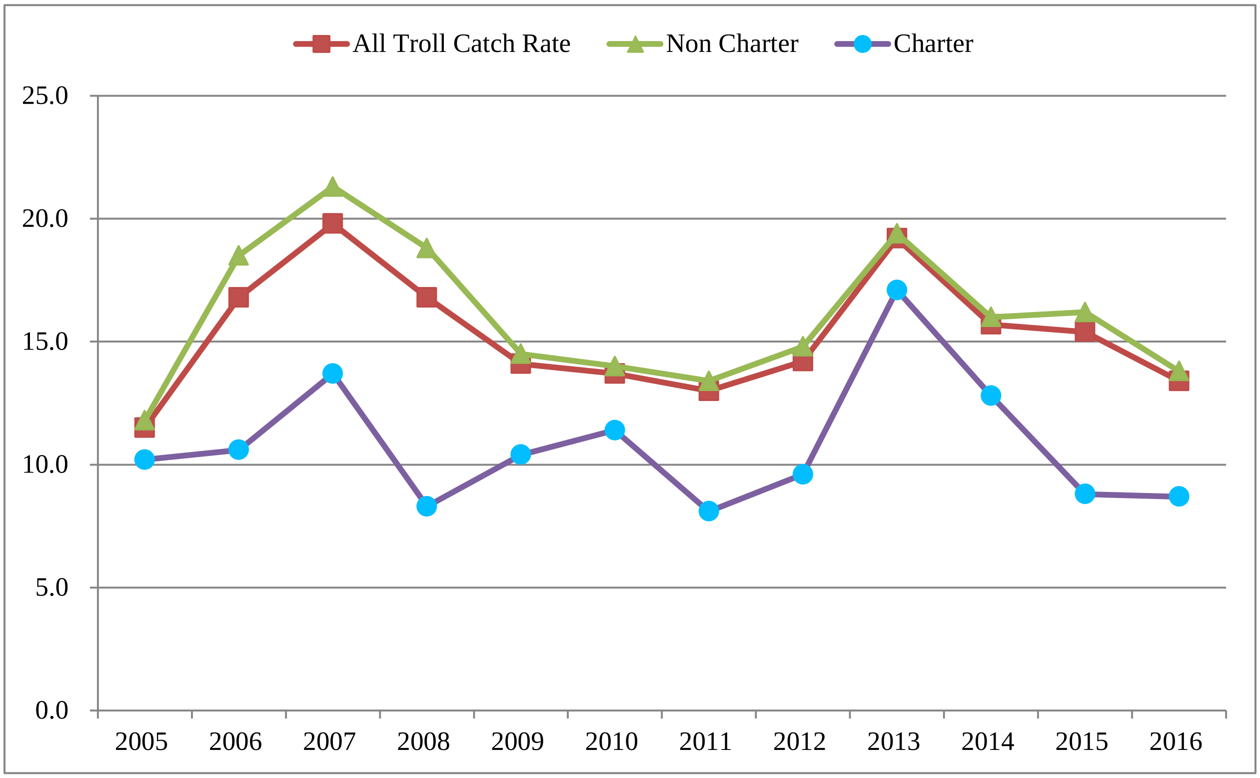
Supporting data shown in Table A-60.

Figure 62. Guam Estimated Trip Length



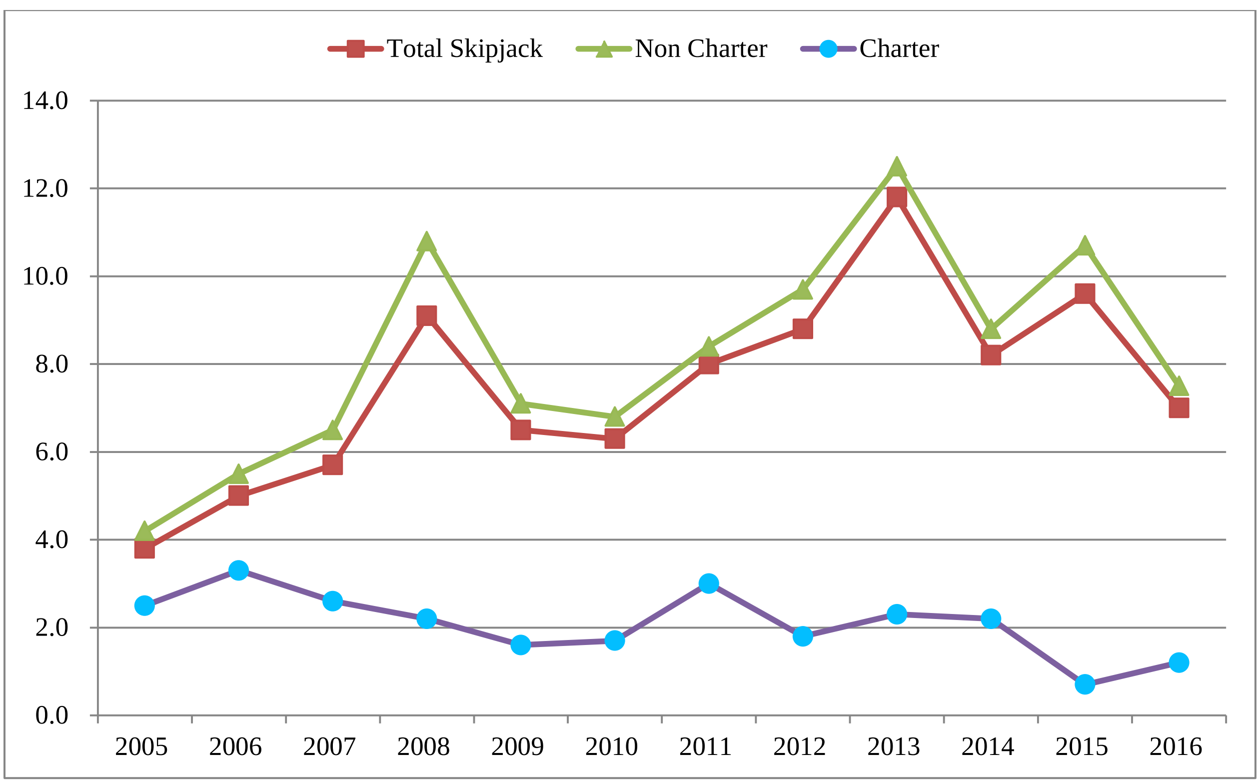
Supporting data shown in Table A-61.

Figure 63. Guam Trolling Catch Rates (lbs per hour)



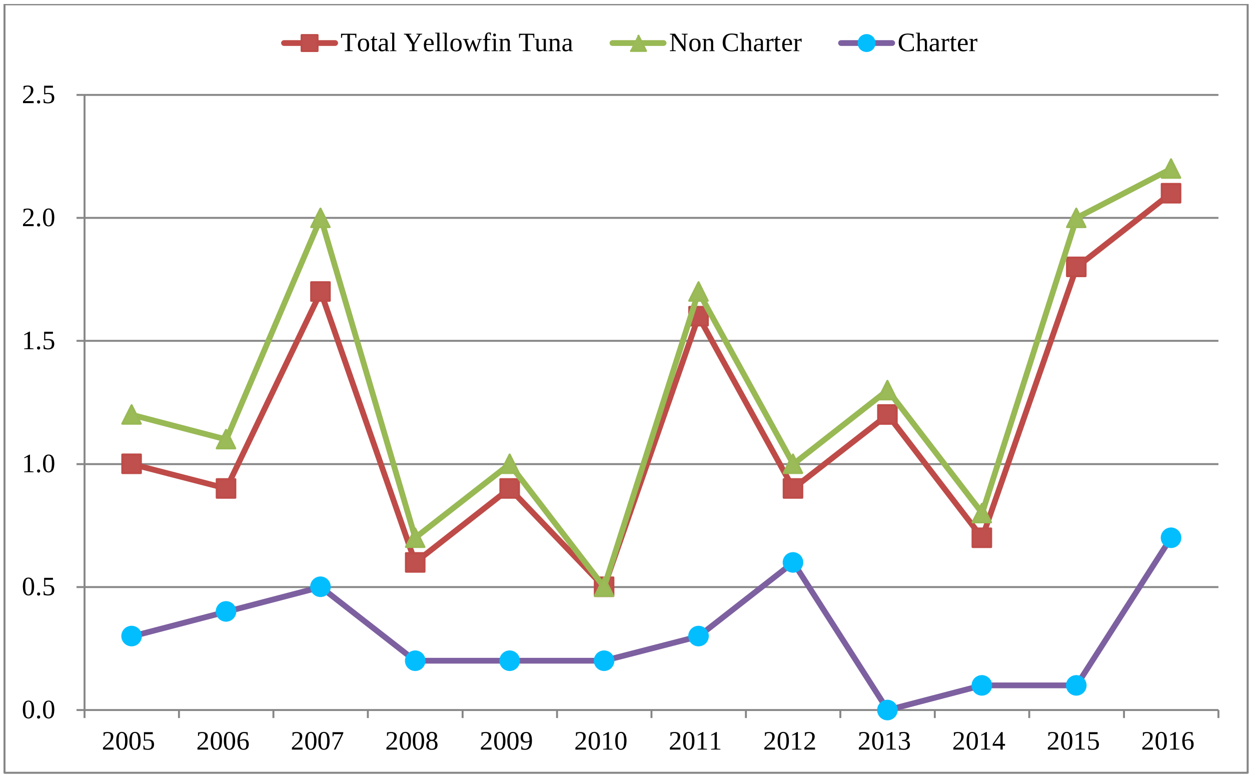
Supporting data shown in Table A-62.

Figure 64. Guam Trolling Catch Rates (lbs per hour): Skipjack



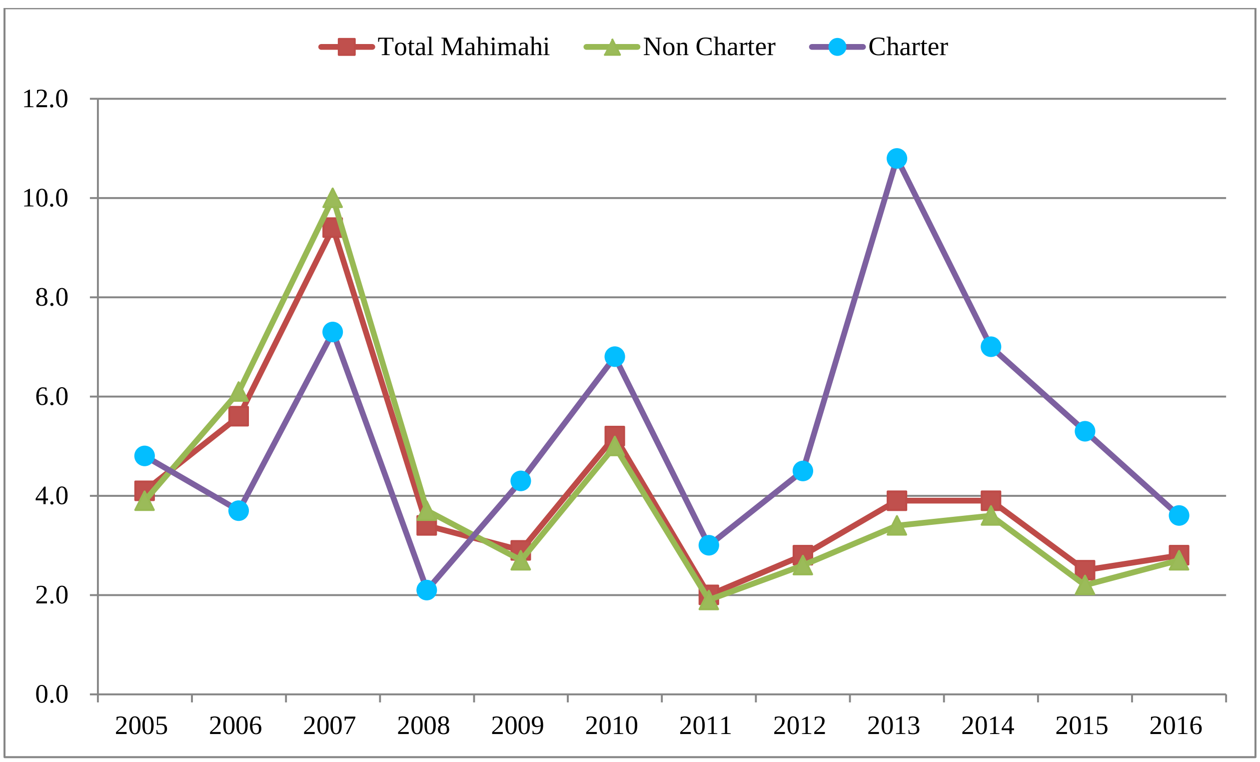
Supporting data shown in Table A-63.

Figure 65. Guam Trolling Catch Rates (lbs per hour): Yellowfin



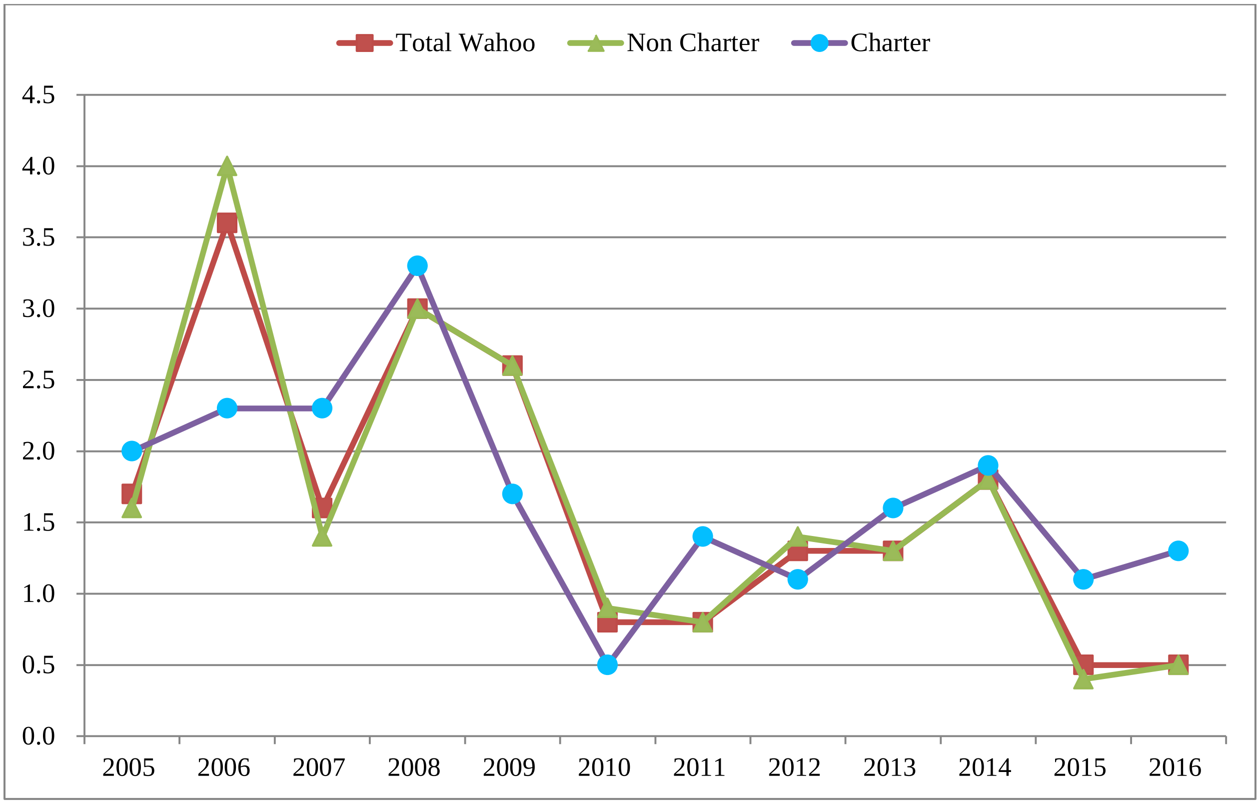
Supporting data shown in Table A-64.

Figure 66. Guam Trolling Catch Rates (lbs per hour): Mahimahi



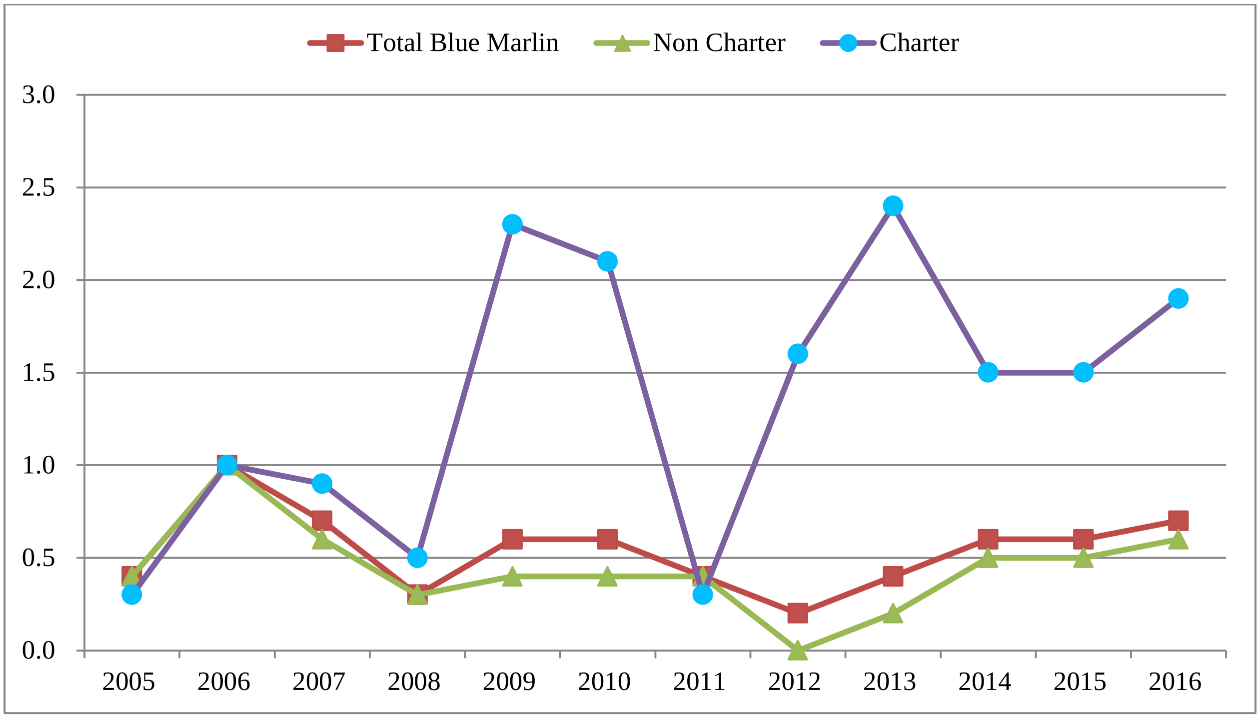
Supporting data shown in Table A-65.

Figure 67. Guam Trolling Catch Rates (lbs per hour): Wahoo



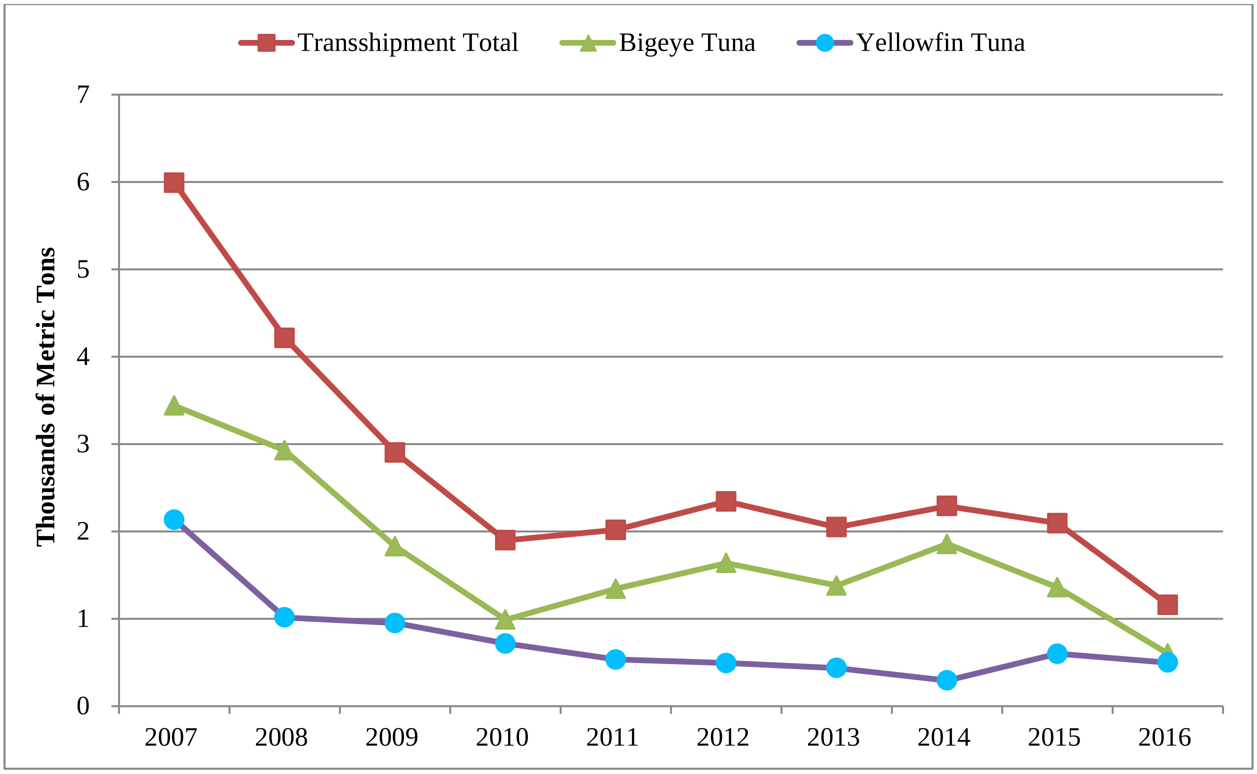
Supporting data shown in Table A-66.

Figure 68. Guam Trolling Catch Rates (lbs per hour): Blue Marlin



Supporting data shown in Table A-67.

Figure 69. Guam Foreign Longline Transshipment Landings: Longliners Fishing Outside the Guam EEZ



Supporting data shown in Table A-68.

2.4 HAWAI`I

2.4.1 DATA SOURCES

This report contains the most recently available information on Hawaii's commercial pelagic fisheries, as compiled from four data sources: the State of Hawaii's Division of Aquatic Resources (HDAR) Commercial Marine License data (CML), Commercial Fishing Report data (Fishing Report), HDAR Commercial Marine Dealer's Report data (Dealer), and NMFS, Pacific Islands Fisheries Science Center's (PIFSC) longline logbook data.

HDAR requires any fisherman who takes marine species for commercial purposes to hold a CML and submit a monthly catch report. An exception to this rule is that should a fishing trip occur on a boat, only one person per vessel is required to submit a catch report. This person is usually, but not necessarily, the captain. Crew members do not ordinarily submit catch reports. HDAR asks fishermen to identify their primary fishing gear or method on the CML at time of licensing. This does not preclude fishermen from using other gears or methods. Data sources and estimation procedures are described below.

The Hawai`i-permitted Longline Fishery: The federal longline logbook system was implemented in December 1990 and is the main source of the data used to determine longline vessel activity, effort, and fish catches. Logbook data have detailed operational information and catch in number of fish. Longline vessel operators are required to declare whether they will be making a deep-set or shallow-set trip prior to their departure. A deep-set is defined as a set with 15 or more hooks between floats as opposed to a shallow-set that is characterized by setting less than 15 hooks between floats.

Number of fish caught by Hawai`i-permitted longline fishery is a sum of the number of fish kept and released whereas the calculation of weight for longline catch only includes the number of fish kept. Another important data set is the HDAR Commercial Dealer data. Dealer data dates back to 1990 with electronic submission beginning in mid-1999. Revenue, average weight and average price are derived from the Dealer data, and so do not include data from landings in California.

The logbook and Dealer data were used to calculate the weight of longline catch. Longline purchases in the Dealer data was identified and separated out by matching longline trips based on a specific vessel name and its return to port date in the logbook data with the corresponding vessel name and purchase date(s) in the Dealer data. The general procedure of estimating longline catch for each species was done by first calculating an average weight by dividing the longline Dealer data "LBS. BOUGHT" by the "NO. BOUGHT". This average weight was multiplied by the total number kept from the longline logbook data to estimate the total weight of catch kept. Revenue was the simple sum of "AMOUNT PAID" from the Dealer data based on longline trips which were matched with logbook data. Swordfish are processed at sea and landed headed and gutted. Tunas and mahimahi that weighed more than 20 lbs and marlins greater than 40 lbs must be gilled and gutted prior to sale. A conversion factor is applied to processed fish to estimate whole weight. Average weight statistics were calculated separately for the deep-set and shallow-set longline fisheries. Each species needed a minimum of 20 samples within a month of each RFMO area, i.e., WCPO or EPO, in order to calculate a mean weight. If this criterion was not met, the time strata was increased to a quarter, year or multi-year period until there were enough samples to calculate a mean weight. Some species which were landed in low numbers needed to be aggregated to a multi-year period. Consequently, their respective annual mean weights are the same from year to year or repeat over time.

Catch and effort summaries in this section were based on RFMO standards and business rules. Longline catch and effort statistics in this section consist of U.S. longline fisheries in the North Pacific Ocean, and attributions from CNMI, Guam and American Samoa in the North Pacific Ocean. Longline vessels operating from California were also included in this report to satisfy RFMO data reporting and NOAA confidentiality standards. Most of these vessels had Hawai`i limited-entry permits. The only exception to summaries using RFMO standards was catch and effort statistics using boundaries within or outside of U.S. EEZs. Since there were substantial differences in operational characteristics and catch between the deep-set longline fishery targeting tunas and the shallow-set longline fishery targeting swordfish, separate summaries were provided for each longline fishery.

MHI Troll Fishery: Catch and effort by the MHI troll fishery was defined as using a combination of pelagic species, gear and area codes from the HDAR Fishing Report data. The HDAR codes for the MHI troll fishery includes summaries of PMUS caught by Miscellaneous Trolling Methods (gear code 6), Lure Trolling (61), Bait Trolling (62), Stick Trolling (63), Casting, Light Tackle, Spinners or Whipping (10) and Hybrid Methods (97) in HDAR statistical areas 100 through 642. These are areas that begin from the shoreline out to 20 minute squares around the islands of Hawai`i, Maui, Kahoolawe, Lanai, Mokolai, Oahu, Kauai and Niihau.

MHI Handline Fishery: The MHI handline fishery includes PMUS caught by Deep Sea or Bottom Handline Methods (HDAR gear code 3), Inshore Handline or Cowrie Shell (Tako) Methods (4), Ika_Shibi (8), Palu-Ahi, Drop Stone or Make Dog Methods (9), Drifting Pelagic Handline Methods (35) and Floatline Methods (91) in HDAR statistical areas 100 to 642 except areas 175, 176, and 181.

Offshore Handline Fishery: The offshore handline fishery includes PMUS caught by Ika-Shibi (HDAR gear code 8), Palu-Ahi, Drop Stone or Make Dog Methods (9), Drifting Pelagic Handline Methods (35), Miscellaneous Trolling Methods (6), Lure Trolling (61), and Hybrid Methods (97) in Areas 15217 (NOAA Weather Buoy W4), 15717 (NOAA Weather Buoy W2), 15815, 15818 (Cross Seamount) , 16019 (NOAA Weather Buoy W3), 16223 (NOAA Weather Buoy W1), 175, 176, 181, 804, 807, 816, 817, 825, 839, 842, 892, 893, 894, 898, 900, 901, 15416, 15417, 15423, 15523, 15718, 15918, 15819, and 16221. This fishery also includes pelagic species caught by Deep Sea or Bottom Handline Methods (3) in Area 16223.

Other Gear: This category represents pelagic species caught by methods or in areas other than those methods mentioned above. Catch and revenue from this category is primarily composed of PMUS caught by the aku boat fishery, fishers trolling in areas outside of the MHI (the distant water albacore troll fishery) or PMUS caught close to shore by diving, spearfishing, squidding, or netting inside of the MHI.

Calculations: Pelagic catch by the MHI troll, MHI handline, offshore handline, and other gear were calculated by summing “Lbs Landed” from the HDAR Fishing Report data based on the gear and area codes used to define each gear type. The percent of catch for each pelagic species was calculated from the "Lbs Landed" by the MHI troll, MHI handline, offshore handline and other gear and used to estimate the revenue of each fishery.

Catch in the HDAR Dealer data, referred to as "LBS. BOUGHT", by each fishery was not clearly differentiated; however, "LBS. BOUGHT" by the longline and aku boat fisheries were identified by CML numbers and/or vessel names and kept separate from the "non-longline & non-aku boat" Dealer data. This remaining "LBS. BOUGHT" along with the "AMOUNT PAID" from Dealer data for the "non-longline and non-aku boat" fisheries was used to calculate average weight, revenue and average price for the MHI troll, MHI handline, offshore handline fisheries and other gear category. "LBS. BOUGHT" from this Dealer data was summed on a species-specific basis. The percent of catch calculated from the HDAR Fishing Report "Lbs Landed" for each species and by each fishery was used in conjunction with total "LBS. BOUGHT" from the HDAR Dealer data to apportion "AMOUNT PAID" or revenue accordingly to each respective fishery. This process was repeated on a monthly basis to account for the seasonality of catch and variability of activity for each fishery. Revenue and average price are inflation-adjusted by the Honolulu CPI.

2.4.2 SUMMARY OF HAWAI`I PELAGIC FISHERIES

The following is a summary of landings, effort, CPUE, fish size, revenue and bycatch for the main pelagic fisheries (deep set and shallow set longline, MHI troll, MHI handline, and offshore handline).

Participation. A total of 3,669 fishermen were licensed in 2016, including 2,030 (55%) who indicated that their primary fishing method and gear were intended to catch pelagic fish. Most licenses that indicated pelagic fishing as their primary method were issued to trollers (47%) and longline fishermen (38%). The remainder was issued to ika shibi and palu ahi (handline) (15%).

Landings. Hawai`i commercial fisheries landed 37,146,000 pounds of pelagic species in 2016, a decrease of 7% from the previous year. Although each fishery targets or intends to catch a particular pelagic species, a variety of other species were also caught. The deep-set longline fishery targeted bigeye tuna. This was the largest of all pelagic fisheries and its total catch comprised 85% (31,547,000 pounds) of all pelagic fisheries. The shallow-set longline fishery targeted swordfish and its catch was 1,854,000 pounds, or 5% of the total catch. The main Hawaiian islands (MHI) troll fishery targeted tunas, marlins and other PMUS caught 2,535,000 pounds or 7% of the total. MHI handline fishery targeted yellowfin tuna while the and offshore handline fishery targeted bigeye tuna. The MHI handline fishery accounted for 773,000 pounds (2% of the total). The offshore handline fishery was responsible for 366,000 pounds or 1% of the total catch.

The largest component of the pelagic catch was tunas, which comprised 68% of the total in 2015. Bigeye tuna alone accounted for 75% of the tunas and 50% of all pelagic catch. Billfish catch made up 15% of the total catch in 2016. Swordfish was the largest of these, at 42% of the billfish and 7% of the total catch. Catches of other PMUS represented 17% of the total catch in 2016 with moonfish being the largest component at 34% of the other PMUS and 6% of the total catch.

Effort. There were 142 active Hawai`i-permitted deep-set longline vessels in 2016, one less vessel than the previous year, with 140 or more deep-set vessels in the past 3 years. The number of deep-set trips (1,479) and sets (19,378) were the highest effort over the past ten years. The number of hooks set by this fishery reached a record 51.1 million hooks in 2016. The Hawai`i-permitted shallow-set longline fishery operates mainly in the first half of the year. In 2016, 13 vessels completed 46 trips and made 727 sets, which was the lowest participation and effort for this segment of the fishery over the past ten years. The number of hooks set by this fishery also decreased to 800,000 in 2016. The number of days fished by MHI troll fishers has been dropping since a peak in 2012, with 1,401 fishers logging 21,956 days fished around the MHI in 2016. There were 417 MHI handline fishers that fished 3,796 days in 2016, both well below their long-term averages. At 6 fishers and 175 days fished in 2016, the offshore handline fishery had its lowest effort since 2008.

CPUE. The deep-set longline fishery targets bigeye tuna and this species had higher CPUE (4.3 fish per 1,000 hooks) compared to yellowfin tuna (0.9) and albacore (0.2). CPUE of billfish for the deep-set fishery is similar to that of albacore (0.1 - 0.2 fish per 1,000 hooks), while the CPUE for blue shark, a bycatch species, is second only to bigeye at 1.4 fish per 1,000 hooks. The Hawai`i-permitted shallow-set longline fishery targets swordfish and achieved a CPUE of 12.4 fish per 1,000 hooks. However, blue shark is a bycatch of this fishery but had the highest CPUE of any species at 13.8 fish per 1,000 hooks in 2016. Mahimahi, bigeye and mako shark CPUE was above 1.0 fish per 1,000 hooks, while all other species were less than 1.0 fish per 1,000 hooks with the exception of bigeye tuna, at 1.2 fish per 1,000 hooks. The 2016 MHI troll fishery CPUE for tuna and marlins were above the long-term average while CPUE for mahimahi and ono declined from their respective peaks in 2014. MHI handline CPUE for yellowfin tuna peaked in 2015 and dropped to its long-term average in 2016. Albacore and bigeye tuna CPUE was substantially lower compared to yellowfin tuna and have shown no clear trend in recent years. CPUE of the offshore handline fishery has been steady for the past nine years, with bigeye catch rates six times higher than that of yellowfin (1,774 and 294 lbs per trip, respectively) in 2016.

Fish Size. The average weight for all species of the deep-set longline fishery in 2016 was close to their respective long-term weights. Bigeye tuna caught in the deep-set fishery was 84 lbs in 2016, 2% greater than the long-term average. Yellowfin tuna average weight in the deep-set fishery was 73 lbs, slightly below the long-term average. 2016 saw record high mean weights for albacore, spearfish and moonfish and record low weights for bigeye tuna, ono, and pomfret by the shallow-set longline fishery in 2016. The shallow-set average weight of swordfish in 2016 was 179 lbs or 8% lower than the long-term average. In general, the average weight of fish caught by the shallow-set longline fishery is higher than fish caught by the deep-set longline fishery. The average weight for most species caught by the troll and handline fisheries were close to their long-term average in 2016 except for bigeye tuna, blue marlin and mahimahi which were at or below previous record lows.

Revenue. The total revenue from Hawaii's pelagic fisheries was $112.8 million in 2016, an increase of 4% from the previous year. The deep-set longline fishery reached a record high $99.1 million in 2016. This fishery represented 88% of the total revenue for pelagic fish in Hawaii. The shallow-set longline fishery decreased to $2.5 million and accounted for 2% of the revenue. The MHI troll revenue was $7.5 million or 7% of the total in 2016 and was followed by the MHI handline fishery at $2.4 million (2%). The offshore handline fishery was worth $1.1 million in 2016. The trend for revenue from the deep-set longline, MHI troll and MHI handline fisheries was increasing while revenue of the shallow-set longline fishery was decreasing. There was substantial variation for revenue from the offshore handline fishery.

Bycatch. A total of 104,461 fish were released by the deep-set longline fishery in 2016. Sharks accounted for 85% of the deep-set longline bycatch. With the exception for mako shark, there is almost no demand for sharks in Hawaii. Of all shark species combined, 99% of the deep-set longline shark catch was released. Conversely, bycatch rate for the deep-set longline fishery was only 3% for targeted and incidentally caught pelagic species in 2016. A total of 13,053 fish were released by the shallow-set longline fishery in 2016. Sharks accounted for 91% of the shallow-set longline bycatch. Of all shark species combined, 99% of the shallow-set longline shark catch was released. Conversely, bycatch rate for the shallow-set longline fishery was 9% for targeted and incidentally caught pelagic species in 2016. Since shallow-set longline trips are often longer than deep-set trips, the higher release rate by the shallow-set sector is to conserve space for swordfish and forego keeping other pelagic species due to their short shelf life.

2.4.3 PLAN TEAM RECOMMENDATIONS

There were no recommendations for Hawaii to be forwarded to the Council by the Pelagics Plan Team in 2017; only Action Items to Pelagic Plan Team members on improvements to modules.

2.4.4 OVERVIEW OF PARTICIPATION – ALL FISHERIES

Table 21. Number of HDAR Commercial Marine Licenses, 2015-2016.

	Number of licenses	
Primary Fishing Method	**2015**	**2016**
Trolling	1,019	949
Longline	741	775
Ika Shibi & Palu Ahi	269	295
Aku Boat (Pole and Line)	16	11
Total Pelagic	2,045	2,030
Total All Methods	3,691	3,669

2.4.5 OVERVIEW OF LANDINGS AND ECONOMIC DATA

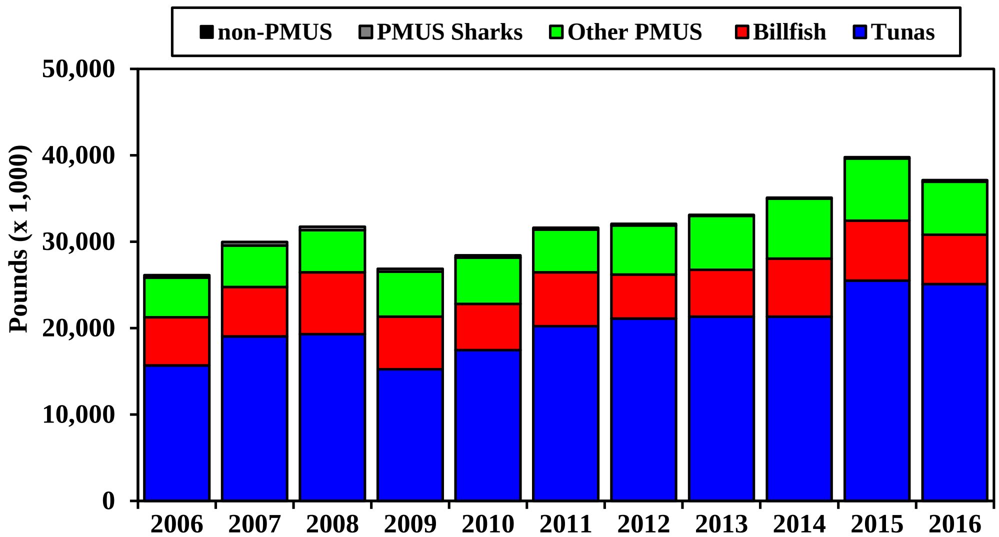
Table 22. Hawai`i commercial pelagic catch, revenue, and average price by species, 2015-2016.

	2015			2016		
Species	**Catch (1,000 lbs)**	**Ex-vessel revenue ($1,000)**	**Average price ($/lb)**	**Catch (1,000 lbs)**	**Ex-vessel revenue ($1,000)**	**Average price ($/lb)**
Tuna PMUS						
Albacore	679	$1,080	$1.61	604	$1,090	$1.79
Bigeye tuna	20,009	$72,191	$3.86	18,731	$72,074	$4.10
Bluefin tuna	0	$4	$8.85	1	$3	$4.69
Skipjack tuna	722	$671	$1.40	791	$781	$1.42
Yellowfin tuna	4,068	$11,355	$3.06	4,954	$14,214	$3.03
Other tunas	36	$57	$2.86	14	$33	$2.86
Tuna PMUS subtotal	**25,515**	**$85,357**	**$3.62**	**25,096**	**$88,195**	**$3.76**
Billfish PMUS						
Swordfish	3,356	$4,724	$2.31	2,418	$4,805	$2.93
Blue marlin	1,804	$1,752	$1.17	1,556	$2,091	$1.61
Spearfish (hebi)	605	$557	$0.93	784	$824	$1.07
Striped marlin	1,112	$1,393	$1.19	892	$1,933	$1.93
Other marlins	50	$50	$1.03	58	$73	$1.31
Billfish PMUS subtotal	**6,928**	**$8,476**	**$1.58**	**5,708**	**$9,726**	**$2.04**
Other PMUS						
Mahimahi	1,495	$4,706	$3.40	1,216	$4,505	$3.78
Ono (wahoo)	1,223	$2,826	$2.58	1,208	$3,242	$2.85
Opah (moonfish)	2,662	$3,212	$1.55	2,164	$3,301	$2.13
Oilfish	528	$281	$0.58	481	$252	$0.58
Pomfrets (monchong)	1,278	$3,029	$2.23	1,083	$3,502	$3.00
PMUS Sharks	150	$99	$0.97	168	$82	$0.70
Other PMUS subtotal	**7,336**	**$14,152**	**$2.18**	**6,319**	**$14,884**	**$2.66**
Other pelagics	**23**	**$13**	**$0.60**	**24**	**$18**	**$0.89**
Total pelagics	**39,802**	**$107,999**	**$3.04**	**37,146**	**$112,824**	**$3.33**

Table 23. Hawai`i commercial pelagic catch, revenue, and average price by fishery, 2015-2016.

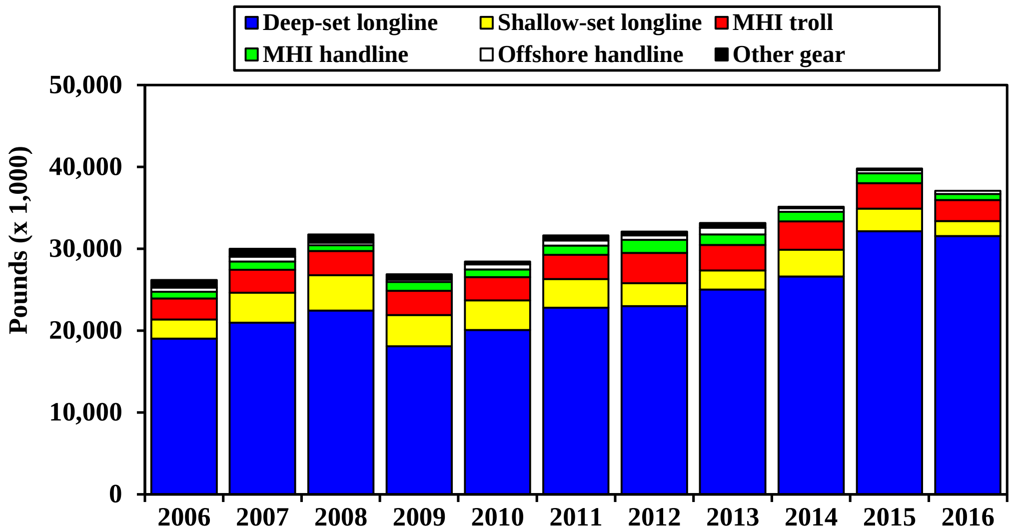
	2015			2016		
Fishery	**Catch (1,000 lbs)**	**Ex-vessel revenue ($1,000)**	**Average price ($/lb)**	**Catch (1,000 lbs)**	**Ex-vessel revenue ($1,000)**	**Average price ($/lb)**
Deep-set longline	32,136	$93,024	$3.10	31,547	$99,096	$3.38
Shallow-set longline	2,778	$2,865	$2.13	1,854	$2,486	$2.65
MHI trolling	3,094	$7,916	$3.15	2,535	$7,540	$3.31
MHI handline	1,200	$2,953	$2.77	773	$2,419	$3.13
Offshore handline	409	$828	$2.32	366	$1,065	$2.60
Other gear	184	$413	$2.69	70	$217	$2.77
Total	**39,802**	**$107,999**	**$3.04**	**37,146**	**$112,824**	**$3.33**

Figure 70. Hawai`i commercial tuna, billfish, other PMUS and PMUS shark catch, 2006-2016.



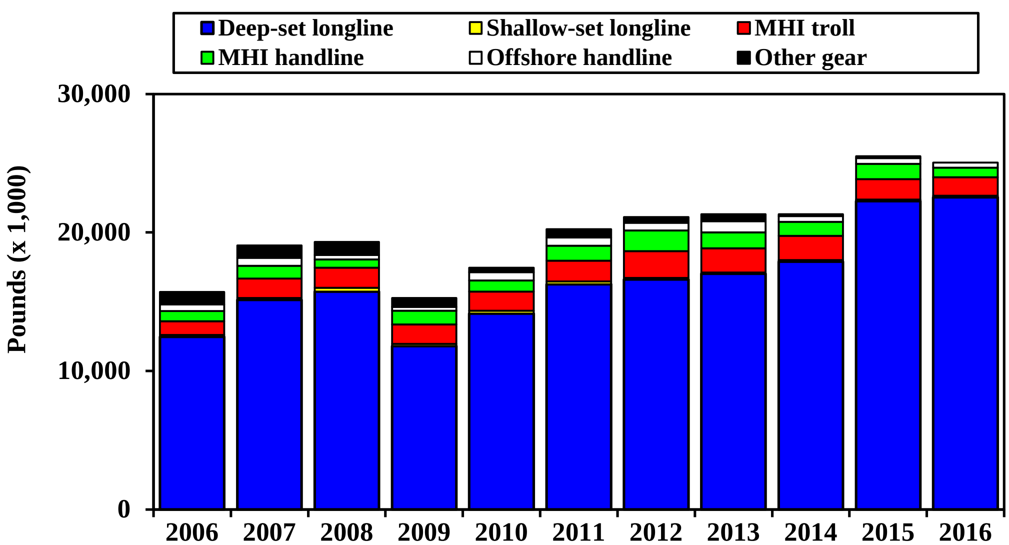
Supporting data shown in Table A-69.

Figure 71. Total commercial pelagic catch by gear type, 2006-2016.



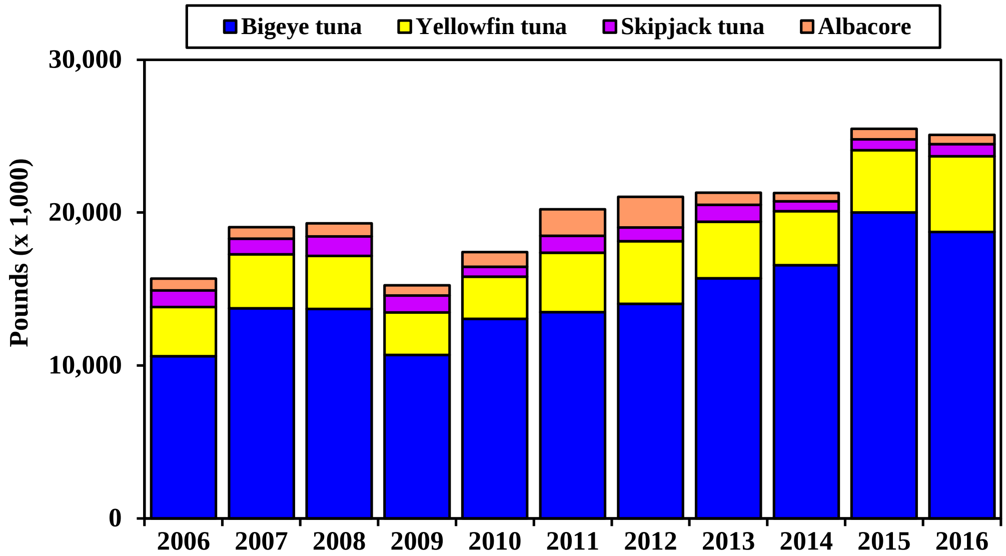
Supporting data shown in Table A-70.

Figure 72. Hawai`i commercial tuna catch by gear type, 2006-2016.



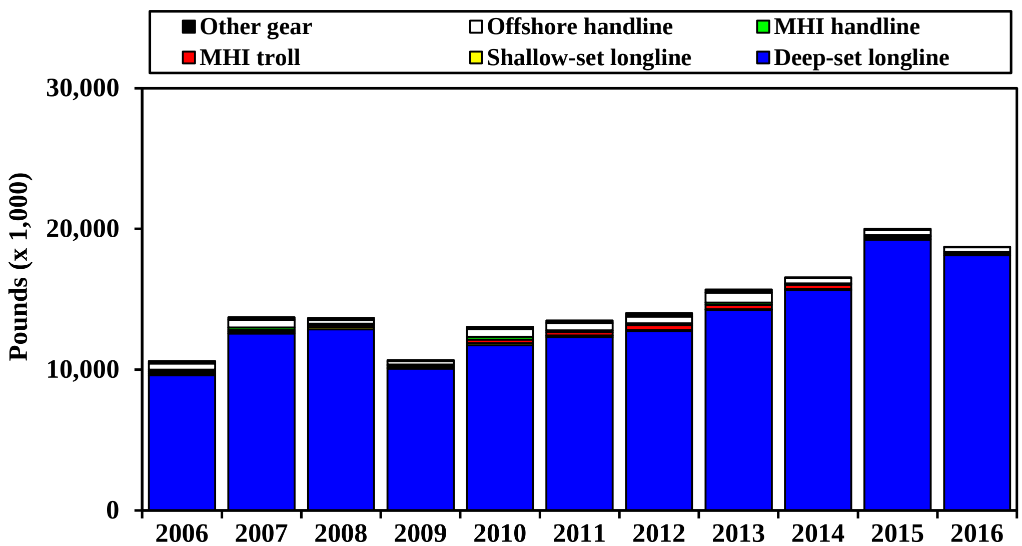
Supporting data shown in Table A-71.

Figure 73. Species composition of the tuna catch, 2006-2016.



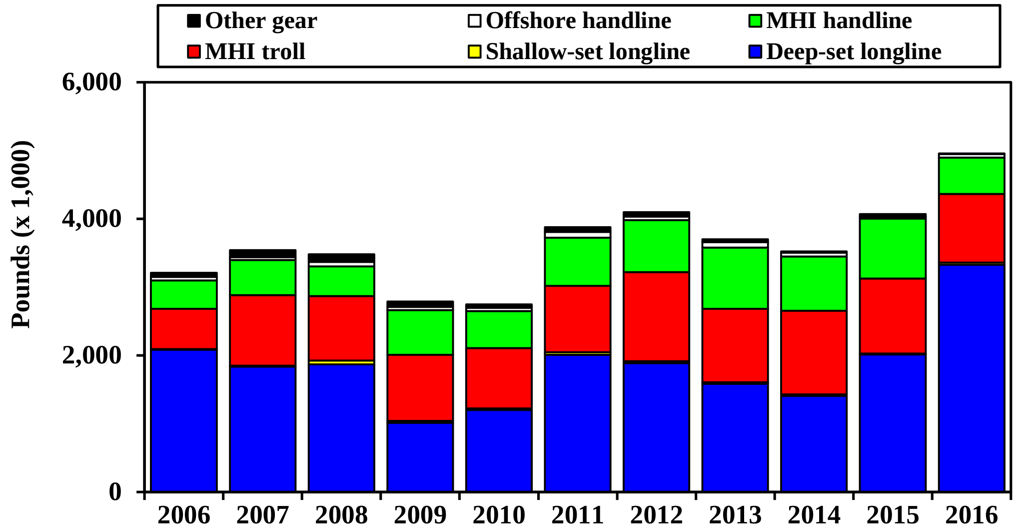
Supporting data shown in Table A-72.

Figure 74. Hawai`i bigeye tuna catch by gear type, 2006-2016.



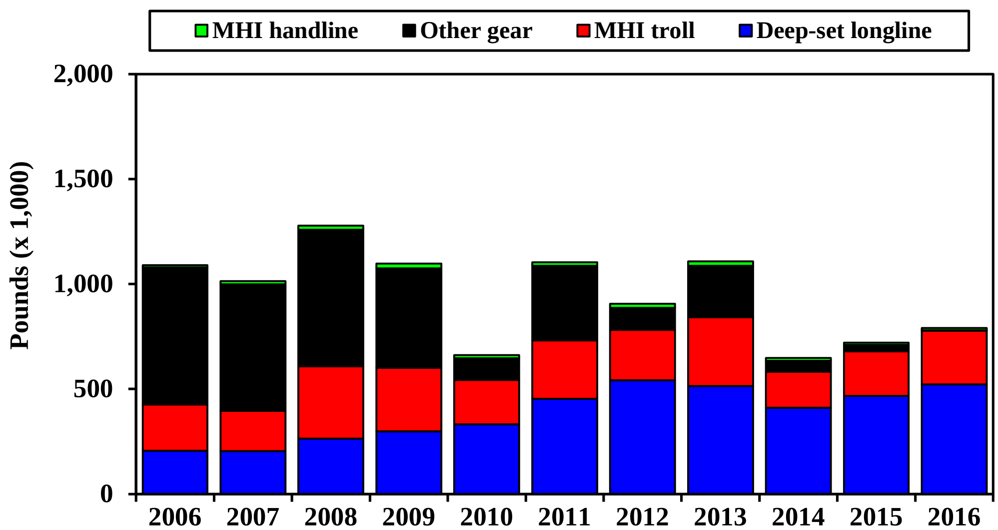
Supporting data shown in Table A-73.

Figure 75. Hawai`i yellowfin tuna catch by gear type, 2006-2016.



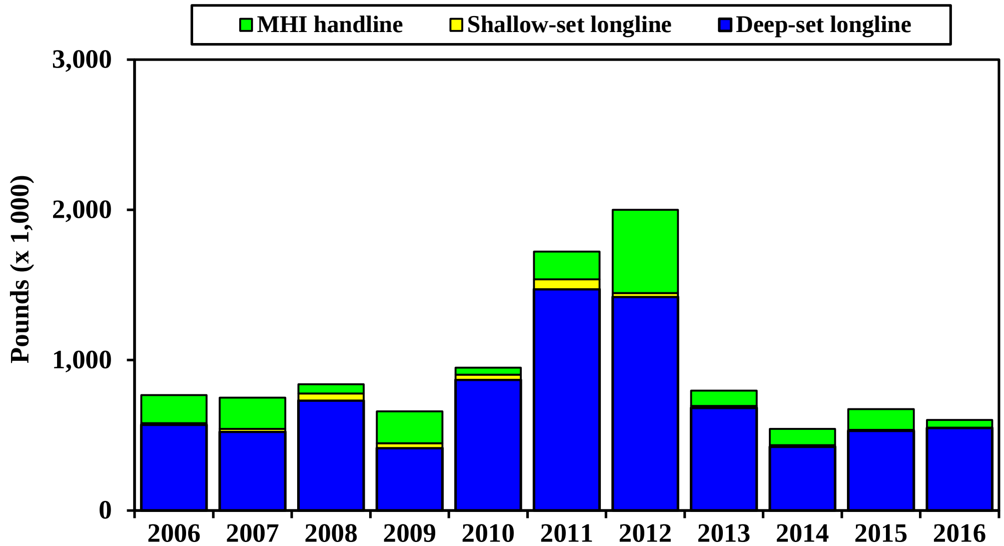
Supporting data shown in Table A-74.

Figure 76. Hawai`i skipjack tuna catch by gear type, 2006-2016.



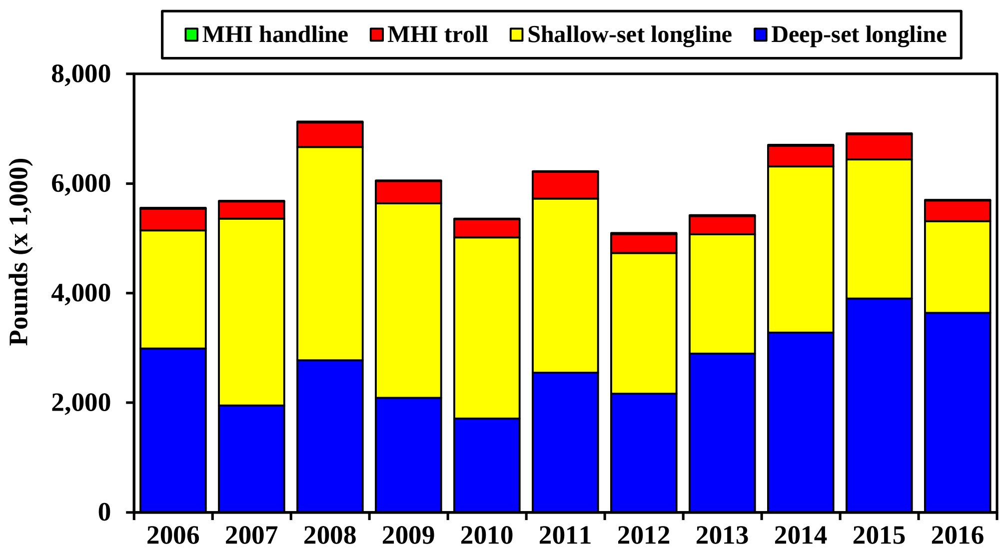
Supporting data shown in Table A-75.

Figure 77. Hawai`i albacore catch by gear type, 2006-2016.



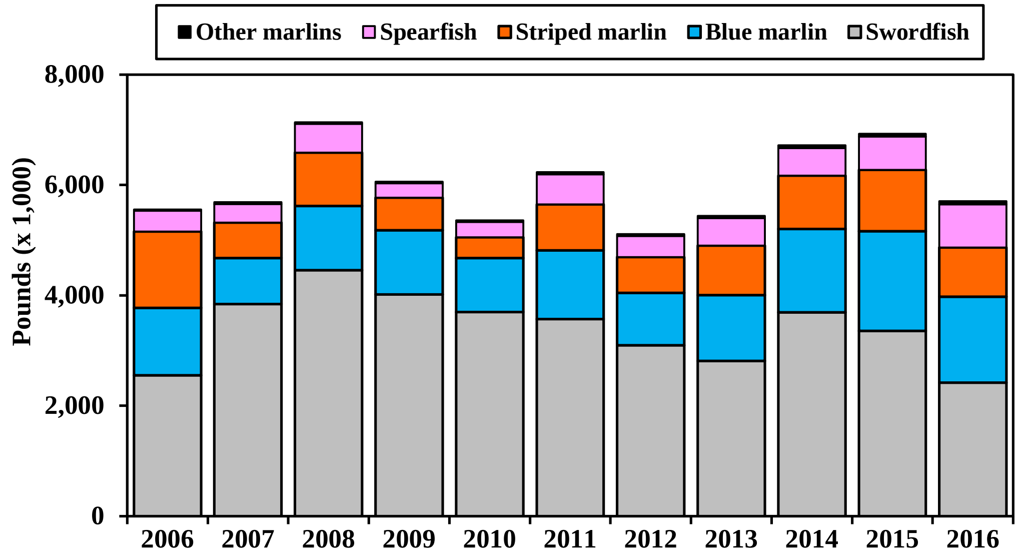
Supporting data shown in Table A-76.

Figure 78. Hawai`i commercial billfish catch by gear type, 2006-2016.



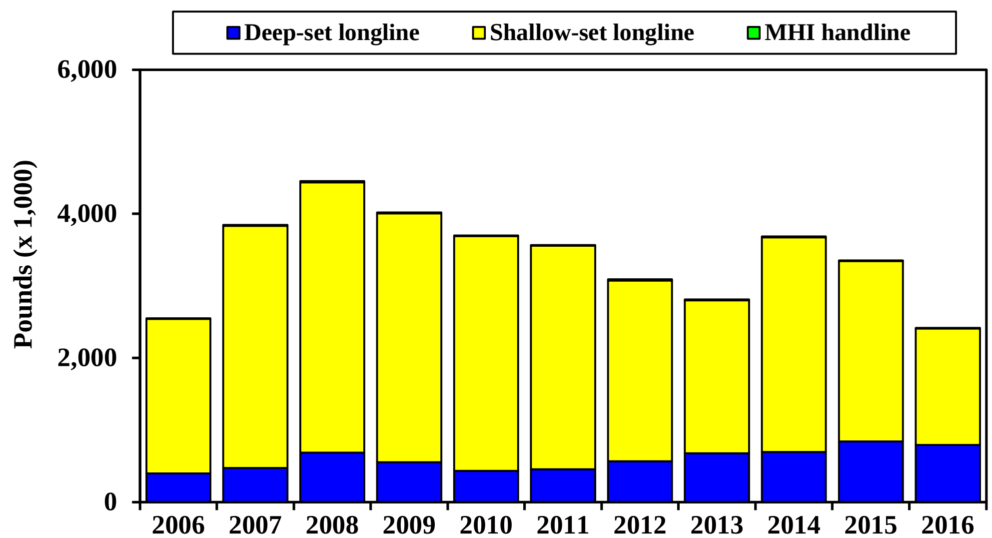
Supporting data shown in Table A-77.

Figure 79. Species composition of the billfish catch, 2006-2016.



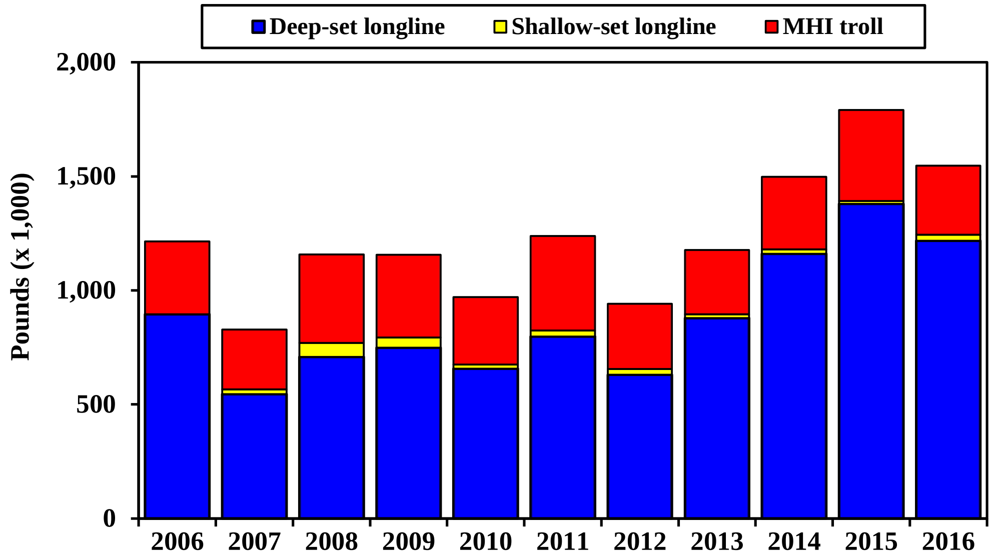
Supporting data shown in Table A-78.

Figure 80. Hawai`i swordfish catch by gear type, 2006-2016.



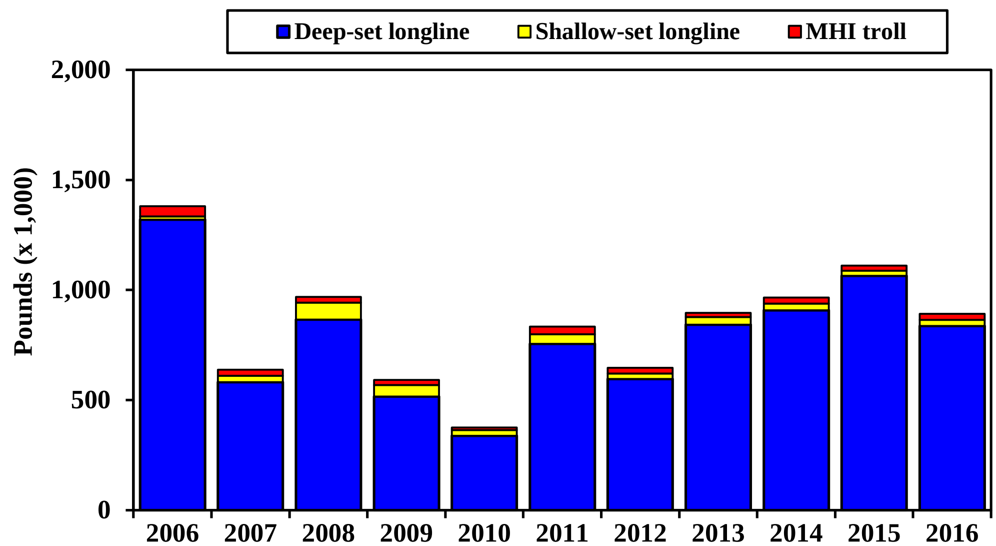
Supporting data shown in Table A-79.

Figure 81. Hawai`i blue marlin catch by gear type, 2006-2016.



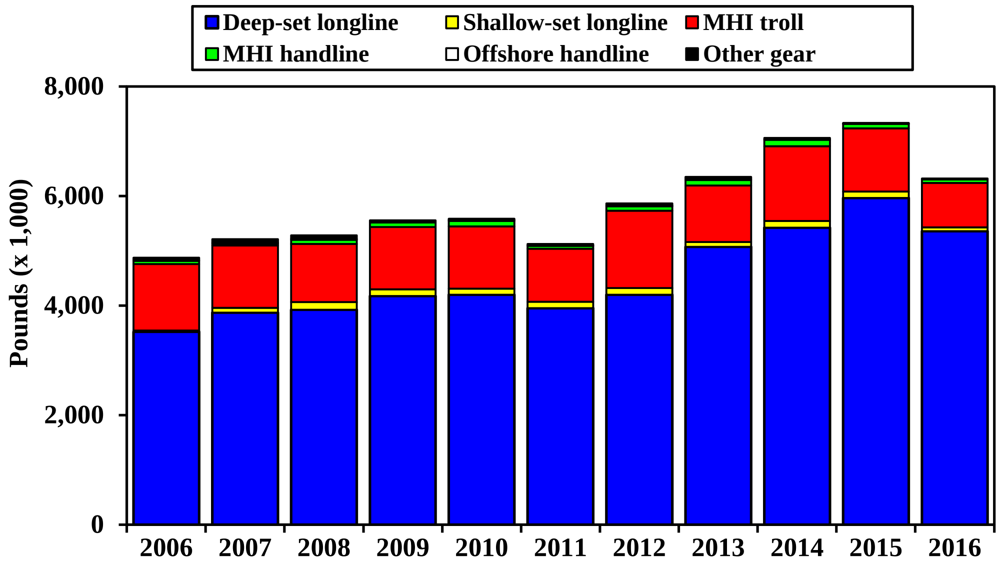
Supporting data shown in Table A-80.

Figure 82. Hawai`i striped marlin catch by gear type, 2006-2016.



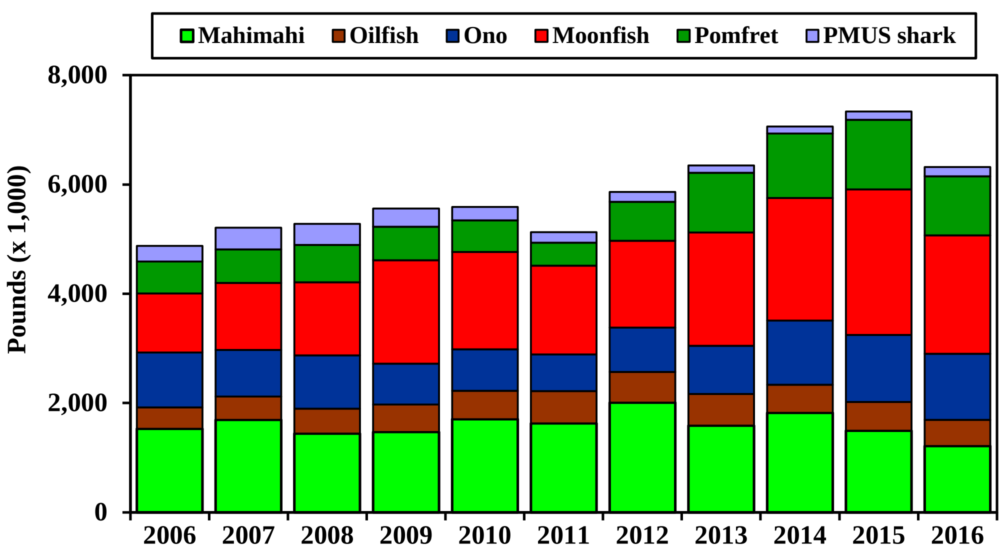
Supporting data shown in Table A-81.

Figure 83. Hawai`i commercial catch of other PMUS by gear type, 2006-2016.



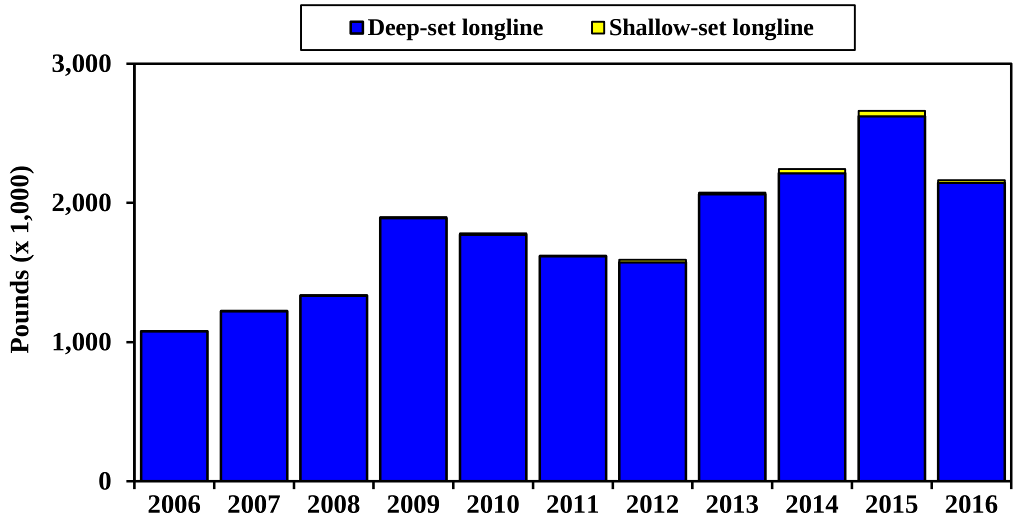
Supporting data shown in Table A-82.

Figure 84. Species composition of other PMUS catch, 2006-2016.



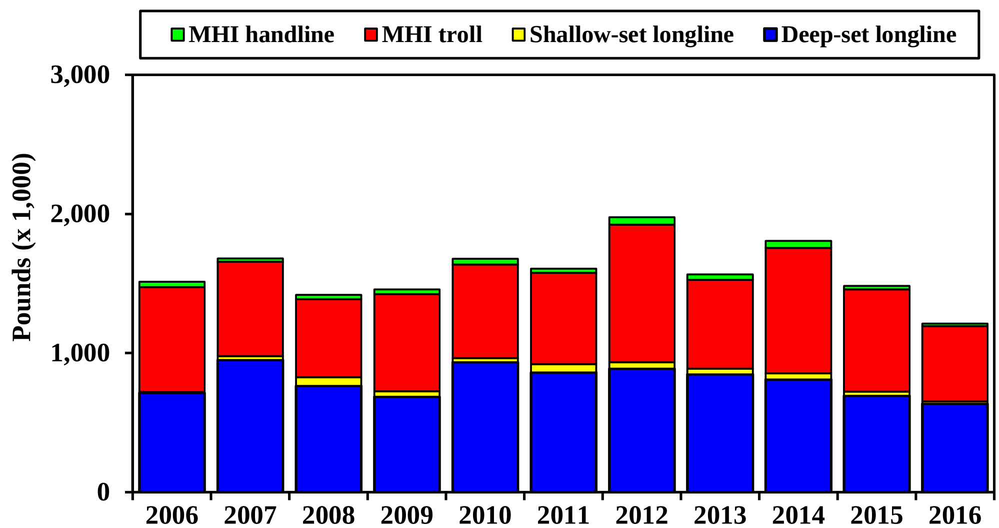
Supporting data shown in Table A-83.

Figure 85. Hawai`i moonfish catch by gear type, 2006-2016.



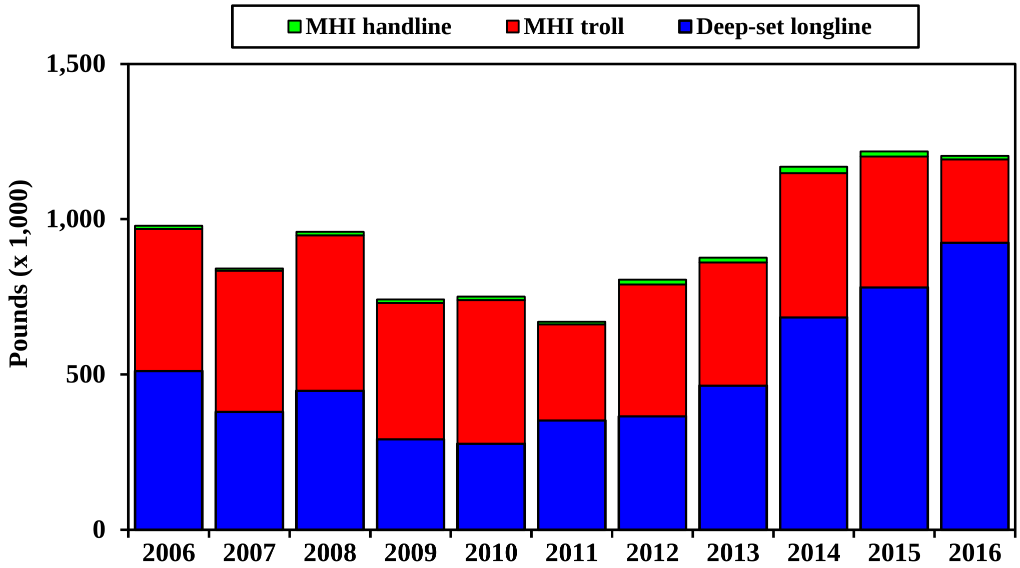
Supporting data shown in Table A-84.

Figure 86. Hawai`i mahimahi catch by gear type, 2006-2016.



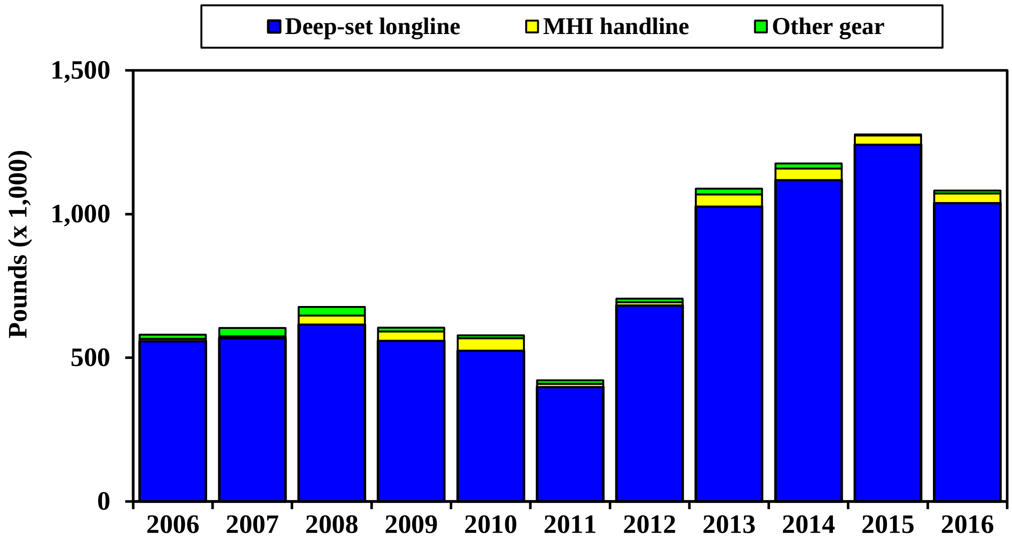
Supporting data shown in Table A-85.

Figure 87. Hawai`i ono (wahoo) catch by gear type, 2006-2016.



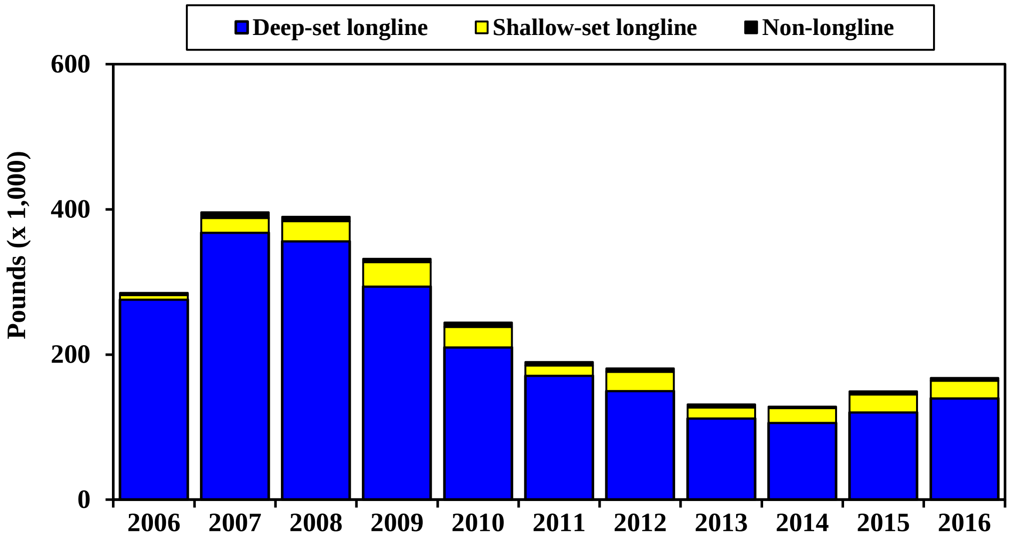
Supporting data shown in Table A-86.

Figure 88. Hawai`i pomfret catch by gear type, 2006-2016.



Supporting data shown in Table A-87.

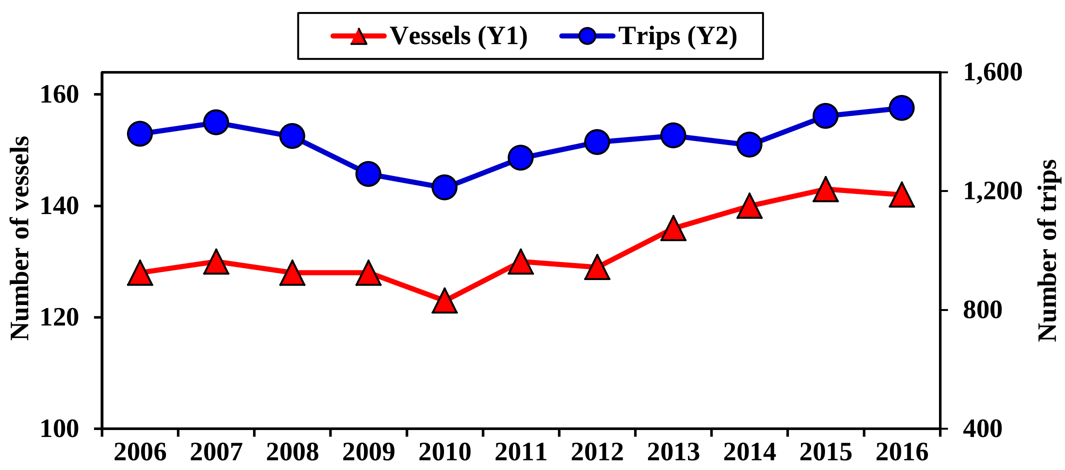
Figure 89. Hawai`i PMUS shark catch by gear type, 2006-2016.



Supporting data shown in Table A-88.

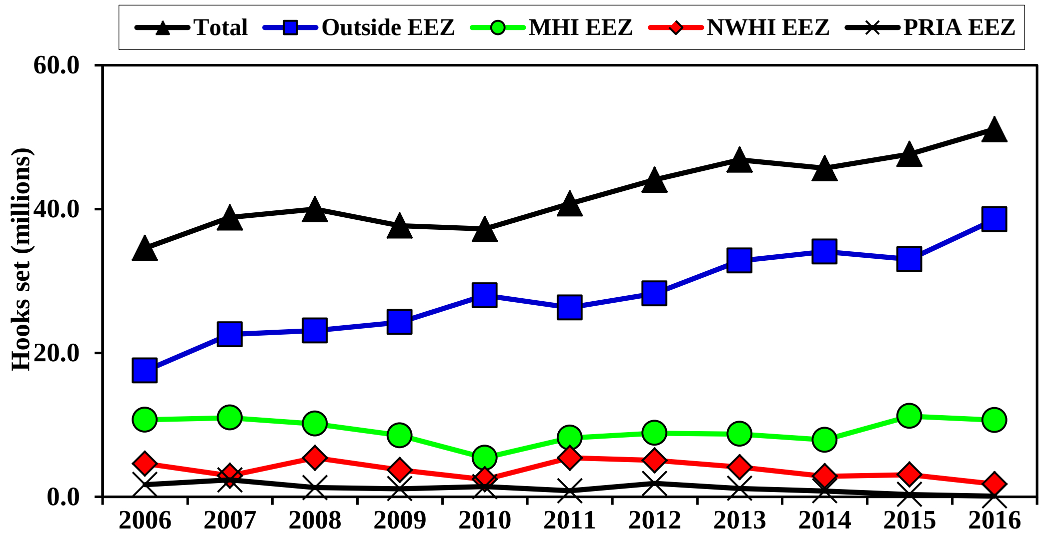
2.4.6 HAWAI`I DEEP-SET LONGLINE FISHERY EFFORT, LANDINGS. REVENUE AND CPUE

Figure 90. Number of Hawai`i-permitted deep-set longline vessels and trips, 2006-2016.



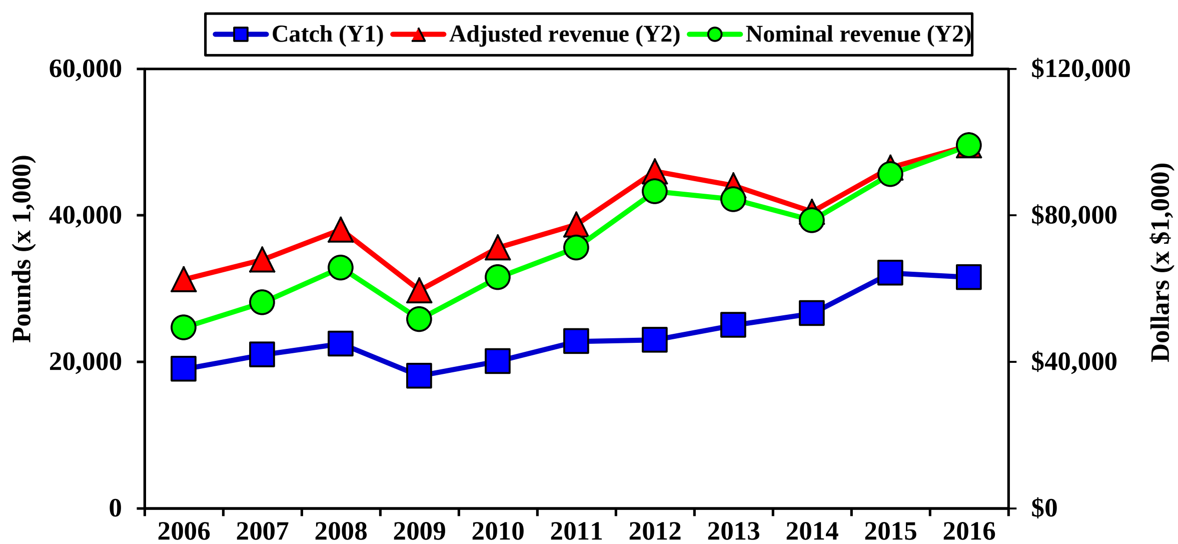
Supporting data and number of sets shown in Table A-89

Figure 91. Number of hooks set by the Hawai`i-permitted deep-set longline fishery, 2006-2016.



Supporting data shown in Table A-90.

Figure 92. Catch and revenue for the Hawai`i-permitted deep-set longline fishery, 2006-2016.



Supporting data shown in Table A-91.

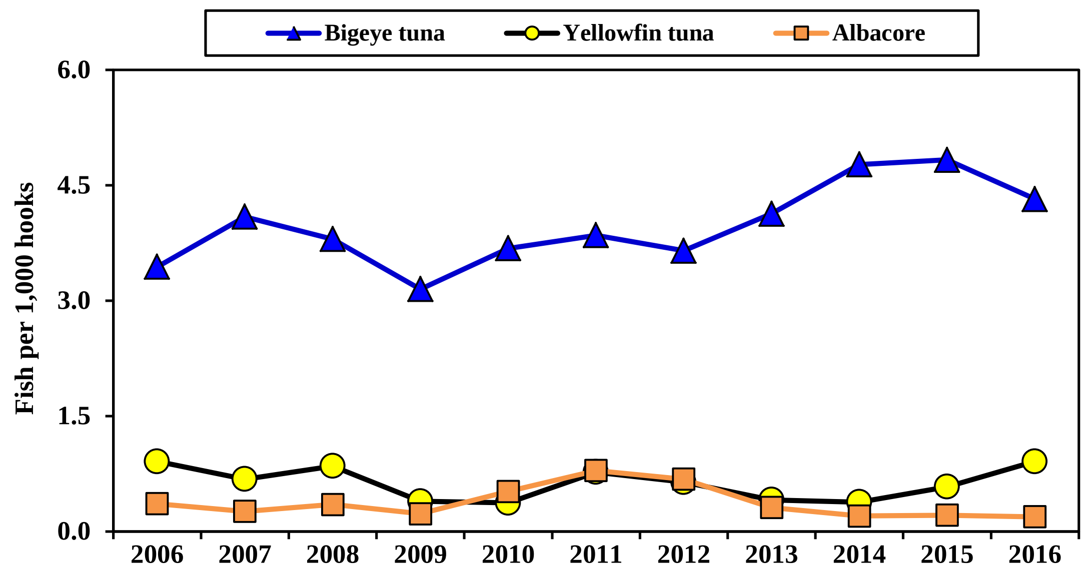
Table 24. Hawai`i-permitted deep-set longline catch (number of fish) by area, 2006-2016.

	Tunas			Billfish				Other PMUS				
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Pomfrets**	**PMUS sharks**
Main Hawaiian Islands EEZ												
2006	30,045	6,031	1,445	819	1,453	6,839	3,412	16,113	3,805	3,056	13,862	16,053
2007	41,570	5,547	1,024	764	584	2,185	2,899	20,878	2,642	2,757	9,533	14,799
2008	31,310	11,000	974	540	735	2,876	4,142	13,282	2,140	2,251	9,259	11,536
2009	22,358	2,454	422	529	513	1,624	1,651	9,169	1,144	2,327	5,482	9,645
2010	14,461	2,797	1,057	372	381	580	1,210	6,414	930	1,210	3,375	7,393
2011	24,343	7,209	3,096	486	755	3,388	2,486	13,078	1,100	1,713	7,907	12,078
2012	30,538	6,294	1,845	568	506	2,309	2,215	11,487	1,337	1,654	7,543	11,244
2013	32,485	4,508	1,271	660	791	3,522	3,278	13,070	1,925	1,838	7,846	12,396
2014	29,799	3,142	538	623	748	3,451	2,868	7,379	2,857	1,371	8,304	15,062
2015	46,884	8,413	1,389	963	2,033	4,299	5,485	13,660	5,362	1,902	19,474	18,758
2016	37,920	10,885	902	946	1,546	2,929	5,832	8,433	5,016	1,848	14,098	19,533
Northwestern Hawaiian EEZ												
2006	23,277	4,874	1,155	354	583	3,956	1,921	4,835	1,654	1,540	3,310	14,199
2007	13,732	2,517	1,167	216	186	1,314	944	3,322	671	1,120	2,363	8,099
2008	21,560	9,898	1,581	405	925	3,924	3,101	7,191	1,970	1,578	4,373	9,813
2009	12,789	1,886	1,852	314	248	1,319	802	1,717	581	1,167	2,739	6,180
2010	8,407	1,586	2,778	271	167	452	539	748	499	1,202	1,613	4,202
2011	19,851	5,675	8,005	387	697	3,837	3,399	8,917	922	1,420	2,814	10,771
2012	18,457	4,322	4,679	377	262	1,746	1,409	4,811	855	1,423	4,585	9,809
2013	16,639	3,192	2,190	262	386	2,120	2,156	3,641	987	1,125	3,201	8,370
2014	13,634	2,057	1,226	243	288	1,569	1,380	1,519	1,233	801	2,616	5,465
2015	14,103	3,429	1,700	361	528	1,646	1,602	1,700	1,026	852	2,486	6,637
2016	6,754	2,543	754	287	226	951	1,344	655	702	471	1,630	3,973

Year	Tunas			Billfish				Other PMUS				PMUS sharks
	Bigeye tuna	Yellowfin tuna	Albacore	Swordfish	Blue marlin	Striped marlin	Spearfish	Mahimahi	Ono (Wahoo)	Moonfish	Pomfrets	
Pacific Remote Islands Area EEZ												
2006	6,652	7,093	2,348	137	602	510	498	1,116	1,468	310	901	3,257
2007	14,419	3,226	1,420	243	423	378	521	866	1,661	135	1,585	4,191
2008	5,908	2,129	2,394	119	310	292	578	1,513	1,108	127	931	2,623
2009	3,911	1,910	1,057	135	288	202	383	342	547	159	1,366	3,161
2010	7,393	1,572	770	164	333	128	201	326	623	131	1,842	3,002
2011	3,968	2,509	925	88	182	374	280	561	617	106	978	1,529
2012	6,397	5,040	3,075	191	232	283	604	1,965	1,176	222	2,761	3,054
2013	4,445	942	1,435	112	201	171	482	966	783	116	2,467	1,959
2014	4,121	621	442	110	184	226	242	466	750	47	1,834	1,280
2015	1,406	97	46	25	86	21	59	74	174	2	132	964
2016	578	212	0	15	44	7	10	5	55	0	80	194
Outside EEZ												
2006	59,098	13,329	7,642	1,843	3,046	9,603	6,088	30,319	10,229	8,057	24,912	23,855
2007	89,183	15,223	6,467	2,218	2,046	4,011	5,601	56,412	7,519	10,699	26,030	31,527
2008	93,258	11,094	8,901	2,596	1,904	6,386	7,481	40,881	8,900	11,277	28,433	24,430
2009	79,630	8,292	5,360	2,369	3,044	4,221	5,937	49,477	6,599	18,249	27,315	31,747
2010	106,767	7,923	14,910	2,131	2,515	2,514	6,425	84,974	6,724	17,361	30,905	36,592
2011	108,790	16,114	20,080	2,295	2,793	8,653	9,392	52,687	7,822	14,931	21,748	31,525
2012	105,336	12,454	20,310	2,431	2,296	4,759	7,068	59,774	8,096	14,247	37,030	33,053
2013	140,034	10,592	9,837	3,230	2,563	6,717	8,959	59,124	10,654	20,386	64,971	34,102
2014	170,269	11,406	6,756	3,604	4,475	9,558	11,348	61,366	18,296	23,564	69,312	51,064
2015	167,550	15,745	7,072	4,048	4,868	7,155	10,707	44,946	18,337	26,593	75,363	59,757
2016	175,687	32,825	8,197	3,863	4,444	7,685	16,837	39,385	24,421	22,024	65,854	65,391

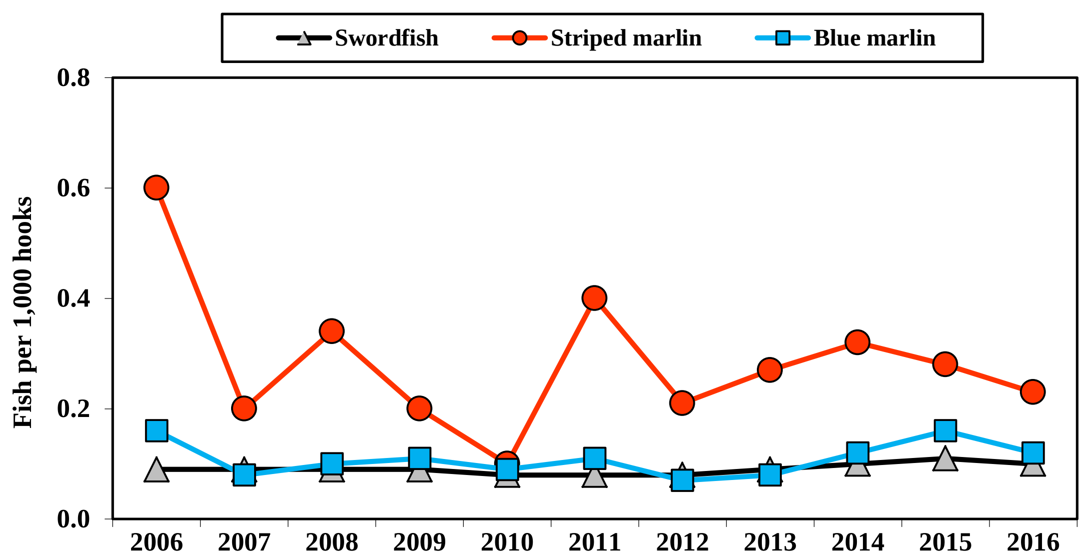
Year	Tunas			Billfish				Other PMUS				PMUS sharks
	Bigeye tuna	Yellowfin tuna	Albacore	Swordfish	Blue marlin	Striped marlin	Spearfish	Mahimahi	Ono (Wahoo)	Moonfish	Pomfrets	
All areas												
2006	119,072	31,327	12,590	3,153	5,684	20,908	11,919	52,383	17,156	12,963	42,985	57,364
2007	158,904	26,513	10,078	3,441	3,239	7,888	9,965	81,478	12,493	14,711	39,511	58,616
2008	152,036	34,121	13,850	3,660	3,874	13,478	15,302	62,867	14,118	15,233	42,996	48,402
2009	118,688	14,542	8,691	3,347	4,093	7,366	8,773	60,705	8,871	21,902	36,902	50,733
2010	137,028	13,878	19,515	2,938	3,396	3,674	8,375	92,462	8,776	19,904	37,735	51,189
2011	156,952	31,507	32,106	3,256	4,427	16,252	15,557	75,243	10,461	18,170	33,447	55,903
2012	160,728	28,110	29,909	3,567	3,296	9,097	11,296	78,037	11,464	17,546	51,919	57,160
2013	193,603	19,234	14,733	4,264	3,941	12,530	14,875	76,801	14,349	23,465	78,485	56,827
2014	217,823	17,226	8,962	4,580	5,695	14,804	15,838	70,730	23,136	25,783	82,066	72,871
2015	229,943	27,684	10,207	5,397	7,515	13,121	17,853	60,380	24,899	29,349	97,455	86,116
2016	220,939	46,465	9,853	5,111	6,260	11,572	24,023	48,478	30,194	24,343	81,662	89,091

Figure 93. Tuna CPUE for the Hawai`i-permitted deep-set longline fishery, 2006-2016.



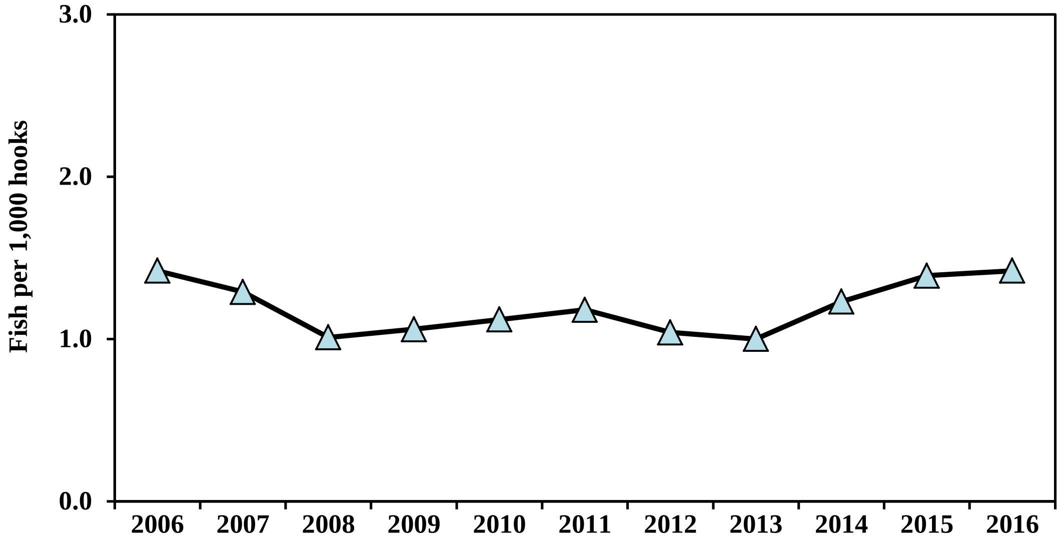
Supporting data shown in Table A-92.

Figure 94. Billfish CPUE for the Hawai`i-permitted deep-set longline fishery, 2006-2016.



Supporting data shown in Table A-93.

Figure 95. Blue shark CPUE for the Hawai`i-permitted deep-set longline fishery, 2006-2016.



Supporting data shown in Table A-94.

Table 25. Released catch, retained catch, and total catch for the Hawai`i-permitted deep-set longline fishery, 2016.

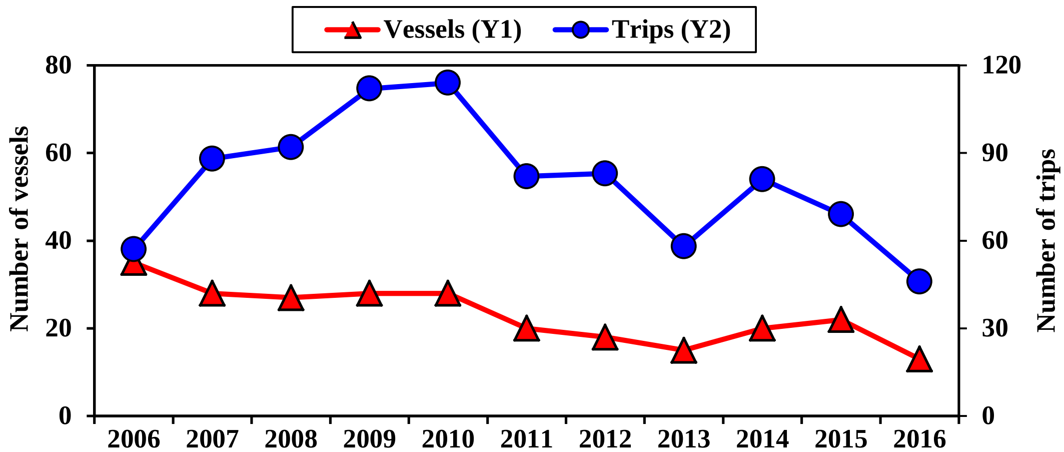
	Deep-set longline fishery			
	Released catch	**Percent released**	**Retained catch**	**Total Catch**
Tuna				
Albacore	18	0.2	9,835	9,853
Bigeye tuna	3,810	1.7	217,129	220,939
Bluefin tuna	1	20.0	4	5
Skipjack tuna	545	1.8	30,316	30,861
Yellowfin tuna	819	1.8	45,646	46,465
Other tuna	0	0.0	6	6
Total tunas	**5,193**	**1.7%**	**302,936**	**308,129**
Billfish				
Blue marlin	73	1.2	6,187	6,260
Spearfish	311	1.3	23,712	24,023
Striped marlin	156	1.3	11,416	11,572
Other marlin	11	1.3	856	867
Swordfish	315	6.2	4,796	5,111
Total billfish	**866**	**1.8%**	**46,967**	**47,833**
Other PMUS				
Mahimahi	281	0.6	48,197	48,478
Moonfish	67	0.3	24,276	24,343
Oilfish	2,584	9.3	25,234	27,818
Pomfret	377	0.5	81,285	81,662
Wahoo	104	0.3	30,090	30,194
Total other PMUS	**3,413**	**1.6%**	**209,082**	**212,495**
Non-PMUS fish	**5,774**	**84.7**	**1,046**	**6,820**
Total non-shark	**15,246**	**2.7%**	**560,031**	**575,277**
PMUS Sharks				
Blue shark	72,608	100.0	6	72,614
Mako shark	3,759	83.8	728	4,487
Thresher shark	10,482	99.6	46	10,528
Oceanic Whitetip shark	1,111	100.0	0	1,111
Silky shark	351	100.0	0	351
Total PMUS sharks	**88,311**	**99.1%**	**780**	**89,091**
Non-PMUS sharks	**904**	**99.7**	**3**	**907**
Grand Total	**104,461**	**15.7%**	**560,814**	**665,275**

Table 26. Average weight (lbs) of the catch by the Hawai`i-permitted deep-set longline fishery, 2006-2016.

Hawaii-permitted deep-set longline fishery	Tunas					Billfish						Other PMUS					Sharks	
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Skipjack tuna**	**Bluefin Tuna**	**Swordfish**	**Striped marlin**	**Blue marlin**	**Spearfish**	**Sailfish**	**Black marlin**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Pomfrets**	**Oilfish**	**Mako shark**	**Thresher shark**
2006	84	71	50	17	196	144	64	164	30	48	183	14	30	85	13	16	179	193
2007	82	74	56	16	196	161	75	188	33	49	222	12	31	86	15	16	190	197
2008	87	58	53	18	196	211	65	196	33	58	252	12	32	89	14	15	183	205
2009	87	80	48	18	196	181	72	189	28	45	189	12	34	90	15	16	190	205
2010	88	90	46	18	196	171	93	202	31	55	189	10	32	91	14	16	203	182
2011	81	67	47	18	196	173	47	188	33	58	189	12	34	91	12	16	188	172
2012	82	71	48	16	250	172	66	200	31	56	186	12	32	92	13	16	198	192
2013	75	84	47	16	196	184	68	225	32	61	189	11	33	89	13	17	198	172
2014	73	84	50	17	---	158	62	205	30	58	258	12	30	89	14	17	201	214
2015	85	75	52	18	196	165	82	185	33	58	219	12	31	91	13	18	196	219
2016	84	73	56	17	221	165	73	197	31	52	242	13	31	88	13	19	180	183
Average	**82.5**	**75.2**	**50.3**	**17.2**	**203.9**	**171.4**	**69.7**	**194.5**	**31.4**	**54.4**	**210.7**	**12.0**	**31.8**	**89.2**	**13.5**	**16.5**	**191.5**	**194.0**
SD	**4.8**	**9.0**	**3.6**	**0.9**	**18.0**	**17.2**	**11.8**	**15.1**	**1.6**	**5.1**	**28.9**	**1.0**	**1.4**	**2.2**	**0.9**	**1.1**	**8.4**	**15.9**

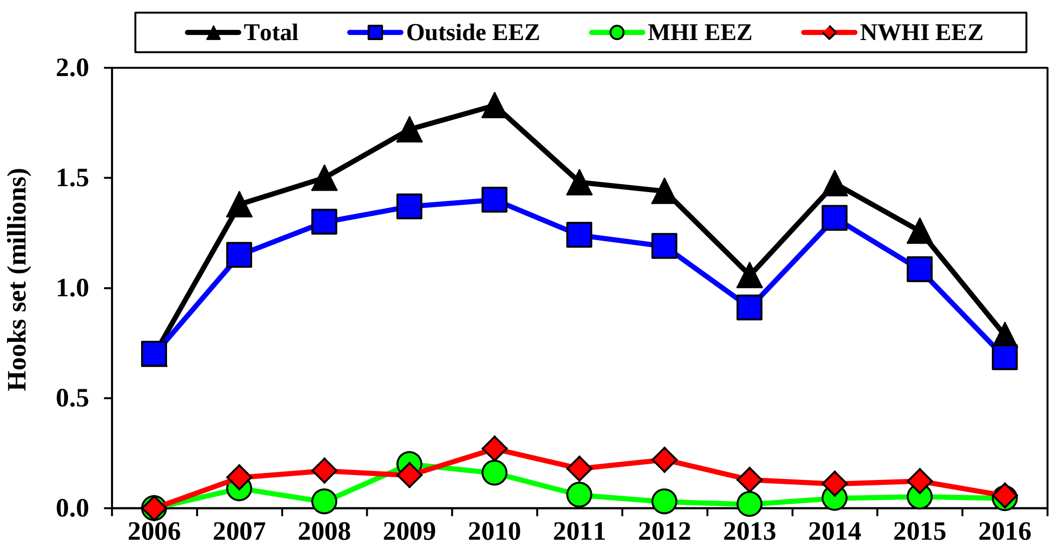
2.4.7 HAWAI`I SHALLOW-SET LONGLINE FISHERY EFFORT, LANDINGS. REVENUE AND CPUE

Figure 96. Number of Hawai`i-permitted shallow-set longline vessels and trips, 2006-2016.



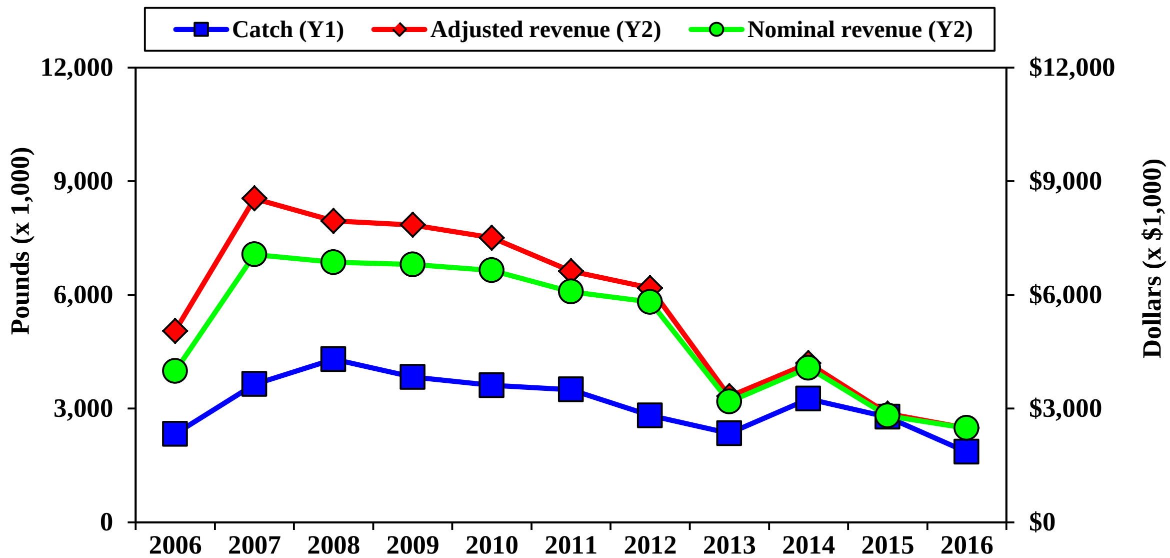
Supporting data and number of sets shown in Table A-95.

Figure 97. Number of hooks set by the Hawai`i-permitted shallow-set longline fishery, 2006-2016.



Supporting data shown in Table A-96.

Figure 98. Catch and revenue for the Hawai`i-permitted shallow-set longline fishery, 2006-2016.



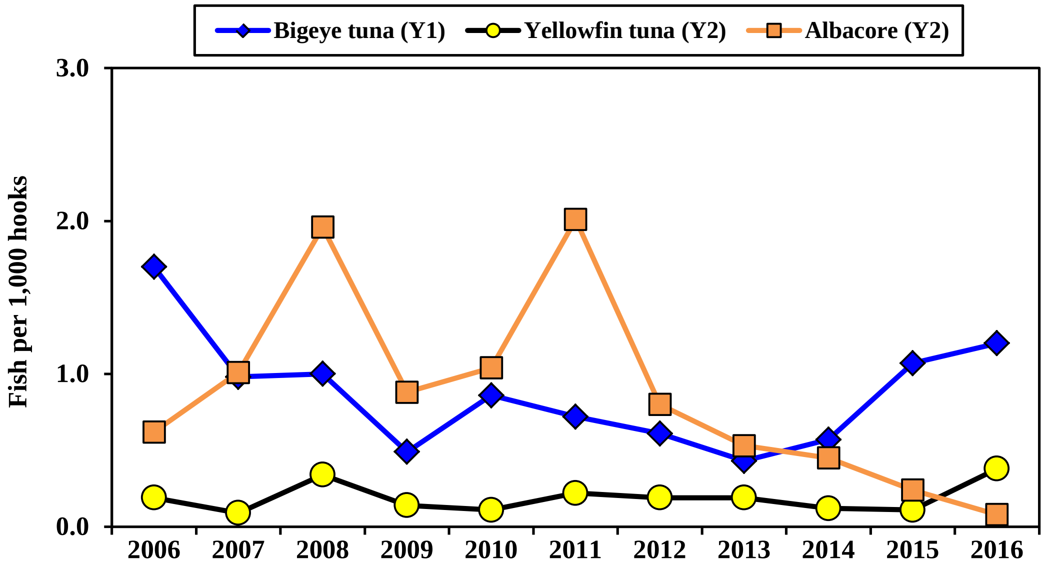
Supporting data shown in Table A-97.

Table 27. Hawai`i-permitted shallow-set longline catch (number of fish) by area, 2006-2016.

Year	Bigeye tuna	Yellowfin tuna	Albacore	Swordfish	Blue marlin	Striped marlin	Spearfish	Mahimahi	Ono (Wahoo)	Moonfish	Pomfrets	PMUS sharks
	Tunas			**Billfish**				**Other PMUS**				
Main Hawaiian Islands EEZ												
2006												
2007	30	21	3	915	5	42	15	146	19	0	3	375
2008	11	21	0	290	22	66	5	63	8	0	2	172
2009	28	24	0	1,882	47	172	25	182	13	24	6	662
2010	25	62	3	925	18	33	12	408	14	0	6	869
2011	26	18	4	369	6	22	21	167	4	3	1	225
2012	3	10	0	196	4	8	2	128	2	0	0	141
2013	0	4	1	88	5	8	1	7	1	0	0	50
2014	3	19	0	348	14	28	25	43	6	0	0	335
2015	3	19	0	497	15	45	23	40	3	0	0	416
2016	5	31	0	450	51	28	32	27	8	0	0	483
Northwestern Hawaiian EEZ												
2006												
2007	76	11	1	2,421	24	79	9	293	11	1	11	697
2008	357	244	9	2,651	213	477	74	1,344	44	9	0	668
2009	58	31	2	1,994	56	106	12	219	4	1	8	453
2010	193	40	15	2,566	24	100	20	375	43	4	14	1,288
2011	183	73	14	1,728	79	245	56	1,339	6	1	3	906
2012	63	45	12	2,034	57	155	39	708	21	1	1	773
2013	93	72	4	1,419	38	290	31	1,672	7	0	3	769
2014	24	38	1	1,341	40	109	12	925	13	0	4	945
2015	37	17	1	1,504	8	66	17	764	2	0	3	1,121
2016	15	16	5	707	17	76	13	42	11	0	2	659

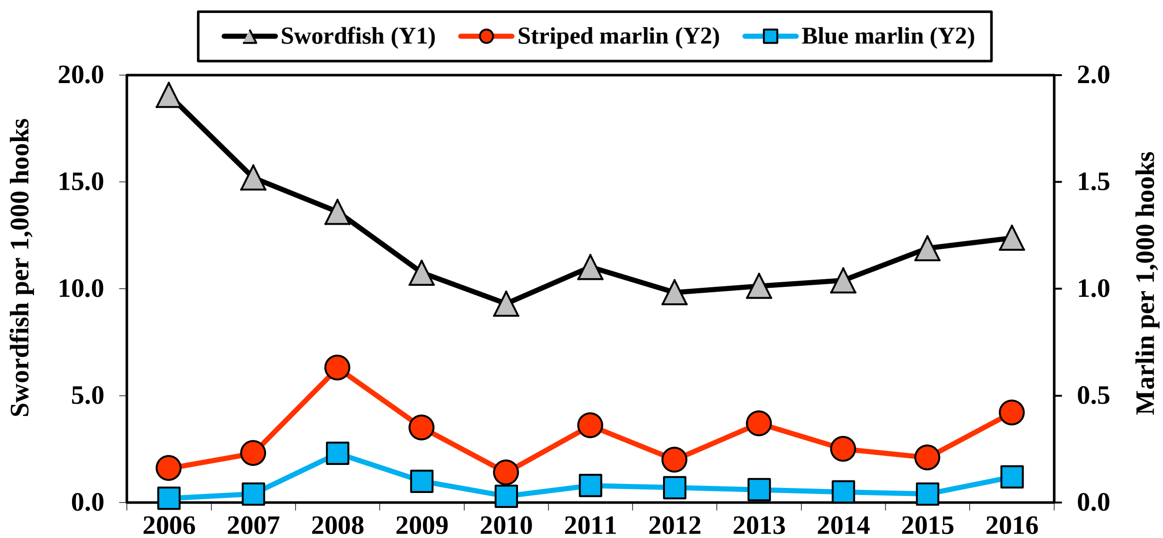
Pacific Remote Islands Area EEZ												
	Tunas			Billfish				Other PMUS				
Year	Bigeye tuna	Yellowfin tuna	Albacore	Swordfish	Blue marlin	Striped marlin	Spearfish	Mahimahi	Ono (Wahoo)	Moonfish	Pomfrets	PMUS sharks
	No shallow-set longline fishing has occurred in the PRIA EEZ since 2006											
Outside EEZ												
2006	1,200	135	434	13,435	13	110	4	465	6	49	149	10,071
2007	1,244	97	1,387	17,507	22	197	47	1,477	57	53	127	15,391
2008	1,122	239	2,921	17,401	116	394	90	3,386	82	96	75	12,863
2009	761	192	1,509	14,632	77	321	40	2,820	21	71	69	8,292
2010	1,367	103	1,902	13,636	22	122	38	1,819	15	213	57	16,800
2011	851	228	2,928	14,083	30	255	104	4,892	24	202	98	7,808
2012	811	227	1,142	12,011	41	122	102	3,623	17	284	352	6,066
2013	359	126	556	9,222	20	92	84	1,995	22	241	129	5,442
2014	810	124	662	13,646	21	231	134	3,321	25	515	228	10,173
2015	1,305	103	305	12,988	26	155	66	1,822	11	645	121	12,489
2016	921	254	54	8,573	27	225	115	1,065	20	271	16	10,737
All areas												
2006	1,200	135	434	13,435	13	110	4	465	6	49	149	10,071
2007	1,350	129	1,391	20,843	51	318	71	1,916	87	54	141	16,463
2008	1,490	504	2,930	20,342	351	937	169	4,793	134	105	77	13,703
2009	847	247	1,511	18,508	180	599	77	3,221	38	96	83	9,407
2010	1,585	205	1,920	17,127	64	255	70	2,602	72	217	77	18,957
2011	1,060	319	2,946	16,180	115	522	181	6,398	34	206	102	8,939
2012	877	282	1,154	14,241	102	285	143	4,459	40	285	353	6,980
2013	452	202	561	10,729	63	390	116	3,674	30	241	132	6,261
2014	837	181	663	15,335	75	368	171	4,289	44	515	232	11,453
2015	1,345	139	306	14,989	49	266	106	2,626	16	645	124	14,026
2016	941	301	59	9,730	95	329	160	1,134	39	271	18	11,879

Figure 99. Tuna CPUE for the Hawai`i-permitted shallow-set longline fishery, 2006-2016.



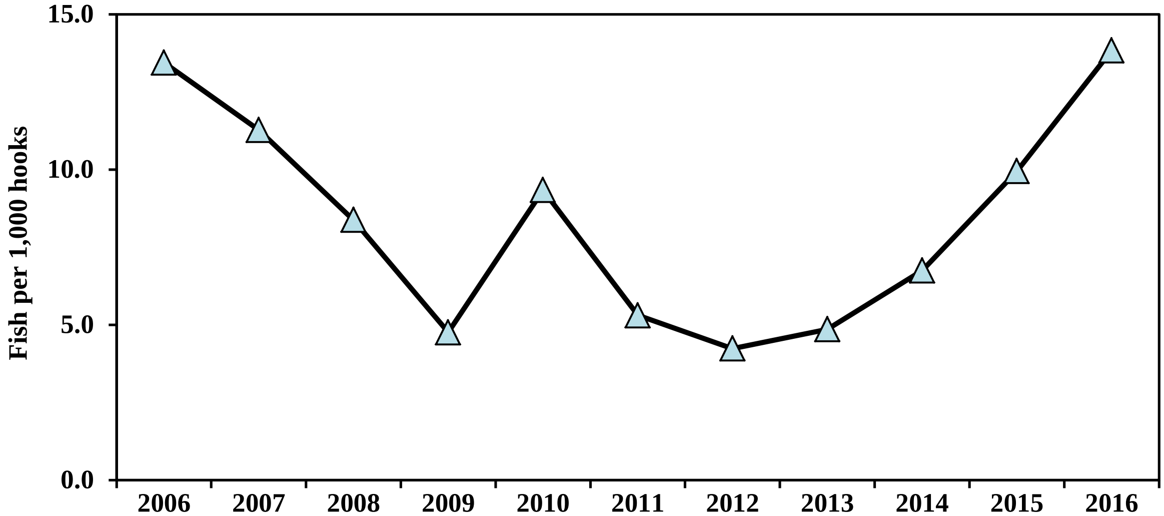
Supporting data shown in Table A-98.

Figure 100. Billfish CPUE for the Hawai`i-permitted shallow-set longline fishery, 2006-2016.



Supporting data shown in Table A-99.

Figure 101. Blue shark CPUE for the Hawai`i-permitted shallow-set longline fishery, 2006-2016.



Supporting data shown in Table A-100.

Table 28. Released catch, retained catch, and total catch for the Hawai`i-permitted shallow-set longline fishery, 2016.

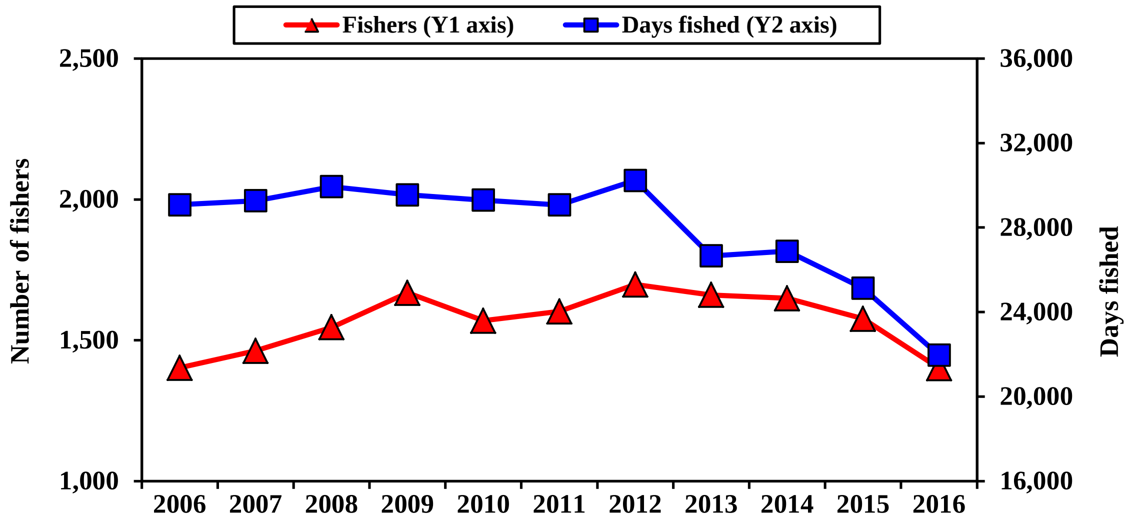
	Shallow-set longline fishery			
	Released catch	Percent released	Retained catch	Total Catch
Tuna				
Albacore	3	5.1	56	59
Bigeye tuna	72	7.7	869	941
Bluefin tuna	0	0.0	0	0
Skipjack tuna	2	10.0	18	20
Yellowfin tuna	16	5.3	285	301
Other tuna	0	0.0	0	0
Total tunas	**93**	**7.0%**	**1,228**	**1,321**
Billfish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

Table 29. Average weight (lbs) of the catch by the Hawai`i-permitted shallow-set longline fisheries, 2006-2016.

Hawaii-permitted shallow-set longline fishery																		
	Tunas					Billfish						Other PMUS					Sharks	
Year	Bigeye tuna	Yellowfin tuna	Albacore	Skipjack tuna	Bluefin Tuna	Swordfish	Striped marlin	Blue marlin	Spearfish	Sailfish	Black marlin	Mahimahi	Ono (Wahoo)	Moonfish	Pomfrets	Oilfish	Mako shark	Thresher shark
2006	110	88	34	18	171	171	130	209	36	52	---	14	52	52	17	23	118	---
2007	101	109	23	18	---	178	107	445	37	52	---	15	42	75	18	18	162	305
2008	119	117	27	18	171	199	87	196	35	52	189	14	38	81	18	18	208	309
2009	121	112	28	18	171	204	92	274	35	44	---	13	44	79	19	16	180	417
2010	95	115	26	18	171	199	111	282	37	54	---	12	49	73	17	18	154	321
2011	110	123	27	18	---	212	91	246	37	52	---	10	39	56	18	17	187	200
2012	97	111	26	18	171	193	98	259	34	---	---	11	36	81	14	16	185	277
2013	106	111	29	18	171	217	92	281	34	---	---	12	43	82	15	23	177	---
2014	87	132	22	18	268	212	90	280	36	52	---	12	40	71	16	24	202	244
2015	79	128	22	19	---	184	97	292	37	52	---	12	39	76	13	22	150	244
2016	86	112	40	19	---	179	97	304	39	52	---	15	32	83	13	21	215	244
Average	**101.0**	**114.4**	**27.6**	**18.2**	**184.9**	**195.3**	**99.3**	**278.9**	**36.1**	**51.3**	**189.0**	**12.7**	**41.3**	**73.5**	**16.2**	**19.6**	**176.2**	**284.6**
SD	**13.7**	**11.6**	**5.4**	**0.4**	**36.7**	**15.6**	**12.5**	**64.5**	**1.5**	**2.8**	**---**	**1.6**	**5.7**	**10.4**	**2.1**	**3.0**	**28.6**	**63.3**

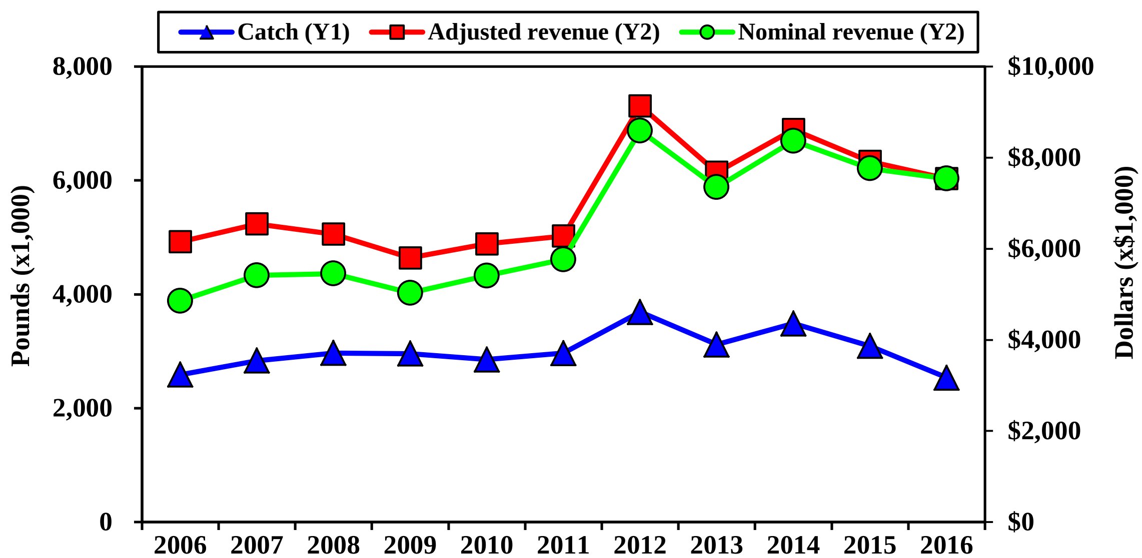
2.4.8 MHI TROLL FISHERY EFFORT, LANDINGS, REVENUE AND CPUE

Figure 102. Number of MHI troll fishers and days fished, 2006-2016.



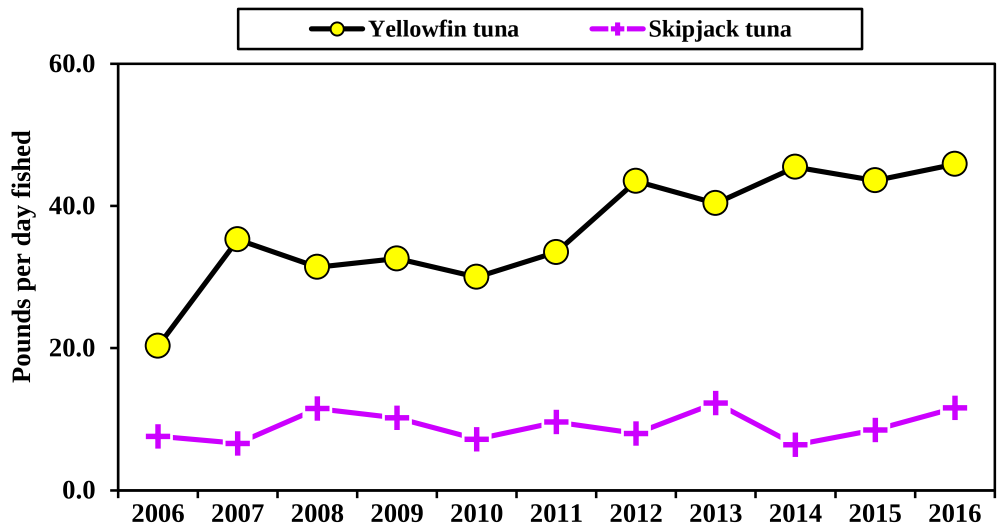
Supporting data shown in Table A-101.

Figure 103. Catch and revenue for the MHI troll fishery, 2006-2016.



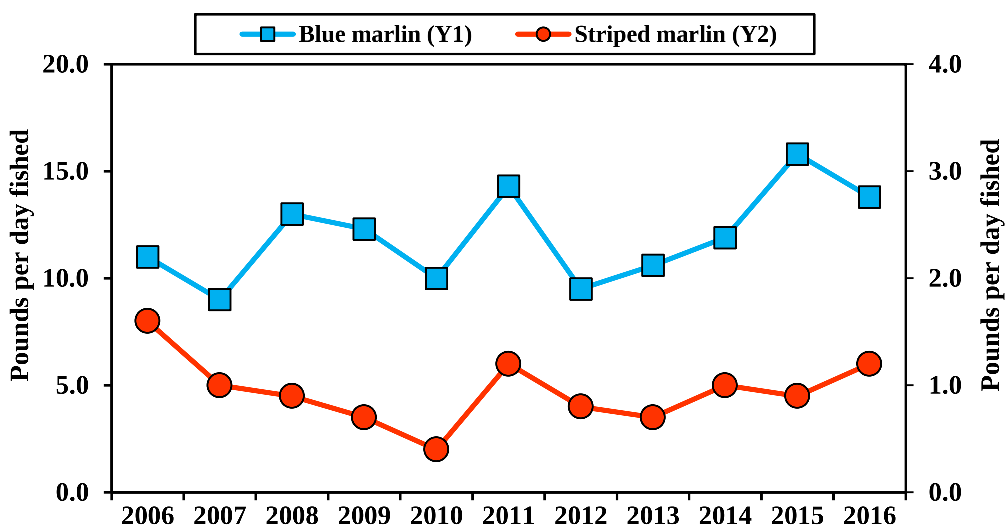
Supporting data shown in Table A-102.

Figure 104. Tuna CPUE for the MHI troll fishery, 2006-2016.



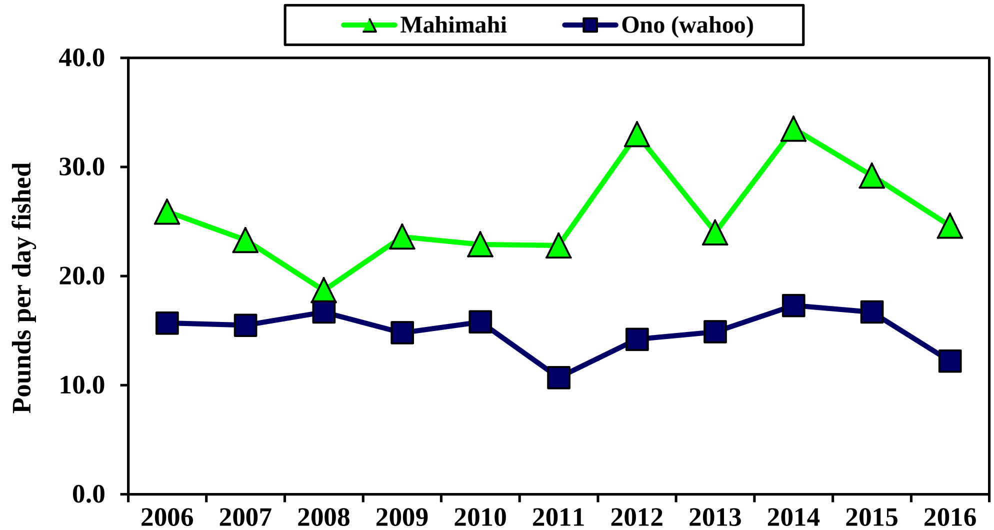
Supporting data shown in Table A-103.

Figure 105. Marlin CPUE for the MHI troll fishery, 2006-2016.



Supporting data shown in Table A-104.

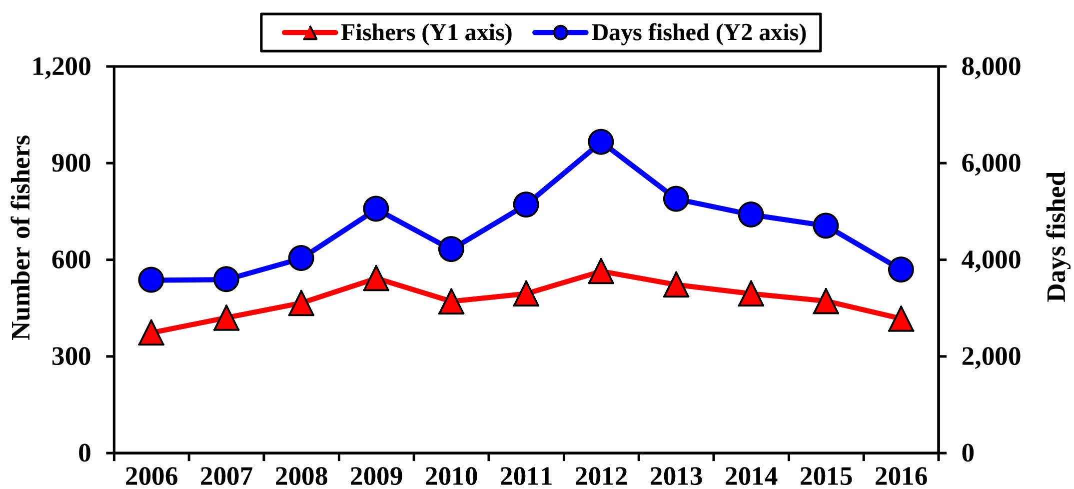
Figure 106. Mahimahi and Ono CPUE for the MHI troll fishery, 2006-2016.



Supporting data shown in Table A-105.

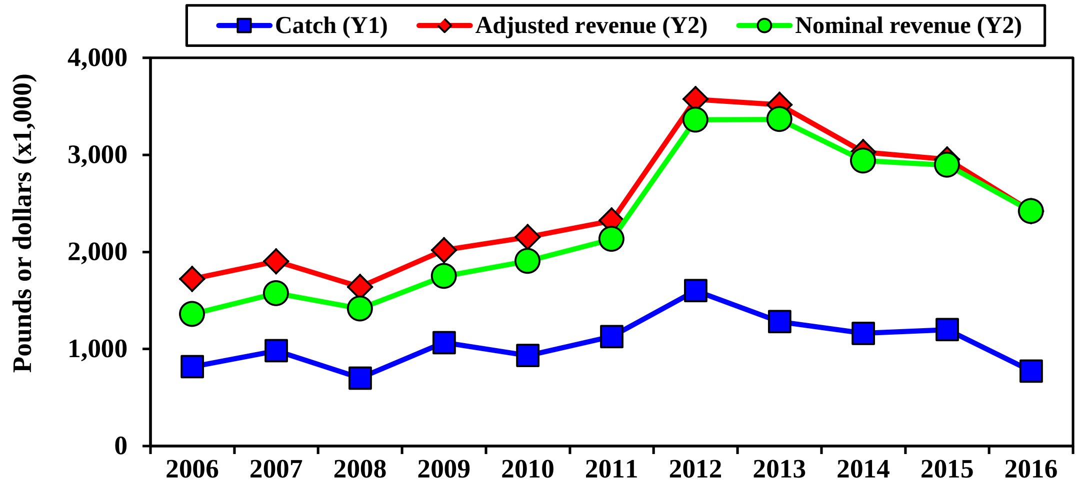
2.4.9 MHI HANDLINE FISHERY EFFORT, LANDINGS, REVENUE AND CPUE

Figure 107. Number of MHI handline fishers and days fished, 2006-2016.



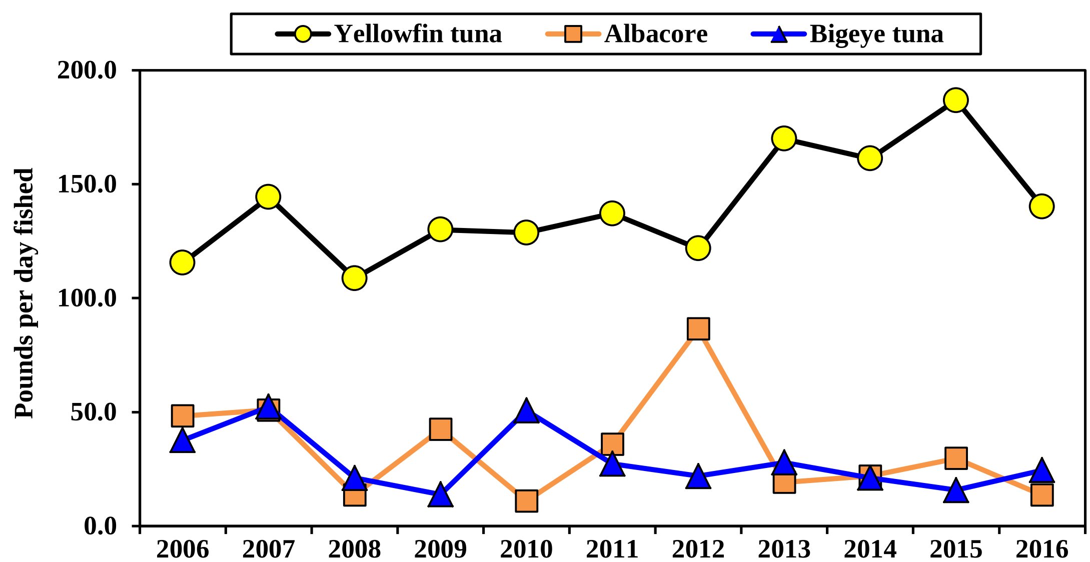
Supporting data shown in Table A-106.

Figure 108. Catch and revenue for the MHI handline fishery, 2006-2016.



Supporting data shown in Table A-107.

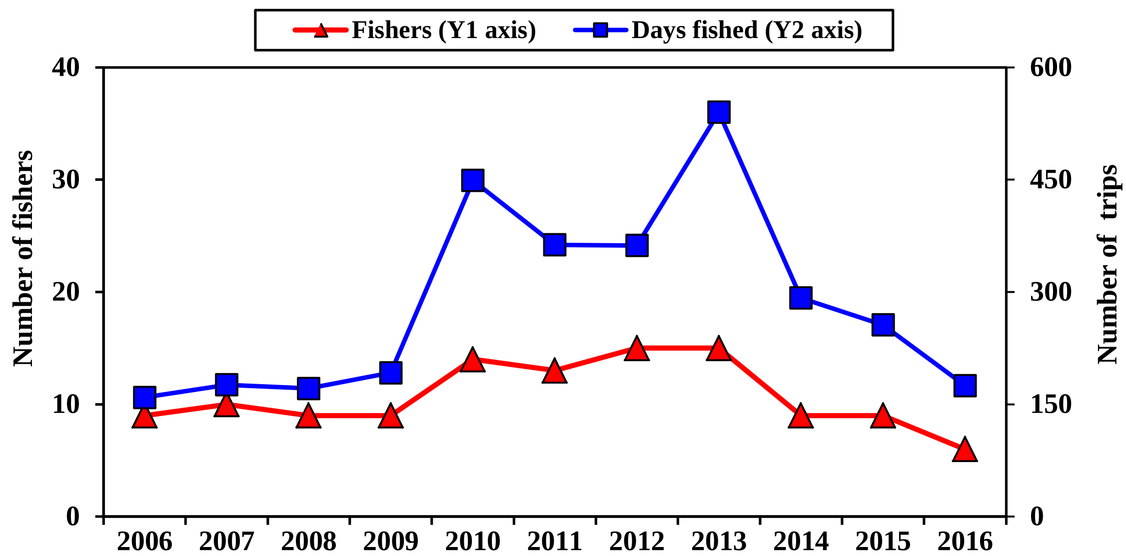
Figure 109. Tuna CPUE for the MHI handline fishery, 2006-2016.



Supporting data shown in Table A-108.

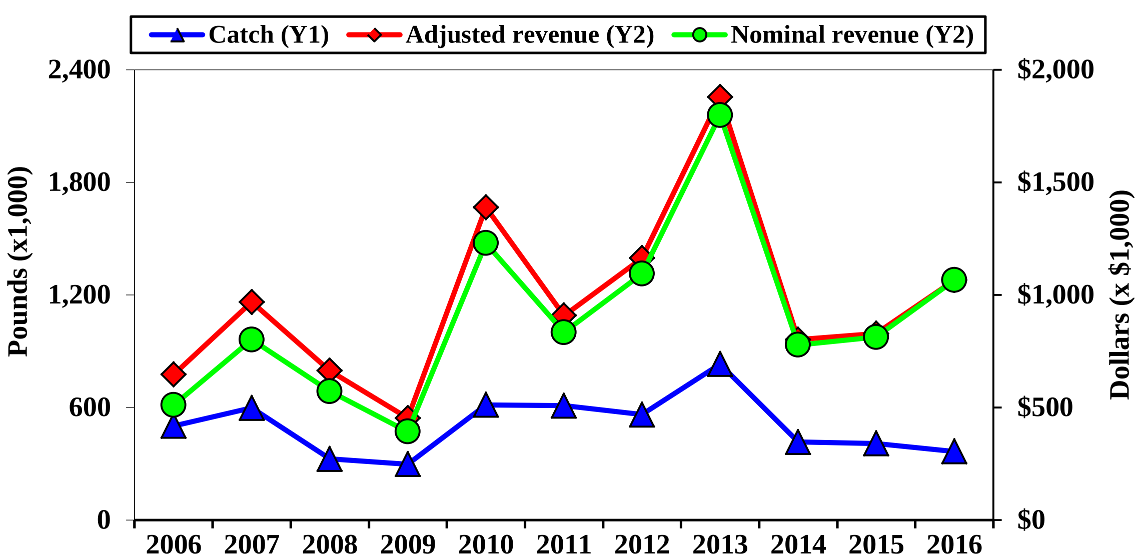
2.4.10 OFFSHORE HANDLINE FISHERY EFFORT, LANDINGS, REVENUE AND CPUE

Figure 110. Number of offshore handline fishers and days fished, 2006-2016.



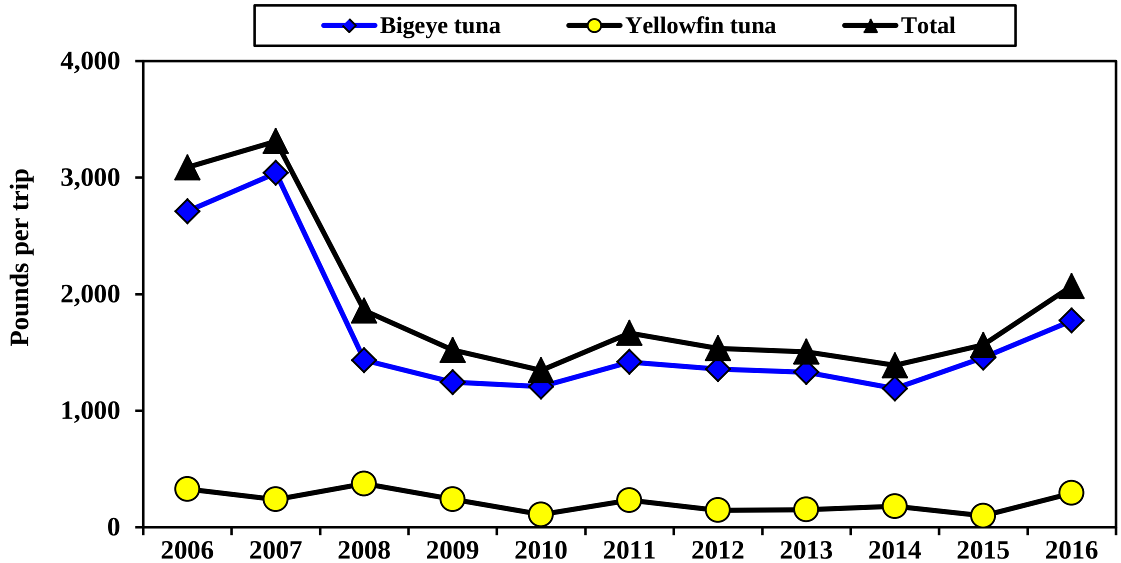
Supporting data shown in Table A-109.

Figure 111. Catch and revenue for the offshore tuna handline fishery, 2006-2016.



Supporting data shown in Table A-110.

Figure 112. Tuna CPUE for the offshore tuna handline fishery, 2006-2016.



Supporting data shown in Table A-111.

Table 30. Average weight (lbs) of the catch by the Hawai`i troll and handline fisheries, 2006-2016.

	Tunas				Billfish			Other PMUS	
Year	**Albacore**	**Bigeye tuna**	**Skipjack tuna**	**Yellowfin tuna**	**Blue marlin**	**Striped marlin**	**Swordfish**	**Mahimahi**	**Ono (wahoo)**
2006	47	27	8	29	209	69	128	16	23
2007	49	31	4	35	267	89	133	16	24
2008	51	35	6	26	205	67	158	15	26
2009	46	30	7	30	231	84	184	14	24
2010	49	32	5	30	257	107	123	14	26
2011	45	27	8	32	222	50	132	13	27
2012	49	22	5	32	270	56	126	12	25
2013	46	24	9	36	266	63	157	12	24
2014	45	25	7	36	253	52	122	12	22
2015	45	22	8	35	176	76	96	13	22
2016	49	22	8	35	150	67	111	12	23
Average	**47.3**	**27.0**	**6.8**	**32.5**	**227.7**	**70.9**	**133.6**	**13.7**	**24.1**
SD	**2.2**	**4.5**	**1.6**	**3.4**	**39.7**	**17.2**	**24.5**	**1.4**	**1.7**

2.5 RECREATIONAL

2.5.1 INTRODUCTION

Fishing, either for subsistence or recreation continues to be an important activity throughout the Western Pacific Region in the four major populated island areas of the Western Pacific Region, Hawai`i, American Samoa, Guam and CNMI. Fish consumption in Micronesia and Polynesia typically averages about 130 lb/per capita/yr (Dalzell et al 1996). Per capita seafood consumption in Hawaii is estimated to be 37 lb/per capita, significantly more than the 16/lb per year for all US consumption (Loke et al, 2012).

2.5.2 RECREATIONAL FISHERIES IN THE WESTERN PACIFIC REGION

In Hawai`i, recreational shoreline fishing was more popular than boat fishing up to and after WWII. Boat fishing during this period referred primarily to fishing from traditional canoes (Glazier 1999). All fishing was greatly constrained during WWII through time and area restrictions, which effectively stopped commercial fishing and confined recreational fishing to inshore areas (Brock 1947). Following WWII, the advent of better fishing equipment and new small boat hulls and marine inboard and outboard engines led to a growth in small vessel-based recreational fishing.

A major period of expansion of small vessel recreational fishing occurred between the late 1950s and early 1970s, through the introduction of fiberglass technology to Hawai`i and the further refinement of marine inboard and outboard engines (Figure 113). By the early 1960s there were an estimated 5,300 small boats in the territory being used for recreational fishing. By the 1980s the number of recreational or pleasure craft had risen to almost 13,000 vessels and to about 15,000 vessels in the 1990s. There are presently about 30 fishing clubs in Hawai`i, and a variety of different recreational fishing tournaments organized both by clubs and independent tournament organizers. Hawai`i also hosts between 150 and 200 boat-based fishing tournaments, about 30 of which are considered major international competitions, with over 20 boats and entry fees of $100. This level of interest in recreational fishing is sufficient to support local fishing magazines, Hawai`i Fishing News and Lawai’a, with articles about local recreational fishing.

Figure 113. Annual number of small vessel fleet registrations in Hawai`i, 1966-2015[4]

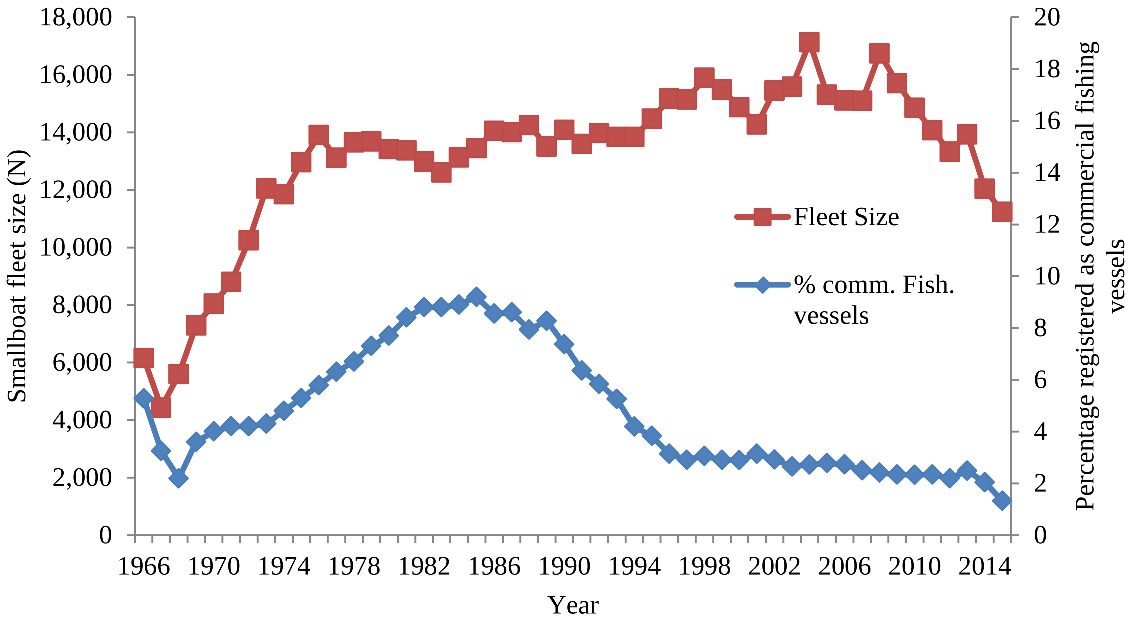


Figure shows total fleet size and percentage of vessels being registered for commercial fishing (Source: Hawai`i Division of Boating and Ocean Resources)

Elsewhere in the region, recreational fishing is less structured. In Guam fishing clubs have been founded along ethnic lines by Japanese and Korean residents. These clubs had memberships of 10-15 people, along with their families. Four such clubs were founded in Guam during the past 20 years, but none lasted for more than a 2-3 years (Gerry Davis, NMFS PIRO pers. comm.). There was also a Guam Boating Association comprising mostly fishermen, with several hundred members. This organization functioned as a fishing club for about 10 years and then disbanded. Some school groups and the boy scouts have formed fishing clubs focused on rod and reel fishing, and there is still one spear-fishing club that has only a handful of members, but appears to be still being active. There are also some limited fishing tournaments on Guam, including a fishing derby for children organized by the local Aquatic and Wildlife Resources Division.

Every summer, on Guam, the fishing community gathers to partake in several fishing derbies and the Gupot Y Peskadot (Fishermen’s Festival). This icmnludes several fising competitions including, Kid’s Fishing Derby, In-Shore Tournament (rod and reel), Spearfishing Challenge and Guam Marianas International Fishing Derby (trolling).

There are few fishing clubs in the in the Northern Mariana Islands. The Saipan Sports-fishing Association (SSA) has been in existence for at least 16 years, and is the sponsor of the annual Saipan International Fishing Tournament, which is usually held in August or September.

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4 At the time of writing, 2016 numbers from DOBOR for Hawaii’s small boat fleet were unavailable

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.

More recently, recreational fishing has undergone a renaissance in American Samoa through the establishment of the PPGFA, which was founded by a group of recreational anglers in 2003[5]. 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 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), Two Percent Bank (40 miles), and East Bank (24 miles East). The PPGFA plays host to the Steinlager I'a Lapo'a Game Fishing Tournament, which is a qualifying event for the International Game Fish Association’s Offshore World Championship.

There was no full-time regular charter fishery in American Samoa similar to those in Hawai`i or Guam. Pago Pago Marine Charters does include fishing charters among other services it offers.

5 http://ppgfa.com/page/about-ppgfa

There is also some recreational fishing activity at some of the PRIAs, namely at Midway, Wake and Palmyra Islands. There are no resident populations at Howland & Baker, Johnston and Jarvis Islands and fishing activity at these locations is likely minimal. There was a tourist facility at Midway until 2002, which operated a charter boat fishery targeting primarily pelagic fish at Midway Atoll. The company operated five vessels for charter fishing at Midway: three 22-26 ft catamarans for lagoon and nearshore fishing operations and two 38 ft sportfishing vessels used for blue water trolling. In addition, there were approximately seven small vessels maintained and used by Midway residents for recreational fishing. Of this total, three vessels engaged primarily in offshore trolling for PMUS including yellowfin tuna, whaoo and marlin. All vessels fishing at Midway were required to file a float plan prior to a fishing trip and complete the “Midway Sports Fishing Boat Trip Log” upon completion of each trip. The U.S. Fish and Wildlife Service was responsible for compiling these catch data.

At Palmyra Atoll, an island privately owned by The Nature Conservancy, a 22 ft catamaran is used for offshore trolling and four small boats operated within the lagoon used for bonefish angling. There are several craft used for recreational fishing at the military base on Wake Island including two landing craft and two small vessels.

2.5.3 RECREATIONAL CATCHES

Estimates of recreational pelagic fish catch for the Western Pacific in 2016 are given in Table 31. Data for Guam, Northern Mariana Islands and American Samoa are based on the proportion of troll catches landed for sale and catches retained and not sold, in all landings sampled by creel surveys in each area. The ratio of unsold to sold catch in the samples was used in conjunction with the total catch estimate expanded from the creel survey data. This was adjusted downwards based on the creel surveys by the ratio of landings by vessels retaining 100 % of their catch to the total unsold catch. This accounts for that fraction of the catch not sold by commercial fishing vessels. The volume of fish landed by vessels retaining all their catch was labeled the nominal recreational catch.

The estimates for American Samoa are almost certainly under-estimates due to the creel surveys not sampling the activities of sports-fishermen belonging to the Pago Pago Yacht Club. Most of their activities are conducted on the weekend, when the creel survey conducted by DMWR is inactive. A special survey is being undertaken by DMWR staff to capture this recreational fishing activity.

The recreational catch for Hawai`i is generated from the Hawai`i Marine Recreational Fisheries Statistical Survey, which is a collaborative effort between the State of Hawai`i’s Division of Aquatic Resources and the NMFS Office of Science and Technology. This survey is part of the NMFS Marine Fisheries Recreational Statistical Survey (MRFSS) which has been modified following a review by the National Academy of Science in 2006, under the auspices of the Marine Recreational Improvement Program.

Table 31. Estimated boat-based recreational pelagic fish catches in the four principal island groups of the Western Pacific Region in 2016

Location	Total catch (lb)	Unsold catch (lb)	Nominal recreational catch (lb)	Recr. catch as % of total catch	Recr. fishing trips
American Samoa	4,772,758	1,187	1,208	0.025%	9
Guam	604,575	232,627	203,877	33.7%	7,011
Hawai`i	43,718,343	NA	6,572,343	15.0%	231,551
CNMI	136,483	18,847	18,306	13.41%	47

[a] Hawaii recreational catch includes boat-based and shore based landings

2.5.4 CHARTER VESSEL SPORT-FISHING

Table 32 through Table 40 present summaries of the charter vessel sportsfishing in the Western Pacific in 2016. Charter fishing in Hawai`i is more focused on catching blue marlin, which in 2004 formed about 50 % of the total annual charter vessel catch by weight, but in 2016 only formed just over quarter of the charter vessel catch and was superseded by yellowfin. Although commercial troll vessels take blue marlin, this species only forms about 10% of their catch, with the majority of the target species being yellowfin, mahimahi, and wahoo (Table 33). Unlike other parts of the U.S., there is little recreational fishery interest in catching sharks in Hawai`i.

Guam has a charter fishing sector, which unlike Hawai`i caters for both pelagic and bottomfish fishing. Until recently the troll charter fishery was expanding, but, over the past few years the number of vessels involved, and level of fishing, has decreased in response to lower tourist volume from Japan. Comprising about 11% % of Guam’s commercuial troll fleet fishing effort, the Guam troll charter industry accounts for about 4.5 % of the troll catch and 18% and 16 % of the Guam blue marlin and wahoo catch respectively. (See Guam module in this volume).

Charter fishing in NMI is limited, with about ten boats operating on Saipan, and a few vessels on Tinian conducting occasional fishing charters. Data collected on charter vessel fishing in NMI during 2016 cannot be reported because of confidentiality protocols. Tourism is not a significant component of the American Samoa economy, and hence there is little charter fishing activity.

Table 32. Estimated catches by pelagic charter fishing vessels in Guam and Hawai`i in 2016

Location	Catch (lb)	Effort (trips)	CPUE (lb/trip	Principal species
Guam	36,621	1,267	28.90	Blue marlin, Wahoo, Skipjack
Hawaii	409,769	7,670	53.43	Yellowfin, Blue marlin, mahimahi

Charter vessel fishing in the Western Pacific Region has elements of both recreational and commercial fishing. The primary motivation for charter patrons is recreational fishing, with the possibility of catching large game fish such as blue marlin. The charter vessel skipper and crew receive compensation in the form of the patron’s fee, but are also able to dispose of fish on local markets, as is the case in Hawai`i. The catch composition of charter vessel catch versus conventional commercial trolling in Hawai`i reflects the different targeting in the two fisheries. Blue marlins are among the dominant feature of charter vessels in Hawai`i (Table 33), along with yellowfin and mahimahi. In Guam, blue marlin are also a dominant feature in charter catches, though the single largest catch is wahoo and skipjack (Table 34).

Table 33. Comparison of species composition of landings made by Hawai`i pelagic charter vessels versus commercial troll vessels, 2016

	Charter troll		Commercial troll	
Species	Landings (lb)	Percentage	Landings (lb)	Percentage
Yellowfin tuna	117,540	28.68%	797,811	42.36%
Blue marlin	113,990	27.82%	180,274	9.57%
Mahimahi	61,418	14.99%	383,351	20.35%
Ono	37,665	9.19%	219,348	11.65%
Aku	37,609	9.18%	198,841	10.56%
S.N. spearfish	20,510	5.01%	13,105	0.70%
Striped marlin	12,960	3.16%	12,721	0.68%
Bigeye tuna	2,599	0.63%	38,117	2.02%
Kawakawa	2,494	0.61%	6,270	0.33%
Uku	1,083	0.26%	13,564	0.72%
Black marlin	598	0.15%	5,058	0.27%
White ulua	353	0.09%	1,672	0.09%
Sailfish	310	0.08%	3,415	0.18%
Kamanu	263	0.06%	1,624	0.09%
Kaku	144	0.04%	455	0.02%
Omilu	120	0.03%	944	0.05%
Kahala	18	0.00%	809	0.04%
all others	98	0.02%	5,967	0.32%
Island Total	409,769	100.00%	1,883,344	100.00%

Table 34. Comparison of species composition of landings made by Guam pelagic charter vessels versus commercial troll vessels, 2016

Species	Charter		Commercial	
	Landings (lb)	Percentage	Landings (lb)	Percentage
Skipjack	4,942	13.49%	432,534	55.12%
Yellowfin	2,954	8.07%	124,566	15.87%
Wahoo	5,356	14.63%	28,254	3.60%
Blue marlin	8,065	22.02%	36,173	4.61%
Pomfrets		0.00%	1,520	0.19%
Others	15304	41.79%	161,629	20.60%
Total	36,621	100.00%	784,676	100.00%

In Hawai`i there is considerable variation in charter vessel catches between the various islands (Table 35), with the largest charter vessel fisheries based on the island of Hawai`i and Oahu, in terms of catch. The Hawai`i catch may be biased downwards due to the widespread practice of catch and release of billfish. Charter trips on Hawai`i and Oahu form over 70% of the total charter activity in the State of Hawai`i.

Table 35. Charter vessel catches in Hawai`i by island, 2016

Island	Catch (lb)	Percent	Trips	Percent	CPUE (lb/trip)
Hawai`i	119,775	29.23%	3,668	47.82%	32.65
Kauai	95,513	23.31%	1,109	14.46%	86.13
Maui County*	42,404	10.35%	1,245	16.23%	34.06
Oahu	152,076	37.11%	1,648	21.49%	92.28
Total	409,769	100.00%	7,670	100.00%	53.42

* DAR confidentiality protocols prevent reporting 2007 charter vessel activity for Molokai and Lanai separately, and these are aggregated with data for Maui, reported collectively as Maui County

Most charter vessel fishing on the island of Hawai`i is conducted from Kona's small boat harbor at Honokohau, and about 32% of the charter vessel catch comprises blue marlin (Table 36). Blue marlin used to amount to about two-thirds of the catch, but, as noted above, this number has fallen considerably with the spread of a stronger catch and release ethic for billfish by charter vessel operators at Honokohau. Elsewhere, yellowfin and mahimahi tend to dominate charter vessel landings.

Table 36. Composition of charter vessel catches in the MHI, 2016

Hawaii	Landings (lb)	%	Kauai	Landings (lb)	%
Blue marlin	37,951	31.69%	Yellowfin tuna	42,265	44.25%
Yellowfin tuna	33,021	27.57%	Aku	16,662	17.44%
Ono	15,601	13.02%	Blue marlin	14,325	15.00%
Short-nosed spearfish	14,645	12.23%	Mahimahi	10,154	10.63%
Mahimahi	9,080	7.58%	Ono	8,722	9.13%
Striped marlin	4,320	3.61%	Short-nosed spearfish	995	1.04%
Aku	3,256	2.72%	Striped marlin	950	0.99%
Bigeye tuna	643	0.54%	Bigeye tuna	910	0.95%
Black marlin	598	0.50%	Kawakawa	373	0.39%
Kawakawa	287	0.24%	Kamanu	54	0.06%
Sailfish	141	0.12%		0	0.00%
Kamanu	92	0.08%		0	0.00%
Kaku	20	0.02%		0	0.00%
Others	123	0.10%	Others	104	0.11%
Total	119,775	100.00%		95,514	100.00%
Maui County	Landings (lb)	%	Oahu	Landings (lb)	%
Mahimahi	13,122	30.94%	Blue marlin	51,421	33.81%
Blue marlin	10,293	24.27%	Yellowfin tuna	38,850	25.55%
Ono	8,137	19.19%	Mahimahi	29,063	19.11%
Yellowfin tuna	3,404	8.03%	Aku	16,685	10.97%
Short-nosed spearfish	1,814	4.28%	Striped marlin	6,191	4.07%
Striped marlin	1,500	3.54%	Ono	5,205	3.42%
Uku	1,083	2.55%	Short-nosed spearfish	3,056	2.01%
Aku	1,007	2.37%	Kawakawa	976	0.64%
Kawakawa	859	2.03%	Kaku	31	0.02%
Bigeye tuna	717	1.69%	Kamanu	22	0.01%
Kamanu	95	0.22%		0	0.00%
Kaku	33	0.08%		0	0.00%
Others	342	0.81%	Others	578	0.38%
Total	42,404	100.00%	Total	152,077	100.00%

2.5.5 RECREATIONAL FISHING DATA COLLECTION IN HAWAI`I

Recreational fish catches in Hawai`i are monitored through the Hawai`i Marine Recreational Fishing Survey (HMRFS), a collaborative project of the NMFS Office of Science and Technology and the Hawai`i Division of Aquatic Resources. This project is a segment of the nationwide MRFSS, which has been used by NMFS to estimate recreational catches in most of the coastal states of the U.S.

The MRFSS program uses a triple survey approach that has been developed over the 20+ years of its history. For each two-month survey period (wave) a random sample of households is called by telephone to determine how many have conducted any fishing in the ocean, their mode of fishing (private boat, rental boat, charter boat, or shoreline), what methods were used, and how much effort (number of trips and hours) was expended.

Concurrently, surveyors are sent out to boat launch ramps, small boat harbors, and shoreline fishing sites to interview fishermen to fill out intercept survey forms. The intercept survey collects data on fishing area, fishing methods, trip/effort, species caught, and lengths and weights of fish. The sites are randomly selected, but stratified by fishing pressure so that the sites with the highest pressures are likely to be surveyed more often. In addition the charter boat operators are surveyed by a separate survey. This additional survey of the charter fleet serves the same function as the random digit dialing household survey and is necessary because out of town fishers that charter vessels would not be covered by randomly calling the Hawaiian populace. The telephone and charter survey data are used to estimate total statewide fishing effort and the intercept surveys provide detailed catch and trip information. Data from the three surveys are combined and expanded to yield statewide estimates of total effort and catch by species, mode, and county.

NMFS and HDAR contributed joint funding for intercept surveys and charter boat surveys on the islands of Oahu, Hawai`i, and Maui. NMFS also funded the Random Digit Dialing household telephone survey via a national contractor beginning in January 2001. The HMRFS project commenced in July 2001 but took until 2003 until annual results were first reported from this initiative.

In 2006, the MRFSS survey was reviewed by the National Research Council of the National Academy of Sciences (NRC 2006). The reviewers were critical of the statistical methods employed to generate expansions of the survey data to annual recreational catch estimates for each state. Consequently, NMFS conducted an overhaul of the MRFSS survey to respond to the NRC criticisms. As such, readers of this report should understand that there is uncertainty surrounding the various expansions from the HMRFS survey and figures reported here may change as new methods are implemented to conduct the expansions from survey data.

Table 37 provides summaries of the recreational boat and shoreline fish catch between 2012 and 2016 for pelagic fish. Recreational catches of pelagic fish were considerably lower in 2016, although these numbers are preliminary. However, if correct, the recreational catch halved in 2016 based on the mean catch for the previous four years (12,600,000 lb)

Table 37. Recreational boat-based pelagic fish catches in Hawai`i between 2011 and 2016.

Year	Shore catch (lb)	Vessel catch (lb)	Total (lb)
2012	NA	12,330,638	12,330,638
2013	0	14,245,945	14,245,945
2014	0	10,833,018	10,833,018
2015	0	13,065,927	13,065,927
2016	0	6,572,343	6,572,343

Source: HDAR HMFRS and NMFS PIFSC

Figure 114 through Figure 117 summarize aspects of the boat-based recreational fishery landings for six major pelagic fish species in Hawai`i (blue marlin, striped marlin, mahi mahi, skipjack, yellowfin and wahoo) between 2011 and 2015. Figure 118 shows the bimonthly distribution of boat-based fishing effort over the same time period. Skipjack tuna are the most commonly recreationally caught pelagic fish (Figure 114) followed by yellowfin tuna, mahimahi and wahoo. In terms of weight, however, yellowfin tuna dominates recreational pelagic fish catches (Figure 115).

Although blue marlin numbers in the catch are small compared to other species, the much greater average weight (Figure 116) means that it can comprise a significant fraction of the recreational catch by weight. Average weights for most species tended to be relatively similar between years for mahimahi, skipjack and wahoo, but may vary considerable between years for blue marlin, striped marlin and yellowfin tuna. This is also reflected in the nominal catch rate (lbs/trip) in Figure 117, where yellowfin catch rate was high in 2011, declined in 2012 and 2014, and then increased with peaks in 2015. The distribution of fishing recreational fishing effort shows that boat based activity tends to be highest in the summer and fall when the weather is at its most calm in Hawai`i.

Figure 114. Annual recreational fishery landings by number for six major pelagic species between 2012 and 2016

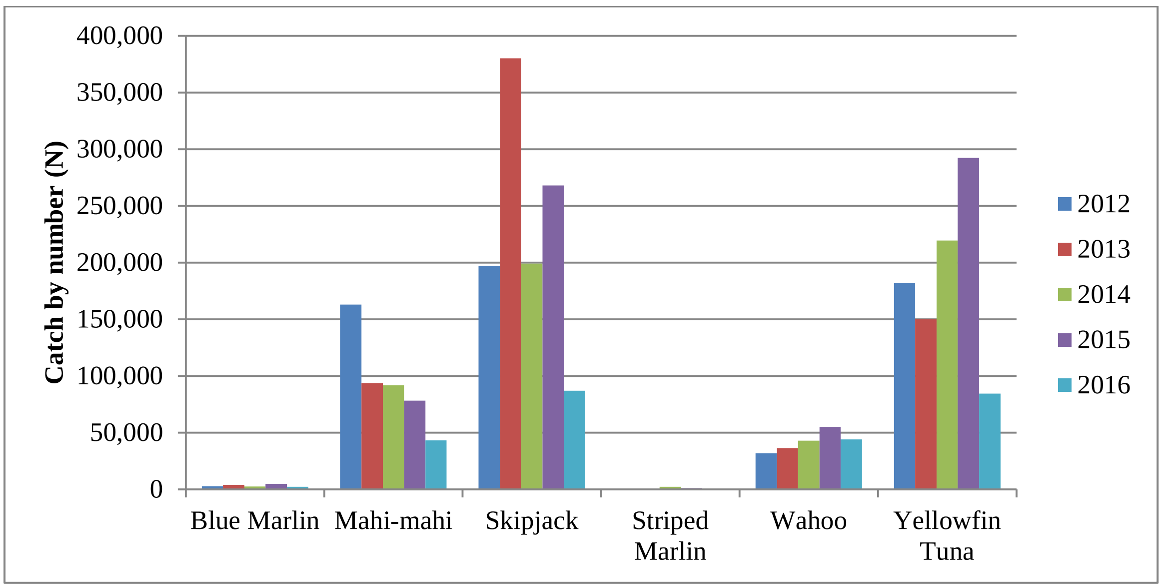


Figure 115. Annual recreational fishery landings by weight of six major pelagic fish species in Hawai`i between 2012 and 2016.

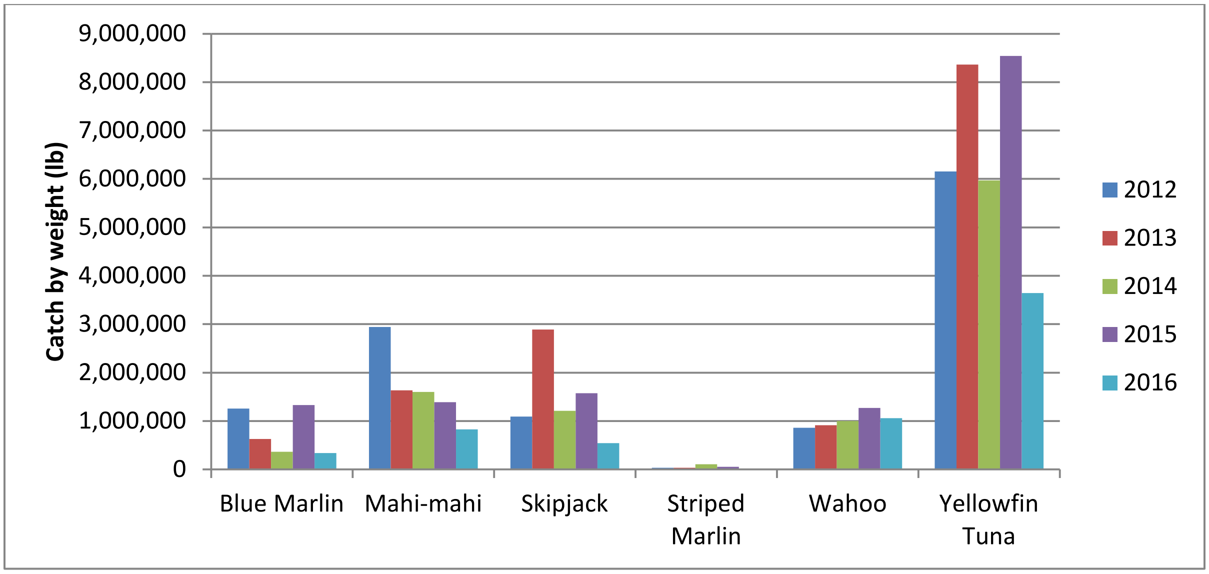


Figure 116. Average weight of six major pelagic fish species caught by recreational fishing in Hawai`i between 2012 and 2016.

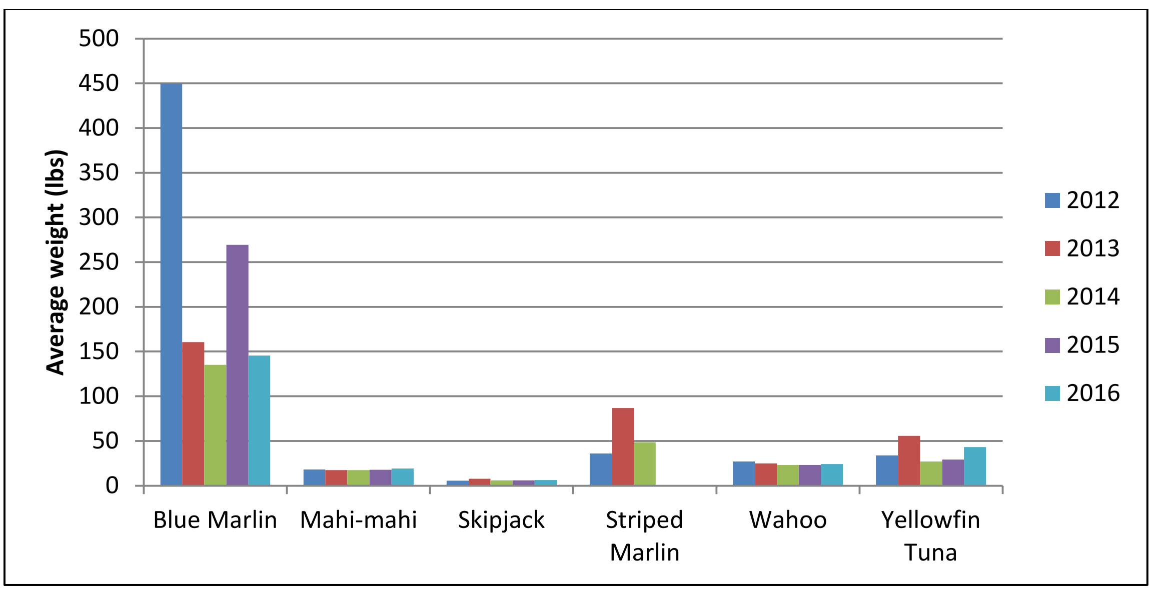


Figure 117. Annual recreational catch per unit effort (lbs per trip) for six major pelagic species in Hawai`i between 2012 and 2016

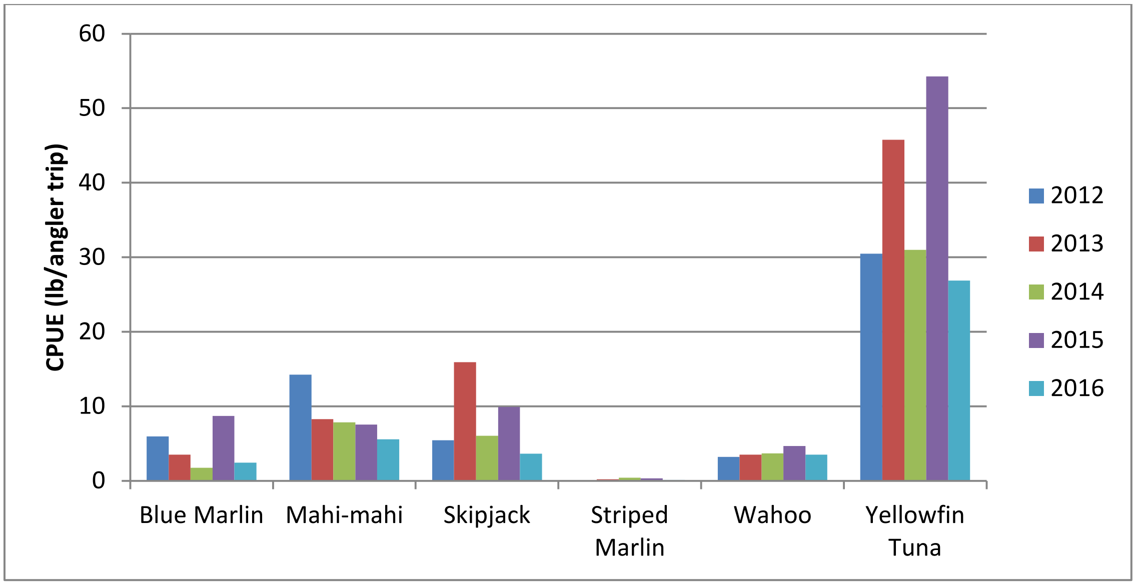
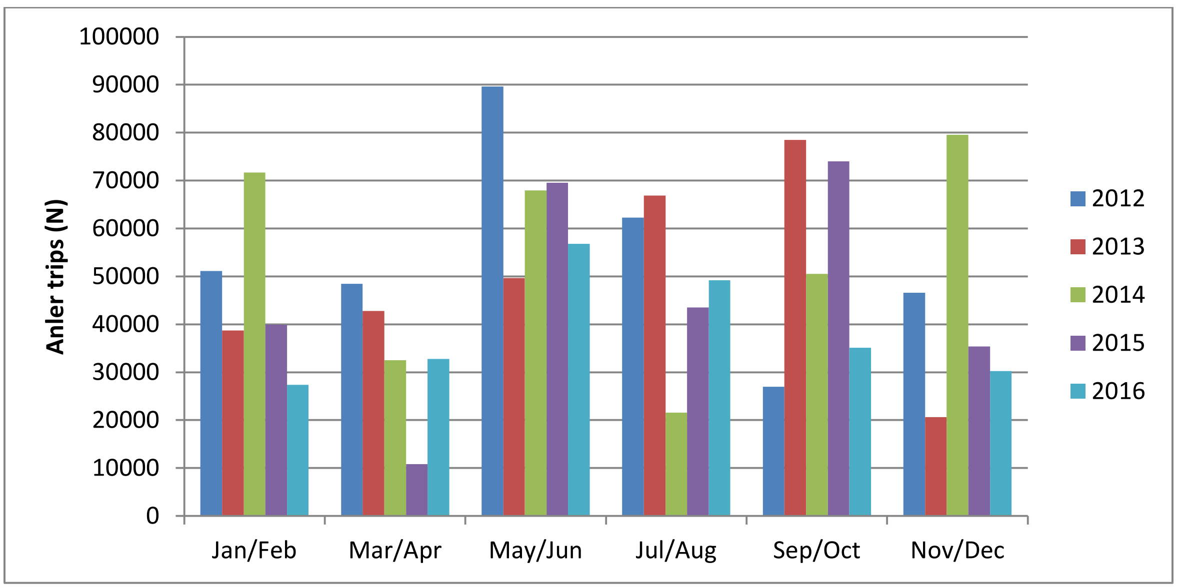


Figure 118. Boat fishing trip estimates (number of angler trips, 2012-2016)



2.5.6 HAWAI`I SMALL BOAT SURVEY 2014

The National Marine Fisheries Pacific Islands Fisheries Science Center conducted a survey of 1,763 Hawai`i Commercial Marine License holders in 2014 (NMFS PIFSC pamphlet 2016). A total of 824 surveys were returned. Among the survey results were purely recreational fishermen, and recreational expense fishermen, as well as part time and full time commercial fishermen. The pure recreational and part time recreational are distinguished by the volumes of fish which they consume at home and give away. Pure recreational fishermen consume about 30% of their catch and give away about 37%. Even recreational expense fishermen who sell about half their catch consume 22% of their catch and give away 20%.

The survey also looked at ther expenses of fishing, with a mean cost per fishing trip of $269, with troll, pelagic handline and bottomfish handline being the most expensive at $292, $284 and $253 respectively. On average a small boat fishermen spends $5,557 per year on fixed costs, which include permit fees, gear, boat and trailer maintenance, vessel insurance, mooring fees, loan payments and financial services.

The total value of the catch, which includes pelagics, bottomfish and reef fish was $5.54 million, which reflects to mean income of $8,850 of fish. This includes pure recreational fishermen who sell about 28% of their catch. Trolling gear was the most deployed fishing gear used by 93% of those surveyed. The average vessel size was 23 ft, worth about $43,000, although some vessels in the survey were worth up to $600,000.

2.5.7 REFERENCES

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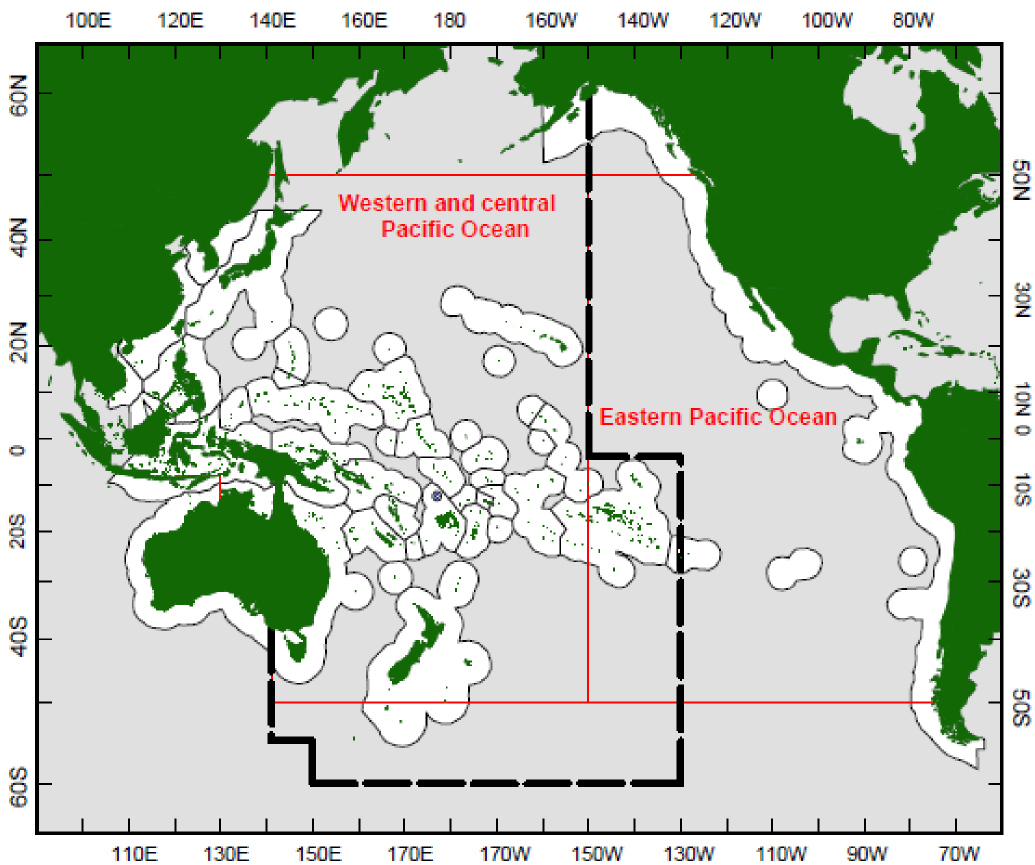
2.6 INTERNATIONAL

2.6.1 INTRODUCTION

The U.S Pacific Island EEZs managed by the Council are surrounded by large and diverse fisheries targeting pelagic species. The International Module contains reported catches of pelagic species in the entire Pacific Ocean by fleets of Pacific Island nations and distant water fishing nations and information for a SAFE report that includes the most recent assessment information in relation to status determination criteria. Fishery trends in the entire Pacific Ocean are illustrated for the purse seine, longline and pole-and-line fisheries. Tables 44–46 provide the U.S. longline landings as submitted to the Western and Central Pacific Fisheries Commission (WCPFC) and Inter-American Tropical Tuna Commission (IATTC).

Figure 119. The WCPO, EPO and the WCPFC Convention Area (WCP–CA) [in dashed lines]).



2.6.2 DATA SOURCES

The data sources for the international module of the SAFE Report are obtained from the various literature of the WCPFC, the IATTC, and the International Scientific Committee for Tuna and Tuna-like species (ISC). These can be found in the bibliography for this module. Additional sources of data include the US data submissions to the WCPFC and IATTC documented in this module

2.6.3 PLAN TEAM RECOMMENDATIONS

There were no recommendations by the Pelagics Plan Team in 2016 to be forwarded to the Council, only Action Items to Pelagic Plan Team members on improvements to modules.

2.6.4 SUMMARY OF FISHERIES

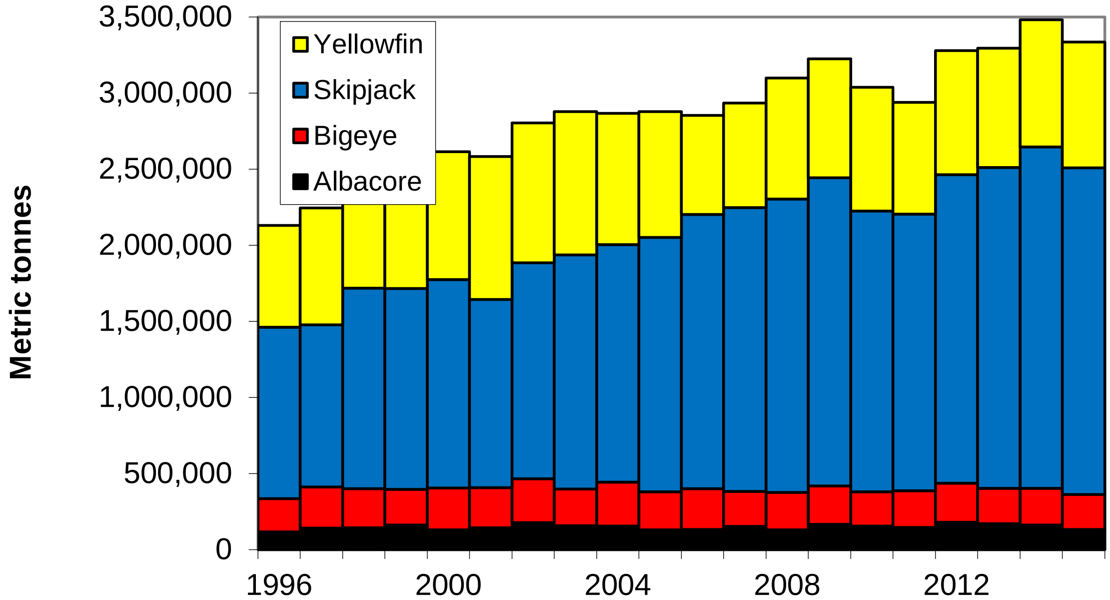
This section presents the total catch of tuna species in the Pacific Ocean as reported to the Secretariat of the Pacific Community (SPC) from all member countries. Table 38 and Figure 120 depict the combined catch of all fisheries, while the following subsections present fishery specific data for the three main fisheries: purse seine, longline, and pole-and-line.

Table 38. Estimated annual catch (mt) of tuna species in the Pacific Ocean.

Year	Albacore	Bigeye	Skipjack	Yellowfin	Total
1996	116,957	219,629	1,124,782	669,126	2,130,494
1997	141,576	269,754	1,066,623	767,295	2,245,248
1998	144,737	256,814	1,316,955	872,665	2,591,171
1999	161,818	235,749	1,318,658	808,283	2,524,508
2000	130,802	274,561	1,369,190	840,339	2,614,892
2001	145,397	263,591	1,234,649	939,464	2,583,101
2002	178,525	287,834	1,419,576	918,107	2,804,042
2003	157,013	241,339	1,538,631	942,398	2,879,381
2004	155,658	289,329	1,558,545	862,670	2,866,202
2005	130,043	250,247	1,670,973	826,571	2,877,834
2006	132,205	269,213	1,800,383	652,015	2,853,816
2007	153,235	230,403	1,864,509	686,988	2,935,135
2008	130,995	246,468	1,926,329	795,043	3,098,835
2009	167,015	252,644	2,024,687	781,136	3,225,482
2010	155,865	224,161	1,845,517	813,362	3,038,905
2011	146,020	241,943	1,816,953	733,494	2,938,410
2012	179,773	256,454	2,027,545	815,647	3,279,419
2013	172,028	230,437	2,108,666	783,291	3,294,422
2014	162,407	241,636	2,243,096	834,122	3,481,261
2015	132,906	230,716	2,145,994	825,709	3,335,325
Average	149,749	250,646	1,671,113	808,386	2,879,894
STD deviation	17,558	20,218	359,518	80,812	358,257

Source: SPC 2016.

Figure 120. Estimated total annual catch of tuna species in the Pacific Ocean.



Source: SPC 2016.

2.6.4.1 PURSE SEINE FISHERY IN THE WCPFC

Source: WCPFC-SC12-2016 GN-WP-01

Vessels: The combined Pacific-Islands fleet has been clearly the highest producer in the tropical purse seine fishery since 2003. There was a hiatus in the Pacific-Islands fleet development in 2008 (when some vessels reflagged to the US purse-seine fleet) but catch/effort has picked up in recent years and catch by this component of the fishery was clearly at its highest level in 2014 and 2015. The fleet sizes and effort by the Japanese and Korean purse seine fleets have been relatively stable for most of this time series. Several Chinese-Taipei vessels re-flagged in 2002, dropping the fleet from 41 to 34 vessels, with fleet numbers stable since. The increase in annual catch by the Pacific Islands fleet until 2005 corresponded to an increase in vessel numbers, and to some extent, mirrors the decline in US purse seine catch, vessel numbers and effort over this period. However, the US purse-seine fleet commenced a rebuilding phase in late 2007, with vessel numbers more than doubling in comparison to recent years, but still below the fleet size in the early-mid 1990s. The increase in vessel numbers in the US purse seine fleet is reflected in the sharp increase in their catch and effort since 2007 (the US catch has been on par with the Korea purse seine fleet over the past five years, although effort by the Korean purse seine fleet in the past four years was clearly lower than the US effort, suggesting higher catch rates or potential issues with effort reporting by the Korean fleet). The total number of Pacific-island domestic vessels has gradually increased over the past two decades, attaining its highest level in 2015 (105 vessels).

Catch: The provisional 2015 purse-seine catch of 1,766,070 mt was the fifth highest catch on record and more than 280,000 mt lower than the record in 2014 (2,051,970 mt); the main reason for this decline in catch appears to be reduced effort more than any other factor. The 2015 purse-seine skipjack catch (1,416,453 mt; 80% of total catch) was about 210,000 mt lower than the record in 2014. The 2015 purse-seine catch estimate for yellowfin tuna (298,847 mt) contributed only 17% of the total catch, continuing the recent trend of a diminishing contribution in the overall catch and amongst the lowest for the past decade. The provisional catch estimate for bigeye tuna for 2015 (48,772 mt) was the lowest catch since 2007 and appears to be related to a combination of lower effort, and possibly environmental conditions which resulted in bigeye tuna being less available to the purse seine gear.

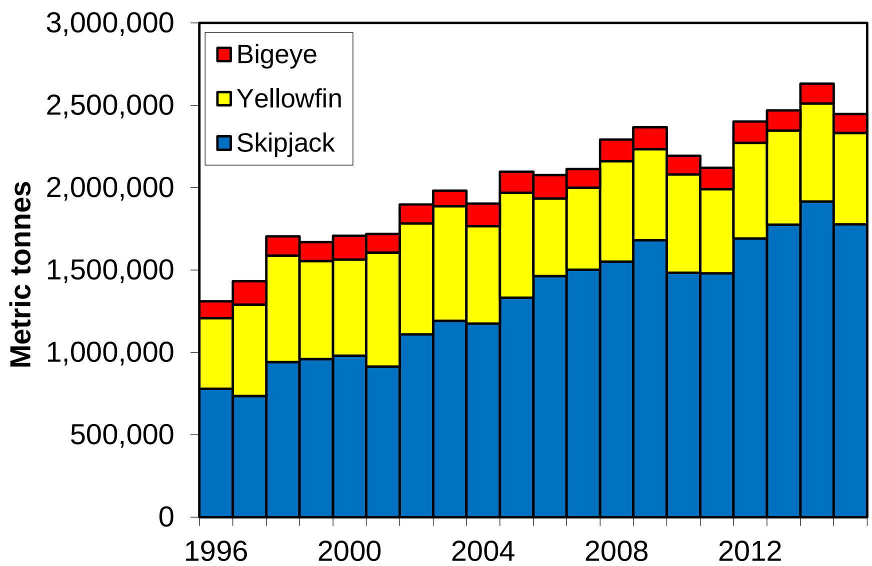
Fleet distribution: The purse-seine catch/effort distribution in tropical areas of the WCP–CA is strongly influenced by El Nino–Southern Oscillation Index (ENSO) events with fishing effort typically expanding further to the east during El Niño years and contracting to western areas during La Niña periods. The WCP–CA fishery was in a prolonged La Niña state in early 2009 and then transitioned to an El Niño period which then presided into the first quarter of 2010. Conditions in the WCP-CA then switched back to a strong La Niña state over the latter months of 2010 and into the first half of 2011. It weakened, and then strengthened toward the end of 2011. The fishery experienced a return to neutral ENSO conditions during 2012. Weak to moderate La Niña conditions were experienced during 2013, then neutral conditions into early 2014. El Niño conditions developed during 2014 and strengthened in 2015 to a level not experienced in the fishery for almost 20 years (i.e. since 1997/1998). El Niño conditions continued into early 2016 and the forecasted weakening has begun with a move towards La Niña by the end of 2016 into 2017. In line with the prevailing ENSO conditions, fishing activity during 2014 and 2015 (strong El Niño conditions) extended to the more central/eastern area of the WCPO compared to 2013 (La Niña conditions). There was more purse-seine effort in the area to the east of longitude 160°E during 2014/2015 than the previous 6 years when effort is usually concentrated to the west of this longitude (i.e. PNG, FSM and Solomon Islands). With the ENSO forecast for late 2016 predicting a weakening of El Nino conditions, there should be a switch back to more effort in the western tropical areas.

Table 39. Total reported purse seine catch (mt) of skipjack, yellowfin and bigeye tuna in the Pacific Ocean.

Year	Skipjack	Yellowfin	Bigeye	Total
1996	779,011	428,389	103,819	1,311,219
1997	735,526	555,437	141,680	1,432,643
1998	942,163	645,325	117,792	1,705,280
1999	960,400	593,748	115,361	1,669,509
2000	979,342	585,211	143,971	1,708,524
2001	913,800	692,133	112,946	1,718,879
2002	1,109,119	673,714	115,269	1,898,102
2003	1,191,751	694,769	95,766	1,982,286
2004	1,175,950	589,842	137,650	1,903,442
2005	1,332,797	637,376	126,109	2,096,282
2006	1,462,885	470,858	142,857	2,076,600
2007	1,502,470	498,547	111,980	2,112,997
2008	1,552,071	609,595	131,008	2,292,674
2009	1,680,260	553,898	132,980	2,367,138
2010	1,484,644	595,443	112,820	2,192,907
2011	1,479,281	511,204	129,403	2,119,888
2012	1,691,438	580,939	130,216	2,402,593
2013	1,776,562	570,171	122,978	2,469,711
2014	1,916,513	594,618	119,896	2,631,027
2015	1,778,107	553,549	116,371	2,448,027
Average	1,322,205	581,738	123,044	2,026,986
STD Deviation	360,633	69,591	13,176	358,609

Source: SPC 2016.

Figure 121. Total purse seine catch of skipjack, yellowfin and bigeye tuna in the Pacific Ocean, 1996–2015.



Source: SPC 2016.

2.6.4.2 LONGLINE FISHERIES IN THE WCPFC

Source: WCPFC-SC12-2016 GN-WP-01

Vessels: The total number of vessels involved in the fishery has generally fluctuated between 3,000 and 6,000 for the last 30 years. The fishery involves two main types of operation:

- Large (typically >250 gross registered tonnes [GRT]) distant-water freezer vessels which undertake long voyages (months) and operate over large areas of the region. These vessels may target either tropical (yellowfin, bigeye tuna) or subtropical (albacore) species.
- Smaller (typically <100 GRT) offshore vessels which are usually domestically based, undertaking trips less than one month, with ice or chill capacity, and serving fresh or air-freight sashimi markets, or albacore canneries. There are several foreign offshore fleets based in Pacific island countries.

The following broad categories of longline fishery, based on type of operation, area fished and target species, are currently active in the WCP–CA.

South Pacific offshore albacore fishery comprises Pacific-Islands domestic “offshore” vessels, such as those from American Samoa, Cook Islands, Fiji, French Polynesia, Kiribati, New Caledonia, Samoa, Solomon Islands, Tonga and Vanuatu; these fleets mainly operate in subtropical waters, with albacore the main species taken. Two new entrants, Tuvalu and Wallis & Futuna, joined this category during 2011, although the latter fleet has not fished recently. Vessel numbers have stabilized in recent years but they may also vary depending on charter arrangements.

Tropical offshore bigeye/yellowfin-target fishery includes “offshore” sashimi longliners from Chinese-Taipei, based in Micronesia, Guam, Philippines and Chinese-Taipei, mainland Chinese vessels based in Micronesia, and domestic fleets based in Indonesia, Micronesian countries, Philippines, PNG, the Solomon Islands and Vietnam.

Tropical distant-water bigeye/yellowfin-target fishery comprises “distant-water” vessels from Japan, Korea, Chinese-Taipei, mainland China and Vanuatu. These vessels primarily operate in the eastern tropical waters of the WCP–CA (and into the EPO), targeting bigeye and yellowfin tuna for the frozen sashimi market. The Portuguese fleet (one vessel) started fishing in 2011.

South Pacific distant-water albacore fishery comprises “distant-water” vessels from Chinese-Taipei, mainland China and Vanuatu operating in the south Pacific, generally below 20°S, targeting albacore destined for canneries.

Domestic fisheries in the sub-tropical and temperate WCP–CA comprise vessels targeting different species within the same fleet depending on market, season and/or area. These fleets include the domestic fisheries of Australia, Japan, New Zealand and Hawai`i. For example, the Hawai`i longline fleet has a component that targets swordfish and another that targets bigeye tuna.

South Pacific distant-water swordfish fishery is a relatively new fishery and comprises “distant-water” vessels from Spain.

North Pacific distant-water albacore and swordfish fisheries mainly comprise “distant-water” vessels from Japan (swordfish and albacore), Chinese-Taipei (albacore only) and Vanuatu (albacore only).

Catch: The provisional WCP–CA longline catch (243,547 mt) for 2015 was lower than the average for the past five years. The WCP–CA albacore longline catch (80,596 mt – 33%) for 2015 was the lowest for three years, 21,000 mt lower that the record of 101,816 mt attained in 2010. The provisional bigeye catch (63,986 mt – 26%) for 2015 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery. The yellowfin catch for 2015 (97,289 mt – 40%) was amongst the highest over the past decade ten years. A significant change in the WCP–CA longline fishery over the past 10 years has been the growth of the Pacific Islands domestic albacore fishery, which has risen from taking 33% of the total south Pacific albacore longline catch in 1998 to accounting for around 50-60% of the catch in recent years. The combined national fleets (including chartered vessels) mainly active in the Pacific Islands domestic albacore fishery have numbered more than 500 (mainly small “offshore”) vessels in recent years and catches are now at a similar level as the distant-water longline vessels active in the WCP–CA. The distant-water fleet dynamics continue to evolve in recent years, with catches down from record levels in the mid-2000s initially due to a reduction in vessel numbers, although vessel numbers for some fleets appear to be on the rise again in recent years, but with variations in areas fished and target species. The Japanese distant-water and offshore longline fleets have experienced a substantial decline in both bigeye catches (from 20,725 mt in 2004 to 6,259 mt in 2015) and vessel numbers (366 in 2004 to 109 in 2015). The Chinese-Taipei distant-water longline fleet bigeye catch declined from 16,888 mt in 2004 to 3,550 mt (in 2015), mainly related to a substantial drop in vessel numbers (137 vessels in 2004 reduced to 75 vessels in 2015). The Korean distant-water longline fleet also experienced declines in bigeye and yellowfin catches over the past decade in line with a reduction in vessel numbers – from 184 vessels active in 2002 reduced to 108 vessels in 2008, back to 126 vessels in 2012, but down to 84 vessels in 2015.

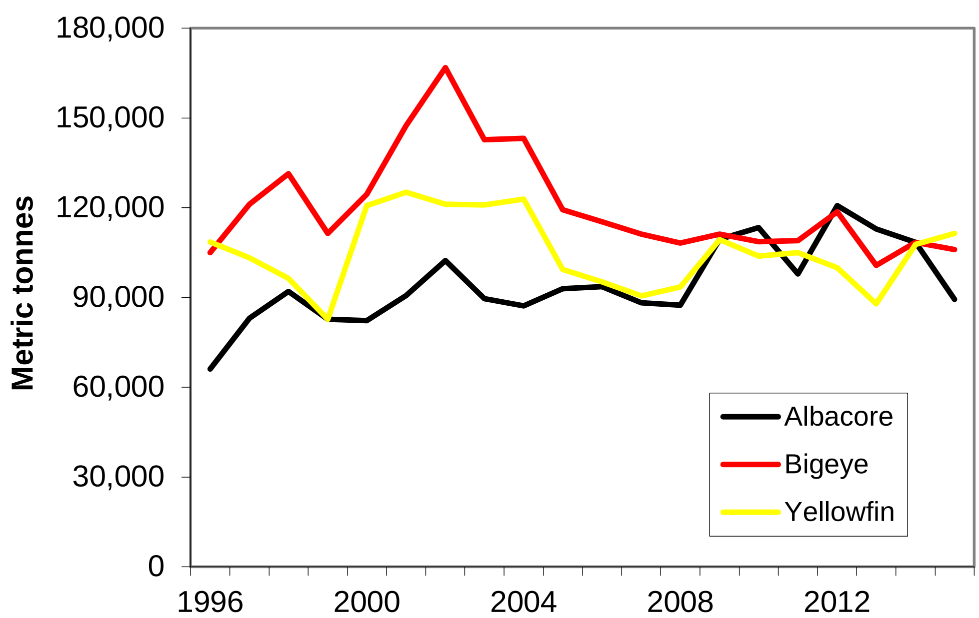
Fleet distribution: Effort by the large vessel, distant-water fleets of Japan, Korea and Chinese-Taipei account for most of the effort but there has been some reduction in vessel numbers in some fleets over the past decade. Effort is widespread as sectors of these fleets target bigeye and yellowfin for the frozen sashimi market in central and eastern tropical waters, and albacore for canning in the more temperate waters. Activity by the foreign-offshore fleets from Japan, mainland China and Chinese-Taipei is restricted to tropical waters, targeting bigeye and yellowfin for the fresh sashimi market; these fleets have limited overlap with the distant-water fleets. The substantial "offshore" effort in the west of the region is primarily by the Indonesian, Chinese-Taipei and Vietnamese domestic fleets targeting yellowfin and bigeye. The growth in domestic fleets in the South Pacific over the past decade has been noted; the most prominent fleets in this category are the Cook Islands, Samoan, Fijian, French Polynesian, Solomon Islands (when chartering arrangements are active) and Vanuatu fleets.

Table 40. Total reported longline catch (mt) of PMUS in the Pacific Ocean.

Year	Albacore	Yellowfin	Bigeye	Striped Marlin	Black Marlin	Blue Marlin	Swordfish	Total
1996	66,146	108,495	105,012	9,052	1,045	18,122	22,248	330,120
1997	83,022	103,228	121,177	9,483	1,118	18,459	28,755	365,242
1998	92,020	96,413	131,423	10,638	1,713	21,305	29,099	382,611
1999	82,722	82,705	111,409	8,503	2,021	18,264	28,108	333,732
2000	82,257	120,706	124,517	6,153	1,401	17,431	30,144	382,609
2001	90,599	125,148	147,425	6,740	1,621	19,779	34,293	425,605
2002	102,322	121,175	166,805	6,533	1,873	19,007	36,487	454,202
2003	89,644	120,886	142,792	7,268	2,104	28,208	38,397	429,299
2004	87,199	122,838	143,188	6,502	2,334	25,630	37,437	425,128
2005	92,925	99,363	119,291	5,808	2,773	23,476	28,711	372,347
2006	93,613	95,204	115,330	5,763	2,507	20,784	32,580	365,781
2007	88,271	90,501	111,226	5,062	1,820	17,428	34,474	348,782
2008	87,435	93,457	108,224	4,930	1,868	16,511	34,771	347,196
2009	109,440	109,388	111,158	4,160	2,066	16,897	35,298	388,407
2010	113,324	103,860	108,639	4,983	2,252	18,592	35,740	387,390
2011	97,892	105,009	109,046	6,328	1,925	16,806	38,407	375,413
2012	120,727	99,930	118,683	6,431	2,006	18,083	42,998	408,858
2013	112,944	87,894	100,690	5,844	1,810	19,841	40,937	369,960
2014	108,460	107,686	108,446	5,594	2,223	20,690	38,445	391,544
2015	89,404	111,462	105,998	5,794	2,493	18,045	41,051	374,247
Average	94,518	105,267	120,524	6,578	1,949	19,668	34,419	382,924
STD deviation	13,206	12,415	17,343	1,659	439	3,047	5,265	32,686

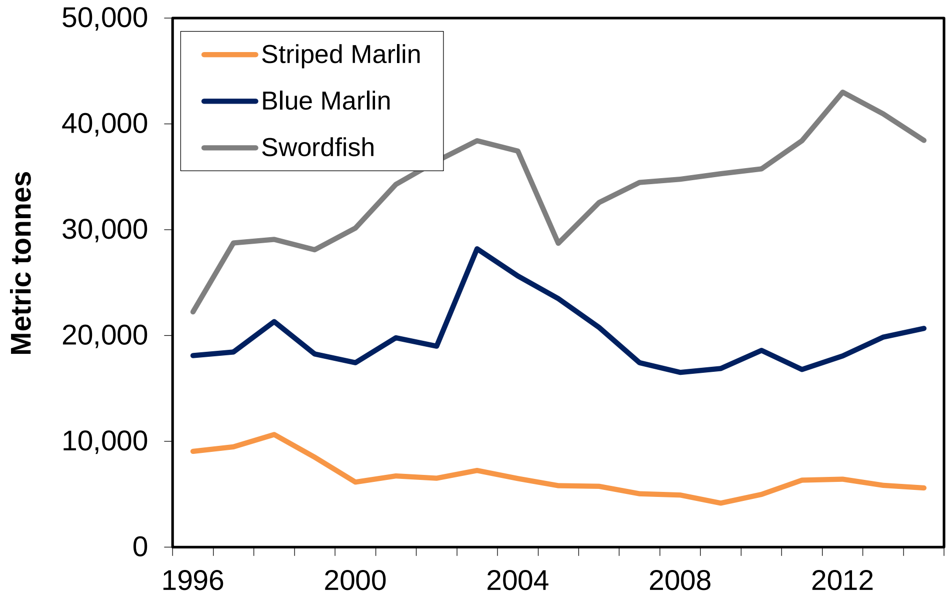
Source: SPC 2016 and IATTC 2017.

Figure 122. Reported longline tuna catches in the Pacific Ocean.



Source: SPC 2016 and IATTC 2017.

Figure 123. Reported longline billfish catches in the Pacific Ocean.



Source: SPC 2016 and IATTC 2017.

2.6.4.3 POLE-AND-LINE FISHERY IN THE WCPFC

Source: WCPFC-SC12-2016 GN-WP-01

Vessels: There are only five pole-and-line fleets active in the WCPO (French Polynesia, Japan, Indonesian, Kiribati and Solomon Islands). The pole-and-line fleet was composed of less than 200 vessels in the 2014 fishery which excludes vessels in the Indonesia domestic fishery.

Catch: The provisional 2015 pole-and-line catch (228,129 mt) was a slight increase on the 2014 catch but remains amongst the lowest annual catch since the late-1960s. Skipjack tends to account for the majority of the catch (~70-83% in recent years, but typically more than 85% of the total catch in tropical areas) and albacore (8–20% in recent years) is taken by the Japanese coastal and offshore fleets in the temperate waters of the north Pacific. Yellowfin tuna (5–16%) and a small component of bigeye tuna (1–4%) make up the remainder of the catch.

Japanese distant-water and offshore fleets (110,433 mt in 2015), and the Indonesian fleets (116,179 mt in 2015), account for nearly all of the WCP–CA pole-and-line catch (99% in 2015). The catches by the Japanese distant-water and offshore fleets in recent years have been the lowest for several decades and this is no doubt related to the continued reduction in vessel numbers (in 2015 reduced to only 79 vessels, the lowest on record). The Solomon Islands fleet recovered from low catch levels experienced in the early 2000s (only 2,773 mt in 2000 due to civil unrest) to reach a level of 10,448 mt in 2003. This fleet ceased operating in 2009, but resumed fishing in 2011 with catches generally around 1,000 mt (910 mt in 2015).

Fleet distribution: The WCP–CA pole-and-line fishery has several components:

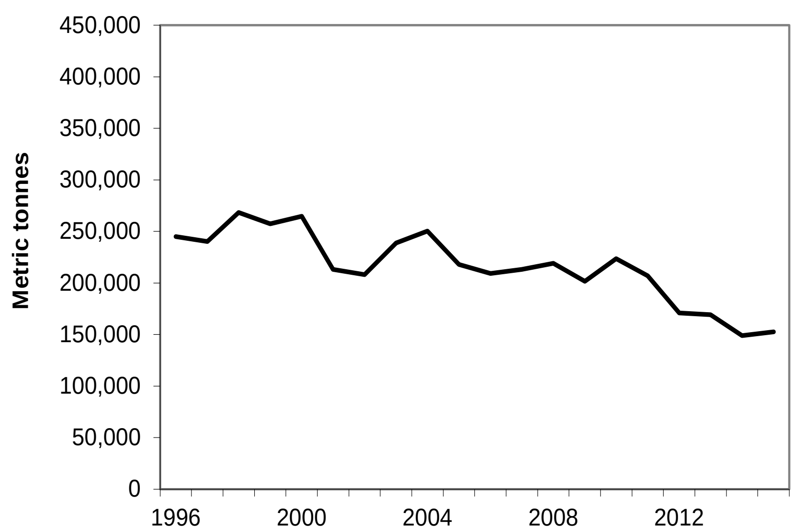
- the year-round tropical skipjack fishery, mainly involving the domestic fleets of Indonesia, Solomon Islands and French Polynesia, and the distant water fleet of Japan
- seasonal sub-tropical skipjack fisheries in the domestic (home) waters of Japan, Australia, Hawai`i and Fiji
- a seasonal albacore/skipjack fishery east of Japan (largely an extension of the Japan home-water fishery).

Table 41. Total reported pole-and-line catch (mt) of skipjack in the Pacific Ocean.

Year	Catch
1996	245,041
1997	240,259
1998	268,456
1999	257,374
2000	264,638
2001	213,116
2002	208,104
2003	238,817
2004	250,464
2005	218,014
2006	209,166
2007	213,286
2008	219,069
2009	201,474
2010	223,456
2011	206,867
2012	170,841
2013	169,189
2014	148,851
2015	152,600
Average	215,954
STD deviation	34,956

Source: SPC 2016.

Figure 124. Reported pole-and-line catch (mt) in the Pacific Ocean.



Source: SPC 2016.

2.6.5 STATUS OF THE STOCKS

National Standard 1 of the MSA requires that conservation and management measures prevent overfishing while achieving, on a continual basis, the optimum yield from each fishery for the U.S. fishing industry. NMFS advisory guidelines for National Standard 1 require the Council to evaluate and describe in their fishery management plans, the criteria for determining if a stock is subject to overfishing, and when a stock is overfished, or approaching a condition of becoming overfished. This section briefly summarizes the status determination criteria (SDC) for pelagic MUS described in the Pelagic FEP, the stock status relative to the SDC, and lists the stock assessments completed since the last SAFE report.

2.6.5.1 DESCRIPTION OF OVERFISHED STATUS DETERMINATION CRITERIA

For all pelagic MUS, the Council adopted a maximum sustainable yield (MSY) control rule shown in Figure 125. The Pelagic FEP uses minimum stock size threshold (MSST) as the SDC for an overfished determination, and a stock is considered overfished when its biomass (B) has declined below the MSST. The MSST is determined based on the natural mortality (M) of the stock and the biomass at MSY (B_{MSY}). Specifically, MSST = cB_{MSY}, where *c* is the greater of 0.5, or 1 minus the natural mortality rate (M). Expressed as a ratio, a stock is overfished when $B_{year}/B_{MSY} < 1\text{-M}$ or 0.50, whichever is greater. To illustrate these specifications of the MSST, for a stock with a natural mortality rate of 0.2, MSST would be set at $0.8B_{MSY}$, and the stock would be overfished if $B_{year}/B_{MSY} < 0.8$. For a stock with a natural mortality rate greater than 0.5, MSST cannot be set below $0.5B_{MSY}$, and the stock would be overfished if $B_{year}/B_{MSY} < 0.5$.

The Council has also adopted a warning reference point, B_{FLAG}, set equal to B_{MSY} to provide a trigger for consideration of management action before a stock's biomass reaches the MSST. A stock is approaching an overfished condition when there is more than a 50 percent chance that the biomass will decline below the MSST within two years.

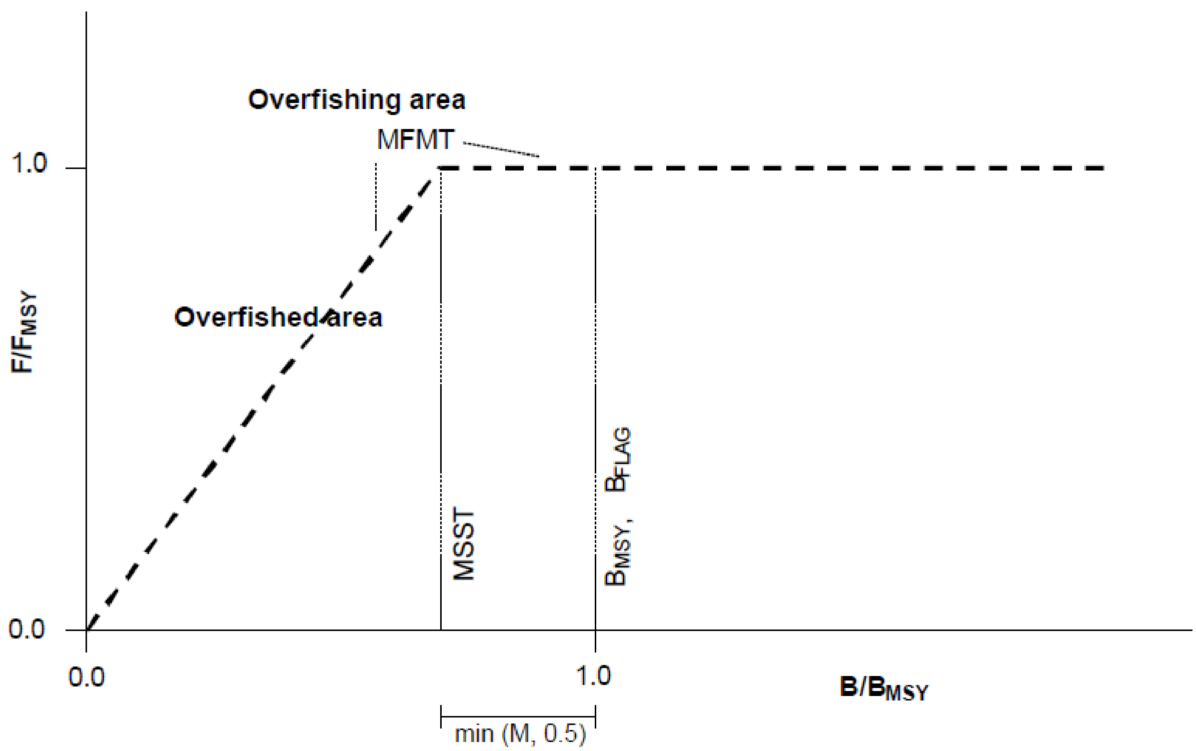
It is important to note that NMFS National Standard 1 guidelines at 50 CFR 665.310(e)(1)(i)(C) defines B_{MSY} as the long-term average size of the stock measured in terms of spawning biomass (SB) or other appropriate measure of the stock's reproductive potential that would be achieved by fishing at B_{MSY}. Thus, whenever available, NMFS will use estimates of SB in determining the status of a stock. When estimates of SB are not available, NMFS may use estimates of total biomass (B), or other reasonable proxies for determining stock status.

2.6.5.2 OVERFISHING SDC

The Pelagic FEP uses maximum fishing mortality threshold (MFMT) as the SDC for overfishing. Specifically, overfishing occurs when fishing mortality (F) is greater than the fishing mortality rate that results in MSY (F_{MSY}). Expressed as a ratio, the MFMT is exceeded and a stock is subject to overfishing when $F/F_{MSY} > 1.0$. However, for a stock where biomass has declined below MSST, the default MSY control rule requires the MFMT to be reduced linearly below F_{MSY} to allow for rebuilding of the stock.

It is also important to note that all finfish managed under the Pelagic FEP are also managed under the international agreements governing the WCPFC and/or the IATTC to which the U.S. is a party. Additionally, both the WCPFC and IATTC have adopted criteria for overfishing and overfished for certain species that differ from those described above. Pursuant to Section 304(e)(1), for those fisheries managed under a fishery management plan or international agreement, NMFS shall determine the status of a stock using the criteria specified in the plan, or the agreement. For the purpose of stock status determinations, NMFS will determine stock status of Pelagic MUS using the SDC described in the Pelagic FEP.

Figure 125. MSY control rule and reference points for pelagic MUS.



2.6.6 INFORMATION ON OVERFISHING LIMIT, ACCEPTABLE BIOLOGICAL CATCH AND ANNUAL CATCH LIMITS

Because pelagic squid have an annual life cycle, and all pelagic finfish are subject to management under the international agreements governing the WCPFC and/or the IATTC, all pelagic MUS are excepted from annual catch limit (ACL) and accountability measure requirements of section 303(a)(15) of the MSA, and related reference points. However, this statutory exception does not preclude the Council from specifying ACLs and related reference points for pelagic MUS using the ACL process described in the Pelagic FEP, if the Council deems such specifications are necessary to meet the objectives of the plan.

2.6.7 STOCK ASSESSMENTS COMPLETED SINCE THE LAST PELAGIC SAFE REPORT

Stock status is most reliably determined from stock assessments that integrate fishery and life history information across the range of the stock. For Pelagic MUS, most stock assessments are conducted by several international organizations. In the EPO, IATTC staff conduct stock assessments mainly for tropical tunas (bigeye and yellowfin) and some billfish (striped marlin, swordfish). These assessments are presented to the Scientific Advisory Committee of the IATTC and then to the full IATTC plenary. Assessments for IATTC managed stocks may be accessed on the IATTC meeting webpage.

In the WCPO, the Secretariat of the Pacific Community's Oceanic Fisheries Program (OFP-SPC) conducts stock assessments as the science provider to the WCPFC. Like the IATTC, the OFP-SPC generally focuses on the tropical tunas, but also conduct stock assessments for South Pacific albacore and southwest Pacific swordfish and striped marlin. In the North Pacific Ocean, the ISC for Tuna and Tuna-like Species in the North Pacific Ocean conducts stock assessments specifically for the WCPFC Northern Committee. These assessments are presented to the Scientific Committee of the WCPFC and then to the full WCPFC plenary. Assessments for WCPFC managed stocks may be accessed on the WCPFC meeting webpage.

Table 42 summarizes the stock assessments for pelagic MUS completed or scheduled for completion between 2012 and 2016.

Table 42. Schedule of completed stock assessments for WPRFMC PMUS.

Management Unit Species	Year Completed		Management Unit Species	Year Completed
Albacore (S. Pacific)	2015		Swordfish (N. Pacific)	2014
Albacore (N. Pacific)	2014		Wahoo	
Other tuna relatives (*Auxis* sp.)			Yellowfin Tuna (WCPO)	2014
(*allothunnus* sp., *Scomber* sp.)			Kawakawa	
Bigeye Tuna (WCPO)	2014		Bluefin Tuna (Pacific)	2016
Black Marlin			Common Thresher Shark	
Blue Marlin	2016		Pelagic Thresher Shark	
Mahimahi			Bigeye Thresher Shark	
Oilfishes			Shortfin Mako Shark	
Opah			Longfin Mako Shark	
Pomfrets			Blue Shark (N. Pacific)	2014
Sailfish			Silky Shark	2013
Shortbill Spearfish			Oceanic Whitetip Shark	2012
Skipjack Tuna (WCPO)	2016		Salmon Shark	
Striped Marlin (N. Pacific)	2015		Squid	

The following pages include a description of the most recent stock assessments and assessment results completed in 2016. For more information on stock assessments and assessment results completed prior to 2016, please see the past Annual Pelagic SAFE Reports.

2.6.7.1 WESTERN AND CENTRAL PACIFIC OCEAN SKIPJACK

Stock assessment: McKechnie et al. 2016.

Stock status (WCPFC SC12 Summary Report): A majority of SC12 CCMs selected the reference case model as the base case to represent the stock status of skipjack tuna. To characterize uncertainty, those CCMs chose the structural uncertainty grid. Dynamics of most model quantities are relatively consistent with the results of the 2014 stock assessment, although there has been a period of several subsequent years with high recruitments and increased spawning biomass. Fishing mortality of all age-classes is estimated to have increased significantly since the beginning of industrial tuna fishing, but fishing mortality still remains below the level that would result in the MSY (F_{recent}/F_{MSY} = 0.45 for the reference case), and is estimated to have decreased moderately in the last several years. Across the reference case and the structural uncertainty grid F_{recent}/F_{MSY} varied between 0.38 (5% quantile) to 0.64 (95% quantile). This indicates that overfishing is not occurring for the WCPO skipjack tuna stock. The estimated MSY of 1,891,600 mt is moderately higher than the 2014 estimate due to the adoption of an annual, rather than quarterly, stock-recruitment relationship. Recent catches are lower than, but approaching, this MSY value. The latest (2015) estimate of spawning biomass is well above both the level that will support MSY (SBlatest/SBMSY = 2.56, for the reference case model, Figure ??) and the adopted LRP of 0.2 SBF=0 (SBlatest/SBF=0 = 0.58, for the reference case model), and SBlatest/SBF=0 was relatively close to the adopted interim target reference point (0.5 SBF=0) for all models explored in the assessment (structural uncertainty grid: median = 0.51, 5% and 95% quantiles = 0.39 and 0.67).

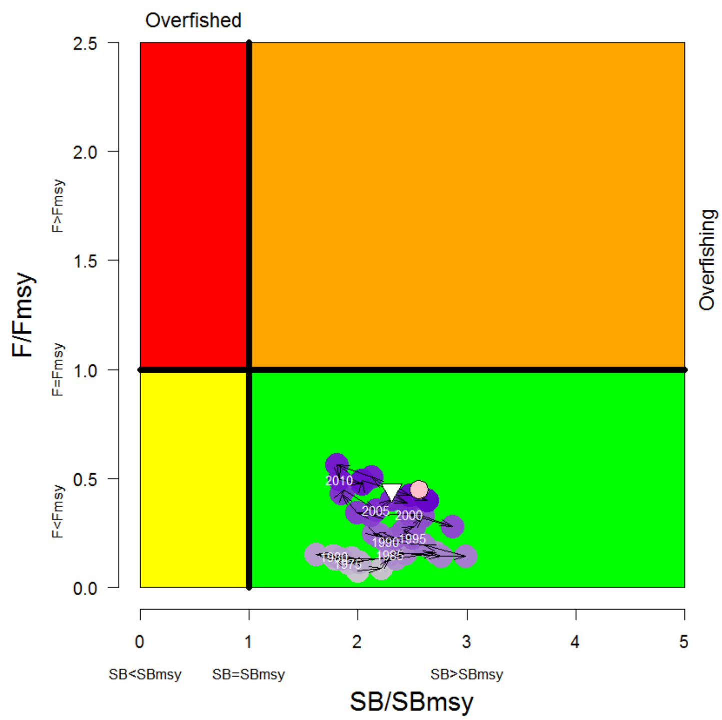


Figure 126. Kobe plot for the skipjack tuna reference case model representing stock status in terms of spawning biomass and fishing mortality.

Red zone represents spawning biomass (SB) lower than SB_{MSY} and fishing mortality (F) greater than F_{MSY}.
Yellow zone represents SB lower than SB_{MSY} and F lower than F_{MSY}.
Orange zone represents SB higher than SB_{MSY} and F greater than F_{MSY}.
Green zone represents SB higher than SB_{MSY} and F lower than F_{MSY}.
The pink circle is latest (2015) SB and the white triangle is recent (2011–2014) SB.

Management advice and implications (WCPFC SC12 Summary Report):

SC12 noted that the skipjack assessment continues to show that the stock is currently moderately exploited and fishing mortality level is sustainable. The recent catches are fluctuating around and some models also indicate that the stock is currently under the TRP.

SC12 noted that fishing is having a significant impact on stock size and can be expected to affect catch rates. The stock distribution is also influenced by changes in oceanographic conditions associated with El Niño and La Niña events, which impact on catch rates and stock size. Additional purse-seine effort will yield only modest gains in long-term skipjack tuna catches and may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas. The management of total effort in the WCPO should recognize this.

SC12 noted that skipjack spawning biomass is now around the adopted TRP and SC12 recommends that the Commission take action to keep the spawning biomass near the TRP and also advocates for the adoption of harvest control rules based on the information provided.

In order to maintain the quality of stock assessments for this important stock, SC12 recommends 1) continued work on developing an index of abundance based on purse seine data; 2) regular large scale tagging cruises and complementary tagging work continue to be undertaken in a way that provides the best possible data for stock assessment purposes.

SC12 also notes that the current method of calculating the TRP is based on the most recent 10 years of recruitment information. However, the information on spawning potential, SB_{2015}, which is used to evaluate current stock status relative to the TRP can change very rapidly for skipjack which mature at age 1 and this rapid maturation may provide an optimistic status evaluation when recruitment is estimated have an increasing trend but is estimated with substantial uncertainty, as is currently observed in the case of skipjack which does not have a fishery-independent index of recruitment strength.

There is ongoing concern by at least one CCM that high catches in the equatorial region may be causing a range contraction of WCPO skipjack tuna, thus reducing skipjack tuna availability to fisheries conducted at higher latitudes than the Pacific equatorial region. SC12 reiterates the advice of SC11 whereby there is no demonstrated statistical evidence for SKJ range contraction. As a result, SC12 recommends that ongoing research on range contraction of skipjack tuna be continued in the framework of Project 67.

2.6.7.2 PACIFIC BLUEFIN TUNA

Stock assessment: ISC Pacific Bluefin Tuna Working Group (PBFWG). 2016.

Stock status (PBFWG):

The PBFWG conducted a benchmark assessment (base-case model) using the best available fisheries and biological information. The base-case model fits well the data that were considered to be more reliable and is internally consistent among most of the sources of data. The 2016 base-case model is a substantial improvement compared to the 2014 assessment and fits all reliable data well. The base-case model indicates: (1) spawning stock biomass (SSB) fluctuated throughout the assessment period (fishing years 1952-2014) and (2) the SSB steadily declined from 1996 to 2010; and (3) the decline appears to have ceased since 2010, although the stock remains near the historic low. The model diagnostics suggest that the estimated biomass trend for the last 30 years is considered robust although SSB prior to the 1980s is uncertain due to data limitations.

Using the base-case model, the 2014 (terminal year) SSB was estimated to be around 17,000 t, which is about 9,000 t below the terminal year estimated in the 2014 assessment (26,000 in 2012). This is because of improvements to the input data and refinements to the assessment model scaled down the estimated value of SSB and not because the SSB declined from 2012 to 2014.

Recruitment estimates fluctuate widely without an apparent trend. The 2014 recruitment was relatively low, and the average recruitment for the last five years may have been below the historical average level. Note that recruitments in terminal years in an assessment are highly uncertain due to limited information on the cohorts. However, two of the last three data points from the Japanese troll CPUE-based index of recruitment, which was consistent with other data in the model, are at their lowest level since the start of the index (1980). Estimated age-specific fishing mortalities on the stock during 2011-2013 and 2002-2004 indicate most age-specific fishing mortalities (F) for intermediate ages (2-10 years) are substantially above F2002-2004 while those for age 0 as well as ages 11 and above are lower.

Although no limit reference points have been established for the PBF stock under the auspices of the WCPFC and IATTC, the F2011-2013 exceeds all calculated biological reference points except for FMED and FLOSS despite slight reductions to F in recent years. The ratio of SSB in 2014 relative to the theoretical unfished[6] SSB (SSB2014/SSBF=0, the depletion ratio) is 2.6%[7] and SSB2012/SSBF=0 is 2.1% indicating a slight increase from 2012 to 2014. Although the SSB2014/SSBF=0 for this assessment (2.6%) is lower than SSB2012/SSBF=0 from the 2014 assessment (4.2%), this difference is due to improvements to the input data and model structure rather than a decline in SSB from 2012 to 2014. Note that potential effects on Fs as a result of the measures of the WCPFC and IATTC starting in 2015 or by other voluntary measures are not yet reflected in the data used in this assessment.

Since reference points for PBF have yet to be identified, two examples of Kobe plots (Figure 127: plot A based on SSBMED and FMED, plot B based on SSB20% and SPR20%) are presented. These versions of the Kobe plot represent two interpretations of stock status in an effort to prompt further discussion. In summary, if these were the reference points, overfishing would be occurring or just at the threshold in the case of FMED; and the stock would be considered overfished. Plot B shows that the stock has remained in an overfished and overfishing status for the vast majority of the assessment period if $F_{20\%}$ and $SSB_{20\%}$ are the reference points. The ISC notes that the SSB estimates before 1980 are more uncertain and that the reason why the fishing mortality is estimated to be so high right after the WWII is not well understood. The low biomass level at the beginning of the assessment period (1952) could potentially be the result of relatively high catches prior to the assessment period of PBF.

Historically, the WPO coastal fisheries group has had the greatest impact on the PBF stock, but since about the early 1990s the WPO purse seine fleets, in particular those targeting small fish[8] (age 0-1), have had a greater impact, and the effect of these fleets in 2014 was greater than any of the other fishery groups. The impact of the EPO fishery was large before the mid-1980s, decreasing significantly thereafter. The WPO longline fleet has had a limited effect on the stock throughout the analysis period. This is because the impact of a fishery on a stock depends on both the number and size of the fish caught by each fleet; i.e., catching a high number of smaller juvenile fish can have a greater impact on future spawning stock biomass than catching the same weight of larger mature fish.

6 "Unfished" refers to what SSB would be had there been no fishing.

7 The unfished SSB is estimated based upon equilibrium assumptions of no environmental or density-dependent effects.

8 It was noted that the term small fish is not used in CMM 2015-04; however, the measure states "Further substantial reductions in fishing mortality and juvenile catch over the whole range of juvenile ages should be considered…"

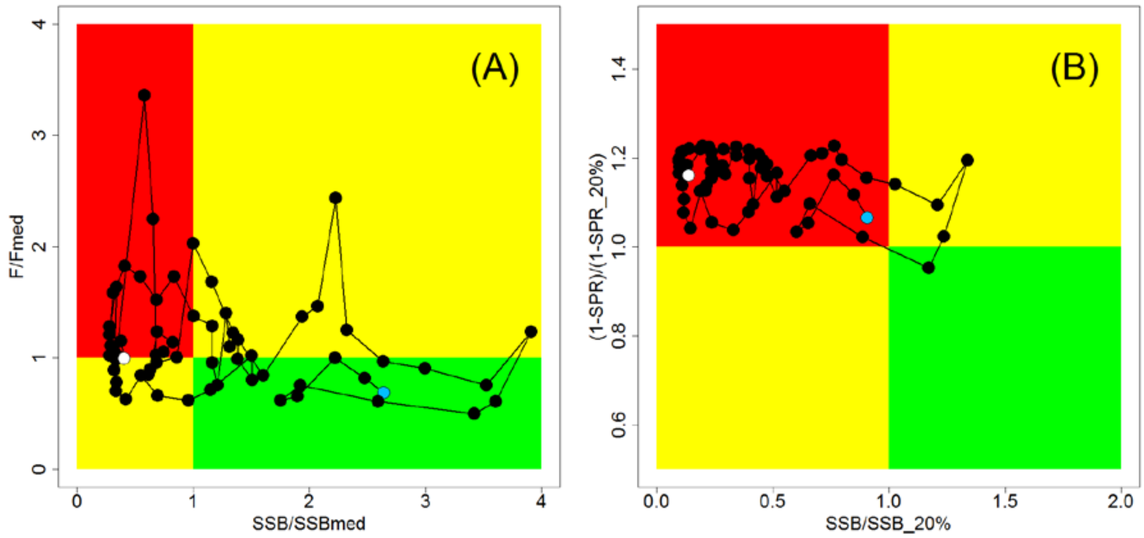


Figure 127. Kobe plots for Pacific Bluefin tuna. (A) SSBMED and FMED; (B) SSB20% and SPR20% based. Note that SSBMED is estimated as the median of estimated SSB over whole assessment period (40,944 t) and FMED is calculated as an F to provide SSBMED in long-term, while the plots are points of estiamtes. The blue and white points on the plot show the start (1952) and end (2014) year of the period modelled in the stock assessment, respectively.

Stock status (WCPFC SC12 Summary Report):

In the absence of any agreed definition of a drastic drop in stock recruitment referred to in CMM 2015-04, SC12 notes with concern that the 2012 and 2014 recruitments are at the lowest levels observed since 1980, noting that ISC noted that recruitment in the terminal years of any assessment is highly uncertain. SC12 also noted a comment from Japan that some indices of 2015 recruitment are above the 2014 level and early anecdotal information regarding the 2016 recruitment suggests it is not particularly low.

The provisional total Pacific Bluefin tuna catch in 2015 was 11,020 mt in the North Pacific Ocean, which was a 36% decrease over 2014 and a 30% decrease over the average for 2010-2014.

SC12 noted that, based on the latest stock assessment carried out by ISC in 2016, SC12 noted that the Pacific bluefin tuna spawning stock biomass is depleted to 2.6% of the estimated unfished spawning stock biomass (SBF=0). SC12 emphasized that this depletion level is considerably below the biomass depletion-based Limit Reference Point of 20% of SBF=0 set by the Commission for all other WCPFC key tuna stocks (skipjack, yellowfin, bigeye, south Pacific albacore and north Pacific albacore). However, SC12 also notes that the Pacific bluefin tuna stock remained below 20% of SBF=0 for most of the time of assessment. SC12 also noted that the initial rebuilding target currently defined by the CMM 2015-04, the median of the SSB of the stock assessment period (42,582 mt) corresponds to a spawning biomass of around 7% of estimated unfished spawning stock biomass.

Conservation advice (ISC PBFWG):

The steady decline in SSB from 1996 to 2010 appears to have ceased, although SSB2014 is near the historic low and the stock is experiencing exploitation rates above all calculated biological reference points except for FMED and FLOSS.

The projection results based on the base-case model under several harvest and recruitment scenarios and time schedules were developed. Under all examined scenarios the initial goal of WCPFC, rebuilding to SSBMED by 2024 with at least 60% probability, is reached and the risk of SSB falling below SSBLOSS at least once in 10 years was low.

The projection results indicate that the probability of SSB recovering to the initial WCPFC target (SSBMED by 2024, 38,000 t, calculated in the same manner as the previous assessment) is 69% or above the level prescribed in the WCPFC CMM if low recruitment scenario is assumed and WCPFC CMM 2015-04 and IATTC Resolution C-14-06 continue in force and are fully implemented.

The ISC notes there are technical inconsistencies in the calculation of SSBMED in the assessment and projection. The ISC also notes the current calculation of SSBMED in the projection includes the most recent estimates of SSB and unless a fixed period of years is specified to calculate SSBMED, the calculation of SSBMED could be influenced by future trends in spawning biomass. The ISC therefore recommends defining SSBMED as the median point estimate for a fixed period of time, either, 1952-2012 or 1952-2014. If 1952-2012 is chosen, then SSBMED is estimated to be 41,069 t, and if 1952-2014 is chosen, SSBMED is 40,994 t. The probabilities of achieving 41,000 t under various scenarios are provided. The probabilities of achieving 43,000 t, where WCPFC CMM 2015-04's initial rebuilding target is specified as 42,592 t, are also provided, although this value is derived from the previous assessment and is higher than the SSBMED calculated in the current assessment. The ISC recommends that in the future absolute values should not be used for the initial rebuilding target, as the calculated values of reference points would change from assessment to assessment.

Scenario 2 with low recruitment has the lowest prospect of recovery among the examined harvest scenarios. The probability of achieving the WCPFC's initial target (SSBMED by 2024) would increase if more conservative management measures were implemented as shown. The projection results indicate that a 10% reduction in the catch limit for fish smaller than the weight threshold in CMM 2015-04 would have a larger effect on recovery than a 10% reduction in the catch limit for fish larger than the weight threshold. The ISC notes that the current assessment model uses a maturity ogive that assumes 20%, 50% and 100% maturity in age 3 (weight on July 1: 34kg), 4 (weight on July 1: 58kg) and 5 (weight on July 1: 85kg), respectively, while the WCPFC CMM 2015-04 specifies that catches of fish smaller than 30kg should be reduced. The weight threshold in the CMM needs to be increased to 85kg (weight of age 5) if the intent is to reduce catches on all juveniles according to the maturity ogive in the assessment.

The projections results assuming a stronger stock-recruitment relationship (where h=0.9) than in the assessment model are not necessarily more pessimistic than the low recruitment scenario. The projection results assume that the CMMs are fully implemented and are based on certain biological or other assumptions. In particular, the ISC noted the implementation of size based management measures need to be monitored carefully. If conditions change, the projection results would be more uncertain. Given the low SSB, the uncertainty in future recruitment, and the influence of recruitment has on stock biomass, monitoring recruitment and SSB should be strengthened so that the recruitment trends can be understood in a timely manner.

Management advice and implications (WCPFC SC12 Summary Report):

SC12 advised WCPFC13 that FFA members expressed concern that the substantial depletion of the Pacific bluefin stock due to excess fishing in the northern WCPFC region has probably resulted in range contraction, thus greatly reducing the availability of bluefin tuna (*Thunnus orientalis*) in the south Pacific. This is of particular significance to Pacific island CCMs because it limits their future opportunities for the participation in fisheries for this stock. SC12 also noted no statistical demonstration is provided to support the range contraction of Pacific Bluefin tuna. SC12 noted the need for additional information.

In view of the upcoming IATTC-WCPFC joint meeting on Pacific bluefin tuna management, SC12 expressed the need of urgent coordinated actions between WCPFC and IATTC in reviewing the current rebuilding plan, establishing the emergency rule as well as considering and developing reference points and HCRs for the long term management of PBF.

2.6.7.3 PACIFIC BLUE MARLIN

Stock assessment: ISC Billfish Working Group. 2016.

Stock status (ISC Billfish Working Group):

Estimates of total BUM stock biomass show a long term decline. Population biomass (age-1 and older) averaged roughly 130,965 t in 1971-1975, the first 5 years of the assessment time frame, and has declined by approximately 40% to 78,082 t in 2014. Female spawning biomass was estimated to be 24,809 t in 2014, or about 25% above SSBMSY. Fishing mortality on the stock (average F, ages 2 and older) averaged roughly F = 0.28 during 2012-2014, or about 12% below FMSY. The estimated spawning potential ratio of the stock (SPR, the predicted spawning output at the current F as a fraction of unfished spawning output) is currently SPR2012-2014 = 21%. Annual recruitment averaged about 897,000 recruits during 2008-2014, and no long-term trend in recruitment was apparent. Overall, the time series of spawning stock biomass and recruitment estimates indicate a long-term decline in spawning stock biomass and suggest a fluctuating pattern without trend for recruitment.

The Kobe plot depicts the stock status relative to MSY-based reference points for the base case model (Figure 128) and shows that spawning stock biomass decreased to roughly the MSY level in the mid-2000s, and has increased slightly in recent years. Based on the results of this 2016 stock assessment update, the Pacific blue marlin stock is not currently overfished and is not experiencing overfishing. Because Pacific blue marlin is mainly caught as bycatch, direct control of the annual catch amount through the setting of a total allowable catch may be difficult."

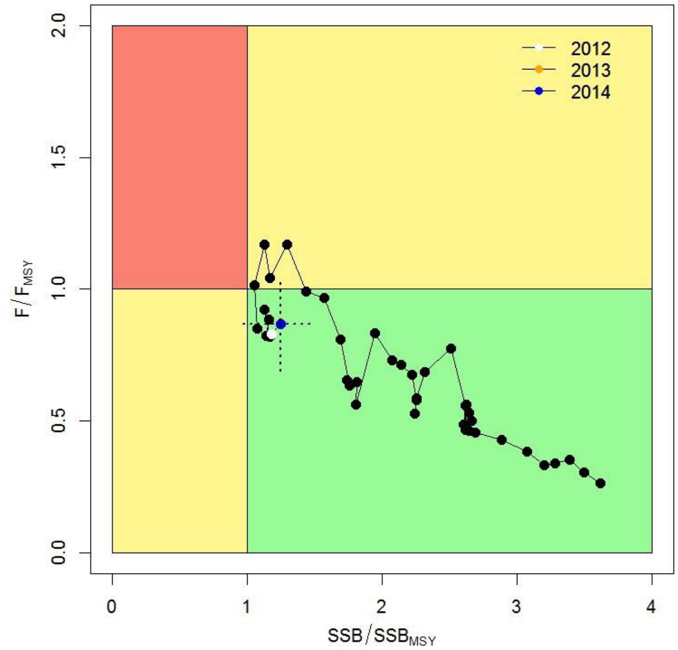


Figure 128. Kobe pliot of the time series of estiamtes of relative fishing mortality (average of age 2+) and relative spawning stock biomass of BUM during 1971-2014. The dashed lines denote the 95% confidence intervals for the estimates in the year 2014.

Conservation advice (ISC Billfish Working Group):

Since the stock is nearly full exploited, the ISC recommends that fishing mortality remain at or below current levels (2012-2014).

Table 43. Estimates of stock status in relation to overfishing and overfished reference points for WPRFMC PMUS.

Stock	Overfishing reference point	Is overfishing occurring?	Approaching Overfishing (2 yr)	Overfished reference point	Is the stock overfished?	Approaching Overfished (2 yr)	Assessment results	Natural mortality[1]	MSST
Skipjack Tuna (WCPO)	$F/F_{MSY}=0.45$	No	No	$SB_{2015}/SB_{MSY}=2.56$, $SB_{2015}/SB_{F=0}=0.58$	No	No	McKechnie et al. 2016	>0.5 yr^{-1}	0.5 B_{MSY}
Yellowfin Tuna (WCPO)	$F/F_{MSY}=0.72$	No	No	$SB_{2012}/SB_{MSY}=1.24$, $SB_{2012}/SB_{F=0}=0.38$, $B_{2012}/B_{MSY}=1.21$	No	No	Davies et al. 2014	0.8-1.6 yr^{-1}	0.5 B_{MSY}
Yellowfin Tuna (EPO)	$F/F_{MSY}=0.98$	No	No	$SB/SB_{MSY}=0.95$, B/BMSY=0.96	No	No	Minte-Vera et al. 2016	0.2-0.7 yr^{-1}	0.5 B_{MSY}
Albacore (S. Pacific)	$F/F_{MSY}=0.39$	No	No	$SB_{2012}/SB_{MSY}=2.56$, SB2012/$SB_{F=0}=0.42$, $B_{2012}/B_{MSY}=1.67$	No	No	Harley et al. 2015	0.4 yr^{-1}	0.6 SB_{MSY}
Albacore (N. Pacific)	$F/F_{MSY}=0.52$	No	No	$SB_{2012}/SB_{F=0}=0.36$	No	No	ISC 2014	0.4 yr^{-1}	0.6 B_{MSY}
Bigeye Tuna (WCPO)	$F/F_{MSY}=1.57$	Yes, because F>MFMT	Not applicable	$SB_{2012}/SB_{MSY}=0.77$, $SB_{2012}/SB_{F=0}=0.16$, $B_{2012}/B_{MSY}=0.89$	No, because $SSB_{2012>}$MSST	No	Harley et al. 2014	0.4 yr^{-1}	0.6 B_{MSY}
Bigeye Tuna (EPO)	$F/F_{MSY}=0.95$	No, because F<MFMT	No	$SB/SB_{MSY}=0.96$, B/BMSY=1.00	No, because $SSB_{>}$MSST	No	Aires-da_Silva et al. 2016	0.1-0.25 yr^{-1}	~0.75 B_{MSY}
Pacific Bluefin Tuna	$F20\%_{2011-2013}=1.66$	Yes, because F>MFMT	Not applicable	$SB_{2014}/SB_{F=0}=0.026$	Yes, because SSB_{2014}<MSST	Not applicable	ISC 2016	0.25-1.6 yr^{-1}	~0.75 B_{MSY}
Blue Marlin (Pacific)	F/FMSY=0.81	No	Unknown	$SB_{2012-2014}/SB_{MSY}=1.23$	No	Unknown	ISC 2016	0.22-0.42 yr^{-1}	~0.7 B_{MSY}
Swordfish (WC N. Pacific)	F/FMSY=0.58	No	Unknown	$SB/SB_{MSY}=1.20$	No	Unknown	ISC 2014	0.3 yr^{-1}	0.7 B_{MSY}
Striped Marlin WC (N. Pacific)	F/FMSY=1.49	Yes, because F>MFMT	Not applicable	$SB_{2013}/SB_{MSY}=0.39$	Yes, because SSB_{2013}<MSST	Not applicable	ISC 2015	0.4 yr^{-1}	0.6 SB_{MSY}
Blue Shark (N. Pacific)[2]	F/FMSY=0.34	No	Unknown	$SB_{2011}/SB_{MSY}=1.62$	No	Unknown	Rice et al. 2014	0.2 yr^{-1}	0.8 B_{MSY}
Oceanic white-tip shark (WCPO)	F/FMSY=6.69	Yes	Not applicable	$SB/SB_{MSY}=0.15$	Yes	Not applicable	Rice and Harley 2012	0.18 yr^{-1}	0.82 B_{MSY}
Silky shark (WCPO)	F/FMSY=4.32	Yes	Not applicable	$SB/SB_{MSY}=0.72$	Yes	Not applicable	Rice and Harley 2013	0.18 yr^{-1}	0.82 B_{MSY}
Other Billfishes	Unknown			Unknown				Unknown	
Other Pelagic Sharks	Unknown			Unknown				Unknown	
Other PMUS	Unknown			Unkown				Unkown	

[1] Estimates based on Boggs et al. 2000 or assumed in the assessments.

2.6.8 U.S. LONGLINE LANDINGS REPORTED TO WCPFC AND IATTC FOR 2014.

The tables of this section show the preliminary catches of pelagic MUS by U.S. Hawai`i and U.S. territorial longline fisheries in the WCP-CA from 2012-2016, as reported to the WCPFC (NMFS PIFSC, unpublished data).

Table 44. U.S. and Territorial longline catch (mt) by species in the WCPFC Statistical Area, 2012–2016.

	U.S. in North Pacific Ocean					CNMI in North Pacific Ocean					Guam in North Pacific Ocean					American Samoa in North Pacific Ocean					American Samoa in South Pacific Ocean					Total				
	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012
Vessels	133	135	140	135	127	117	117	109	113		118	112				23	22	17	17	115	20	21	23	22	25	151	156	162	157	153
Species																														
Albacore, North Pacific	209	197	178	265	480				23							35	19	8	11	115						244	217	186	298	595
Albacore, South Pacific		0																			1,558	1,855	1,430	2,128	3,147	1,558	1,855	1,430	2,128	3,147
Bigeye tuna	3,761	3,427	3,823	3,654	3,660	884	999	1,000	492		939	856				588	441	236	305	1,338	98	116	82	84	164	6,270	5,840	5,141	4,534	5,162
Pacific bluefin tuna	0	0		0	0																0	6	3	2	7	1	6	3	3	7
Skipjack tuna	183	176	167	188	115				25							25	11	9	9	123	50	67	116	66	251	259	254	291	288	490
Yellowfin tuna	1,098	681	567	568	576				93							175	105	30	32	272	195	255	424	390	348	1,469	1,041	1,021	1,083	1,196
Other tuna	0	0		0	0				0							0							0			0	0		0	0
TOTAL TUNA	5,252	4,482	4,734	4,674	4,831	884	999	1,000	633		939	856				823	577	283	357	1,849	1,902	2,299	2,055	2,671	3,916	9,801	9,213	8,072	8,335	10,596
Black marlin	1	0	1	1	1												0	0	0	0				0	2	1	0	1	1	3
Blue marlin	429	445	428	305	226				20							58	55	31	22	50	31	25	28	31	36	517	526	486	378	313
Sailfish	15	11	15	7	5				3							2	2	0	1	3	2	2	2	2	1	20	15	17	12	9
Spearfish	251	188	163	133	111				34							28	15	11	9	35	2	1	1	1	1	281	204	175	177	147
Striped marlin, North Pacific	281	378	343	262	209				42							48	36	14	23	54			0			329	414	357	328	263
Striped marlin, South Pacific		0																			2	3	7	4	7	2	3	7	4	7
Other marlins	1	1		1	1				0								0			0						1	1		1	1
Swordfish, North Pacific	595	665	865	558	862				8							43	24	15	17	38						638	690	880	583	900
Swordfish, South Pacific		0																			7	8	10	11	14	7	8	10	11	14
TOTAL BILLFISH	1,573	1,688	1,813	1,266	1,414				107							180	133	72	72	180	43	40	47	48	62	1,796	1,862	1,932	1,493	1,656

	U.S. in North Pacific Ocean					CNMI in North Pacific Ocean					Guam in North Pacific Ocean					American Samoa in North Pacific Ocean					American Samoa in South Pacific Ocean					Total				
	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012
Blue shark				1	12											0		0		2	1	1	1	1	3	1	1	1	2	18
Mako shark	37	35	35	31	42				3							9	4	2	4	8					0	46	39	37	39	50
Thresher	3	5	5	5	9				0							0	1	1	0	3					0	4	6	6	5	13
Other sharks	0			0	0															0						0			0	1
Oceanic whitetip shark				0	1																								0	1
Silky shark																														
Hammerhead shark	0																									0				
Tiger shark																														
Porbeagle																														
TOTAL SHARKS	40	40	40	37	65				3							10	5	2	5	14	1	1	1	1	4	51	45	43	46	82
Mahimahi	202	199	236	238	288				9							28	21	15	27	52	4	6	12	19	11	234	226	263	293	351
Moonfish	304	279	385	377	356				37							74	55	22	35	86	2	2	1	2	3	380	336	408	450	445
Oilfish	160	165	169	171	169				28							29	20	13	17	59	2	0	0	1	0	190	185	182	216	228
Pomfret	339	380	373	315	215				26							46	39	18	18	56	0	0	0			386	419	392	359	270
Wahoo	309	256	243	154	117				17							47	27	18	15	39	52	58	75	87	85	407	340	336	274	241
Other fish	7	7	6	9	8				0							1	1	0	0	1	1	1	0	0	0	9	9	6	10	9
TOTAL OTHER	1,322	1,285	1,411	1,263	1,154				117							224	164	87	113	292	60	66	89	109	99	1,606	1,515	1,587	1,602	1,545
GEAR TOTAL	8,187	7,495	7,999	7,241	7,464	884	999	1,000	860		939	856				1,237	878	445	546	2,335	2,007	2,405	2,192	2,828	4,081	13,254	12,635	11,635	11,476	13,880

Table 45. U.S. longline catch (mt) by species in the North Pacific Ocean, 2012-2016.

	U.S. (ISC)				
	2016	2015	2014	2013	2012
Vessels	141	143	141	136	129
Species					
Albacore, North Pacific	250	243	208	317	660
Albacore, South Pacific					
Bigeye tuna	8,260	8,774	7,131	6,493	5,873
Pacific bluefin tuna	0	0	0	1	0
Skipjack tuna	237	212	187	233	245
Yellowfin tuna	1,522	921	658	736	887
Other tuna	0	0		0	0
TOTAL TUNA	10,269	10,150	8,185	7,781	7,667
Black marlin	1	0	1	1	1
Blue marlin	564	631	535	406	298
Sailfish	20	15	19	12	9
Spearfish	340	263	218	213	163
Striped marlin, North Pacific	392	493	426	398	282
Striped marlin, South Pacific					
Other marlins	1	2		1	1
Swordfish, North Pacific	1,092	1,516	1,665	1,270	1,395
Swordfish, South Pacific					
TOTAL BILLFISH	2,410	2,919	2,864	2,300	2,148
Blue shark	0			1	16
Mako shark	70	59	53	52	68
Thresher	4	7	7	6	14
Other sharks	0			0	1
Oceanic whitetip shark				0	
Silky shark					
Hammerhead shark	0				
Tiger shark					
Porbeagle					
TOTAL SHARKS	75	66	60	59	98
Mahimahi	296	328	389	403	427
Moonfish	981	1,207	1,043	952	741
Oilfish	218	239	235	262	257
Pomfret	471	564	509	466	312
Wahoo	420	354	313	213	168
Other fish	9	8	6	10	9
TOTAL OTHER	2,394	2,700	2,495	2,307	1,914
GEAR TOTAL	15,148	15,835	13,603	12,447	11,827

Table 46. U.S. longline catch (mt) by species in the Eastern Pacific Ocean, 2012-2016.

	All U.S. vessels					U.S. vessels GT 24 m					U.S. vessels LE 24 m				
	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012
Vessels	123	131	126	120	102	25	30	34	30	29	98	101	92	90	73
Species															
Albacore, North Pacific	6	26	23	19	65	2	19	17	6	19	4	7	6	13	46
Albacore, South Pacific		0													
Bigeye tuna	2,087	3,050	2,073	2,043	875	334	553	508	587	309	1,753	2,497	1,564	1,457	565
Pacific bluefin tuna		0	0	0				0	0			0		0	
Skipjack tuna	28	25	11	11	7	6	5	2	3	2	23	20	9	8	5
Yellowfin tuna	249	134	61	43	39	68	38	18	23	23	181	96	43	20	16
Other tuna					0					0					
TOTAL TUNA	2,370	3,234	2,168	2,117	986	410	615	545	619	353	1,961	2,620	1,622	1,498	633
Black marlin	0			0	0						0			0	0
Blue marlin	78	131	76	59	21	7	9	17	14	4	71	123	59	45	17
Sailfish	2	2	4	1	1	0	0	1	0	0	2	2	2	1	1
Spearfish	60	59	44	38	17	7	6	9	9	5	53	53	35	29	12
Striped marlin, North Pacific	63	79	69	70	19	11	9	13	19	6	52	70	55	51	14
Striped marlin, South Pacific															
Other marlins		1			0		0		0	0	0	1		0	
Swordfish, North Pacific	454	826	786	687	495	255	347	388	279	217	199	479	397	408	279
Swordfish, South Pacific															
TOTAL BILLFISH	658	1,099	978	854	554	280	371	429	321	232	377	728	549	534	322

	All U.S. vessels					U.S. vessels GT 24 m					U.S. vessels LE 24 m				
	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012	2016	2015	2014	2013	2012
Blue shark	0				1	0				0	0				1
Mako shark	24	20	16	14	19	12	9	10	7	11	12	10	6	6	7
Thresher	0	2	1	1	1	0	0		0	1	0	1	1	1	1
Other sharks	0										0				
Oceanic whitetip shark															
Silky shark															
Hammerhead shark															
Tiger shark															
Porbeagle															
TOTAL SHARKS	25	21	17	14	21	12	10	10	7	12	12	12	7	7	9
Mahimahi	66	108	138	129	86	11	9	35	35	30	55	98	103	94	57
Moonfish	603	872	637	504	299	114	156	165	145	99	490	717	472	359	200
Oilfish	29	54	53	47	29	8	11	16	14	10	21	44	37	33	19
Pomfret	86	145	117	108	42	10	22	30	30	10	75	123	87	78	31
Wahoo	64	72	51	27	11	14	14	12	8	4	50	58	39	18	8
Other fish	0	0	0	0	0		0	0	0	0	0	0	0	0	0
TOTAL OTHER	849	1,252	997	814	468	157	212	258	231	153	691	1,040	739	583	315
GEAR TOTAL	3,901	5,606	4,160	3,800	2,029	859	1,207	1,243	1,178	750	3,042	4,399	2,917	2,622	1,279

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3 FISHERY ECOSYSTEMS

3.1 SOCIOECONOMICS

This section outlines the pertinent economic, social, and community information available for assessing the successes and impacts of management measures or the achievements of the Fishery Ecosystem Plan for the Pelagic Fisheries (Western Pacific Regional Fishery Management Council, 2016). It meets the objective "Support Fishing Communities" adopted at the 165th Council meeting; specifically, it identifies the various social and economic groups within the region's fishing communities and their interconnections. The section begins with an overview of the socioeconomic context for the region, then provides a summary of relevant studies and data for each jurisdiction, followed by summaries of relevant studies and data for each fishery within the jurisdiction.

In 1996, the Magnuson-Stevens Fishery Conservation and Management Act's National Standard 8 (NS8) specified that conservation and management measures take into account the importance of fishery resources to fishing communities, to provide for their sustained participation in fisheries and to minimize adverse economic impacts, provided that these considerations do not compromise the achievement of conservation. Unlike other regions of the U.S., the settlement of the Western Pacific region was intimately tied to the sea (Figure 129), which is reflected in local culture, customs, and traditions.

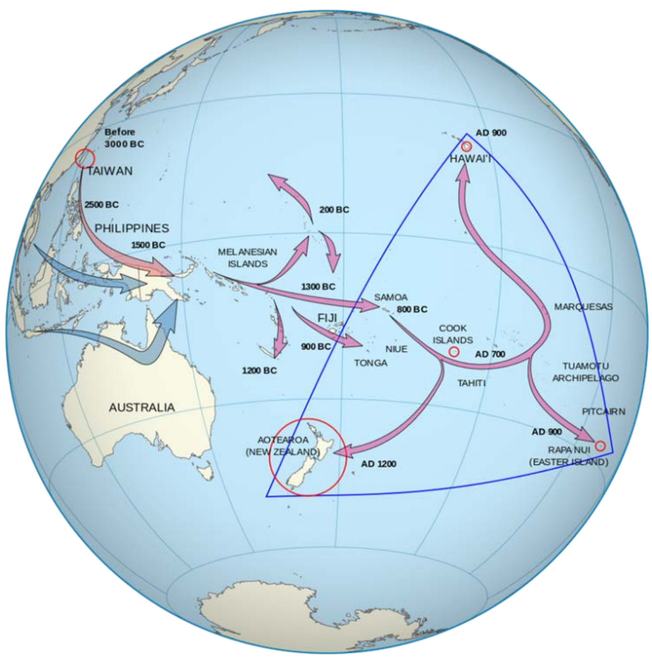

Figure 129. Settlement of the Pacific Islands, courtesy Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Polynesian_Migration.svg

Polynesian voyagers relied on the ocean and marine resources on their long voyages in search of new islands, as well as in sustaining established island communities. Today, the population of the region also represents many Asian cultures from Pacific Rim countries, which reflect similar importance of marine resources. Thus, fishing and seafood are integral local community ways of life. This is reflected in the amount of seafood eaten in the region in comparison to the rest of the United States, as well as the language, customs, ceremonies, and community events. It can also affect seasonality in prices of fish. Because fishing is such an integral part of the culture, it is difficult to cleanly separate commercial from non-commercial fishing, with most trips involving multiple motivations and multiple uses of the fish caught. While economics are an important consideration, fishermen report other motivations such as customary exchange as being equally, if not more, important. Due to changing economies and westernization, recruitment of younger fishermen is becoming a concern for the sustainability of fishing and fishing traditions in the region.

3.1.1 RESPONSE TO PREVIOUS COUNCIL RECOMMENDATIONS

At its 165th meeting held in Honolulu, HI, the Council reiterated its recommendation that NMFS expedite economic analysis on the impact of US purse seine effort limits on American Samoa. This analysis was completed and presented at the 168th Council meeting in Honolulu, HI (Western Pacific Regional Fishery Management Council 2016f).

In addition, the Council approved modifications to the FEP objectives, one of which is to identify the various social and economic groups within the region’s fishing communities and their interconnections, in support of fishing communities. This chapter meets this objective.

At its 166th meeting held in Tumon, Guam, the Council recommended NMFS PIFSC to conduct an economic survey in the CNMI to determine the expense and expenditure differences in fisheries between Saipan, Tinian, Rota and Guam to determine the differences between the islands as well as between the fishery sectors. The Council also recommended NMFS PIFSC design and implement a socio-economic survey to determine the fisheries opportunities and impacts of increased recent development in the CNMI, given the new hotels and casinos in Saipan. A small boat cost-earnings survey is scheduled for the Marianas in 2017-2018 that will address both of these recommendations.

In addition, the Council directed staff to develop a brief report identifying data sources, quality and coverage for each required socioeconomic parameter in the annual/SAFE reports, as resources permit. This report should also identify the quality and coverage of this data, as well as any gaps. This data synthesis was conducted and used to guide the development of this chapter.

The Council also directed the Plan Team to consider for future Annual/SAFE reports:

- to include the human perspective, the importance of the community, and the extended cultural and social values of fishing in the dashboard summary format. This chapter is the first effort at including the importance of community and extended cultural and social values into a SAFE report in this region.
- to break out trip costs by island for the CNMI sections of the report, as trip costs vary by island. This chapter provides a reference to existing data on island-specific trip costs.
- to explore partnering with the CNMI Department of Commerce on efforts to address socioeconomic data gaps in the CNMI SAFE/annual report. The CNMI Department of Commerce Statistical Yearbook was reviewed in the development of this chapter. Information on fishing as an occupation is only reported in aggregate with farming and forestry. In addition, fishing in CNMI is a continuum of commercial to non-commercial

activities that many do not consider a profession. For these reasons, occupational information was not included in this chapter. The other section relevant to fishing summarizes the amounts and values of commercial fish landings, which is already reported by PIFSC. In addition, the yearbook has not received new data on fish and fisheries since 2004.

- to include enhanced information on social, economic and cultural impacts of a changing climate and increased pressure on the ocean and its resources. PIFSC developed a Regional Action Plan and Climate Science Strategy as a first step in providing this information (Polovina et al., 2016).

The Council also recommended NMFS PIFSC to develop a study of the socio-economic impacts of the BRFAs on the Hawaii bottomfish fishery. Discussion of BRFAs is included in the Bottomfish Oral History project being conducted in 2017.

At its 168th meeting held in Honolulu, HI, the Council requested NMFS PIFSC provide information on catch and CPUE of troll vessels and continue analysis of economics in the American Samoa longline fishery. PIFSC Socioeconomics Program ongoing data collection program within the American Samoa longline will continue to collect trip-cost data to allow for net revenue analysis in the future.

In addition, the Council recommended that a counterfactual study of the American Samoa economy, using non-confidential macroeconomic metrics such as Gross Domestic Product (GDP) or available proxies, be undertaken, with specific regard to impacts of the ELAPS closure on the American Samoa economy as a whole. The Pacific Islands Regional Office (PIRO) is considering future work on this topic.

The Council also requested NMFS PIFSC Socio-Economics Program undertake a rollout of the “Community Snapshot Tool”, once available, to Council staff, PIRO staff, and other interested parties so that these groups know how to utilize the tool for policy analysis and other uses. The tool will begin development in 2017, starting with Hawaii. The tool will be rolled out when the Hawaii module is completed.

Finally, the Council requested the PIFSC socioeconomic program to complete the economic impact analysis of the monument expansion closure on the Hawaii longline fleet and broader fishing and seafood industries for Council review by October 30, 2016. This report was delivered to the Western Pacific Regional Fishery Management Council in early 2017

3.1.2 AMERICAN SAMOA

3.1.2.1 INTRODUCTION

As described in Chapter 1, fishing has played a crucial role in American Samoan culture and society since the Samoan archipelago was populated. An overview of American Samoa history, culture, geography, and relationship with the U.S. is described in Section 1.3 of the Fishery Ecosystem Plan for American Samoa (Western Pacific Regional Fishery Management Council, 2016a). Over the past decade, a number of studies have synthesized more specifics about the role of fishing and marine resources across American Samoa, as well as information about the people who engage in the fisheries or use fishery resources (see Armstrong, et al. 2011, Grace-

McCaskey 2015, Levine and Allen 2009, and Richmond and Levine, 2012). These studies describe the importance of marine resources in cultural, economics, and subsistence aspects of Samoan village life. Fishing was held in high esteem in traditional Samoan culture, with fishing skill bringing high social status and fishing activities figuring prominently in mythology. The basic units of Samoan social structure are the family and village, with the family as the central unit. The village leadership decided, according to season, what sort of community fishing should take place. The tautai, or master fisherman, of the village was a key decision maker who was awarded higher status than others (who might otherwise outrank him) when it came to matters of fishing. Village-level systems of governance and resource tenure are still largely intact, and Samoan cultural systems and representation are formally incorporated into the territorial government. Reciprocity is emphasized over individual accumulation. Gifts of food (especially fish and other marine resources) mark every occasion and maintain Samoan social structure to this day.

Recent studies have found that American Samoa is ethnically and culturally very homogeneous (Levine et al., 2016, Richmond and Levine 2012). Polynesians account for the vast majority (93%) of the territory's people, and the primary language spoken at home is Samoan (91%), although English is often spoken in school and business settings. Contemporary American Samoan culture is characterized by a combination of traditional Samoan values and systems of social organization, as well as the strong influence of Christianity. Maintaining *fa'a Samoa* or "the Samoan way" was considered a priority under the territorial constitution. Given the cultural homogeneity, nearly everyone in American Samoa accepts and complies with Samoan traditions of land and resource tenure.

However, over the last half century or more, fishing has become less prominent as a central and organizing community force. During this time, modern fishing gear and technology was introduced, tuna canneries became a major economic force in Pago Pago, the population more than tripled, and the gradual but continuous introduction of Western cultural norms and practices altered American Samoans' relationship with the sea. While many traditions and village-based systems of governance have been maintained, the islands have experienced a shift from a subsistence-oriented economy where sharing of fish catch was extremely important to a cash-based economy, where fishing is often viewed as a more commercial venture.

A recent study by Levine et al. (2016) found that American Samoans still consume seafood frequently, with 78% of respondents stating that they eat fish or seafood once a week or more. Most American Samoans purchase seafood from stores or restaurants, with 65% of survey respondents listing this as their first or second choice for obtaining seafood. Other common means for obtaining fish include markets and roadside vendors (45%) and fish caught by household members (37%). This corroborates Levine and Allen's (2009) observation that American Samoans largely rely on, and in many cases prefer, store-bought food to locally caught fish, with the majority of fish consumed in American Samoa imported from Samoa.

The introduction of outboard engines and other technology in the 1950s and 1960s allowed American Samoan boats to go farther and faster, but also made it necessary for boat owners and operators to sell a portion of their catch to pay for fuel and engine maintenance. The disruption of other traditional values, as well as the introduction of a cash economy based primarily on government jobs and cannery employment, also decreased reliance on traditional, subsistence fishing and allowed commercial fishing to develop on the islands (Levine and Allen, 2009).

Unlike other areas within the Western Pacific Region, American Samoa also experienced the development of domestic industrial-scale fisheries, including tuna processing, transshipment, and home port industries. This is due to the excellent harbor at Pago Pago, 390,000 km^2 of EEZ, and certain special provisions of U.S. law, which allowed the development of American Samoa's decades-old fish processing industry. For example, the territory is exempt from the Nicholson Act, which prohibits foreign ships from landing their catches in U.S. ports, and American Samoan products with less than 50 percent market value from foreign sources enter the U.S. duty free.

The two most important economic sectors are the American Samoa Government (ASG), which receives income and capital subsidies from the federal government, and tuna canning. According to the Statistical Yearbook (American Samoa Government, 2015), main imports include fish brought in for processing. Exports are primarily canned tuna and by-products, including fish meal and pet food. In 2015, domestic exports (including reexports) from American Samoa amounted to $387,554,000, of which $365,587,000 (or 94%) comprised canned tuna (American Samoa Government, 2015). Private businesses and commerce comprise a smaller third sector. Unlike some of its South Pacific neighbors, American Samoa has never had a robust tourist industry.

In 2015, the ASG employed 6,804 people (38 percent of total employment; American Samoa Government, 2015, p. 117), and the private sector employed 8,290 people (Figure 130). Two canneries employed 2,759 people, which is 16% of the people employed. Ancillary businesses involved in re-provisioning the fishing fleet generate a significant number of jobs and amount of income for local residents.

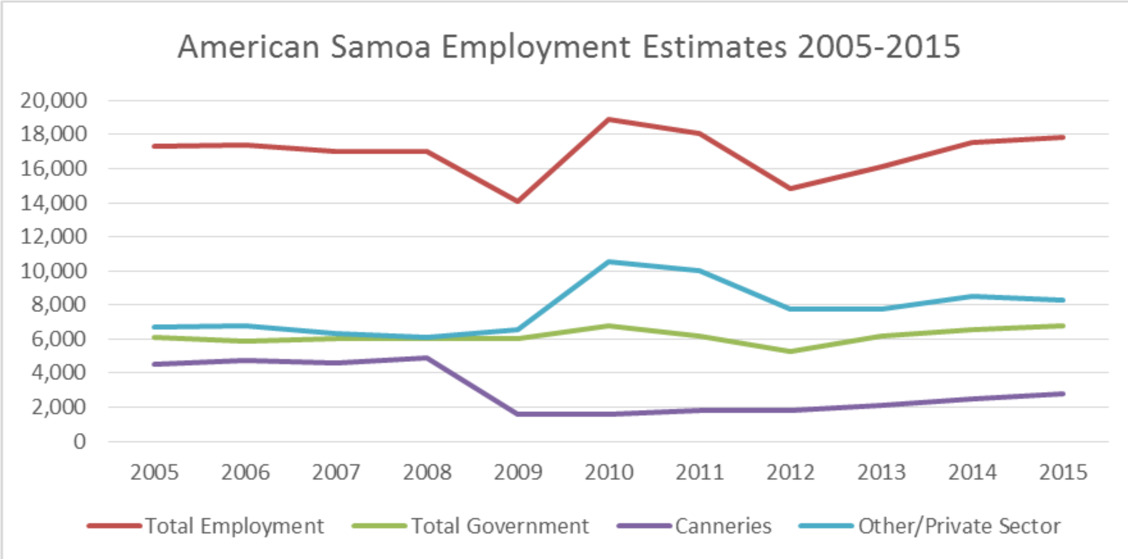

Figure 130. American Samoa Employment Estimates, 2005-2015. Data from American Samoa Statistical Yearbook 2015, American Samoa Government (2015).

The canneries have been operating since 1954, represent the largest private-sector source of employment in the region, and, until recently, were the principle industry in the territory. Although as many as 90% of cannery workers are not American Samoa citizens, the canneries play a large role in the American Samoa economy, e.g. via delivery of goods or services to tuna processors and expenditures and buying patterns of cannery workers. Trends in world trade, specifically reductions in tariffs, have been reducing the competitive advantage of American Samoa's duty-free access to the U.S. canned tuna market, and the viability of the canneries has been questionable for almost a decade. In 2009, the Chicken of the Sea cannery closed, resulting in a loss of approximately 2,000 jobs. It was bought by Tri Marine International, which invested $70 million in rebuilding and expansion, and reopened in 2015. In October, 2016, SunKist Co. suspended operations due to lack of fish, in part due to Effort Limit Area for Purse Seine (ELAPS) closures (Pacific Islands Report, 2016). That same month, Tri Marine International announced that it would suspend production indefinitely in December 2016 (Honolulu Star Advertiser, 2016), and there are currently no plans to reopen (Pacific Islands Report, 2017). Tuna cannery closures in American Samoa are likely to have significant impacts on the American Samoa economy and communities, although the specifics are unknown.

Even before Tri Marine International's closure, American Samoa's economy was identified as being in a highly transitional state that should be monitored closely (Grace McCaskey, 2015). It will be important to monitor any changes and developments related to the tuna industry, given the historically close connection between the tuna canneries, employment levels, population trends, and the economic welfare of the territory. It is also possible that increased federal aid in recent years has masked the full extent of the economic recession.

Members of the American Samoa fishing community have also expressed concerns about the impact of National Marine Sanctuary of American Samoa (NMSAS) expansion and management of the Rose Atoll Marine National Monument on fishing activities. In both of these cases, the local communities have been concerned about the impacts on fishing practices as well as broader social and cultural issues, such as traditional marine tenure and the ability of villages to manage their own resources.

3.1.2.2 PEOPLE WHO FISH

Few studies have been conducted that include demographics or other information about people who fish in American Samoa. Information at the fishery level will be reported in the fishery specific sections below. Qualitative research has resulted in some general observations about trends in fishing by American Samoans.

One household survey by Levine et al. (2016) found that over half of residents participate in fishing or gathering of marine resources. Approximately 15% reported fishing once a week or more and over 30% of households stated that they engaged in fishing or gathering at least once a month. Commercial fishing is very uncommon in American Samoa, only 3% of those who fish stated that they frequently fished to sell their catch, and 62% never sell their catch. More commonly, people fish to feed themselves and their family, or to give to extended friends, family, pastors, and village leaders.

While fishing and marine resources are universally considered to be important aspects of fa’a Samoa, access to cash income has made American Samoans less inclined to engage in strenuous fishing activities when food imports are so readily available (Levine and Allen, 2009). Only a small number of American Samoans, engage in boat-based or commercial fishing. Although unemployment in the territory has increased, the percentage of individuals participating in subsistence activities (including fishing for food or home use) decreased between 2000 and 2013 (Grace McCaskey, 2015). However, a large number of island residents have been employed by the canneries in Pago Pago, which facilitated the ready availability of low-cost fish for many islanders, meaning the livelihood and economy of American Samoans are still tightly tied to fishing activities.

As described in the Fishery Ecosystem Plan for American Samoa (Western Pacific Regional Fishery Management Council, 2009a), American Samoans have been discouraged from working on foreign longline vessels delivering tuna to the canneries for a number of reasons, including harsh working conditions, low wages, and long fishing trips. While American Samoans prefer employment on the U.S. purse seine vessels, the capital-intensive nature of purse seine operations limits the number of job opportunities for locals in that sector as well.

Local fishermen have indicated an interest in participating in the more lucrative overseas market for fresh fish. However, they are limited by inadequate shore-side ice and cold storage facilities in American Samoa and infrequent and expensive air transportation links.

As noted by Levine and Allen (2009), the trend of decreasing reliance on local fish as a food source is reflective of a society that has been undergoing a shift from a subsistence-oriented economy to a cash economy. Changes such as a decrease in leisure time, a shift in dietary preferences towards store-bought foods or a preference to buy fish at the market rather than expend effort in fishing, and increased availability of inexpensive imported reef fish from Western Samoa and Tonga, also may be contributing to decreasing rates of subsistence fishing (Richmond and Levine, 2012).

3.1.2.3 COSTS OF FISHING

The American Samoa longline continuous economic data collection program started in 2006, the same time as the Pacific Islands Regional Office (PIRO) started their observer program in the fishery. Different from the Hawaii longline that targets bigeye tuna and swordfish, the American Samoa longline mainly targets albacore. Fisher participation in the economic data collection program is voluntary. The project is designed to collect data from all observed trips. Observers accompanied fewer than 10% of the American Samoa based longline fishing trips during the period 2006-2009; observer coverage increased to 25% in 2010 and 33% in 2011, then fell significantly in 2012 to 20%. In addition, some of the observed trips only had the observers cover partial of the trips, due to the long trip length, in that cases, it was difficult for observers to collect trip cost data when they left the trips before it ended. In an effort to increase the number of observations for the economic data collection program, PIFSC economists began to supplement observer data with in-person interviews of owners or agents starting in 2012. The latter effort has doubled the sample size compared when only the observers collected the cost data.

Similar to the Hawaii longline fisheries continuous economic data collection program, the American Samoa continuous economic data collection obtains information on the fishery via a form requesting data on 10 variable cost items common to American Samoa longline trip expenditures, excluding labor costs. For some cost items, including diesel fuel, engine oil, and bait, information is collected on unit price, quantity used, and total cost. For other items, including boat freezer operating costs/ice, gear, provisions, communications, and miscellaneous items, information is collected on total cost only. Additional information is also collected about the vessel operator and crew. The total number of crewmembers, and the subset who are not United States or American Samoa nationals, is collected. Survey forms are produced and available in first languages (English and Samoan) to ease survey burden.

These data are currently under PIFSC editorial review and future versions of this report will include a time-series of American Samoa longline trip costs. Metadata for these data are available online (PIFSC, 2016a). Other relevant cost information in Pan et al., (2017) include estimates of annual fishing expenditures (fixed costs) and levels of investment in the fishery from a 2009 cost-earnings survey.

Since 2009, PIFSC economists have maintained a continuous small boat economic data collection program in American Samoa through collaboration with the PIFSC Western Pacific Fisheries Information Network (WPacFIN). The economic data collection gathers fishing expenditure data for boat-based reef fish, bottomfish, and pelagic fishing trips on an ongoing basis. Data for fishing trip expenses include; gallons of fuel used, price per gallon of fuel, cost of ice used, cost of bait & chum used, cost of fishing gear lost, and the engine type of the boat. These economic data are collected from same subset of fishing trips as the boat-based creel survey carried out by the local fisheries management agencies and WPacFIN.

These data are currently under PIFSC editorial review and future versions of this report will include a time-series of American Samoa boat-based trip costs by target species and/or gear. Metadata for these data are available online (PIFSC, 2016b).

3.1.2.4 AMERICAN SAMOA LONGLINE

The canneries used to buy fish from the small-scale domestic longline fleet based in American Samoa, although the quantity of this fish was insignificant compared to cannery deliveries by the U.S. purse seine, U.S. albacore and foreign longline fleets. Pan (2015) observed that at the end of 2013, the majority of the vessels in the American Samoa fleet were tied up at dock, and 18 vessels posted “For Sale” signs. They noted that the collapse of the fishery seemed inevitable due to the poor economic performance resulting from the continuous decline in CPUE, increases in fuel prices, and a sharp drop in albacore prices in 2013. A cost-earnings study conducted in 2009 had already indicated a thin profit margin and significant economic challenges encountered by the longline fleet (Arita and Pan 2013). The small-scale alia fleet has been reduced to one vessel that still operates.

3.1.2.4.1 Commercial Participation, Landings, Revenue, Prices

Data for 2016 commercial participation, landings, revenue, prices, was unavailable at the time of publication but will be included in the 2017 Pelagics Annual Report.

3.1.2.4.2 Economic Performance Measures

NOAA Fisheries has established a national set of economic performance indicators to monitor the economic health of the nation’s fisheries (Brinson et al., 2015). The PIFSC Socioeconomics Program has used this framework to evaluate select regional fisheries; specifically, the American Samoa Longline, Hawaii Longline, and Main Hawaiian Islands (MHI) Deep 7 bottomfish fisheries. These indicators include metrics related to catch, effort, and revenues. This section will present revenue performance metrics of; (a) total fishery revenues, (b) fishery revenue per trip, (c) Gini coefficient, and (d) the share of annual revenues from the fishery.

The American Samoa longline fishery only includes landings in American Samoa by American Samoa longline permitted vessels, it does not include the bigeye landings in Hawaii by the dual (Hawaii and American Samoa) permitted vessels. The American Samoa longline fishery is a limited entry fishery with a maximum of 60 permits. Under the limited access program, NMFS issued a total of 60 initial longline limited entry permits starting from 2005 to qualified candidates. The American Samoa longline limited entry permit is required for anyone using longline gear to fish for pelagic species within the EEZ around America Samoa or anyone landing or transshipping pelagic species in American Samoa that were caught within the EEZ around American Samoa. The total active permits (vessels) fishing in the South Pacific Ocean and landed in American Samoa in 2016 was 20. The American Samoa longline permit may be used to fish with longline gear in the EEZ around Guam, the CNMI, and the Pacific Remote Island Areas; and to land catch in those areas. It may not be used to fish with longline gear in the Hawaii EEZ.

Data on Aggregate Landings; Active Vessels; Trips; Days at Sea; Aggregate Revenue from Species in Fishery; and data for revenue per vessel calculation (for Gini coefficient) are from Pacific Islands Fisheries Science Center, Fisheries Research and Monitoring Division. The Gini coefficient measures the equality of the distribution of revenue among active vessels in the fishery. A value of zero represents a perfectly equal distribution of revenue amongst these vessels, whereas, a value of one represents a perfectly unequal distribution, in the case that a single vessel earns all of the revenue.

Trends in fishery revenues are shown Figure 129 while trends in revenue distribution are shown in Figure 132. Supporting data are provided in Table 47.

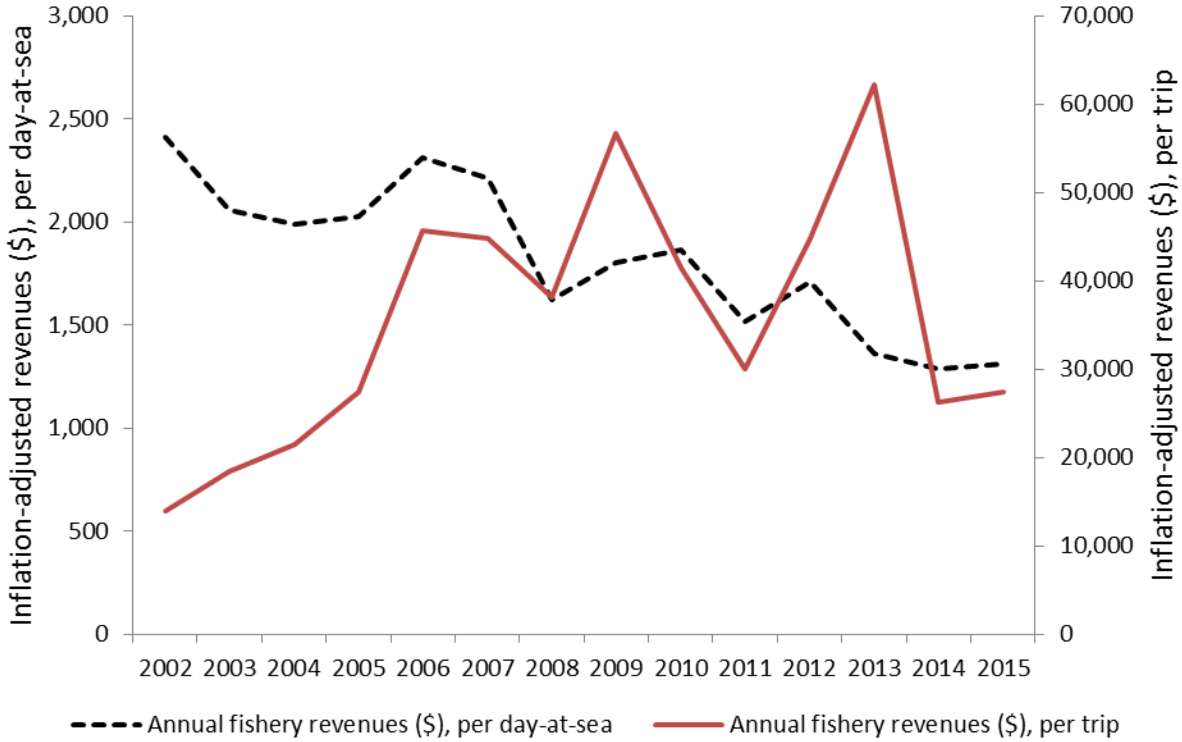

Figure 131. Trends in fishery revenues for the American Samoa longline fishery

Figure 132. Trends in revenue distribution for the American Samoa longline fishery

Table 47. American Samoa longline fishery economic performance measures

Year	Annual fishery revenues ($)[1], per vessel	Annual fishery revenues ($)[1], per trip	Annual fishery revenues ($)[1], per day-at-sea	Gini coefficient
2002	369,767	13,980	2,412	0.58
2003	328,145	18,467	2,056	0.49
2004	336,822	21,420	1,991	0.51
2005	344,534	27,441	2,026	0.47
2006	565,379	45,621	2,310	0.28
2007	621,814	44,857	2,209	0.23
2008	389,432	38,154	1,625	0.34
2009	464,577	56,709	1,803	0.26
2010	456,841	41,531	1,866	0.28
2011	371,242	29,999	1,519	0.29
2012	382,541	44,802	1,710	0.34
2013	294,027	62,198	1,361	0.27
2014	224,650	26,228	1,285	0.41
2015	270,834	27,476	1,309	0.42

Source: Pacific Islands Fisheries Science Center: Fishery Economic Performance Measures. Pacific Islands Fisheries Science Center, https://inport.nmfs.noaa.gov/inport/item/46097

[1] Inflation-adjusted revenue (in 2015 dollars) uses the American Samoa Consumer Price Index (ASCPI) to convert nominal into real values for the American Samoa longline fishery. The ASCPI is based on the Yearbook (http://doc.as.gov/research-and-statistics/statistical-yearbook/) for 2009-2014 and *CPI: Economic Report: The Minimum Wage in American Samoa*, 2007 (https://www.dol.gov/whd/AS/EconomicReport-2007.pdf) for the years 2006-2007 when the Yearbook is not available (published). The ASCPI adjustment factor time series used for this analysis can be found here: https://www.pifsc.noaa.gov/wpacfin/as/Data/Pelagic/apel18main.htm

3.1.2.5 American Samoa Purse-Seine Fishery

In 2015, the purse seine fishery experienced an Effort Limit Area for Purse Seine (ELAPS) closure, reaching its fishing day limit in June and remaining closed for the remainder of 2015. A study was conducted to analyze the financial and economic impacts of the 2015 ELAPS closure and identify and evaluate connectivity between fishing activity and the broader American Samoa economy (Western Pacific Regional Fishery Management Council, 2016f). The analysts compared the ELAPS closure to two counterfactual scenarios: (1) a closure without ELAPS, which is the average of 2012 to 2014, and (2) the average of 2013 and 2014. The study found that the closure of the ELAPS in 2015 appeared to result in overall losses to the combined sectors of vessels, canneries and vessel support companies into the two counterfactual periods. The tuna canning industry is highly dependent on the purse-seine fleet. The ELAPS closure significantly impacted the vessels, shore-side processing, and the economy. Cannery operations recently were suspended, in part due to lack of fish supply.

3.1.2.5.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the American Samoa longline and troll fisheries. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports.

3.1.2.6 AMERICAN SAMOA TROLL

According to Levine and Allen (2009), until 1995, boat-based fishing in was primarily trolling and bottomfish handlining, with the pelagic fishery in American Samoa being largely troll-based. In 1996, the majority of trolling fishermen converted their alias to longlining, especially larger commercial trollers, although some continued to troll occasionally. Consequently, the fishery has experienced a decline in its catch and effort. In 1996, 7 of the 35 trolling vessels rarely sold catch; their captains primarily fished for recreation on weekends, holidays, or competed in fishing tournaments. By 2001, longlining became the dominant fishing method in American Samoa and the number of trolling boats and their total catch dropped dramatically.

3.1.2.6.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the American Samoa troll fishery. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports.

3.1.2.7 AMERICAN SAMOA CHARTER SPORT FISHERY

As described by Markrich and Hawkins (2016) and Grace McCaskey (2015), recreational fishing (defined in the MSA as fishing purely for sport or pleasure) is historically uncommon in American Samoa. There are few tourists and vessels, a small non-commercial fishing supply sector, and little in the way of supporting infrastructure, such as boat ramps and municipal dock space.

However, tournament fishing for pelagic species began American Samoa in the 1980s, and typically around 20 vessels participate. The Pago Pago Game Fishing Association was founded in 2003 and today has more than 40 members. They hold several one-day tournaments throughout the year, as well as one multi-day tournament, the high-profile Steinlager I'a Lapo'a International Game Fishing Tournament, which attracts participants from Samoa and even New Zealand and Australia. Catch from tournaments is often sold, as most of the entrants are local small-scale commercial fishermen. Although the tourism industry is small in the territory, the PPGFA and the I'a Lapo'a Tournament have done a great deal to increase awareness of angling opportunities available in American Samoa.

3.1.3 CNMI

3.1.3.1 INTRODUCTION

An overview of CNMI history, culture, geography, and relationship with the U.S. is described in Section 1.3 of the Fishery Ecosystem Plan for the Mariana Archipelago (Western Pacific Regional Fishery Management Council, 2016c). The Commonwealth of the Northern Mariana

Islands (CNMI) are at the northern end of the archipelago. Over the past decade, a number of studies have synthesized more specifics about the role of fishing and marine resources across CNMI, as well as information about the people who engage in the fisheries or use fishery resources.

The ancestors of the indigenous Chamorros first arrived in the Marianas around 3,500 years ago and relied on seafood as their principal source of protein (see Chapter 1, Allen and Amesbury 2012, and Grace McCaskey 2014). Similar to other archipelagos in the Western Pacific, fish and marine resources have played a central role in shaping the social, cultural, and economic fabric of CNMI that continues today. They fished for both reef and pelagic species, collected mollusks and other invertebrates and caught sea turtles. The occupation of CNMI by foreign nations dramatically changed the island’s ecosystems, reshaped communities, and disrupted fishing traditions. In the 17th and 18th centuries, Spanish colonizers destroyed the Chamorros’ seagoing canoes, suppressed offshore fishing practices, and relocated populations from their traditional home. CNMI was briefly occupied by Germany from 1899 to the beginning of WWII. During WWII, CNMI was occupied by the Japanese military, and then was captured by the United States. Throughout this time, fishing has remained an important activity. Later immigrants to the islands from East and Southeast Asia also possessed a strong fishing tradition. Today, only Saipan, Rota, and Tinian are permanently inhabited, with 90% of the population on the island of Saipan.

3.1.3.2 PEOPLE WHO FISH

Allen and Amesbury (2012) summarized results of studies that demonstrated the sociocultural importance of fishing to Saipan residents. In a 2005 study, most of the active or commercial fishermen who responded to the survey had fished more than 10 years. They most often participated in snorkel spear fishing at night (participated in by 73% of the fishermen) and snorkel spear fishing during daytime (58% of the fishermen), followed by hook-and-line less than 100 ft. deep (36%), trolling (21%) cast net (talaya; 14%) hook-and-line more than 100 ft. deep (9%), trapping (octopus, crabs, etc.; 19%), foraging the reef (8%); 18% said they participated in one or more other techniques. Less than a third (30%) said they owned a boat. Their primary reasons for fishing were social and cultural, including that they just really like fishing (32%), they need the fish to feed their family (23%), giving catch to family and friends strengthened social bonds (13%), their family has always fished (12%), and it strengthens bonds with their children/family (6%). Only 4% said they needed the money from the fish they sold. Other motivations included strengthening the bond with their fellow fishermen, fishing to catch fish for fiestas/parties, and seasonal fishing for manahak, ti'ao, and i'e (2% each).

The fishermen reported fishing an average of 71 days a year, with 26% going once every 2-3 days and 24% fishing once every 2 weeks. They also reported a decrease in their amount of fishing over time, fishing an average of 93 days a year 10 years ago. Saipan reef fish were the most frequently caught species (caught by 54% of the fishermen), followed by shallow-water bottomfish (23%) and reef invertebrates such as octopus, shellfish and crabs (14%).

As in other parts of the region, much of their catch was consumed by themselves and immediate family (70%), with another 20% consumed by extended family and friends. Only 8% of the catch was sold. Only 18 respondents identified themselves as commercial fishermen. They reported a median monthly income of $200 from fishing, with a mean (average) of just over $1,000. Costs exceeded sales for almost every income category of fishermen, suggesting that for most fishermen, fishing is not a business but rather that they sell their catch simply to recover some of the costs.

While fish remains an important part of the local diet and an integral part of the people's history and culture, adaptation to and integration with a more westernized lifestyle appears to have changed people's diets on Saipan. Nearly half (45%) of the survey respondents reported eating "somewhat less fish" than they did 10 years ago, although the majority still ate fish between 1 and 3 times a week. The majority also purchased their fish from a store or restaurant (40%) while 31% purchase fish from roadside vendors. Less common was acquiring fish from an extended relative/friend (13%) or their own catch (11%). Most of the fish consumed came from the U.S. mainland (41%), while the next most important source was from inside Saipan's reef (31%), deep water or pelagic fish caught off Saipan (23%), or imported from other Pacific islands such as Chuuk (10%).

Few other surveys have been conducted on fishing in general in CNMI. A household survey conducted in 2012 found that 37% of respondents said they or someone else in their household was a fisherman (Kotowicz and Allen, 2015). Respondents from fishing households tended to be younger, have lower education levels, and have a higher rate of unemployment than respondents from non-fishing households.

The designation of the Marianas Trench Marine National Monument (the Monument) in 2009 has resulted in concerns about loss of fishing access (see Richmond and Kotowicz, 2015, Kotowicz and Richmond, 2013, and Kotowicz and Allen, 2015). Despite long distance, high cost, and inconvenience, travel to the areas now protected by the Monument were rare but culturally significant events, and fishing was an essential component.

3.1.3.3 COSTS OF FISHING

Since 2009, the PIFSC Socioeconomics Program has maintained a continuous economic data collection program on Saipan through collaboration with the PIFSC Western Pacific Fisheries Information Network (WPacFIN). The economic data collection program gathers fishing expenditure data for boat-based reef fish, bottomfish, and pelagic fishing trips on an ongoing basis. Data for fishing trip expenses include; gallons of fuel used, price per gallon of fuel, cost of ice used, cost of bait & chum used, cost of fishing gear lost, and the engine type of the boat. These economic data are collected from same subset of fishing trips as the boat-based creel survey carried out by the local fisheries management agencies and WPacFIN.

These data are currently under PIFSC editorial review and future versions of this report will include a time-series of Saipan boat-based pelagic trip costs by target species and/or gear. Metadata for these data are available online (PIFSC, 2016b).

Island-specific (Saipan, Tinian, and Rota) trip cost estimates from 2011 for pelagic fishing trips are available in Hospital and Beavers (2014). Other relevant cost information in Hospital and Beavers (2014) include estimates of annual fishing expenditures (fixed costs) and levels of investment in the fishery.

3.1.3.4 CNMI TROLL

While proportionally few residents own a boat, more than 400 vessels were registered in the CNMI small boat fleet between 2010 and 2011 (see Allen and Amesbury, 2012 for review). More than 200 of the vessels were active and operating in CNMI waters, and more than 100 of the vessels were involved in fishing activities. The active small boat fleet targets tunas, other small pelagics (through trolling), and bottomfish, although with the increases in the price of gas, pelagic fishing has dropped off somewhat. The fish are marketed locally, given away to family and friends, or used for ceremonial purposes such as parties, culturally significant fiestas, and each village's patron saint's day.

On Saipan, fisheries managers estimated the active small boat fleet at approximately 100 vessels in 2010-2011. Full-time commercial fishing is primarily conducted by ethnic nonindigenous minorities, namely Filipino residents (who fish primarily as independent owners and/or operators) and recent immigrants from the Federated States of Micronesia (who are primarily employed for wages). Chamorro and Carolinians, in contrast, primarily fish for recreational and subsistence purposes, selling catch to recoup costs. A few vessel owner operators are considered "pescadors", a term used to refer to fishermen who provide fish for important community and familial events. Pescadors customarily provide 100-200 lbs of reef fish for cooked dishes and pelagic species for kelaguen (a raw fish dish) for community and family celebrations. The system of seafood distribution underwent significant changes from approximately 2000-2010 with the establishment of large seafood vendors. In contrast to individual fishermen/vendors who only market their own catch, large vendors typically own and operate a number of vessels and purchase catch from independent fishermen to sell, which is reportedly depressing prices. In addition, increases in fuel prices, low market prices for fish, and downturns in the domestic economy have led to a general decline in participation in this fishery since 2000, with respect to numbers of fishermen, trips, landings, and seafood purchasers. The Saipan Fishermen's Association (SFA) is a nonprofit organization established in 1985 that holds annual fishing derbies and participated in community involvement projects, such as beach cleanup.

On Tinian, estimates of fleet size range from 15 to 20 vessels in 2010-2011. An estimated 1-3 fishermen fished consistently with the primary intent of selling fish. Respondents suggested that fishing and eating of fish was more habitual, rather than geared toward a particular event. Increasing fuel prices have reportedly led to the decline in number of active fishermen, and fishermen frequently sell fish to cover fuel costs. Three restaurants and two stores in Tinian purchase fish, although fishermen also sell house to house and commonly have an established clientele. A few charter boats serve tourist clientele, however they do not land much catch and even trolling trips serve more as photo opportunities. Charter boats are reportedly owned by nonlocal residents and target tourists from their country of origin (Japan, China, or Korea).

On Rota fishermen target pelagic species when in season, fishing for bottomfish the rest of the year. Like on the other islands, the number and activity of fishermen have declined as a result of increased fuel prices. Family members will often make requests for certain kinds of fish, but they will also contribute money to purchase fuel for a fishing trip. In addition, fishermen will often check demand with local restaurants, based on fuel prices. In 2010-2011, fishermen sold catch to 3 restaurants, or to neighbors and friends within the community (door to door or from a cooler on the roadside). One general store in sold fish caught by a family member, who fishes specifically to sell. Rota holds one fishing derby in celebration of San Francisco, the saint of their island.

A survey of the small boat fleet was also conducted in 2011 (see Hospital and Beavers, 2014 for full report). On average, respondents were 41 years old and had been boat fishing for an average of 15 years, providing evidence of a deep tradition of boat fishing in the CNMI. They were more likely to identify themselves as Chamorro relative to the general population of the CNMI, although they were equally likely to have been born in the CNMI. In general, small boat fishermen were more educated then the general population and of comparable affluence. Pelagic trolling as the most popular gear type, followed by deepwater bottomfish fishing, shallow-water bottomfish, and spear fishing. Most (71%) fishermen reported fishing at a Fish Aggregating Device (FAD) during the past 12 months, and on nearly 22% of their fishing trips. A high degree of seasonal fishing effort was reported across most subgroups of the fleet, although fishermen on Tinian and Rota were more likely to fish year-round.

A majority of fishermen (74%) reported selling at least a portion of their catch in the past 12 months. However, less than half (43%) of survey respondents indicated that they could always sell all the fish that they wanted. A significant percentage of fish caught was consumed at home (28%) or given away to relatives, friends, or for cultural events (38%), reflecting the strong family and social connections associated with fishing in the CNMI. Approximately 29% of fish catch was sold, with the remaining catch either released (2%) or exchanged for goods and services (3%). Even fishermen who regularly sell fish still retain approximately 22% of their catch for home consumption and participation in traditional fish-sharing networks and customary exchange. Additionally, 86% of respondents considered the pelagic fish they catch to be an important source of food. These findings validate the importance of fishing in building and maintaining social and community networks, perpetuating fishing traditions, and providing fish to local communities as a source of food security.

Fishing in the CNMI is a social activity; only 3% of fishermen reported to fish alone, while 70% reported that their boat is used without them on occasion. In addition, the majority of fishermen (57%) agreed that as a fisherman, they are respected by the greater community. While nearly a third of respondents were neutral (27%) and some were hesitant to express an opinion or simply did not know (13%), the study found that very few (3%) felt that they were not respected by the community.

Overall, the CNMI small boat fisheries are a complex mix of subsistence, cultural, recreational, and quasi-commercial fishermen whose fishing behaviors provide evidence of the importance of fishing to the people of the CNMI. For nearly all fishery participants, the social and cultural motivations for fishing far outweigh any economic prospects. Nearly all fishermen supplement their income with other jobs and are predominantly subsistence fishermen, selling occasionally to recover trip expenses.

3.1.3.4.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the CNMI troll fishery. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports.

3.1.4 GUAM

3.1.4.1 INTRODUCTION

An overview of Guam's history, culture, geography, and relationship with the U.S. is described in Section 1.3 of the Fishery Ecosystem Plan for the Mariana Archipelago (Western Pacific Regional Fishery Management Council, 2016c). Guam is the largest and southernmost island of the archipelago. It is also the largest and most heavily populated island in Micronesia. Over the past decade, a number of studies have synthesized more specifics about the role of fishing and marine resources across Guam, as well as information about the people who engage in the fisheries or use fishery resources.

The ancestors of the indigenous Chamorros first arrived in the Marianas around 3,500 years ago and were expert fishermen and seafarers, relying on seafood as their principal source of protein (see Chapter 1, Allen and Bartram, 2008, Grace McCaskey 2014, Hospital and Beavers 2012). They fished on the high seas in large sailing canoes (proas) and used numerous methods to catch reef and bottomfish from boats Similar to other archipelagos in the Western Pacific, fish and marine resources have played a central role in shaping the social, cultural, and economic fabric of Guam that continues today. Chamorros fished for both reef and pelagic species, collected mollusks and other invertebrates and caught sea turtles.

The occupation of Guam by foreign nations dramatically changed the island's ecosystems, reshaped communities, and disrupted fishing traditions. In the 17th and 18th centuries, Spanish colonizers destroyed the Chamorros' seagoing canoes, suppressed offshore fishing practices, and relocated populations from their traditional home. Following the Spanish-American War in 1898, the U.S. Navy took control of Guam, until it was occupied by Japan from 1941 to 1944. Guam became a U.S. territory in 1950, and the U.S. military is currently in the process of building up an even greater presence on the island. Throughout this time, fishing has remained an important activity, although by the beginning of the American period in 1898, the indigenous inhabitants had lost many of their seafaring and fishing skills and even the native names of many of the offshore species. Later immigrants to the islands from East and Southeast Asia also possessed a strong fishing tradition. In 2000, for Guam's population that identified as a single ethnicity 37% were Chamorro, followed by 32% Asian (about 80% of whom were Filipino), 17% other Pacific Islander, 7% white and 1% black. Despite rapid socioeconomic change, households still reflect the traditional pattern of extended families with multigenerational clustering of relatives, especially in Guam's southern villages. Social occasions such as neighborhood parties, wedding and baptismal parties, wakes and funerals, and especially the village fiestas that follow the religious celebrations of village patron saints all require large quantities of fish and other traditional foods, reflecting the role of fish in maintaining social ties and cultural identities. Sometimes fish are also sold to earn money to buy gifts for friends and relatives on important Catholic religious occasions such as novenas, births and christenings, and other holidays.

Since the late 1970s, Guam's most important commercial fisheries activity has been its role as a major regional fish transshipment center and resupply base for domestic and foreign tuna fishing fleets. Services provided include fueling, provisioning, unloading, air and sea transshipment, net and vessel repairs, crew repatriation, medical care, and warehousing. Among Guam's advantages as a home port are well-developed and highly efficient port facilities in Apra Harbor; an availability of relatively low-cost vessel fuel; a well-established marine supply/repair industry;

and recreational amenities for crew shore leave. In addition, the territory is exempt from the Nicholson Act, which prohibits foreign ships from landing their catches in U.S. ports. Initially, the majority of vessels calling in Apra Harbor to discharge frozen tuna for transshipment were Japanese purse seine boats and carrier vessels. In the late 1980s, Guam became an important port for Japanese and Taiwanese longline fleets, but port calls have steadily declined and the transshipment volume has also declined accordingly. By the early 1990s, an air transshipment operation was also established on Guam. Fresh tuna was flown into Guam from the Federated States of Micronesia and elsewhere on air cargo planes and out of Guam to the Japanese market on wide-body passenger planes. Further, vessels from Japan and Taiwan also landed directly into Guam where their fish was packed and transshipped by air to Japan. A second air transshipment operation began in the mid-1990s; it was transporting to Europe fish that did not meet Japanese sashimi market standards, but this has since ceased operations. Moreover, the entire transshipment industry has contracted markedly with only a few operators still making transshipments to Japan. Annual volumes of tuna transshipped of between 2007 and 2011 averages about 3,400 mt, with a 2012 estimate of 2,222 mt, compared to over 12,000 mt at the peak of operations between 1995 and 2001. As early as 2006, it was noted that the Port of Guam had lost much of its competitive advantage compared to alternative transshipment locations in the western Pacific and elsewhere, a trend that may not be reversible.

Otherwise, commercial fisheries have a relatively minor contribution to Guam’s economy; the social and cultural importance of fisheries in Guam dwarfs their commercial value. Nearly all Guam domestic fishermen hold jobs outside the fishery, with fishing typically supplementing family subsistence. High value is placed on sharing one’s fish catch with relatives and friends, and this social obligation extends to part-time and full-time commercial fishermen alike. A 2005 survey of Guam households found that nearly one-quarter (24 percent) of the fish consumed was caught by the respondent or an immediate family member, and an additional 14 percent was caught by a friend or extended family member (Allen and Bartram, 2008). However, a little more than half (51 percent) of the fish consumed was purchased at a store or restaurant and 9 percent was purchased at a flea market or from a roadside stand. The same study found that annual seafood consumption in Guam is estimated to be about 60 lbs per capita, with approximately 43% imported from the U.S.

The Westernization of Guam, particularly since World War II, not only resulted in a transition from a subsistence to wage-based economy but also contributed to dramatic changes in eating patterns, including lower seafood consumption. Indeed, recent years have seen steady declines in the market demand for fresh local fish across Guam (Hospital and Beavers, 2012). While some families continue to supplement their diet by fishing and farming, no existing communities are completely dependent on local fishing as a source of food. A household survey conducted in 2016 found that only 29% of respondents participate in fishing (National Coral Reef Monitoring Program, 2016a).

As recently as the early 1970s, relatively few people in Guam fished offshore, because boats and deep-sea fishing equipment were prohibitively expensive (Allen and Bartram, 2008). During the economic boom from the late 1980s through most of the 1990s, Guam developed a small boat fishery that conducts trolling and bottomfishing, mostly within 30 miles of shore.

The Guam Fishermen's Cooperative Association (GFCA) plays an important role in preserving important fishing traditions. It began operations in 1976 and was incorporated in 1977. In 2006 its membership included 164 full-time and part-time fishermen from every district on Guam, and it processed and marketed approximately 80% of the local commercial catch. In addition, it plays a role in fisheries data collection, marine education and training, and fisheries conservation and management. The GFCA strives to provide benefits not just to fishermen but to residents throughout Guam, benefitting the broader Guam community. It utilizes a Hazard Analysis and Critical Control Point (HACCP) system to ensure safe seafood, and tests fish for potential toxins or whenever requested by the Guam Department of Health and Sanitation. It has also become a focal point for community activities such as the Guam Marianas International Fishing Derby, cooking competitions, the Guam Fishermen's Festival, dissemination of educational materials on marine resources, vessel safety and seafood preparation, public meetings on resource management issues, and communications via radio base to relay information and coordinate rescues. It also has adopted a policy of purchasing local origin products that benefits 40 small businesses on Guam, regularly donates seafood for village functions and charitable activities, and provides assistance to victims of periodic typhoons with emergency supplies of ice and fuel. In addition, the GFCA has become a voice for Guam fishermen in the policy arena to ensure that concerns of fishermen are incorporated into issues such as the military buildup.

Fishing in Guam continues to be important not only in contributing to the subsistence needs of the Chamorro and other residents but in preserving their histories and identities. Knowledge of how fish are distributed and consumed locally is crucial to understanding the social and cultural significance of fishing on Guam.

3.1.4.2 PEOPLE WHO FISH

Few studies have been conducted on fishing in Guam in general. A household survey conducted in 2012 found that 35% of respondents said they or someone else in their household was a fisherman (Kotowicz and Allen, 2015). Respondents from fishing households tended to have lower education levels and have a higher rate of unemployment than respondents from non-fishing households.

A few studies have targeted pelagic fishermen or the small boat fleet. While these boats also engage in bottomfishing and reef fishing, the primary pelagic fishing method is trolling, thus, results of these studies will be reported in the Guam Troll section.

3.1.4.3 COSTS OF FISHING

Since 2012, the PIFSC Socioeconomics Program has maintained a continuous economic data collection program on Guam through collaboration with the PIFSC Western Pacific Fisheries Information Network (WPacFIN). The economic data collection gathers fishing expenditure data for boat-based reef fish, bottomfish, and pelagic fishing trips on an ongoing basis. Data for fishing trip expenses include; gallons of fuel used, price per gallon of fuel, cost of ice used, cost of bait & chum used, cost of fishing gear lost, and the engine type of the boat. These economic data are collected from same subset of fishing trips as the boat-based creel survey carried out by the local fisheries management agencies and WPacFIN.

These data are currently under PIFSC editorial review and future versions of this report will include a time-series of Guam boat-based pelagic trip costs by target species and/or gear. Metadata for these data are available online (PIFSC, 2016b).

Guam trip cost estimates from 2011 for pelagic fishing trips are available in Hospital and Beavers (2012). Other relevant cost information in Hospital and Beavers (2012) include estimates of annual fishing expenditures (fixed costs) and levels of investment in the fishery.

3.1.4.4 GUAM TROLL

As noted in Chapter 1, Guam's primary pelagic fishing method is trolling. While the majority of trolling activity is non-commercial, pelagic fish catch from troll fisheries historically account for about 80 percent of the island's boat-based fisheries commercial harvest. In addition, Guam's charter fishing fleet is considered a commercial fleet and trolls for pelagic fish. In 1998, the charter fleet attracted approximately 3% of visitors to Guam and consisted of about 12 core boats.

In 2001, pelagic fishers were interviewed to develop a profile of contemporary demographic and sociological characteristics of Guam's pelagic fishers (see Rubenstein, 2001, for full report). Their study was designed to capture a representative sample of the majority of pelagic fishers, and included 97 respondents. Of these, all but two were men, and neither of the two women were Pacific Islanders, reflecting the strong cultural values in Micronesia that discourage women from involvement in pelagic fishing. With respect to ethnic distribution of fishers, indigenous Chamorros reflected the general population of Guam (41%). Micronesians were over-represented, forming nearly 18% of the fishing population, but only about 6% of the general population, as were Euro-Americans, comprising 27% of the fishing population but only about 18% of the general population. Asians were under-represented; 7% of the pelagic fishing population were Filipino, vs. nearly 23% of the general population, and other Asians accounted for 3% of the pelagic fishing population, vs. 13% of the general population. Respondents were significantly more affluent than the general population on average, although there was a wide range of variation. Almost three quarters (72%) of respondents either owned or co-owned a boat. While trolling was the most common method of fishing (occurring on 70% of trips), many also reported trolling and bottomfishing on the same trip.

There were three main motivations for fishing. The predominant motivation (65%) emphasized personal enjoyment, and a number of respondents within this category (especially Chamorros and other Micronesians) emphasized the sense of cultural identity they derive from fishing. A second motivation (18%) was consumption of fish for family subsistence, and the final motivation (16%) was income. However, more than half (51%) identified multiple motivations. In addition, nearly all fishers (96%) reported regularly giving fish to family (36%), friends (13%), or both (47%). Most (53%) said they did not give fish to people other than family and close friends; of those who did occasionally, the main recipients were church fiestas (32%) and other church events or organizations (20%), reflecting Guam's long and well-entrenched Catholic tradition.

More than half of the respondents (58%) reported that they sell portions of their catches, although again with multiple motivations. People who sold fish one to four times per month (53%) were mostly seeking to recover some of the cost of fishing and boat ownership, whereas those who sold fish eight or more times per month (36%) were more likely selling to make a profit. The majority of fishers (69%) earned less than $500 monthly from fish sales. A number reported that infrequent fish sales subsidize the cost of fishing equipment and boats, a common theme in the Western Pacific region. There were 22% of respondents who earned more than $1,000 per month, relying heavily on fishing for their income.

In 2011, another survey was conducted of the small boat fleet, which found similar patterns (Hospital and Beavers, 2012). On average, fishermen responding to the survey were 44 years old and reported to have been boat fishing for an average of 20 years. Respondents were also more educated and more affluent then the general population. The majority of respondents described themselves as Chamorro (72%) followed by white (23%) with relatively small proportions of Filipinos (6%), Micronesians (6%), other ethnicities (5%), and Carolinians (1%). While the percentage of Micronesians was lower than in the 2001 study, the researchers noted that efforts to engage Filipinos and Micronesians were less successful than the investigators had hoped. As in the previous study, there was considerable evidence of co-ownership and sharing of fishing vessels. In addition, fishermen reported the use of multiple gear types, with pelagic trolling as the most popular gear type followed by shallow-water bottomfish fishing and deepwater bottomfish fishing. Almost all (96%) fishermen reported fishing at a Fish Aggregating Device (FAD) during the past 12 months, and on nearly half (53%) of their fishing trips. Fishing for bottomfish and reef fish was highly seasonal compared to pelagics; whereas over half of the survey respondents (54%) fished all year for pelagics, only 16% fished year-round for bottomfish and reef fish.

A larger proportion of fishermen reported selling at least a portion of their fish (70%) than in the 2001 study, and 82% of could always sell all the fish that they wanted to sell. However, nearly 30% reported that they had not sold any fish in the past 12 months, and nobody reported selling all the fish they caught. Instead, cost recovery was cited as the primary motivation for the sale of fish, with fish sales contributing very little to personal income for the majority (59%). In fact, 64% of fishermen reporting the sale of fish earned fishing revenues of less than $1000, which would not cover overall trip expenditures for the year. Sale of pelagic fish contributes to nearly 67% of fishing income, with another 20% from bottomfish revenues, and the rest from reef fish.

While respondents sold approximately 24% of their total catch, 29% was consumed at home, while 42% was given away. The remaining catch was either released (2%) or exchanged for goods and services (3%). This diversity of catch disposition extends to fishermen who regularly sell fish, as they still retain approximately 30% of their catch for home consumption and participation in traditional fish-sharing networks and customary exchange. Additionally, 78% consider the pelagic fish they catch to be an important source of food, 79% for bottomfish, and 85% for reef fish. These findings validate the importance of fishing in terms of building and maintaining social and community networks, perpetuating fishing traditions, and providing food security to local communities.

Like with CNMI, fishing on Guam is a social activity. Only 7% of fishermen reported fishing alone, and 45% reported that their boat is used without them on occasion. In addition, 61% reported to be a member of a fishing club, association or group. The majority of fishermen (60%) also agreed that as a fisherman, they are respected by the Guam community. Very few felt that they were not respected by the community.

There was also an open-ended portion of the survey that asked for comments. The two most prevalent themes were that of a rising population and rising fuel costs. Many believed that the expanding population would increase the demand for fish and number of fishermen, yet at the same time, others noted that fuel costs and economic considerations could restrict fishing. In addition, there was concern about the designation of Marianas Trench Marine National Monument (the Monument), especially since respondents felt that the Marine Preserve Areas established in 1997 had already displaced them from their traditional fishing grounds. Military exercises also affected fishing trips. Other studies have also documented concerns about fishing access related to the designation of the Monument (see Richmond and Kotowicz, 2015, Kotowicz and Richmond 2013, and Kotowicz and Allen, 2015). Despite long distance, high cost, and inconvenience, travel to the areas now protected by the Monument were rare but culturally significant events, and fishing was an essential component.

Similar to CNMI, Guam's small boat fisheries are a complex mix of subsistence, cultural, recreational, and quasi-commercial fishermen whose fishing behaviors provide evidence of the importance of fishing to the island of the Guam. For nearly all fishery participants, the social and cultural motivations for fishing far outweigh any economic prospects. Nearly all fishermen supplement their income with other jobs and are predominantly subsistence fishermen, selling occasionally to recover trip expenses.

3.1.4.4.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the Guam troll fishery. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports.

3.1.5 HAWAII

3.1.5.1 INTRODUCTION

The geography and overall history of the Hawaiian Archipelago, including indigenous culture and current demographics and description of fishing communities is described in section 1.3 of the Fishery Ecosystem Plan for the Hawaii Archipelago (Western Pacific Regional Fishery Management Council. 2016b). Over the past decade, a number of studies have synthesized more specifics about the role of fishing and marine resources across the Hawaiian archipelago, as well as information about the people who engaging in the fisheries or use fishery resources.

As described in Chapter 1, a number of studies have outlined the importance of fishing for Hawaiian communities through history (e.g., see Geslani et al., 2012, and Richmond and Levine, 2012). Traditional Native Hawaiian subsistence relied heavily on fishing, trapping shellfish, and collecting seaweed to supplement land-based diets. Native Hawaiians also maintained fishponds, some of which date back thousands of years are still used today. The Native Hawaiian land and marine tenure system, known as ahupuaʻa-based management, divided the islands into large parcels called moku, which are reflected in modern political boundaries (Census County Districts).

Immigrants from many other countries with high seafood consumption and cultural ties to fishing and the ocean came to work on the plantations around the turn of the 20th Century, establishing in Hawaii large populations of Chinese, Japanese, Koreans, Filipinos, and Portuguese, among others. In 1985, the Compact of Free Association also encouraged a large Micronesian population to migrate to Hawaii. According to the 2010 Census, the State of Hawaii's population is almost 1.4 million. Ethnically, it has the highest percentage of Asian Americans (38.6%) and Multiracial Americans (23.6%) and the lowest percentage of White Americans (24.7%) of all states. Approximately 21% of the population identifies as Native Hawaiian or part Native Hawaiian. Tourism from many of these Asian countries also increases the demand for fresh, high-quality seafood, especially sushi, sashimi, and related raw fish products such as poke.

Today, fishing continues to play a central role in the local Hawaiian culture, diet, and economy. In 2012, an estimated 486,000 people were employed in marine-related businesses in Hawai‘i, with the level of commercial fishing-related employment well above the national average (Richmond et al., 2015). The Fisheries Economics of the United States 2014 report found that the seafood industry (including the commercial harvest sector, seafood processors and dealers, seafood wholesalers and distributors, importers, and seafood retailers) generated $743 million in sales impacts and approximately 10,000 full and part-time jobs that year (National Marine Fisheries Service, 2016). Recreational anglers took 1.4 million fishing trips, and 1,061 full- and part-time jobs were generated by recreational fishing activities in the state. Similarly, the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Department of the Interior et al., 2011) estimated that 157 thousand people over 16 years old participated in saltwater angling in Hawai'i in 2011. They fished approximately 1.9 million days, with an average of 12 days per angler. This study estimated that fishing-related expenditures totaled $203 million, with each angler spending an average of $651 on trip-related costs. These numbers are not significantly different from those reported on the 2006 and 2001 national surveys.

Seafood consumption in Hawai'i is estimated at approximately two to three times higher than the entire U.S., and Hawai'i consumes more fresh and frozen finfish while shellfish and processed seafood is consumed more across the entire U.S. (see Geslani et al., 2010 and Davidson et al., 2012 for review). In addition, studies have shown that seafood is eaten frequently, at least once a week by most, and at least once a month by almost all respondents (National Coral Reef Monitoring Program, 2016b). Fresh seafood is the most popular type of seafood purchased, and while most is purchased at markets or restaurants, a sizeable amount is reported as caught by friends, neighbors, or extended family (National Coral Reef Monitoring Program, 2016b, Davidson et al., 2012).

At the same time, local supply is inadequate in meeting the high seafood demand. In 2010, 75% of all seafood consumed in the State of Hawaii was imported from either the U.S. mainland or foreign markets, and the rise in imported fish has influenced the price of local catch (Arita et al., 2011; Hospital et al., 2011). In addition, rising costs of fuel and other expenses have made it more difficult to recover trip costs (Hospital et al., 2011). A majority of commercial fishers report selling their fish simply to recover these costs, not necessarily to make income (Hospital et al., 2011). Many describe the importance of sharing fish as a part of maintaining relationships within family or other networks as being more important than earning income from fishing (personal communication, Bottomfish Oral History project, in progress).

Pelagic fish play a large role in seafood consumption, with Hawaii residents regularly consuming substantial amounts of fresh bigeye and yellowfin tuna as ‘ahi poke (bite-sized cubes of seasoned raw tuna) and ahi sashimi (sliced raw tuna). ‘Ahi is also a significant part of cultural celebrations, especially during the holiday period from late November (Thanksgiving) through late January to mid-February (Chinese New Year). Changes in bigeye regulations can have far-reaching effects not only on Hawai‘i's fishing community but also on the general population (Richmond et al., 2015). While most of the fresh tuna consumed in Hawaii is supplied by the local industry, market observations suggest that imported tuna is becoming more commonplace to meet local demands (Pan, 2014).

3.1.5.2 PEOPLE WHO FISH

Hawaii includes a mix of commercial, non-commercial, and subsistence characteristics across fisheries. Pelagic fish are caught not only by the industrial-scale Hawaii longline fishery, but also by small boat fishermen. The longline fishery will be addressed in section 3.1.5.4. Within the small boat fleet, there is a nearly continuous gradation from the full-time and part-time commercial fleet to the charter and personal recreation fleets. A single boat (and trip) will often utilize multiple gear types and target fish from multiple fisheries. Thus, other than the longline fishery, the other fisheries are typically not studied individually. Rather, studies have typically been conducted based on ability to reach potential respondents. Studies have targeted fishermen via State of Hawaii Commercial Marine Licenses (CMLs) (Chan and Pan, 2017, Madge et al., 2016), shoreline and boat ramp intercepts (Hospital et al., 2011, Madge et al., 2016), and vessel and angler registries (Madge et al, 2016). The number of participants involved in small boat fishing increased between 2003 and 2013 from 1,587 small boat-based commercial marine license holders to 1,843 (excluding charter, aquarium, and precious coral fisheries, Chan and Pan, 2017). Together, these small boat fishermen produced 6.2 million pounds of fish in 2013, with a commercial value amounted to $16 million.

The Hawaii small boat pelagic fleet was studied in 2007-2008 (hereafter, referred to as the 2008 study), following a design last used in 1997 (Hospital et al., 2011). This work was updated in 2014 by Chan and Pan (2017). Both studies found that the small boat pelagic fleet is predominantly owner-operated and a male dominated activity (98% of respondents were male in both studies). The ethnic composition was predominantly Asian (45% in 2008, 41% in 2014) and White (23% in 2008, 26% in 2014), which is similar to the state population as a whole. In 2014, proportionally more Native Hawaiians and Pacific Islanders responded to the survey than are represented in the general population (18% vs. 10%). In addition, the majority of respondents had a household income above $50,000 (75% in 2008, 69% in 2014).

These studies also asked respondents to classify themselves based on categories ranging from commercial to non-commercial. In 2014, 7% identified as full-time commercial, 51% identified as part-time commercial, 27% identified as recreational expense where they sold some catch to offset fishing expenses, 11% as purely recreational, 3% as subsistence, and 1% as cultural. Different activities were then compared based on self-classification.

As previously mentioned, the Hawaii small boat pelagic fishery is a mixed-gear fishery. In 2008, 47% of respondents reported using more than one gear type, predominantly trolling (for pelagic fish) and handline (for bottomfish). In 2014, 65% of respondents reported trolling as their most common gear, while 16% indicated bottomfish handline, and 12% stated pelagic handline was their most commonly used gear. Trolling was more commonly used by recreational fishermen whereas pelagic handline and bottomfish gears were more commonly used by commercial fishermen. The 2014 study also asked about species composition of catch. While 93% of the respondents reporting landing pelagic fish in the past 12 months, about half of respondents also reported they caught and landed bottomfish or reef fish. Only 7% of survey respondents did not catch any pelagic fish in the past 12 months. Thus, the small boat fleet includes not only a mixture of gear types, but also targets both pelagic and insular fish stocks.

Both studies also examined how fishermen self-identified vs. their commercial and non-commercial activities. In both cases, many people who considered themselves recreational, subsistence, or cultural fishers still sold fish. In 2008, 42% of fishermen self-classified as commercial fishermen, yet 60% of respondents reported selling fish in the past 12 months. In addition, just over 30% of fishermen who self-classified as recreational reported selling fish in the past year. Results for the 2014 study are shown in Table 48.

Table 48. Catch disposition by fisherman self-classification, from Chan and Pan (2017).

	Number of respondents *(n)*	Caught and released (%)	Given away (%)	Consumed at home (%)	Sold (%)
All Respondents	*738*	5.6	13.9	15.4	65.0
By Fisherman Classification					
Full-time commercial	*55*	6.2	9.4	11.6	72.8
Part-time commercial	*369*	5.2	12.9	14.4	67.5
Recreational expense	*200*	6.7	19.8	21.7	51.8
Purely recreational	*78*	5.4	37.3	29.6	27.6
Subsistence	*24*	1.9	20.7	31.0	46.5
Cultural	*8*	4.0	36.8	22.5	36.7

In 2014, the average value of fish sold by all respondents was approximately $8,500. Full-time commercial fishermen reported the highest value of fish sold ($35,528 annually and $558 per trip), part-time commercial fishermen reported $8,391 annually and $245 per trip, cultural fishermen $3,900 annually and $150 per trip, recreational expenses fishermen $2,690 annually and $95 per trip, subsistence fishermen $1,905 annually and $79 per trip, and purely recreational fishermen reported selling close to $1,000 annually ($58 per trip). While income from fish selling served as an important source of personal income for full-time commercial fishermen, the majority of fishermen reported selling fish to cover trip expenses, not necessarily to make a profit; few fishermen reported substantial, if any, profits from fishing. In the 2008 study, respondents expressed concern about their ability to cover trip costs, noting that trip costs continued to increase from year to year, but fish prices remained relatively flat.

The 2008 study was also the first attempt to quantify the scale of unsold fish that was shared within community networks. Approximately 38% of pelagic fish caught by commercial fishermen was not sold, 97% of survey respondents indicated they participated in fish sharing networks with friends and relatives, and more than 62% considered the fish they catch as an important food source for their family. Community networks were also present in the outlets where fish were sold, which included the United Fishing Agency (UFA) auction in Honolulu, dealers/wholesalers, markets/stores, restaurants, roadside, but also sales to friends, neighbors, and coworkers. The 2014 study also documented 27% of sales to friends, neighbors, or coworkers and corroborated the importance of giving away fish for all self-classification categories (Table 48). In addition, 17% of respondents (who all held CMLs) sold no fish in the past 12 months.

Taken together, the results from these studies suggest a disconnect between Hawaii fishermen's attitudes and perceptions of their fishing activity relative to current regulatory frameworks. The small boat fleet is extremely heterogeneous with respect to gear type, target species, and catch disposition, while regulations attempt to treat each separately with clear distinctions between commercial and recreational activities. In addition to providing income, the Hawaii small boat fleet serves many vital nonmarket functions, including building social and community networks, perpetuating fishing traditions, and providing fish to local communities.

A survey was also conducted on the attitudes and preferences of Hawaii non-commercial fishers (see Madge et al., 2016). Nearly all survey respondents were male (96%). Their average age was 53, and, on average, they had engaged in non-commercial saltwater fishing in Hawaii for 31 years. The majority had household income equal to or greater than $60,000, reported high levels of education, and reflected a large racial diversity (primarily various Asian ethnicities and White). They primarily fished via private motor boat (61%), followed by shore, including beach, pier, and bridge (38%). Offshore trolling and whipping/casting, and free-dive spearfishing were the most frequent gears reported as "always" used, and a majority of respondents reported using multiple gears on a single fishing trip.

As with the small boat fleet, even though this study targeted "non-commercial fishermen", 9% reported that their primary motivation for fishing was to sell some catch to recover trip expenses. However, the primary motivation for the majority (51%) was purely for recreational purposes (only for sport or pleasure). A total of 78% of respondents indicated they "always" or "often" share catch with family and friends, and only 35% indicated they "never" supply fish for community/cultural events. Fishing for home/personal consumption was the most important trip catch outcome (36% rated it "extremely important"), followed by catching enough fish to be able to share with friends and family (20%). Thirty-six percent indicated that their catch was extremely or very important to their regular diet. Thus, similar to the small boat fleet, non-commercial fishermen demonstrate mixed motivations that include commercial activities. They also play an important role in providing fish via social and community networks, even though they report their primary motivation as fishing only for sport or pleasure.

The National Marine Fisheries Service (NMFS) and the Hawaiʻi Division of Aquatic Resources (DAR) have been collecting information on recreational fishing in Hawaiʻi, administered through the Hawaiʻi Marine Recreational Fishing Survey (HMRFS, see Allen and Bartlett, 2008, and Ma and Ogawa, 2016). The program collected data from 1979-1981, but not from 1982-2000, and then began annual data collection again in 2001. A dual survey approach is currently used. A telephone survey of a random sample of households determines how many have done any fishing in the ocean, their mode of fishing, methods used, and effort. The telephone survey component will be discontinued after 2017 due to declining land line coverage. Concurrently, surveyors conduct in-person intercept surveys at boat launch ramps, small boat harbors, and shoreline fishing sites. Fisher County of residence and zip code is regularly collected in the intercept surveys, but has not yet been compared to the composition of the general public. As with the other surveys, this program has documented a mix of gears used and pelagic and insular fish caught. The majority of trips from the onsite interviews were from “pure recreational fishermen” (defined as people who do not sell their catch), with an average of almost 60% to over 80%, depending on year and island. However, they also noted that in Hawaii the divisions between commercial, non-commercial or recreational are not clearly defined, and results suggested that the majority of catch for some categories of fishermen may be consumed by themselves or given away, further reinforcing common themes from other studies.

3.1.5.3 COSTS OF FISHING

The Economic Cost Data Collection Program of the Hawaii longline fishery was the first to establish continuous (routine) trip expenditure collection in the Pacific Islands Region. The program was implemented in August 2004 through a cross-agency collaboration with the Pacific Islands Fishery Science Center (PIFSC) Economics Program and the NOAA Observer Program managed by the Pacific Islands Regional Office (PIRO). Before the establishment of these programs, trip-level economic information on the fisheries was limited primarily to the dockside value of landed fish. Data on fishing expenses were obtained intermittently, through one-time surveys conducted once every five or so years (Hamilton, Curtis, & Travis 1996; O’Malley and Pooley, 2003; Kalberg and Pan, 2016). The historical paucity of economic data had been a significant hurdle in the evaluation of the economic impact associated with proposed regulatory alternatives.

The data form is comprised of eight cost items commonly arising in American Samoa longline trips, but excludes labor costs. Non-labor cost items include: diesel fuel, engine oil, bait, ice, as well as total costs for gear replacement, provisions, and communications. The form requests unit price, quantity used, and total costs of fuel, bait, and oil usage. In addition, the total number of crew members, and the subset who are not United States nationals, is collected for both tuna and swordfish trips. Survey forms are produced and available in first languages (English, Korean, Vietnamese) to ease survey burden.

The participation of fishermen in the economic data survey is voluntary. The project is designed to collect data from all observed trips. Observers conduct interviews with the captains on board while returning to port or when a trip is completed. Observers accompany 100% of the Hawaii-based shallow-set longline trips (targeting swordfish) and about 20% of the deep-set trips (targeting tuna). Since the economic data collection project was implemented in August 2004, the average response rate based on observed trips has been around 60%. The data collection program wouldn't succeed without the generous support of vessel owners and operators.

These data are currently under PIFSC editorial review and future versions of this report will include a time-series of trip costs for the Hawaii longline fishery by target species. Metadata for *these data are available online (PIFSC, 2016c). Other relevant cost information for the Hawaii longline fishery are described in Kalberg and Pan (2016) and include estimates of annual fishing expenditures (fixed costs) and levels of investment in the fishery.*

Past research has documented the costs of pelagic small boat fishing in Hawaii (Hamilton and Huffman, 1998; Hospital et al., 2011). This section presents the most recent estimates of trip-level costs of fishing for boat-based pelagic fishing trips in Hawaii. Fishing trip costs were collected from the 2014 Hawaii small boat survey (Chan and Pan, 2017). Fishermen were asked their fishing trip costs for the most common and second most common gear types they used in the past 12 months and the survey provides information on the variable costs incurred during the operation of vessel including; boat fuel, truck fuel, oil, ice, bait, food and beverage, daily maintenance and repair, and other. Table 49 provides estimates for the cost of an average boat-based pelagic-targeted trip during 2014. Estimates for annual fishing expenditures (fixed costs) and levels of investment in the fishery are also provided in the literature (Hamilton and Huffman, 1998; Hospital et al., 2011; Chan and Pan, 2017).

Table 49. Hawaii small boat trip costs: pelagic fishing trips, 2014

Cost Category	Troll		Pelagic Handline	
	$ per trip	% of total trip cost	$ per trip	% of total trip cost
Fuel	179.00	61%	148.66	52%
Non-fuel	112.67	39%	163.08	48%
Total cost	291.67	100%	283.72	100%

Source: Pacific Islands Fisheries Science Center: Hawaii small boat cost-earnings data: 2014. Pacific Islands Fisheries Science Center, https://inport.nmfs.noaa.gov/inport/item/29820

3.1.5.4 HAWAII LONGLINE

The Hawaii longline fishery (HLF) is the dominant commercial fishery in the Hawaiian Islands and is described in detail in Richmond et al. (2015). It operates out of the port of Honolulu, and in 2010 there were 123 active vessels. The majority of longline fish is sold at the Honolulu fish auction, modeled after the Tsukiji auction in Tokyo, where dealers bid on individual fish. Over 40 dealers representing a variety of different market strategies regularly purchase fish at the auction. Many dealers represent locally-owned small businesses. Additional businesses connected to the bigeye fishery include processors, airline and shipping companies, ice distributors, gear stores, restaurants, and retail outlets.

Owners and operators of Hawai'i's longline vessels comprise three main ethnic groups: Korean-American (K-A), Vietnamese-American (V-A), and Euro-American (E-A) (Allen and Gough, 2007); and the crew is predominantly Filipino (Allen and Gough, 2006). Unlike the broader Asian-American population in Hawaii, most HLF K-A and V-A fishers are first generation immigrants and speak limited English. E-A fishers largely consist of individuals from the mainland U.S. whose native language is English. The fishery is considered well regulated, although there are concerns about growing social and economic impacts from increased competition and regulation. Social network analysis revealed that fishers interacted more within ethnic groups than across ethnic groups. V-A fishers reported the most cross-scale linkages, whereas K-A fishers reported only one tie to an industry leader outside their community (Barnes-Mauthe et al. 2013). This indicates that the interests of K-A fishers may not be adequately represented in the management and policy arena. It also supports previous research that suggests the three ethnic communities should not be assumed to utilize the same fishing practices, exhibit the same attitudes toward fishery management and regulations, or display the same level of trust across groups. According to Kalberg and Pan (2015), The V-A group had the highest number of active vessels in 2012 (n=70), while the E-A had 44 active vessels, and K-A had 15. In addition, on average each vessel had more foreign crew than U.S. crew members.

An economic model documented some of the major changes to the fishery's role in the local economy, based on 2005 data (Arita et al., 2011). These included rising fuel costs, a steady rise in foreign crewmembers, and weakening profits. From 2003-2004, a study was conducted on Filipino crew members in the longline fleet (see Allen and Gough, 2006). Filipino crew sampled ranged from 21 to 52 years of age in 2003; the average age was 37, and 55% were older than 36. A total of 89% had completed high school, nearly 30% also completed an associate or trade school degree (often focused on maritime studies), an additional 16% completed at least some college coursework, and 5% completed college studies. In many cases, they had received more formal education than the captains or owners for whom they were working in Hawaii. Crew were responsible for an average of five dependents, and all respondents indicated that their households depended heavily on the Hawaii longline industry for income, with 63% relying on the fishery as their sole source of income. Many had an extensive background in commercial fishing, with an average of 11 years of experience. In comparison, only 25% of respondents reported more than 5 years total involvement in seafaring in a 2004 study of overall seafarers. While there are a number of challenges to obtaining foreign laborers for employment on Hawaii longline vessels, they are often willing to work for less money and earn more money as a crew member than they would in their home country. Crew must reside on the vessel and do not receive a 'shore pass' to leave the pier area. However, many developed strong social networks and a number of Hawaii-based Filipinos developed businesses in the pier area to serve crew needs. The average annual income of a Hawaii-longline crew member was well over double the average earned in the Philippines; even the lowest paid crew members earned 62% more than the family average for the Philippines and did not have to pay for food or housing while living on the longline vessel. Nearly 70% reported high or very high levels of job satisfaction, nearly 80% reported a reasonable income and no problem with their workload or living conditions.

In 2010, the bigeye tuna fishery experienced the first extended closure of the western and central Pacific Ocean (WCPO) to US longliners from the state of Hawai'i. Richmond et al. (2015) monitored the socioeconomic impacts of this closure to examine how the bigeye fishery community (including fishermen, a large fish auction, dealers, processors, retailers, consumers, and support industries) perceived and were affected by the constraints of the 40-day closure over the holiday season. During the closure period, they found a reduced supply and quality of bigeye landed, an increase in price for high quality fish, and longer distances traveled to fish in rougher waters. These factors resulted in increased stress and in some cases lost revenue for individuals and businesses connected to the fishery. Different stakeholder groups responded differently to the closure, with fish dealers among those most affected. Some dealers chose to purchase high quality tuna despite abnormally high prices and sell at a loss to maintain relationships with their customers. During the closure, US boats could continue to fish for bigeye in the Eastern Pacific

Ocean and foreign and dual permitted vessels could still fish in the WCPO, which mitigated some of the impacts to the fishery. US legislation and federal rules have since been put in place that have prevented subsequent closures of the fishery.

Frozen tuna treated with carbon monoxide to enhance color has appeared in Hawaii markets since the late 1990s. It is often labeled as “Tasteless Smoke” and is sold in markets in thawed form, which is similar in appearance to fresh ahi poke. The price of Tasteless Smoke tuna is lower than the price of fresh tuna landed by local vessels. During the closure, imported products were available in retail markets and the price in the retail market stayed consistent, suggesting that local and imported products are substitutes and that imports increase quickly to meet demand when local landings are low (Pan, 2014). However, conversation with multiple dealers suggested that only a few dealers increased their reliance on imports during the closure (Richmond et al., 2015).

In the fall of 2016, concerns about the working conditions of foreign crewmembers garnered national media attention. In response, the Hawaii Longline Association commissioned a follow-up study, based on the methodology developed by Allen and Gough (2006), and conducted by one of the same researchers (see Gough, 2016). Many of the same crew were interviewed in both 2006 and 2016 due to high retention in the fleet. The study interviewed crew from 75% of Hawaii longline vessels on crew recruitment and fees, on board conditions and access, pay structure, medical care, document retention on board, and grievance mechanisms. There were no indications of foreign crew employed against their will, nor documentation of respondents who wished to return to their country of origin but were unable to do so; trends reported did not reflect forced labor or human trafficking. While no exploitation was reported, the study also identified potential operational flaws that *could* result in exploitation of foreign crew. It also suggested recommendations to improve those systems to reduce industry vulnerability to scrutiny, including safeguards for both crew and vessel owners.

On August 26, 2016, a Presidential proclamation expanded the Papahānaumokuākea Marine National Monument to include the majority of the United States Exclusive Economic Zone surrounding the Hawaiian Islands, which would largely affect the longline fleet. An internal report noted the potential for differential impacts (e.g., based on target species, vessel size, or ethnicity, see PIFSC Socioeconomics Program, 2017). For example, the shallow-set fishery appears to have nominally higher share of catch, effort, and revenues from the Northwest Hawaiian Islands, compared to the deep-set fishery. Closure of the EEZ could lead to longer trips, which could in turn lead to increased costs and lower quality of domestic product. This could affect domestic market share as well as impacting both seafood safety and safety at sea for domestic fishing vessels.

3.1.5.4.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the Hawaii longline fishery. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports. Economic data for the Hawaii longline fishery are currently found in the Hawaii fishery module.

3.1.5.4.2 Economic Performance Measures

NOAA Fisheries has established a national set of economic performance indicators to monitor the economic health of the nation's fisheries (Brinson et al., 2015). The PIFSC Socioeconomics Program has used this framework to evaluate select regional fisheries; specifically, the Hawaii Longline, American Samoa Longline, and Main Hawaiian Islands (MHI) Deep 7 bottomfish fisheries. These indicators include metrics related to catch, effort, and revenues. This section will present revenue performance metrics of; (a) total fishery revenues, (b) fishery revenue per trip, (c) Gini coefficient, and (d) the share of annual revenues from the fishery.

Data on Aggregate Landings; Active Vessels; Trips; Days at Sea; Aggregate Revenue from Species in Fishery; and data for revenue per vessel calculation (for Gini coefficient) are from Pacific Islands Fisheries Science Center, Fisheries Research and Monitoring Division. The Gini coefficient measures the equality of the distribution of revenue among active vessels in the fishery. A value of zero represents a perfectly equal distribution of revenue amongst these vessels, whereas, a value of one represents a perfectly unequal distribution, in the case that a single vessel earns all of the revenue. The Gini coefficient is calculated at the individual vessel level which is usually associated with one permit. However, there were situations that one permit is associated with different vessel names during a year, because the Hawaii longline fishing permit can be transferred and owners usually renamed the vessel during a year. We count those as one vessel, as long as the permit number is the same.

Trends in fishery revenues are shown in Figure 133 while trends in revenue distribution are shown in Figure 134. Supporting data are provided in Table 50.

Figure 133. Trends in fishery revenues for the Hawaii longline fishery

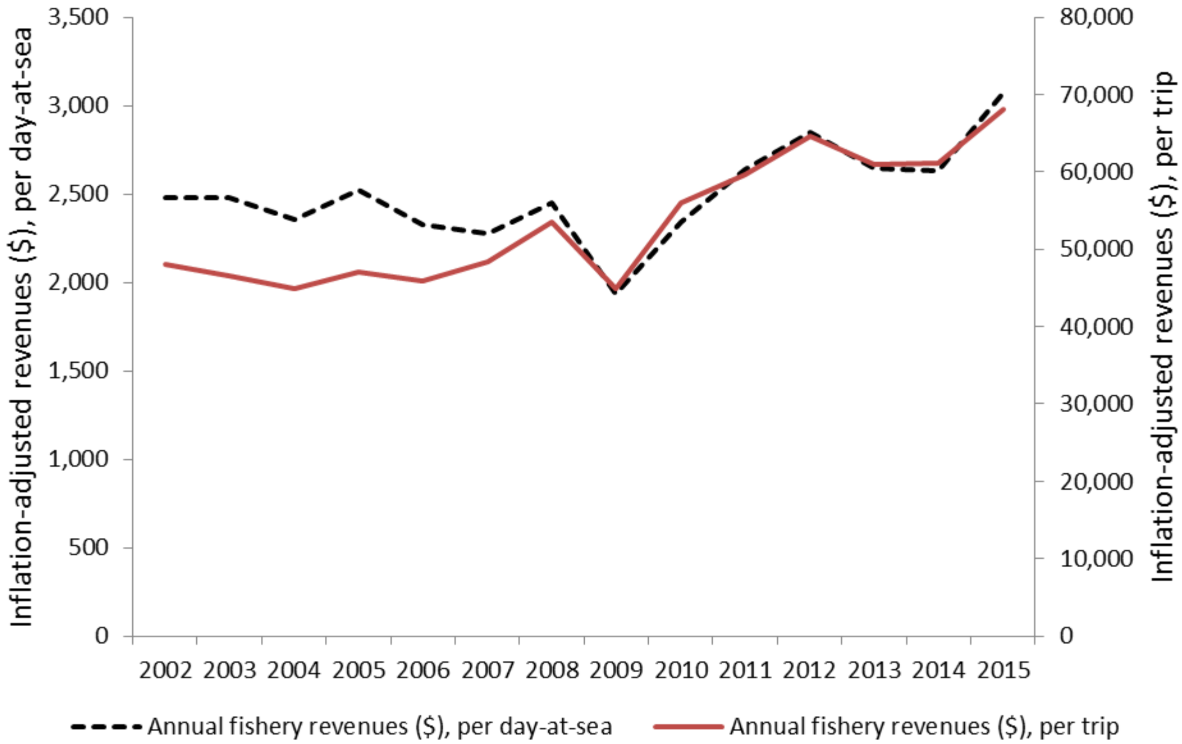

Figure 134. Trends in revenue distribution for the Hawaii longline fishery

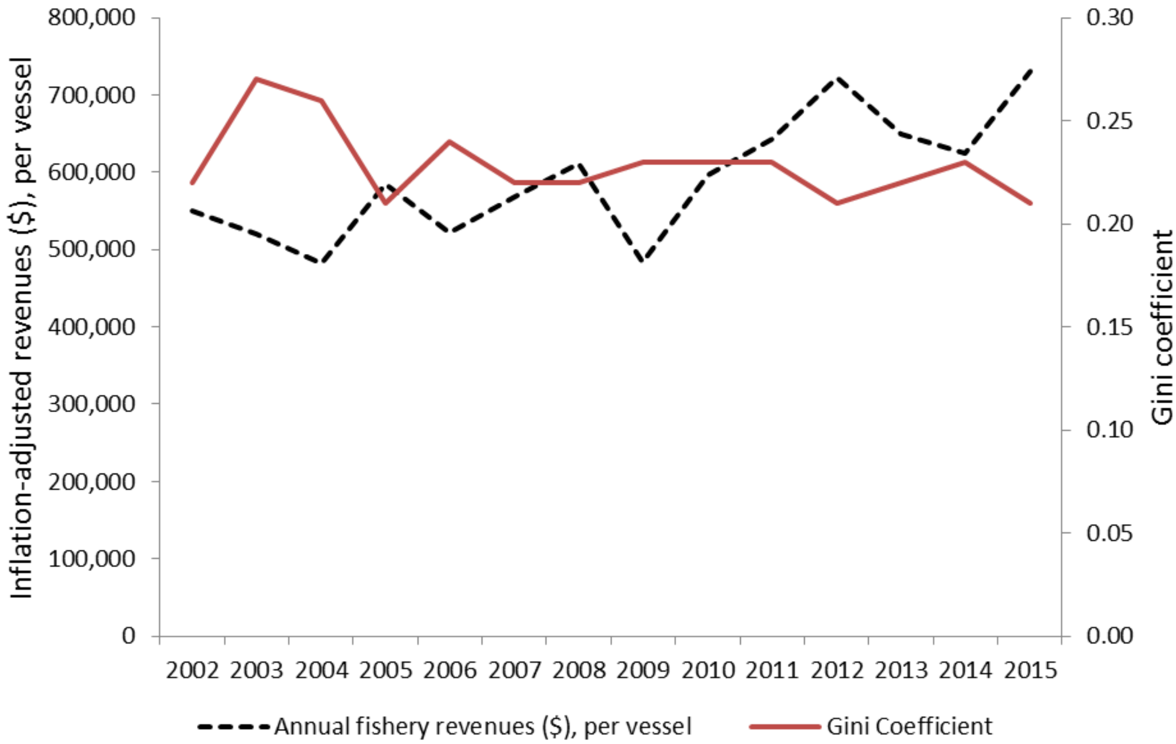

Table 50. Hawaii longline fishery economic performance measures

Year	Annual fishery revenues ($)[1], per vessel	Annual fishery revenues ($)[1], per trip	Annual fishery revenues ($)[1], per day-at-sea	Gini coefficient
2002	550,105	47,999	2,478	0.22
2003	519,549	46,577	2,476	0.27
2004	481,469	44,904	2,354	0.26
2005	584,382	47,067	2,525	0.21
2006	521,391	45,825	2,326	0.24
2007	567,862	48,353	2,276	0.22
2008	611,817	53,544	2,449	0.22
2009	483,433	44,979	1,938	0.23
2010	596,082	55,953	2,344	0.23
2011	642,046	59,586	2,636	0.23
2012	723,168	64,649	2,847	0.21
2013	650,147	60,909	2,646	0.22
2014	625,317	61,177	2,631	0.23
2015	730,341	68,107	3,072	0.21

Source: Pacific Islands Fisheries Science Center: Fishery Economic Performance Measures. Pacific Islands Fisheries Science Center, https://inport.nmfs.noaa.gov/inport/item/46097

[1] Inflation-adjusted revenues (in 2015 dollars) use the Honolulu Consumer Price Index (CPI-U) https://www.bls.gov/regions/west/data/consumerpriceindex_honolulu_table.pdf

3.1.5.5 HAWAII TROLL

Trolling was one of the gear types included in the 2014 Small Boat Survey (Chan and Pan, 2017). Fisher demographics and catch disposition were summarized in section 3.1.5.2. Most small boat fishermen trolled, with 65% of respondents stating that trolling was their most commonly used gear. Approximately half of their trips occurred in state waters, and half in federal waters. A higher percentage of those who identified troll as their most commonly used gear reported using only a single gear (35%) in comparison to respondents who most commonly used other gear types. However, a larger percentage (45%) reported using two types of gear. Trolling was more commonly used by fishermen who self-identified as recreational, although respondents spanned all response categories (full-time commercial, part-time commercial, recreational expense, purely recreational, subsistence, and cultural). This finding corroborates the observation that the troll fishery has a significant cultural and subsistence role in Hawaii's fishing communities (Markrich and Hawkins 2016).

3.1.5.5.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the Hawaii troll fishery. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports.

3.1.5.6 HAWAII HANDLINE

Pelagic handline was one of the gear types included in the 2014 Small Boat Survey (Chan and Pan, 2017). Fisher demographics and catch disposition were summarized in section 3.1.5.2. Only 12% of respondents stated that pelagic handline was their most commonly used gear. A larger percentage of their fishing trips occurred in state waters (62%) vs. federal waters (38%). In comparison to respondents who most commonly used other gear types, those who identified pelagic handline as their most commonly used gear reported the lowest percentage of single gear use (8%). They predominantly reported using two types of gear (49%). Pelagic handline was most commonly used by fishermen who self-identified as commercial, although respondents spanned all response categories (full-time commercial, part-time commercial, recreational expense, purely recreational, subsistence, and cultural). This finding corroborates the observation that the pelagic handline fishery has a significant cultural and subsistence role in Hawaii's fishing communities (Markrich and Hawkins 2016).

3.1.5.6.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the MHI handline fishery. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports.

3.1.5.7 OFFSHORE HANDLINE

There is currently no socioeconomics information specific to this fishery. Subsequent reports will include new data as resources allow.

3.1.5.7.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the Hawaii offshore handline fishery. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports.

3.1.5.8 AKU BOTA (POLE AND LINE)

There is currently no socioeconomics information specific to this fishery. Subsequent reports will include new data as resources allow.

3.1.5.8.1 Commercial Participation, Landings, Revenue, Prices

This section will describe trends in commercial participation, landings, revenues and prices, as data allows, for the Hawaii aku boat (pole and line) fishery. The data request was not submitted in time to allow for these data to be included in this report. Supporting figures and tables will be added in future reports.

The total revenue from Hawaii's pelagic fisheries was $112.8 million in 2016, an increase of 4% from the previous year. The deep-set longline fishery reached a record high $99.1 million in 2016. This fishery represented 88% of the total revenue for pelagic fish in Hawaii. The shallow-set longline fishery decreased to $2.5 million and accounted for 2% of the revenue. The MHI troll revenue was $7.5 million or 7% of the total in 2016 and was followed by the MHI handline fishery at $2.4 million (2%). The offshore handline fishery was worth $1.1 million in 2016. The trend for revenue from the deep-set longline, MHI troll and MHI handline fisheries was increasing while revenue of the shallow-set longline fishery was decreasing. There was substantial variation for revenue from the offshore handline fishery.

3.1.6 PACIFIC REMOTE ISLAND AREAS

3.1.6.1 INTRODUCTION

Human habitation in the Pacific Remote Island Area is limited. The Fishery Ecosystem Plan for the Pacific Remote Islands Area provides a description of the geography, history, and socio-economic considerations of the archipelago in section 1.3 (Western Pacific Regional Fishery Management Council 2016e). Grace-McCaskey (2014) provided a brief review of the importance of this area from a cultural perspective. She noted that although this region was uninhabited when first visited by Westerners, Polynesians and Micronesians likely had been periodically visiting all of the islands periodically for centuries. Most of the islands in the PRIA were modified during WWII and many have subsequently become National Wildlife Refuges and part of the Pacific Remote Islands Marine National Monument. Only Wake, Johnston, and Palmyra have seasonal and year-round residents, primarily related to military and refuge management. Because they are located far from areas of high human population, they are considered to be some of the healthiest reef ecosystems in the world, although some are experiencing residual impacts from military use. There are no designated fishing communities in the PRIA. Most of the fishing effort has been concentrated around Johnston and Palmyra by members of the Hawaii fishing community.

3.1.7 ONGOING RESEARCH AND INFORMATION COLLECTION

Social indicators are being compiled for all jurisdictions, in accordance with a national project to describe and evaluate community well-being in terms of social, economic, and psychological welfare (https://www.st.nmfs.noaa.gov/humandimensions/social-indicators/index). In addition, a web-based tool is being developed to compile relevant socioeconomic data into a “Community Snapshot” by Census County Division or equivalent. An update to the CNMI Community Profile is also in preparation.

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3.2 PROTECTED SPECIES

This section of the report summarizes information on protected species interactions in fisheries managed under the Pelagic FEP. Protected species covered in this report include sea turtles, seabirds, marine mammals, sharks, and corals. Most of these species are protected under the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), and/or the Migratory Bird Treaty Act (MBTA). A list of protected species found in or near waters where fisheries managed under the Pelagic FEP operate and a list of critical habitat designations in the Pacific Ocean are included in Appendix B.

3.2.1 HAWAI`I SHALLOW-SET LONGLINE FISHERY

3.2.1.1 INDICATORS FOR MONITORING PROTECTED SPECIES INTERACTIONS AND EFFECTIVENESS OF MANAGEMENT MEASURES IN THE HAWAI`I SHALLOW-SET LONGLINE FISHERY

This report monitors the status of protected species interactions in the Hawai`i shallow-set longline fishery using the following indicators:

- General interaction trends over time
- Effectiveness of FEP conservation measures
- Take levels compared to authorized take levels under the ESA
- Take levels compared to marine mammal Potential Biological Removals (PBRs), where applicable

Details of these indicators are discussed below.

3.2.1.1.1 Conservation Measures

The Pelagic FEP includes a number of conservation measures to mitigate seabird and sea turtle interactions in the shallow-set longline fishery. These measures include the following:

- Longline vessel owners/operators are required to adhere to regulations for safe handling and release of sea turtles and seabirds.
- Longline vessel owners/operators must have on board the vessel all required turtle handling/dehooking gear specified in regulations.
- Longline vessel owners/operators can choose between side-setting or stern-setting longline gear with additional regulatory specifications to reduce seabird interactions (e.g., blue-dyed bait, weighted branch lines, strategic offal discards, using a “bird curtain”).
- When shallow-set longline fishing north of the Equator:
    - Use 18/0 or larger circle hooks with no more than 10° offset.
    - Use mackerel-type bait.
    - 100 percent observer coverage

- vessel owners and operators required to annually attend protected species workshop
- closure for remainder of year when fishery reaches annual interaction limits (“hard caps”) of 26 leatherback and 34 loggerhead turtles

3.2.1.1.2 ESA Consultations

The Hawai`i shallow-set longline fishery is covered under a NMFS Biological Opinion dated January 30, 2012 and modified on May 22, 2012 (NMFS 2012). NMFS concluded that the fishery is not likely to jeopardize four sea turtle species (loggerhead, leatherback, olive ridley and green turtles) and humpback whales, and not likely to adversely affect hawksbill turtles. A USFWS Biological Opinion dated January 6, 2012 (USFWS 2012a), also concluded that the fishery is not likely to jeopardize short-tailed albatrosses. Several informal consultations conducted by NMFS have determined that the fishery is not likely to adversely affect other ESA-listed marine mammals, the Eastern Pacific distinct population segment (DPS) of scalloped hammerhead shark or Hawaiian monk seal critical habitat (Table 51).

NMFS and USFWS have issued incidental take statements (ITS) for species included in the Biological Opinions and determined that the fishery, as currently managed, does not jeopardize the ESA-listed species (Table 52). The 1-year ITSs for loggerhead and leatherback turtles is 34 and 26 (half of the 2-year ITS), respectively, and are equivalent to the hard caps and trigger closures for this fishery. Exceedance of the 2-year or 5-year ITSs requires reconsultation of the fishery under the ESA.

Although the shallow-set fishery did not exceed the ITSs for turtles, the Hawai`i shallow-set longline fishery had an observed interaction with a Guadalupe fur seal in 2016, which was previously not known to interact with the fishery. As a result, NMFS will reinitiate consultation.

Table 51. Summary of ESA consultations for the Hawai`i shallow-set longline fishery.

Species	Consultation Date	Consultation Type[a]	Outcome[b]
Loggerhead turtle, North Pacific DPS	2012-01-30	BiOp	LAA, non-jeopardy
Leatherback turtle	2012-01-30	BiOp	LAA, non-jeopardy
Olive ridley turtle	2012-01-30	BiOp	LAA, non-jeopardy
Green turtle	2012-01-30	BiOp	LAA, non-jeopardy
Hawksbill turtle	2012-01-30	BiOp	NLAA
Humpback whale	2012-01-30, with corrections dated 2012-05-22	BiOp	LAA, non-jeopardy
False killer whale, MHI insular DPS	2015-03-02	LOC	NLAA
Fin whale	2015-09-16	LOC	NLAA
Blue whale	2008-08-27	LOC	NLAA
North Pacific right whale	2008-08-27	LOC	NLAA
Sei whale	2008-08-27	LOC	NLAA
Sperm whale	2008-08-27	LOC	NLAA
Hawaiian monk seal	2008-08-27	LOC	NLAA
Scalloped hammerhead shark, Eastern Pacific DPS	2015-03-02	LOC	NLAA
Short-tailed albatross	2012-01-06	BiOp (FWS)	LAA, non-jeopardy
Critical Habitat: Hawaiian monk seal	2015-09-16	LOC	NLAA

[a] BiOp = Biological Opinion; LOC = Letter of Concurrence.

[b] LAA = likely to adversely affect; NLAA = not likely to adversely affect.

Table 52. Summary of Incidental Take Statements (ITS) for the Hawai`i shallow-set longline fishery.

Species	ITS Time Period	Takes	Mortalities	Source BiOp
Loggerhead turtle (North Pacific DPS)	2-year	68	14	NMFS 2012
Leatherback turtle	2-year	52	12	NMFS 2012
Olive Ridley turtle	2-year	4	2	NMFS 2012
Green turtle	2-year	6	2	NMFS 2012
Humpback whale[a]	2-year	4	0.80	NMFS 2012, with corrections
Short-tailed albatross	5-year	1 injury or death		USFWS 2012a

[a] The humpback whale Hawai`i DPS was delisted under the ESA effective October 11, 2016. Interactions were recorded to monitor the ITS up through that date.

3.2.1.1.3 Non-ESA Marine Mammals

Fishery impacts to marine mammal stocks are primarily assessed and monitored through the Stock Assessment Reports (SARs) prepared pursuant to the MMPA. The SARs include detailed information on these species' geographic range, abundance, potential biological removal (PBR) estimates, bycatch estimates, and status. The most recent SARs are available online at: http://www.nmfs.noaa.gov/pr/sars/.

The Hawai`i shallow-set longline fishery is a Category II under the MMPA 2017 List of Fisheries (LOF) (82 FR 3655, January 12, 2017), meaning that this fishery has occasional incidental mortality and serious injuries of marine mammals. The 2017 LOF lists the following marine mammal stocks that are incidentally killed or injured in this fishery:

- Blainville's beaked whale, HI stock
- Bottlenose dolphin, HI Pelagic stock
- False killer whale, HI Pelagic stock
- Humpback whale, Central North Pacific stock
- Risso's dolphin, HI stock
- Rough-toothed dolphin, HI stock
- Short-finned pilot whale, HI stock
- Striped dolphin, HI stock

Most bycatch estimates in the SARs are based on the most recently available 5-year period, but there is a data lag of at least two years due to the SAR review process. This annual report focuses on available long-term interaction trends and summarizes relevant information from the most recent SAR.

3.2.1.2 DATA SOURCE FOR MONITORING PROTECTED SPECIES INTERACTIONS IN THE HAWAI`I SHALLOW-SET LONGLINE FISHERY

Protected species interactions in the Hawai`i longline fishery have been monitored through mandatory observer coverage since 1994. Observer coverage in the Hawai`i longline fishery was between 3 and 5 percent from 1994 through 1999 and increased to 10 percent in 2000. Since 2004, the shallow-set component of the Hawai`i longline fishery has had 100 percent observer coverage. Annual observed interactions are tallied based on vessel arrival date (rather than interaction date) for the purposes of this report for consistency with the Observer Program reports.

3.2.1.3 SEA TURTLE INTERACTIONS IN THE HAWAI`I SHALLOW-SET LONGLINE FISHERY

Table 53 summarizes the incidental take data of sea turtles from 2004 to 2016 in the Hawai`i shallow-set longline fishery. Since there is full observer coverage for this fishery, all sea turtle interactions have been documented. The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from the PIFSC. The incidental take data for the fourth quarter of 2007 were combined with 2008 data due to vessel confidentiality rules.

All sea turtles observed in the Hawai`i shallow-set longline fishery from 2004 to 2016 were released alive. One loggerhead in 2013 was entangled in marine debris that became entangled with fishing gear and was not counted towards the annual shallow-set interaction limit. One unidentified hard shell in 2013 was classified as a loggerhead per protocol and was counted towards the annual shallow-set interaction limit. The highest interaction rates involved both leatherback and loggerhead turtles (average takes/1,000 hooks = 0.0063 and 0.0089, respectively), whereas interactions with greens, olive ridleys, and unidentified hard shell turtles were much less frequent (0.0003, 0.0003, and 0.0003 respectively).

There are no obvious temporal trends evident in the annual take data for sea turtles for the Hawai`i shallow-set fishery for this time range. Observed number of sea turtle takes per year was variable, ranging between 0-4 greens, 0-2 olive ridleys, 1-19 leatherbacks, 0-17 loggerheads, and 0-2 unidentified hard shell turtles. Furthermore, there have been multiple years where no interactions were observed with greens, olive ridleys, and unidentified sea turtles.

Table 53. Observed takes and takes per fishing effort (1,000 hooks) for sea turtles in the Hawai`i shallow-set longline fishery, 2004-2016[a]

Year	Observer Coverage (%)	Sets	Hooks	Green		Leatherback		Loggerhead		Olive ridley		Unidentified hard shell	
				Takes	Takes/ 1,000 hooks	Takes	Takes/ 1,000 hooks	Takes	Takes/ 1,000 hooks	Takes	Takes/ 1,000 hooks	Takes	Takes/1 ,000 hooks
2004	100	88	76,750	0	0.000	1	0.013	1	0.013	0	0.000	0	0.000
2005	100	1,604	1,328,806	0	0.000	8	0.006	10	0.008	0	0.000	0	0.000
2006	100	939	745,125	0	0.000	2	0.003	17[b]	0.023	0	0.000	2[c]	0.003
2007[d]	100	1,496	1,292,036	0	0.000	5	0.004	15	0.012	1	0.001	0	0.000
2008	100	1,487	1,350,127	1	0.001	2	0.001	0	0.000	2	0.001	0	0.000
2009	100	1,833	1,767,128	1	0.001	9	0.005	3	0.002	0	0.000	0	0.000
2010	100	1,879	1,828,529	0	0.000	7	0.004	5	0.003	0	0.000	0	0.000
2011	100	1,579	1,611,395	4	0.002	17	0.011	14	0.009	0	0.000	0	0.000
2012	100	1,307	1,418,843	0	0.000	7[e]	0.005	5	0.004	0	0.000	0	0.000
2013	100	912	1,000,084	0	0.000	7	0.007	5[f]	0.005	0	0.000	1[g]	0.001
2014	100	1,349	1,509,727	1	0.001	19	0.013	13	0.009	1	0.001	1	0.001
2015	100	1,178	1,286,628	0	0.000	6	0.005	15	0.012	1	0.001	0	0.000
2016	100	778	849,681	0	0.000	5	0.006	16	0.019	0	0.000	0	0.000

[a] Take data are based on vessel arrival dates

[b] The released conditions of two loggerheads were unknown.

[c] The released condition of one unidentified hard shell turtle was unknown.

[d] Due to vessel confidentiality rules, data for the fourth quarter in 2007 are combined with data for 2008. Take data for 2007 reflect those from first, second and third quarters.

[e] The released condition of one leatherback was unknown.

[f] One injured loggerhead was entangled in marine debris, which became entangled with fishing gear. This loggerhead will not count toward the annual shallow-set interaction limit, but is included in this table.

[g] One turtle listed as an unidentified hard shell sea turtle in the Observer Program Status Report is being classified as a loggerhead per protocol for the shallow-set interaction limit and will count toward the annual shallow-set limit.
Sources: 2004-2016 PIRO Observer Program Annual and Quarterly Status Reports

3.2.1.3.1 Comparison of Interactions with ITS

The Hawai`i shallow-set longline fishery operates under ITSs in the 2012 Biological Opinion (NMFS 2012). The 1-year ITSs for leatherback and loggerhead turtle interactions in this fishery are used as a “hard cap” of interactions in a given year, in that the fishery will be closed for the remainder of the year if these numbers are reached. The 2-year ITSs are used for purposes of reinitiating consultation if these numbers are reached in any given two year time period.

NMFS began monitoring the ITS for the Hawai`i shallow-set longline fishery in Quarter 1 of 2012 and uses a rolling 2-year period to track incidental take. NMFS always uses the date of the interaction for tracking sea turtle interactions against the ITS, regardless of when the vessel returns to port. In the PIRO Observer Program Quarterly and Annual Reports, NMFS bases the percent observer coverage on vessel departures and bases sea turtle interactions on vessel arrivals. For this reason, the number of quarterly or annual sea turtle interactions counted against an ITS may vary from those reported on the Observer Program's quarterly and annual reports. NMFS uses post-hooking mortality criteria (Ryder et al. 2006) to calculate sea turtle mortality rates. Since the 2012 Biological Opinion through the end of 2015, the fishery has not exceeded the 2-year ITS for any of the species (Table 54).

Table 54. Observed interactions and estimated total mortality (M) (using Ryder et al. 2006) of sea turtles in the Hawai`i shallow-set longline fishery compared to the 2-year ITS in the 2012 Biological Opinion[a]

Species	2-year ITS Interactions (M)	2-year Monitoring Period Interactions (M)			
		2012-2013	2013-2014	2014-2015	2015-2016
Green turtle	6(2)	0	1(0.25)	1(0.25)	0
Leatherback turtle	52(12)	18(3.05)	27(4.27)	21(4.07)	10(2.5)
Loggerhead turtle	68(14)	12(0.95)	21(2.31)	28(2.95)	28(3)
Olive Ridley turtle	4(2)	0	1(0.05)	2(0.15)	1(0.1)

[a] Interactions are counted based on capture date

3.2.1.3.2 Effectiveness of FEP Conservation Measures

As of the end of 2016, the fishery has not reached the current annual hard cap (26 leatherback and 34 loggerhead turtles) for either species since those hard caps were revised based on the 2012 Biological Opinion ITSs. From 2004-2012, the shallow-set fishery operated under hard caps of 17 loggerhead turtles and 16 leatherback turtles (except in 2010 when the loggerhead hard cap was 46 under Pelagic FEP Amendment 18; later returned to 17 loggerheads due to litigation). The fishery reached the loggerhead hard cap in 2006 and the leatherback hard cap in 2011.

Management measures in the Hawai`i shallow-set longline fishery have been effective in reducing the number of sea turtle interactions. The introduction of sea turtle bycatch-reduction measures for the fishery in 2004, such as switching from J-hooks to circle hooks, and from squid bait to mackerel bait, resulted in an 89% decrease in sea turtle interactions in 2004-2006 compared to interactions observed in 1994-2002 (Gilman et al. 2007). The rate of deeply hooked sea turtles, which is thought to result in higher mortality levels, also declined after those measures were implemented (Gilman et al. 2007).

3.2.1.4 MARINE MAMMAL INTERACTIONS IN THE HAWAI`I SHALLOW-SET LONGLINE FISHERY

Table 55 through Table 59 summarize the incidental take data of marine mammals from 2004 to 2016 in the Hawai`i shallow-set longline fishery. Since there is full observer coverage for this fishery, all marine mammal interactions have been documented. The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Reported interactions listed in these tables reflect all observed interactions, including mortalities, serious injuries, and non-serious injuries. Refer to the most recent SARs for mortality and serious injury estimates and stock-specific estimates of interactions. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from the PIFSC. The incidental take data for the fourth quarter of 2007 were combined with 2008 data due to vessel confidentiality rules.

The majority of observed interactions and all mortalities during this time period involved small dolphin species (Table 55). Of these species, Risso's dolphins had the highest rate of interactions (average takes/1,000 hooks = 0.0022), followed by bottlenose dolphins (0.0011), striped dolphins (0.0004), common dolphins (0.0001) and only one take of a rough-toothed dolphin. Marine mammals grouped as small whales (Table 56) and large whales (Table 57) had comparatively lower rates of interactions than most small dolphin species. For small whales, false killer whales had the highest interaction rate (0.0003), and there was only one take each of a Blainville's beaked whale in 2011, a pygmy sperm whale in 2008 and a ginkgo-tooth beaked whale in 2015. In the large whale group, humpback whales had the highest rate of interactions (0.0003), and there was only one take each of a Bryde's whale in 2005 and a fin whale in 2015. Observed interactions with unidentified cetacean groups are shown in Table 58.

Interactions with pinnipeds, including Northern elephant seals, Guadalupe fur seals, unidentified pinnipeds and unidentified sea lions have been occasionally observed since 2013 (Table 59). A total of five interactions with unidentified pinnipeds and sea lions were observed in 2015, all of which were taken outside of the EEZ offshore of California. One Guadalupe fur seal was released injured in 2016.

There are no obvious temporal trends evident in the annual take data of any species of marine mammal for the Hawai`i shallow-set fishery for this time range. For most species, interactions were relatively infrequent and thus, appeared random. Interactions with Risso's dolphins and bottlenose dolphins were more frequent, but fluctuations in the number of interactions from year to year do not suggest a clear trend for either species over time.

Table 55. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for dolphins in the Hawai`i shallow-set longline fishery, 2004-2016[a]

Year	Observer Coverage (%)	Sets	Hooks	Bottlenose dolphin		Risso's dolphin		Rough-toothed dolphin		Short-beaked common dolphin		Striped dolphin	
				Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks
2004	100	88	76,750	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000
2005	100	1,604	1,328,806	0	0.000	1	0.001	0	0.000	0	0.000	0	0.000
2006	100	939	745,125	1	0.001	2(1)	0.003	0	0.000	0	0.000	0	0.000
2007[b]	100	1,496	1,292,036	3	0.002	3	0.002	0	0.000	0	0.000	0	0.000
2008	100	1,487	1,350,127	0	0.000	4(1)	0.003	0	0.000	0	0.000	1	0.001
2009	100	1,833	1,767,128	0	0.000	3	0.002	0	0.000	0	0.000	0	0.000
2010	100	1,879	1,828,529	2	0.001	7(1)	0.004	0	0.000	0	0.000	2(1)	0.001
2011	100	1,579	1,611,395	2	0.001	4	0.002	0	0.000	1[c]	0.001	0	0.000
2012	100	1,307	1,418,843	1	0.001	0	0.000	0	0.000	0	0.000	1	0.001
2013	100	912	1,000,084	2(1)	0.002	3	0.003	1(1)	0.001	0	0.000	0	0.000
2014	100	1,349	1,509,727	4	0.003	6(2)	0.004	0	0.000	1	0.001	2	0.001
2015	100	1,178	1,286,628	2	0.002	3(2)	0.002	0	0.000	0	0.000	0	0.000
2016	100	778	849,681	1	0.001	2	0.002	0	0.000	0	0.000	1	0.001

[a] Take data are based on vessel arrival dates.

[b] Due to vessel confidentiality rules, data for the fourth quarter in 2007 are combined with data for 2008. Take data for 2007 reflect those from first, second and third quarters.

[c] Animal is identified as only a common dolphin in the Observer Program Status Report.Sources: 2004-2016 PIRO Observer Program Annual and Quarterly Status Reports

Table 56. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for small whales in the Hawai`i shallow-set longline fishery, 2004-2016[a]

Year	Observer Coverage (%)	Sets	Hooks	Blainville's beaked whale		False killer whale		Pygmy sperm whale		Ginkgo-toothed beaked whale	
				Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks
2004	100	88	76,750	0	0.000	0	0.000	0	0.000	0	0.000
2005	100	1,604	1,328,806	0	0.000	0	0.000	0	0.000	0	0.000
2006	100	939	745,125	0	0.000	0	0.000	0	0.000	0	0.000
2007[b]	100	1,496	1,292,036	0	0.000	0	0.000	0	0.000	0	0.000
2008	100	1,487	1,350,127	0	0.000	1	0.001	1	0.001	0	0.000
2009	100	1,833	1,767,128	0	0.000	1	0.001	0	0.000	0	0.000
2010	100	1,879	1,828,529	0	0.000	0	0.000	0	0.000	0	0.000
2011	100	1,579	1,611,395	1	0.001	1	0.001	0	0.000	0	0.000
2012	100	1,307	1,418,843	0	0.000	1	0.001	0	0.000	0	0.000
2013	100	912	1,000,084	0	0.000	0	0.000	0	0.000	0	0.000
2014	100	1,349	1,509,727	0	0.000	1	0.001	0	0.000	0	0.000
2015	100	1,178	1,286,628	0	0.000	0	0.000	0	0.000	1	0.001
2016	100	778	849,681	0	0.000	0	0.000	0	0.000	0	0.000

[a] Take data are based on vessel arrival dates.

[b] Due to vessel confidentiality rules, data for the fourth quarter in 2007 are combined with data for 2008. Take data for 2007 reflect those from first, second and third quarters.

Sources: 2004-2016 PIRO Observer Program Annual and Quarterly Status Reports

Table 57. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for large whales in the Hawai`i shallow-set longline fishery, 2004-2016 [a]

Year	Observer Coverage (%)	Sets	Hooks	Bryde's whale		Humpback whale		Fin whale	
				Takes (M)	Takes/1,000 hooks	Takes (M)	Takes/1,000 hooks	Takes (M)	Takes/1,000 hooks
2004	100	88	76,750	0	0.000	0	0.000	0	0.000
2005	100	1,604	1,328,806	1	0.001	0	0.000	0	0.000
2006	100	939	745,125	0	0.000	1	0.001	0	0.000
2007[b]	100	1,496	1,292,036	0	0.000	0	0.000	0	0.000
2008	100	1,487	1,350,127	0	0.000	1	0.001	0	0.000
2009	100	1,833	1,767,128	0	0.000	0	0.000	0	0.000
2010	100	1,879	1,828,529	0	0.000	0	0.000	0	0.000
2011	100	1,579	1,611,395	0	0.000	1	0.001	0	0.000
2012	100	1,307	1,418,843	0	0.000	0	0.000	0	0.000
2013	100	912	1,000,084	0	0.000	0	0.000	0	0.000
2014	100	1,349	1,509,727	0	0.000	0	0.000	0	0.000
2015	100	1,178	1,286,628	0	0.000	1	0.001	1	0.001
2016	100	778	849,681	0	0.000	0	0.000	0	0.000

[a] Take data are based on vessel arrival dates.

[b] Due to vessel confidentiality rules, data for the fourth quarter in 2007 are combined with data for 2008. Take data for 2007 reflect those from first, second and third quarters.

Source: 2004-2016 PIRO Observer Program Annual and Quarterly Status Reports

Table 58. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for unidentified dolphins, beaked whales, whales, and cetaceans in the Hawai`i shallow-set longline fishery, 2004-2016[a]

Year	Observer Coverage (%)	Sets	Hooks	Unidentified dolphin[b]		Unidentified beaked whale		Unidentified whale[b]		Unidentified cetacean[b]	
				Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks
2004	100	88	76,750	0	0.000	0	0.000	0	0.000	0	0.000
2005	100	1,604	1,328,806	0	0.000	0	0.000	1	0.001	0	0.000
2006	100	939	745,125	0	0.000	0	0.000	0	0.000	0	0.000
2007[c]	100	1,496	1,292,036	0	0.000	0	0.000	0	0.000	0	0.000
2008	100	1,487	1,350,127	0	0.000	0	0.000	1	0.001	0	0.000
2009	100	1,833	1,767,128	0	0.000	0	0.000	1	0.001	0	0.000
2010	100	1,879	1,828,529	1	0.001	0	0.000	0	0.000	0	0.000
2011	100	1,579	1,611,395	0	0.000	1	0.001	0	0.000	2	0.001
2012	100	1,307	1,418,843	0	0.000	0	0.000	0	0.000	1	0.001
2013	100	912	1,000,084	0	0.000	2	0.002	0	0.000	0	0.000
2014	100	1,349	1,509,727	0	0.000	0	0.000	0	0.000	0	0.000
2015	100	1,178	1,286,628	0	0.000	0	0.000	0	0.000	0	0.000
2016	100	778	849,681	0	0.000	0	0.000	0	0.000	0	0.000

[a] Take data are based on vessel arrival dates.

[b] Unidentified species identification based on PIRO Observer Program classifications. Unidentified cetacean refers to a marine mammal not including pinnipeds (seal or sea lion); unidentified whale refers to a large whale; unidentified dolphin refers to a small cetacean with a visible beak; and unidentified beaked whale refers to an animal in the Ziphiidae family. Further classifications based on observer description, sketches, photos and videos may be available from the PIFSC.

[c] Due to vessel confidentiality rules, data for the fourth quarter in 2007 are combined with data for 2008. Take data for 2007 reflect those from first, second and third quarters.

Source: 2004-2016 PIRO Observer Program Annual and Quarterly Status Reports

Table 59. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for pinnipeds in the Hawai`i shallow-set longline fishery, 2004-2016[a]

Year	Observer Coverage (%)	Sets	Hooks	Northern elephant seal		Guadalupe fur seal		Unidentified pinniped		Unidentified sea lion	
				Takes (M)	Takes/1,000 hooks	Takes (M)	Takes/1,000 hooks	Takes (M)	Takes/1,000 hooks	Takes (M)	Takes/1,000 hooks
2004	100	88	76,750	0	0.000	0	0.000	0	0.000	0	0.000
2005	100	1,604	1,328,806	0	0.000	0	0.000	0	0.000	0	0.000
2006	100	939	745,125	0	0.000	0	0.000	0	0.000	0	0.000
2007[b]	100	1,496	1,292,036	0	0.000	0	0.000	0	0.000	0	0.000
2008	100	1,487	1,350,127	0	0.000	0	0.000	0	0.000	0	0.000
2009	100	1,833	1,767,128	0	0.000	0	0.000	0	0.000	0	0.000
2010	100	1,879	1,828,529	0	0.000	0	0.000	0	0.000	0	0.000
2011	100	1,579	1,611,395	0	0.000	0	0.000	0	0.000	0	0.000
2012	100	1,307	1,418,843	0	0.000	0	0.000	0	0.000	0	0.000
2013	100	912	1,000,084	1	0.001	0	0.000	0	0.000	0	0.000
2014	100	1,349	1,509,727	1	0.001	0	0.000	0	0.000	1	0.001
2015	100	1,178	1,286,628	0	0.000	0	0.000	3[c]	0.002	2[c]	0.002
2016	100	778	849,681	0	0.000	1	0.001	0	0.000	0	0.000

[a] Take data are based on vessel arrival dates.

[b] Due to vessel confidentiality rules, data for the fourth quarter in 2007 are combined with data for 2008. Take data for 2007 reflect those from first, second and third quarters.

[c] The interactions with these pinnipeds and sea lions occurred off the California coast, outside the EEZ, while fishing under the Hawai`i Longline Permit.

Source: 2004-2016 PIRO Observer Program Annual and Quarterly Status Reports

3.2.1.4.1 Comparison of Interactions with ITS

The Hawai`i shallow-set longline fishery operates under the ITS in the 2012 Biological Opinion for humpback whales. The 1-year ITS for humpback whales is 2 interactions and 0.40 mortalities, and the 2-year ITS is 4 interactions and 0.80 mortalities.

NMFS began monitoring the ITS for the Hawai`i shallow-set longline fishery in Quarter 1 of 2012 and uses a rolling 2-year period to track incidental take. NMFS always uses the date of the interaction for tracking marine mammal interactions against the ITS, regardless of when the vessel returns to port. In the PIRO Observer Program Quarterly and Annual Reports, NMFS bases the percent observer coverage on vessel departures and bases marine mammal interactions on vessel arrivals. For this reason, the number of quarterly or annual marine mammal interactions counted against an ITS may vary from those reported on the Observer Program's quarterly and annual reports. NMFS uses mortality and serious injury (M&SI) determinations under the MMPA to calculate marine mammal mortality rates. Since the 2012 Biological Opinion through the end of 2016, the fishery has not exceeded the 2-year ITS for humpback whales (Table 60).

On September 8, 2016, NMFS issued a final rule identifying 14 distinct population segments (DPS) of the humpback whale under the ESA (81 FR 62260). Under this final rule, the Hawai`i DPS is not listed. Interactions were recorded for purposes of monitoring the ITS through the effective date, which was October 11, 2016.

Table 60. Observed interactions and estimated total mortality (M) of humpback whales in the Hawai`i shallow-set longline fishery compared to the 2-year ITS in the 2012 Biological Opinion[a]

Species	2-year ITS Interactions (M)	2-year Monitoring Period Interactions (M)			
		2012-2013	2013-2014	2014-2015	2015-2016
Humpback whale	4(0.8)	0	0	1(0.29)	1(0.29)

[a] Interactions are counted based on capture date.

3.2.1.4.2 Comparison of Interactions with PBR under the MMPA

Marine mammal takes against the PBR are monitored through the SARs. A summary of the current mean annual M&SI and the PBR for stocks relevant to the Hawai`i shallow-set longline fishery is presented in Table 61. The PBR of a stock reflects only marine mammals of that stock observed within the EEZ around Hawai`i, with the exception of the Central North Pacific stock of humpback whales for which PBR applies to the entire stock. The mean annual M&SI specified in the SARs includes only interactions determined as mortalities and serious injuries; it does not include interactions classified as non-serious injuries. The shallow-set longline fishery has not had an observed interaction with a short-finned pilot whale, but a mean annual M&SI is estimated for the Hawai`i stock based on a proration of unidentified blackfish interactions.

For marine mammal stocks where the PBR is available, the mean annual M&SI for the shallow-set longline fishery inside the EEZ around Hawai`i is well below the corresponding PBR in the time period covered by the current SAR (Table 61).

Table 61. Summary of mean annual mortality and serious injury (M&SI) and potential biological removal (PBR) by marine mammal stocks with observed interactions in the Hawai`i shallow-set longline fishery

Stock	Years Included in 2016 SAR	Outside EEZ[a]	Inside EEZ	
		Mean Annual M&SI	Mean Annual M&SI	PBR (Inside EEZ only)[c]
Bottlenose dolphin, HI Pelagic	2007-2011	1.2	0.2	38
Risso's dolphin, HI	2007-2011	3.6	0	42
Rough-toothed dolphin, HI	2007-2011	0	0	46
Striped dolphin, HI	2007-2011	0.6	0	154
Blainville's beaked whale, HI	2007-2011	0	0	11
False killer whale, HI Pelagic	2010-2014	0.1	0.1	9.3
Short-finned pilot whale, HI	2007-2011	0.1	0	70
Kogia spp. whale (Pygmy or dwarf sperm whale), HI	2007-2011	Pygmy = 0 Dwarf = 0	Pygmy = 0 Dwarf = 0	undetermined
Humpback whale, Central North Pacific	2009-2013	0.2[b]		83[b]
Fin whale, HI	2007-2011	0	0	0.1
Guadalupe fur seal, CA	2010-2014	0[d]		542 [d]

[a] PBR estimates are not available for portions of the stock outside of the U.S EEZ around Hawai`i, except for the Central North Pacific stock of humpback whales for which PBR applies to the entire stock.

[b] PBR and M&SI for the Central North Pacific stock for humpback whales apply to the entire stock.

[c] PBR estimates for Hawai`i stocks are only available for portions of the stock within the U.S. EEZ around Hawai`i.

[d] PBR and M&SI estimates for the Guadalupe fur seal use data from 2010-2014, which only include data from the U.S. West Coast and therefore do not include the seal taken in 2016 in the Hawai`i shallow-set longline fishery. The M&SI estimate is only for the Hawai`i shallow-set longline fishery, and the PBR estimate applies to the entire population.

Source: 2016 SARs.

3.2.1.5 SEABIRD INTERACTIONS IN THE HAWAI`I SHALLOW-SET LONGLINE FISHERY

Table 62 summarizes the incidental take data of seabirds from 2004 to 2016 in the Hawai`i shallow-set longline fishery. Since there is full observer coverage for this fishery, the interactions in Table 15 represent fishery-wide totals.

Interaction data provided here may vary slightly from other sources depending on how interactions were reported (date of trip departure or arrival, set date, or haul date in a given year). The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from NMFS.

NMFS annually publishes the report Seabird Interactions and Mitigation Efforts in Hawai`i Longline Fisheries (Seabird Annual Report), which includes verified numbers of seabird interactions and information on fishing regulations and effort, interaction rates, and band recovery data for seabirds caught in the shallow-set and deep-set fisheries. The reports are available at: http://www.fpir.noaa.gov/SFD/SFD_seabirds.html.

The large majority of observed interactions and all mortalities during this time period involved Laysan albatrosses (average takes/1,000 hooks = 0.0309) and black-footed albatrosses (0.0171). There were also four interactions with shearwaters (0.0003) and one northern fulmar, all of which were released injured. NMFS identified the shearwaters as sooty shearwaters (NMFS 2016). There have been no observed takes of short-tailed albatross by this fishery. The table suggests a marginal increase in takes of black-footed albatross after 2008, however no such trend is apparent for Laysan albatross.

Table 62. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for seabirds in the Hawai`i shallow-set longline fishery, 2004-2016 [a]

Year	Observer Coverage (%)	Sets	Hooks	Laysan Albatross		Black-footed Albatross		Northern fulmar		Unidentified shearwater		Short-tailed Albatross
				Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks	Takes (M)
2004	100	88	76,750	1	0.013	0	0.000	0	0.000	0	0.000	0
2005	100	1,604	1,328,806	62(18)	0.047	7(4)	0.005	0	0.000	0	0.000	0
2006	100	939	745,125	8(3)	0.011	3(3)	0.004	0	0.000	0	0.000	0
2007[b]	100	1,496	1,292,036	39(6)	0.030	8(2)	0.006	0	0.000	0	0.000	0
2008	100	1,487	1,350,127	33(11)	0.024	6(4)	0.004	0	0.000	0	0.000	0
2009	100	1,833	1,767,128	81(17)	0.046	29(7)	0.016	0	0.000	1[c]	0.001	0
2010	100	1,879	1,828,529	40(7)	0.022	39(11)	0.021	1	0.001	0	0.000	0
2011	100	1,579	1,611,395	49(10)	0.030	19(5)	0.012	0	0.000	0	0.000	0
2012	100	1,307	1,418,843	61(11)	0.043	37(10)	0.026	0	0.000	0	0.000	0
2013	100	912	1,000,084	46(10)	0.046	28(17)	0.028	0	0.000	2[c]	0.002	0
2014	100	1,349	1,509,727	36(2)	0.024	29(14)	0.019	0	0.000	1[c]	0.001	0
2015	100	1,178	1,286,628	45(6)	0.035	41(10)	0.032	0	0.000	0	0.000	0
2016	100	778	849,681	26(3)	0.031	40(12)	0.047	0	0.000	0	0.000	0

[a] Take data are based on vessel arrival dates.

[b] Due to vessel confidentiality rules, data for the fourth quarter in 2007 are combined with data for 2008. Take data for 2007 reflect those from first, second and third quarters.

[c] These birds were later identified as sooty shearwaters in the NMFS Seabird Annual ReportSources: 2004-2016 PIRO Observer Program Annual and Quarterly Status Reports

3.2.1.5.1 Comparison of Interactions with ITS

The short-tailed albatross ITS in the USFWS 2012 Biological Opinion for the Hawai`i longline fishery is 1 incidental take every 5 years in the shallow-set fishery. Exceeding this number will lead to reinitiating consultation of the impact of this fishery on the species. Since there have been no observed takes of short-tailed albatross in the fishery, the ITS has not been exceeded as of the end of 2016.

3.2.1.6 SCALLOPED HAMMERHEAD SHARK INTERACTIONS IN THE HAWAI`I SHALLOW-SET LONGLINE FISHERY

There have been no recorded or observed take of scalloped hammerhead sharks in the range of the Eastern Pacific DPS in the shallow-set fishery. Based on the known range and likely occurrence for the Eastern Pacific DPS, it is unlikely that these sharks occur in the area where shallow-set fishing occurs.

3.2.2 HAWAI`I DEEP-SET LONGLINE FISHERY

3.2.2.1 INDICATORS FOR MONITORING PROTECTED SPECIES INTERACTIONS AND EFFECTIVENESS OF MANAGEMENT MEASURES IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

In this annual report, the Council monitors protected species interactions in the Hawai`i deep-set longline fishery using the following indicators:

- General interaction trends over time
- Effectiveness of FEP conservation measures
- Take levels compared to authorized take levels under ESA
- Take levels compared to marine mammal PBRs, where applicable

Details of these indicators are discussed below.

3.2.2.1.1 Conservation Measures

The Pelagic FEP includes a number of conservation measures to mitigate seabird and sea turtle interactions in the deep-set longline fishery. These measures include the following:

- Longline vessel owners/operators are required to adhere to regulations for safe handling and release of sea turtles and seabirds.
- Longline vessel owners/operators must have on board the vessel all required turtle handling/dehooking gear specified in regulations.
- Deep-set fishing operations north of 23º N latitude are required to comply with seabird mitigation regulations, which include choosing between side-setting or stern-setting longline gear with additional regulatory specifications (e.g., blue-dyed bait, weighted branch lines, strategic offal discards, using a “bird curtain”).
- The fishery is observed at a minimum of 20 percent coverage.

- Vessel owners and operators are required to annually attend a protected species workshop.

3.2.2.1.2 ESA Consultations

The Hawai`i deep-set longline fishery is covered under a NMFS Biological Opinion dated September 19, 2014 (NMFS 2014). NMFS concluded that the fishery is not likely to jeopardize four sea turtle species (North Pacific DPS loggerhead, leatherback, olive ridley and green turtles), three marine mammal species (humpback whale, sperm whale and MHI insular DPS false killer whale) and the Indo-West Pacific DPS of scalloped hammerhead sharks, and not likely to adversely affect hawksbill turtles, four marine mammal species (blue, North Pacific right and sei whale, and Hawaiian monk seal) and the Eastern Pacific DPS of scalloped hammerhead sharks (Table 63). A USFWS Biological Opinion dated January 6, 2012, also concluded that the fishery is not likely to jeopardize short-tailed albatrosses (USFWS 2012a). An additional informal consultation dated September 16, 2015 concluded that the fishery is not likely to adversely affect fin whales or Hawaiian monk seal critical habitat.

NMFS and USFWS have issued ITSs for species included in the Biological Opinions and determined not to jeopardize the species (Table 64). Exceedance of the 3-year or 5-year ITSs requires reconsultation of the fishery under the ESA. The ITSs for green turtle and loggerhead turtles were exceeded in 2015 and the ITS for olive ridley turtles was exceeded during the first quarter of 2016, and reconsultation was completed on March 24, 2017.

Table 63. Summary of ESA consultations for the Hawai`i deep-set longline fishery.

Species	Consultation Date	Consultation Type[a]	Outcome[b]
Loggerhead turtle, North Pacific DPS	2017-03-24	Supplemental BiOp	LAA, non-jeopardy
Leatherback turtle	2014-09-19	BiOp	LAA, non-jeopardy
Olive ridley turtle	2017-03-24	Supplemental BiOp	LAA, non-jeopardy
Green turtle	2017-03-24	Supplemental BiOp	LAA, non-jeopardy
Hawksbill turtle	2014-09-19	BiOp	NLAA
Humpback whale	2014-09-19	BiOp	LAA, non-jeopardy
False killer whale, MHI insular DPS	2014-09-19	BiOp	LAA, non-jeopardy
Fin whale	2015-09-16	LOC	NLAA
Blue whale	2014-09-19	BiOp	NLAA
North Pacific right whale	2014-09-19	BiOp	NLAA
Sei whale	2014-09-19	BiOp	NLAA
Sperm whale	2014-09-19	BiOp	LAA, non-jeopardy
Hawaiian monk seal	2014-09-19	BiOp	NLAA
Scalloped hammerhead shark, Eastern Pacific DPS	2014-09-19	BiOp	NLAA
Scalloped hammerhead shark, Indo-West Pacific DPS	2014-09-19	BiOp	LAA, non-jeopardy
Short-tailed albatross	2012-01-06	BiOp (FWS)	LAA, non-jeopardy
Critical Habitat: Hawaiian monk seal	2015-09-16	LOC	NLAA

[a] BiOp = Biological Opinion; LOC = Letter of Concurrence.

[b] LAA = likely to adversely affect; NLAA = not likely to adversely affect.

Table 64. Summary of ITSs for the Hawai`i deep-set longline fishery.

Species	ITS Time Period	Takes	Mortalities	Source BiOp
Loggerhead turtle (North Pacific DPS)	3-year	9	9	NMFS 2014, NMFS 2017
Leatherback turtle	3-year	72	27	NMFS 2014
Olive Ridley turtle	3-year	99	96	NMFS 2014, NMFS 2017
Green turtle	3-year	9	9	NMFS 2014, NMFS 2017
Humpback whale[b]	3-year	6	3	NMFS 2014
Sperm whale	3-year	9	6	NMFS 2014
False killer whale (MHI insular DPS)	3-year	1	0.74	NMFS 2014
Scalloped hammerhead shark (Indo-West Pacific DPS)[a]	3-year	6	3	NMFS 2014
Short-tailed albatross	5-year	2 injuries or deaths		FWS 2012

[a] An ITS is not required for the Indo-West Pacific DPS of scalloped hammerhead sharks due to the lack of take prohibition under ESA section 4(d), but NMFS included an ITS to serve as a check on the no-jeopardy conclusion by providing a reinitiation trigger.

[b] The humpback whale Hawai`i DPS was delisted under the ESA effective October 11, 2016. Interactions were recorded up through that date to monitor the ITS.

3.2.2.1.3 Non-ESA Marine Mammals

Fishery impacts to marine mammal stocks are primarily assessed and monitored through the SARs prepared pursuant to the MMPA. The SARs include detailed information on these species' geographic range, abundance, PBR estimates, bycatch estimates, and status. The most SARs are available online at: http://www.nmfs.noaa.gov/pr/sars/.

The Hawai`i deep-set longline fishery is a Category I under the MMPA 2017 List of Fisheries (LOF) (82 FR 3655, January 12, 2017), meaning that NMFS has determined that this fishery has frequent incidental mortality and serious injuries of marine mammals. The 2017 LOF lists the following marine mammal stocks that are incidentally killed or injured in this fishery:

- Bottlenose dolphin, HI Pelagic stock
- False killer whale, MHI Insular stock (also ESA-listed)
- False killer whale, HI Pelagic stock
- False killer whale, NWHI stock
- Pygmy killer whale, HI stock
- Risso's dolphin, HI stock
- Short-finned pilot whale, HI stock
- Sperm whale, HI stock (also ESA-listed)
- Striped dolphin, HI stock

Most bycatch estimates in the SARs are based on the most recently available 5-year period, but there is a data lag of approximately 2 years due to the SAR review process. This annual report focuses on available long-term interaction trends and summarizes relevant information from the most recent SAR.

3.2.2.2 DATA SOURCE FOR MONITORING PROTECTED SPECIES INTERACTIONS IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

Protected species interactions in the Hawai`i longline fishery have been monitored through mandatory observer coverage since 1994. Observer coverage in the Hawai`i longline fishery was between 3 and 5 percent from 1994 through 1999, increased to 10 percent in 2000, then to 20 percent in 2001. This report summarizes protected species interactions in the Hawai`i deep-set longline fishery since 2002, when separate reporting by deep-set and shallow-set components of the longline fishery began. Annual observed interactions are tallied based on vessel arrival date (rather than interaction date) for the purposes of this report for consistency with the Observer Program reports.

3.2.2.3 SEA TURTLE INTERACTIONS IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

Table 65 summarizes the incidental take data of sea turtles from 2002 to 2016 in the Hawai`i deep-set longline fishery. Observer coverage on vessels operating in this fishery ranged from 20.1% to 26.1%. The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from the PIFSC. Observed take data are expanded to represent the estimated number of incidental takes for the entire fishery by PIFSC (referred to in this document as “McCracken estimates (ME).” When ME were not available, a standard expansion factor estimate was used (EF Est. = 100/% observer coverage * # takes).

Using the expanded estimates, the average annual numbers of incidental takes during this time period were 3 greens, 11 leatherbacks, 4 loggerheads, and 41 olive ridleys. The highest interaction rates involved olive ridley sea turtles (2002-2016 average takes/1,000 hooks = 0.001), whereas interactions with leatherbacks, greens, and loggerheads were much more infrequent (0.0003, <0.0001, and 0.0001 respectively).

Observed sea turtle takes year to year were variable, ranging between 0-3 greens (0-16 expanded estimates), 1-7 leatherbacks (4-38), 0-4 loggerheads (0-17), and 3-31 olive ridleys (10-69). Furthermore, there have been multiple years where no interactions were observed with greens and loggerheads.

Preliminary results from an analysis conducted by PIFSC and presented to the Scientific and Statistical Committee at its 122nd Meeting in March 2016 showed that leatherback interactions in 2014 were significantly higher than levels expected from previous years (2007-2013). The higher level of interactions in 2014 was considered in the 2014 Biological Opinion, which concluded that the fishery is not likely to jeopardize leatherback turtles. Leatherback interactions since the 2014 Biological Opinion remain below the ITS of 72 interactions over three years. The Council at its 165th Meeting in March 2016 recommended continued monitoring of the interactions and further analysis to evaluate patterns of leatherback interactions in the Hawai`i deep-set longline fishery.

The higher level of olive ridley turtle interactions was considered in the 2017 Supplemental Biological Opinion, which analyzed impacts with data through the second quarter of 2016 (25 of the 31 interactions occurred in the first two quarters). The 2017 Supplemental Biological Opinion concluded that the fishery is not likely to jeopardize olive ridley turtles after considering this higher level of interactions. The Council's Protected Species Advisory Committee at its March 2017 meeting discussed the olive ridley turtle interaction trend and recommended evaluation of the increasing trend in conjunction with the previously recommended effort to evaluate ecosystem factors influencing bycatch in the longline fishery.

Table 65. Observed takes, mortalities (M), takes per fishing effort (1,000 hooks), and estimated annual takes using expansion factor estimates and ME for sea turtles in the Hawai`i deep-set longline fishery, 2002-2016[a]

				Green				Leatherback				Loggerhead				Olive ridley				Unidentified hard shell		
				Observed				Observed				Observed				Observed				Observed		
Year	Obs. Cov. (%)	Sets	Hooks	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	ME
2002	24.6	3,523	6,786,303	1(1)	0.0001	-	3	2	0.0003	-	5	4(1)	0.0006	-	17	7(7)	0.0010	-	31	0	0.0000	-
2003	22.2	3,204	6,442,221	0	0.0000	-	0	1(1)	0.0002	-	4	0	0.0000	-	0	3(3)	0.0005	-	14	0	0.0000	-
2004	24.6	3,958	7,900,681	1(1)	0.0001	-	5	3	0.0004	-	15	0	0.0000	-	0	13(13)	0.0016	-	46	0	0.0000	-
2005	26.1	4,602	9,360,671	0	0.0000	-	0	1	0.0001	-	4	0	0.0000	-	0	4(4)	0.0004	-	16	0	0.0000	-
2006	21.2	3,605	7,540,286	2(2)	0.0003	-	6	2(2)	0.0003	-	9	0	0.0000	-	0	11(10)	0.0015	-	54	0	0.0000	-
2007	20.1	3,506	7,620,083	0	0.0000	-	0	2	0.0003	-	4	1(1)	0.0001	-	7	7(7)	0.0009	-	26	0	0.0000	-
2008	21.7	3,915	8,775,951	0	0.0000	-	0	1	0.0001	-	11	0	0.0000	-	0	3(3)	0.0003	-	18	0	0.0000	-
2009	20.6	3,520	7,877,861	0	0.0000	-	0	1(1)	0.0001	-	4	0	0.0000	-	0	4(4)	0.0005	-	18	0	0.0000	-
2010	21.1	3,580	8,184,127	1(1)	0.0001	-	1	1(1)	0.0001	-	6	1(1)	0.0001	-	6	4(3)[a]	0.0005	-	10	0	0.0000	-
2011	20.3	3,540	8,260,092	1(1)	0.0001	-	5	3	0.0004	-	14	0	0.0000	-	0	7(6)	0.0008	-	36	0	0.0000	-
2012	20.4	3,659	8,768,728	0	0.0000	-	0	1(1)	0.0001	-	6	0	0.0000	-	0	6(6)	0.0007	-	34	0	0.0000	-
2013	20.4	3,830	9,278,133	1(1)	0.0001	-	5	3	0.0003	-	15	2(2)	0.0002	-	11	9(9)	0.0010	-	42	0	0.0000	-
2014	20.8	3,831	9,608,244	3(3)	0.0003	-	16	7(2)	0.0007	-	38	0	0.0000	-	0	8(7)	0.0008	-	50	0	0.0000	-
2015	20.6	3,728	9,393,234	1(1)	0.0001	-	4	4(2)	0.0004	-	18	2(2)	0.0002	-	9	13(12)	0.0014	-	69	0	0.0000	-
2016	20.1	3,880	9,872,439	1(1)	0.0001	-	5	3(1)	0.0003	-	15	2(1)	0.0002	-	7	31(28)	0.0031	-	162	1(1)	0.0001	5

[a] Take data are based on vessel arrival dates.

[a] One olive ridley turtle interaction (released injured) occurred inside the American Samoa EEZ. This interaction was included in the Observer Program Annual Report for the Hawai`i deep-set fishery because the vessel departed Honolulu under the Hawai`i longline permit.

Sources: Take data—2002-2016 PIRO Observer Program Annual and Quarterly Status Reports

Expansion estimates for 2002-2003 — NMFS 2005.

ME—McCracken, 2005; McCracken, 2006; McCracken, 2007; McCracken, 2008; McCracken, 2009; McCracken, 2010; McCracken, 2011b; McCracken, 2012; McCracken, 2013; McCracken, 2014; McCracken 2017c, McCracken 2017d

3.2.2.3.1 Comparison of Interactions with ITS

The Hawai`i deep-set longline fishery operates under the 3-year ITS in the 2014 Biological Opinion for leatherback sea turtles, and in the 2017 Supplemental Biological Opinion for all other sea turtle species (Table 66, Table 67). NMFS began monitoring the 2014 Biological Opinion ITS in Quarter 3 of 2014 and the 2017 Supplemental Biological Opinion ITS in Quarter 3 of 2016, and uses a rolling 3-year period to track incidental take. NMFS always uses the date of the interaction for tracking sea turtle interactions against the ITS, regardless of when the vessel returns to port. In the PIRO Observer Program Quarterly and Annual Reports, NMFS bases the percent observer coverage on vessel departures and bases sea turtle interactions on vessel arrivals. For this reason, the number of quarterly or annual sea turtle interactions counted against an ITS may vary from those reported on the Observer Program's quarterly and annual reports. NMFS uses post-hooking mortality criteria (Ryder et al. 2006) to calculate sea turtle mortality rates.

Table 66. Estimated total interactions (extrapolated using quarterly observer coverage) and total mortalities (M) (using Ryder et al. 2006) of sea turtles in the Hawai`i deep-set longline fishery from 2014 third quarter to 2016 fourth quarter compared to the 3-year ITS in the 2014 Biological Opinion[a]

Species	3-year ITS Interactions (M)	Estimated Total Interactions and Mortalities from Q3 2014 to Q4 2016 Interactions (M)
Green turtle[b]	9(9)	15(14.1)[b]
Leatherback turtle	72(27)	39(14.1)
Loggerhead turtle[b]	9(9)	19(13.9)[b]
Olive ridley turtle[b]	99(96)	207(196.65)[b]

[a] Interactions are counted based on capture date.

[b] These species exceeded their ITSs, and interactions beginning the third quarter of 2016 count against their new ITSs (NMFS 2017). Estimated total interactions and mortalities for these species only include takes through the second quarter of 2016.

Table 67. Estimated total interactions (extrapolated using quarterly observer coverage) and total mortalities (M) (using Ryder et al. 2006) of green, loggerhead, and olive ridley sea turtles in the Hawai`i deep-set longline fishery from 2016 third quarter to 2016 fourth quarter compared to the 3-year ITS in the 2017 Supplemental Biological Opinion[a]

Species	3-year ITS Interactions (M)	Estimated Total Interactions and Mortalities from Q3 2016 to Q4 2016 Interactions (M)
Green turtle		
East Pacific DPS	12(12)	0
Central North Pacific DPS	6(6)	0
East Indian-west Pacific DPS	6(6)	0
Southwest Pacific DPS	6(6)	0
Central West Pacific DPS	3(3)	0
Central South Pacific DPS	3(3)	0

Loggerhead turtle	18(13)	0
Olive Ridley turtle		
Endangered Mexico and threatened eastern Pacific populations	141(134)	20.79(19.75)
Threatened western Pacific populations	42(40)	6.21(5.89)

[a] Interactions are counted based on capture date.

3.2.2.4 MARINE MAMMAL INTERACTIONS IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

Table 68 through Table 71 summarize the incidental take data of marine mammals from 2002 to 2016 in the Hawai`i deep-set longline fishery. Observer coverage on vessels operating in this fishery ranged from 20.1% to 26.1%. The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Reported interactions listed in these tables reflect all observed interactions, including mortalities, serious injuries, and non-serious injuries. Refer to the most recent SARs for mortality and serious injury estimates and stock-specific abundance estimates and geographic range. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from the PIFSC. Observed take data are expanded to represent the estimated number of annual incidental takes for the entire fishery by PIFSC (referred to in this document as "ME"). When ME were not available, a standard expansion factor estimate was listed in the table (EF Est. = 100/% observer coverage * # takes).

The majority of observed interactions and all observed mortalities during this time period involved dolphin and small whale species (Table 68, Table 69). False killer whales had the highest interaction rate over the 2002-2016 period (average takes/1,000 hooks = 0.0006), followed by short-finned pilot whales (<0.0001), bottlenose dolphins (<0.0001) and Risso's dolphins (<0.0001). Very few interactions were observed with striped dolphins, pantropical spotted dolphins, rough-toothed dolphins, Blainville's beaked whales, pygmy killer whales, and *Kogia* species whales. Interactions with marine mammals grouped as large whales were also rare, with observed interactions recorded with humpback whales and one sperm whale (Table 70). Observed interactions with unidentified cetacean groups are shown in Table 71.

There are no obvious temporal trends evident in the observed annual take data of each species of marine mammal for the Hawai`i deep-set fishery for this time range. For most species, interactions were rare, only being observed once or twice during the 2002-2016 period. Observed interactions with false killer whales were more frequent, but fluctuations in the number of interactions (ranging between 6 and 55 expanded annual estimated takes) do not suggest a clear trend for this species over time. There was also variability in expanded annual estimated takes of other marine mammals such as bottlenose dolphins (0-11 takes), Risso's dolphins (0-10 takes), and short-finned pilot whales (0-6 takes).

Table 68. Observed takes, mortalities (M), takes per fishing effort (1,000 hooks), and estimated annual takes using expansion factor estimates and ME for dolphins in the Hawai`i deep-set longline fishery, 2002-2016[a]

				Bottlenose dolphin				Pantropical spotted dolphin				Rough-toothed dolphin				Risso's dolphin				Striped dolphin			
				Observed				Observed				Observed				Observed				Observed			
Year	Obs. Cov. (%)	Sets	Hooks	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME
2002	24.6	3,523	6,786,303	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-
2003	22.2	3,204	6,442,221	1(1)	0.0002	5	-	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-
2004	24.6	3,958	7,900,681	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	0	-	0	0.0000	-	0	0	0.0000	0	-
2005	26.1	4,602	9,360,671	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	0	-	1	0.0001	-	3	0	0.0000	0	-
2006	21.2	3,605	7,540,286	1	0.0001	-	1	0	0.0000	-	0	0	0.0000	0	-	2	0.0003	-	5	1(1)	0.0001	-	6
2007	20.1	3,506	7,620,083	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	0	-	1(1)	0.0001	-	3	0	0.0000	-	0
2008	21.7	3,915	8,775,951	0	0.0000	-	0	1(1)	0.0001	-	3	0	0.0000	0	-	1	0.0001	-	2	0	0.0000	-	0
2009	20.6	3,520	7,877,861	1	0.0001	-	5	0	0.0000	-	0	0	0.0000	0	-	0	0.0000	-	0	0	0.0000	-	0
2010	21.1	3,580	8,184,127	1	0.0001	-	4	0	0.0000	-	0	0	0.0000	-	0	1	0.0001	-	3	0	0.0000	-	0
2011	20.3	3,540	8,260,092	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0	1(1)	0.0001	-	4
2012	20.4	3,659	8,768,728	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0
2013	20.4	3,830	9,278,133	2(1)	0.0002	-	11	0	0.0000	-	0	1(1)	0.0001	-	5	0	0.0000	-	0	0	0.0000	-	0
2014	20.8	3,831	9,608,244	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0
2015	20.6	3,728	9,393,234	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0	2(1)	0.0002	-	10	0[b]	0.0000	-	4[b]
2016	20.1	3,880	9,872,439	1	0.0001	5	-	0	0.0000	0	-	1(1)	0.0001	5	-	0	0.0000	0	-	0	0.0000	0	-

[a] Take data are based on vessel arrival dates.

[b] One unidentified dolphin was later identified as a striped dolphin (Table 71), but is listed as an unidentified dolphin in the 2015 Annual Observer Report.

Sources: Take data—2002-2016 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2005; McCracken, 2006; McCracken, 2011a; McCracken, 2016; McCracken, 2017b.

Table 69. Observed takes, mortalities (M), takes per fishing effort (1,000 hooks), and estimated annual takes using expansion factor estimates and ME for small whales in the Hawai`i deep-set longline fishery, 2002-2016[a]

Year	Obs. Cov. (%)	Sets	Hooks	Blainville's beaked whale				False killer whale				*Kogia* species				Pygmy killer whale				Short-finned pilot whale			
				Observed				Observed				Observed				Observed				Observed			
				Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME
2002	24.6	3,523	6,786,303	1(1)	0.0001	4	-	5	0.0007	20	-	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-
2003	22.2	3,204	6,442,221	0	0.0000	0	-	2	0.0003	9	-	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-
2004	24.6	3,958	7,900,681	0	0.0000	-	0	6(1)	0.0008	-	28	0	0.0000	0	-	0	0.0000	0	-	1	0.0001	-	3
2005	26.1	4,602	9,360,671	1	0.0001	-	6	2(1)	0.0002	-	6	0	0.0000	0	-	0	0.0000	0	-	1	0.0001	-	6
2006	21.2	3,605	7,540,286	0	0.0000	-	0	4	0.0005	-	17	0	0.0000	0	-	0	0.0000	0	-	2	0.0003	-	6
2007	20.1	3,506	7,620,083	0	0.0000	-	0	4	0.0005	-	15	0	0.0000	0	-	0	0.0000	0	-	1	0.0001	-	2
2008	21.7	3,915	8,775,951	0	0.0000	-	0	3	0.0003	-	11	0	0.0000	0	-	0	0.0000	0	-	3	0.0003	-	5
2009	20.6	3,520	7,877,861	0	0.0000	-	0	10(1)	0.0013	-	55	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	-	0
2010	21.1	3,580	8,184,127	0	0.0000	-	0	4	0.0005	-	19	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0
2011	20.3	3,540	8,260,092	0	0.0000	-	0	3	0.0004	-	10	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0
2012	20.4	3,659	8,768,728	0	0.0000	-	0	3	0.0003	-	15	0	0.0000	-	0	0	0.0000	-	0	0	0.0000	-	0
2013	20.4	3,830	9,278,133	0	0.0000	-	0	4	0.0004	-	22	0	0.0000	-	0	1(1)	0.0001	-	5	1(1)	0.0001	-	4
2014	20.8	3,831	9,608,244	0	0.0000	-	0	11	0.0011	-	55	1	0.0001	-	10	0	0.0000	-	0	0	0.0000	-	0
2015	20.6	3,728	9,393,234	0	0.0000	0	-	5(1)	0.0005	-	21	0	0.0000	-	0	0	0.0000	-	0	1	0.0001	-	4
2016	20.1	3,880	9,872,439	0	0.000	0	-	7	0.0007	35	-	0	0.000	0	-	0	0.0000	0	-	0	0.0000	0	-

[a] Take data are based on vessel arrival dates.

Sources: Take data—2002-2016 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2005; McCracken, 2006; McCracken, 2011a; McCracken, 2016; McCracken, 2017b.

Table 70. Observed takes, takes per fishing effort (1,000 hooks), and estimated annual takes using expansion factor estimates and ME for large whales in the Hawai`i deep-set longline fishery, 2002-2016[a]

Year	Obs. Cov. (%)	Sets	Hooks	Humpback whale				Sperm whale			
				Observed		EF Est.	ME	Observed		EF Est.	ME
				Takes	Takes/1,000 hooks			Takes	Takes/1,000 hooks		
2002	24.6	3,523	6,786,303	1	0.0001	4	-	0	0.0000	0	-
2003	22.2	3,204	6,442,221	0	0.0000	0	-	0	0.0000	0	-
2004	24.6	3,958	7,900,681	1	0.0001	-	6	0	0.0000	-	0
2005	26.1	4,602	9,360,671	0	0.0000	-	0	0	0.0000	-	0
2006	21.2	3,605	7,540,286	0	0.0000	-	0	0	0.0000	0	-
2007	20.1	3,506	7,620,083	0	0.0000	-	0	0	0.0000	0	-
2008	21.7	3,915	8,775,951	0	0.0000	-	0	0	0.0000	0	-
2009	20.6	3,520	7,877,861	0	0.0000	-	0	0	0.0000	0	-
2010	21.1	3,580	8,184,127	0	0.0000	-	0	0	0.0000	-	0
2011	20.3	3,540	8,260,092	0	0.0000	-	0	1	0.0001	-	6
2012	20.4	3,659	8,768,728	0	0.0000	-	0	0	0.0000	-	0
2013	20.4	3,830	9,278,133	0	0.0000	-	0	0	0.0000	-	0
2014	20.8	3,831	9,608,244	1	0.0001	-	5	0	0.0000	-	0
2015	20.6	3,728	9,393,234	0	0.0000	-	0	0	0.0000	-	0
2016	20.1	3,880	9,872,439	0	0.0000	0	-	0	0.0000	0	-

[a] Take data are based on vessel arrival dates.

Sources: Take data—2002-2016 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2005; McCracken, 2006; McCracken, 2011a; McCracken, 2016; McCracken, 2017b.

Table 71. Observed takes, takes per fishing effort (1,000 hooks), and estimated annual takes using expansion factor estimates for unidentified species of cetaceans in the Hawai`i deep-set longline fishery, 2002-2016[a]

				Unidentified cetacean[b]			Unidentified whale[b]			Unidentified dolphin[b]		
				Observed			Observed			Observed		
Year	Obs. Cov. (%)	Sets	Hooks	Takes	Takes/ 1,000 hooks	EF Est.	Takes	Takes/ 1,000 hooks	EF Est.	Takes	Takes/ 1,000 hooks	EF Est.
2002	24.6	3,523	6,786,303	2	0.0003	8	0	0.0000	0	0	0.0000	0
2003	22.2	3,204	6,442,221	1	0.0002	5	1	0.0002	5	0	0.0000	0
2004	24.6	3,958	7,900,681	0	0.0000	0	0	0.0000	0	0	0.0000	0
2005	26.1	4,602	9,360,671	1	0.0001	4	0	0.0000	0	0	0.0000	0
2006	21.2	3,605	7,540,286	0	0.0000	0	2	0.0003	9	2	0.0003	9
2007	20.1	3,506	7,620,083	1	0.0001	5	0	0.0000	0	1	0.0001	5
2008	21.7	3,915	8,775,951	2	0.0002	9	2	0.0002	9	0	0.0000	0
2009	20.6	3,520	7,877,861	0	0.0000	0	3	0.0004	15	0	0.0000	0
2010	21.1	3,580	8,184,127	0	0.0000	0	3	0.0004	14	0	0.0000	0
2011	20.3	3,540	8,260,092	2	0.0002	10	0	0.0000	0	0	0.0000	0
2012	20.4	3,659	8,768,728	2	0.0002	10	0	0.0000	0	0	0.0000	0
2013	20.4	3,830	9,278,133	2	0.0002	10	0	0.0000	0	0	0.0000	0
2014	20.8	3,831	9,608,244	2	0.0002	10	0	0.0000	0	0	0.0000	0
2015	20.6	3,728	9,393,234	1	0.0001	5	0	0.0000	0	1[c]	0.0001	5
2016	20.1	3,880	9,872,439	2	0.0002	10	0	0.0000	0	0	0.0000	0

[a] Take data are based on vessel arrival dates.

[b] Unidentified species identification based on PIRO Observer Program classifications. Unidentified cetacean refers to a marine mammal not including pinnipeds (seal or sea lion); unidentified whale refers to a large whale; and unidentified dolphin refers to a small cetacean with a visible beak. Further classifications based on observer description, sketches, photos and videos may be available from the Pacific Islands Fisheries Science Center.

[c] This dolphin was later identified as a striped dolphin (Table 68),

Sources: Take data—2002-2016 PIRO Observer Program Annual and Quarterly Status Reports

3.2.2.4.1 Comparison of Interactions with ITS

The Hawai`i deep-set longline fishery operates under the 3-year ITS in the 2014 Biological Opinion for to all marine mammals protected under the ESA, which includes humpback whales, sperm whales, and the MHI insular DPS of false killer whales (Table 72). NMFS began monitoring the Hawai`i deep-set longline fishery ITS in Quarter 3 of 2014 and uses a rolling 3-year period to track incidental take. NMFS always uses the date of the interaction for tracking marine mammal interactions against the ITS, regardless of when the vessel returns to port. In the PIRO Observer Program Quarterly and Annual Reports, NMFS bases the percent observer coverage on vessel departures and bases the marine mammal interactions on vessel arrivals. For this reason, the number of quarterly or annual marine mammal interactions counted against an ITS may vary from those reported in the Observer Program's quarterly and annual reports. NMFS uses M&SI determinations under the MMPA to calculate marine mammal mortality rates. Takes for these three species are still under the 3-year ITS at this time.

On September 8, 2016, NMFS issued a final rule identifying 14 distinct population segments (DPS) of the humpback whale under the ESA (81 FR 62260). Under this final rule, the Hawai`i DPS is not listed. Interactions were recorded for purposes of monitoring the ITS through the effective date, which was October 11, 2016.

Table 72. Estimated total interactions (extrapolated using quarterly observer coverage) and total mortalities (M) of cetaceans in the Hawai`i deep-set longline fishery compared to the 3-year ITS in the 2014 Biological Opinion[a]

Species	3-year ITS Interactions (M)	Estimated Total Interactions and Mortalities from Q3 2014 to Q4 2016 Interactions (M)
Humpback whale[b]	6(3)	5(1.45)
Sperm whale	9(3)	0
MHI insular false killer whale	1(0.74)	0

[a] Interactions are counted based on capture date.

[b] The humpback whale Hawai`i DPS was delisted under the ESA effective October 11, 2016. Interactions were recorded up through that date to monitor the ITS.

3.2.2.4.2 Comparison of Interactions with PBR under the MMPA

Marine mammal takes against the PBR are monitored through the SARs. A summary of the current mean estimated annual M&SI and the PBR for stocks relevant to the Hawai`i shallow-set longline fishery is presented in Table 73 and Table 74. The PBR of a stock reflects only marine mammals of that stock observed within the EEZ around Hawai`i, with the exception of the Central North Pacific stock of humpback whales for which PBR applies to the entire stock. The mean estimated annual M&SI specified in the SARs includes only interactions determined as mortalities and serious injuries; it does not include interactions classified as non-serious injuries.

For most marine mammal stocks where the PBR is available, the number of observed takes of marine mammal species in the deep-set longline fishery inside the EEZ around Hawai`i is well below the PBR in the time period covered by the most current SAR (Table 73).

The M&SI interactions inside the Hawai`i EEZ for the MHI Insular and HI Pelagic stocks of false killer whales in 2009-2013 exceeded the PBR for these stocks (Table 74). A False Killer Whale Take Reduction Team was formed in 2010 pursuant to the MMPA to address incidental takes of false killer whales in the Hawai`i-permitted longline fisheries. NMFS implemented the False Killer Whale Take Reduction Plan in 2012. The objective of the plan is to reduce mortality and serious injury of false killer whales in the Hawai`i-permitted longline fisheries. Monitoring of false killer whale interactions in the MHI Insular and HI Pelagic stocks is ongoing under the False Killer Whale Take Reduction Plan.

Table 73. Summary of mean estimated annual mortality and serious injury (M&SI) and PBR by marine mammal stocks with observed interactions in the Hawai`i deep-set longline fishery.

Stock	Years Included in 2016 SAR	Outside EEZ[a]	Inside EEZ[c]	
		Mean Estimated Annual M&SI	Mean Estimated Annual M&SI	PBR (Inside EEZ only)
Bottlenose dolphin, HI Pelagic	2007-2011	1.9	0	38
Pantropical spotted dolphin, HI Pelagic	2007-2011	0.6	0	115
Rough-toothed dolphin, HI	2007-2011	0	0	46
Risso's dolphin, HI	2007-2011	0.9	0.6	42
Striped dolphin, HI	2007-2011	0.8	0	154
Blainville's beaked whale, HI	2007-2011	0	0	11
Kogia spp. whale (Pygmy or dwarf sperm whale), HI	2007-2011	Pygmy = 0 Dwarf = 0	Pygmy = 0 Dwarf = 0	undetermined
Short-finned pilot whale, HI	2007-2011	1.0	0.1	70
Humpback whale, Central North Pacific	2009-2013	0		83[b]
Sperm whale, HI	2007-2011	0	0.7	10.2

[a] PBR estimates are not available for portions of the stock outside of the U.S EEZ around Hawai`i, except for the Central North Pacific stock of humpback whales for which PBR applies to the entire stock.

[b] PBR for the Central North Pacific stock for humpback whales apply to the entire stock.

[c] PBR estimates are only available for portions of the stock within the U.S. EEZ around Hawai`i

Source: 2016 SARs

Table 74. Summary of mean estimated annual M&SI and PBR for false killer whale stocks with observed or prorated interactions in the Hawai`i deep-set longline fishery.

False Killer Whale Stock	Years Included in 2016 SAR	Outside EEZ[a]	Inside EEZ	
		Mean Estimated Annual M&SI	Mean Estimated Annual M&SI	PBR (Inside EEZ only)
MHI Insular	2010-2014	-	0.1	0.18
HI Pelagic	2010-2014	10.7	10.2	9.3
NWHI	2010-2014	-	0.4	2.3
Palmyra Atoll	2006-2010	-	0.3	6.4

[a] PBR estimates are not available for portions of the stock outside of the U.S EEZ around Hawai`i and Palmyra Atoll.

Source: 2016 SARs

3.2.2.5 SEABIRD INTERACTIONS IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from the NMFS. Observed take data are expanded to represent the estimated number of annual incidental takes for the entire fishery by PIFSC (referred to in this document as "ME"). When ME were not available, a standard expansion factor estimate was listed in the table (EF Est. = 100/% observer coverage * # takes).

Interaction data provided here may vary slightly from other sources depending on how interactions were reported (date of trip departure or arrival, set date, or haul date in a given year). NMFS annually publishes the report *Seabird Interactions and Mitigation Efforts in Hawai`i Longline Fisheries* (Seabird Annual Report), which includes verified numbers of seabird interactions and information on fishing regulations and effort, interaction rates, and band recovery data for seabirds caught in the shallow-set and deep-set fisheries. The reports are available at: http://www.fpir.noaa.gov/SFD/SFD_seabirds.html.

Table 75 summarizes the incidental take data of seabirds from 2002 to 2016 in the Hawai`i deep-set longline fishery. During this time, observer coverage on vessels operating in this fishery ranged from 20.1% to 26.1%. The large majority of observed interactions during this time period involved Laysan albatross (average takes/1,000 hooks = 0.0026) and black-footed albatross (0.0039). Additional takes of unidentified shearwaters (0.0003), sooty shearwaters (<0.0001), brown boobies (<0.0001) and red-footed boobies (<0.0001) have been observed. Most of the unidentified shearwaters have been identified as sooty shearwaters (NMFS 2016). There have been no observed takes of short-tailed albatrosses by this fishery.

Expanded annual estimated takes suggested a high degree of variability from year to year, ranging between 7 and 236 for Laysan albatross, 16 and 541 for black-footed albatross, 0 and 12 for booby species, and 0 and 62 for shearwater species. Interactions with black-footed albatross in 2015 were substantially higher compared to previous years. Interactions with sooty shearwaters and boobies were relatively infrequent.

Results from an analysis of seabird interaction rates in the Hawai`i deep-set longline fishery (Gilman et al. 2016) was presented to the Protected Species Advisory Committee and Pelagic Plan Team. The analysis included data from October 2004 to May 2014. Results indicate that seabird interaction rates significantly increased as annual mean multivariate ENSO index values increased, meaning that decreasing ocean productivity may have contributed to the increasing trend in seabird catch rates. The analysis also showed a significant increasing trend in the number of albatrosses attending vessels, which may also be contributing to the increasing seabird catch rates. Both side setting and blue-dyed bait significantly reduced the seabird catch rate compared to stern setting and untreated bait, respectively. Of two options for meeting regulatory requirements, side setting had a significantly lower seabird catch rate than blue-dyed bait.

The Council at its 166th Meeting in June 2016 directed the Plan Team and the Protected Species Advisory Committee to continue monitoring interactions through the SAFE to detect any future changes in albatross interactions that may be attributed to fishing operations. The Council noted that current seabird measures implemented in the Hawaii longline fishery are effective and recent increase in seabird captures are driven by non-fishery factors at this time. The Council additionally recommended research to be conducted, as appropriate, on at-sea foraging behavior of albatross species to improve understanding of interaction rates in the Hawaii longline fisheries. Additional discussion on the factors influencing seabird interaction trends is included in Section 4.1of this report.

Table 75. Observed takes, mortalities (M), takes per fishing effort (sets and 1,000 hooks), and estimated annual takes using expansion factor estimates and ME for seabirds in the Hawai`i deep-set longline fishery, 2002-2016[a]

				Laysan albatross				Black-footed albatross				Booby species				Sooty shearwater			Unidentified shearwater				Short-tailed albatross
				Observed				Observed				Observed				Observed			Observed				Observed
Year	Obs. Cov. (%)	Sets	Hooks	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)
2002	24.6	3,523	6,786,303	16(13)	0.002	65	-	18(17)	0.003	73	-	0	0.000	0	-	0	0.000	0	0	0.000	0	-	0
2003	22.2	3,204	6,442,221	44(44)	0.007	198	-	24(23)	0.004	108	-	0	0.000	0	-	0	0.000	0	0	0.000	0	-	0
2004	24.6	3,958	7,900,681	2(2)	0.000	-	10	4(4)	0.001	-	16	0	0.000	0	-	0	0.000	0	2(2)	0.000	8	-	0
2005	26.1	4,602	9,360,671	6(6)	0.001	-	43	12(12)	0.001	-	82	1(1)[b]	0.000	4	-	0	0.000	0	0	0.000	0	-	0
2006	21.2	3,605	7,540,286	1(1)	0.000	-	7	17(17)	0.002	-	70	0	0.000	0	-	3(3)	0.000	14	2(2)[c]	0.000	9	-	0
2007	20.1	3,506	7,620,083	7(7)	0.001	-	44	14(14)	0.002	-	77	0	0.000	0	-	0	0.000	0	0	0.000	0	-	0
2008[d]	21.7	3,915	8,775,951	14(13)	0.002	-	55	34(33)	0.004	-	118	1[e]	0.000	-	4	0	0.000	0	14(14)[c]	0.002	-	62	0
2009	20.6	3,520	7,877,861	18(18)	0.002	-	60	23(23)	0.003	-	110	0	0.000	-	0	0	0.000	0	4(4)[c]	0.001	-	24	0
2010	21.1	3,580	8,184,127	39(38)	0.005	-	155	17(17)	0.002	-	65	0	0.000	-	0	0	0.000	0	1(1)[c]	0.000	-	0	0
2011	20.3	3,540	8,260,092	32(31)	0.004	-	187	13(12)	0.002	-	73	0	0.000	-	0	0	0.000	0	3(3)[c]	0.000	-	19	0
2012	20.4	3,659	8,768,728	30(25)	0.003	-	136	35(35)	0.004	-	167	0	0.000	-	0	1(1)	0.000	5	6(6)[c]	0.001	-	36	0
2013	20.4	3,830	9,278,133	48(46)	0.005	-	236	50(47)	0.005	-	257	0	0.000	-	0	0	0.000	0	8(8)[c]	0.001	-	43	0
2014	20.8	3,831	9,608,244	13(10)	0.001	-	77	32(29)	0.003	-	175	0	0.000	-	0	0	0.000	0	1(1)[c]	0.000	-	7	0
2015	20.6	3,728	9,393,234	24(22)	0.003	-	119	107(92)	0.011	-	541	1(1)[g]	0.000	-	6	5(4)	0.001	5	0	0.000	-	21[f]	0
2016	20.1	3,880	9,872,439	34(32)	0.003	-	166	104(99)	0.011	-	485	2(1)[g]	0.000	-	12	4(4)	0.000	20	0	0.000	0	-	0

[a] Take data are based on vessel arrival dates.

[b] This animal was identified as a brown booby on the 2005 PIRO Observer Program Annual and Quarterly Status reports.

[c] These birds were later identified as sooty shearwaters in the NMFS Seabird Interactions and Mitigation Efforts in Hawai`i Longline Fisheries (Seabird Annual Report).

[d] One *unidentified seabird* was released injured in the second quarter of 2008 (takes/1,000 hooks = 0.000, ME = 2).

[e] This animal was identified as a red-footed booby on the 2008 PIRO Observer Program Annual and Quarterly Status reports.

[f] These birds were identified as sooty shearwaters in the 2015 PIRO Observer Program Annual and Quarterly Status reports.

[g] These birds were identified as red-footed boobies in the 2015 and 2016 PIRO Observer Program Annual and Quarterly Status reports.

Sources: Take data—2002-2016 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2005; McCracken, 2006; McCracken, 2007; McCracken, 2008; McCracken, 2009; McCracken, 2010; McCracken, 2011b; McCracken, 2012; McCracken, 2013; McCracken, 2014; McCracken, 2017c; McCracken, 2017d.

3.2.2.5.1 Comparison of Interactions with ITS

The short-tailed albatross ITS in the USFWS 2012 Biological Opinion for the Hawai`i longline fishery is two incidental takes every five years in the deep-set fishery. Exceeding this number will lead to reinitiating consultation of the impact of this fishery on the species. Since there have been no observed takes of short-tailed albatrosses in the fishery, the ITS has not been exceeded as of the end of 2016.

3.2.2.6 SCALLOPED HAMMERHEAD SHARK INTERACTIONS IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

Table 76 summarizes the incidental take data for the Indo-west Pacific DPS of scalloped hammerhead shark in the Hawai`i deep-set longline fishery. The data only include interactions that occurred within the range of the Indo-west Pacific DPS, and do not include interactions occurred within the range of the Central Pacific DPS, which is not listed under the ESA.

Three observed interactions with the Indo-west Pacific DPS of scalloped hammerhead shark have been recorded since 2004. Estimates of total interaction for the fleet are only available using the expansion factor calculations.

The 2014 Biological Opinion includes a three-year ITS of 6 takes from the Indo-west Pacific DPS of scalloped hammerhead shark. NMFS began monitoring the Hawai`i deep-set longline fishery ITS in Quarter 3 of 2014 and uses a rolling three-year period to track incidental take. NMFS counts takes for the Indo-west Pacific DPS of scalloped hammerhead shark based on the end of haul incidental take date. NMFS uses data from condition at time of release to calculate shark mortality rates. Interactions since the third quarter of 2014 are monitored against this ITS, and there has been no observed interaction with this DPS through the end of 2016.

Table 76. Observed and estimated interactions with Indo-west Pacific DPS of scalloped hammerhead sharks in the Hawai`i deep-set longline fishery, 2004-2016.

Year	Observed	Observer coverage (%)	Expansion factor[a]	Estimated interactions[b]
2004	2	24.6	4.07	9
2005	0	26.1	3.83	0
2006	0	21.2	4.72	0
2007	1	20.1	4.98	5
2008	0	21.7	4.61	0
2009	0	20.6	4.85	0
2010	0	21.1	4.74	0
2011	0	20.3	4.93	0
2012	0	20.4	4.9	0
2013	0	20.4	4.9	0
2014	0	20.8	4.81	0
2015	0	20.6	4.85	0
2016	0	20.1	4.98	0

[a] 100 ÷ observer coverage. E.g., for 2008, 100/21.70 = 4.61.

[b] (Observed interactions) x (Expansion factor). E.g., for 2010, 1(4.74) = 5.

Source: NMFS 2014 (2004-2013 data), NMFS unpublished (2014-2016 data)

3.2.3 AMERICAN SAMOA LONGLINE FISHERY

3.2.3.1 INDICATORS FOR MONITORING PROTECTED SPECIES INTERACTIONS AND EFFECTIVENESS OF MANAGEMENT MEASURES IN THE AMERICAN SAMOA LONGLINE FISHERY

In this annual report, the Council monitors protected species interactions in the Hawai`i deep-set longline fishery using the following indicators:

- General interaction trends over time
- Effectiveness of FEP conservation measures
- Take levels compared to authorized take levels under ESA

Take levels compared to marine mammal PBRs, where applicable

Details of these indicators are discussed below.

3.2.3.1.1 FEP Conservation Measures

The Pelagic FEP includes conservation measures to mitigate sea turtle interactions in the American Samoa longline fishery. These measures include the following:

- Longline vessel owners/operators are required to adhere to regulations for safe handling and release of sea turtles and seabirds.

- Longline vessel owners/operators must have on board the vessel all required turtle handling/dehooking gear specified in regulations.

- Owners and operators of vessels longer than 40 ft (12.2 m) must use longline gear that is configured according to the following requirements:

    - Each float line must be at least 30 m long.

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

    - Each branch line must be at least 10 m long.

    - No branch line may be attached to the mainline closer than 70 m to any float line.

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

Additionally, the American Samoa longline fishery has had observer coverage since 2006, with coverage rate of approximately 20 percent or higher since 2010. Longline vessel owners and operators are also required to annually attend a protected species workshop.

3.2.3.1.2 ESA Consultations

The American Samoa longline fishery is covered under a NMFS Biological Opinion dated October 30, 2015 (NMFS 2015). NMFS concluded that the fishery is not likely to jeopardize five sea turtle species (South Pacific DPS loggerhead, leatherback, olive ridley, green and hawksbill turtles) and the Indo-West Pacific DPS of scalloped hammerhead sharks, and not likely to adversely affect six species of reef-building corals (Table 77). The 2015 Biological Opinion also included a Conference Opinion for the green turtle DPSs and an ITS, which became effective at the time of the final listing in 2016 (81 FR 20058, April 5, 2016). Several informal consultations conducted by NMFS and FWS have concluded that the fishery is not likely to adversely affect two marine mammal species or the Newell's shearwater. NMFS has also determined that the fishery has no effect on three marine mammal species or three petrel species.

NMFS and USFWS have issued ITSs for species included in the Biological Opinions and determined not to jeopardize the species (Table 78). Exceeding the three-year ITSs requires reconsultation of the fishery under the ESA.

Table 77. Summary of ESA consultations for the American Samoa longline fishery.

Species	Consultation Date	Consultation Type[a]	Outcome[b]
Loggerhead turtle, South Pacific DPS	2015-10-30	BiOp	LAA, non-jeopardy
Leatherback turtle	2015-10-30	BiOp	LAA, non-jeopardy
Olive ridley turtle	2015-10-30	BiOp	LAA, non-jeopardy
Green turtle	2015-10-30	BiOp	LAA, non-jeopardy
Hawksbill turtle	2015-10-30	BiOp	LAA, non-jeopardy
Humpback whale	2010-07-27	LOC	NLAA
Fin whale	2010-05-12	No Effects Memo	No effect
Blue whale	2010-05-12	No Effects Memo	No effect
Sei whale	2010-05-12	No Effects Memo	No effect
Sperm whale	2010-07-27	LOC	NLAA
Scalloped hammerhead shark, Indo-West Pacific DPS	2015-10-30	BiOp	LAA, non-jeopardy
Reef-building corals	2015-10-30	BiOp	NLAA
Newell's shearwater	2011-05-19	LOC (FWS)	NLAA
Chatham petrel	2011-07-29	No Effects Memo	No effect
Fiji petrel	2011-07-29	No Effects Memo	No effect
Magenta petrel	2011-07-29	No Effects Memo	No effect

[a] BiOp = Biological Opinion; LOC = Letter of Concurrence.

[b] LAA = likely to adversely affect; NLAA = not likely to adversely affect.

Table 78. Summary of ITSs for the American Samoa longline fishery.

Species	ITS Time Period	Takes	Mortalities	Source BiOp
Loggerhead turtle (South Pacific DPS)	3-year	6	3	NMFS 2015
Leatherback turtle	3-year	69	49	NMFS 2015
Olive Ridley turtle	3-year	33	10	NMFS 2015
Green turtle[a]	3-year	60	54	NMFS 2015
Central South Pacific DPS[a]	3-year	30	27	NMFS 2015
Southwest Pacific DPS[a]	3-year	20	17.82	NMFS 2015
East Pacific DPS[a]	3-year	7	6.48	NMFS 2015
Central West Pacific DPS[a]	3-year	2	1.62	NMFS 2015
East Indian-West Pacific DPS[a]	3-year	1	1.08	NMFS 2015
Hawksbill turtle	3-year	6	3	NMFS 2015
Scalloped hammerhead shark (Indo-West Pacific DPS)[b]	3-year	36	12	NMFS 2015

[a] The green turtle DPS-specific ITSs became effective in May 2016 when the DPS listings were finalized.

[b] An ITS is not required for the Indo-West Pacific DPS of scalloped hammerhead sharks due to the lack of take prohibition under ESA section 4(d), but NMFS included an ITS to serve as a check on the no-jeopardy conclusion by providing a re-initiation trigger.

3.2.3.1.3 Non-ESA Marine Mammals

Fishery impacts to marine mammal stocks are primarily assessed and monitored through the SARs prepared pursuant to the MMPA. The SARs include detailed information on these species' geographic range, abundance, PBR estimates, bycatch estimates, and status. The most recent SARs are available online at: http://www.nmfs.noaa.gov/pr/sars/.

The American Samoa longline fishery is a Category II under the MMPA 2017 LOF (82 FR 3655, January 12, 2017), meaning that this fishery has occasional incidental mortality and serious injuries of marine mammals. The 2017 LOF lists the following marine mammal stocks that are incidentally killed or injured in this fishery:

- Bottlenose dolphin, unknown stock
- Cuvier's beaked whale, unknown stock
- False killer whale, American Samoa stock
- Rough-toothed dolphin, American Samoa stock
- Short-finned pilot whale, unknown stock

Most bycatch estimates in the SARs are based on the most recently available 5-year period, but there is a data lag of approximately two years due to the SAR review process. This annual report focuses on available long-term interaction trends and summarizes relevant information from the most recent SAR.

3.2.3.2 DATA SOURCE FOR MONITORING PROTECTED SPECIES INTERACTIONS IN THE AMERICAN SAMOA LONGLINE FISHERY

Protected species interactions in the American longline fishery have been monitored through mandatory observer coverage since 2006. Observer coverage in the fishery ranged between 6 and 8 percent from 2006-2009, increased to 25 percent in 2010 and 33 percent in 2011. Coverage has been consistently around 20 percent since 2012. This report summarizes protected species interactions in the American Samoa longline fishery since 2006. Annual observed interactions are tallied based on vessel arrival date (rather than interaction date) for the purpose of this report for consistency with the Observer Program reports.

3.2.3.3 SEA TURTLE INTERACTIONS IN THE AMERICAN SAMOA LONGLINE FISHERY

Table 79 summarizes the incidental take data of sea turtles from 2006 to 2016 in the American Samoa longline fishery. Observer coverage on vessels operating in this fishery ranged from 6.4% to 33.3%, with higher coverage starting in 2010 and becoming consistent around 20% since 2012. The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from the PIFSC. Observed take data were expanded to represent the estimated number of incidental takes for the entire fishery using a standard expansion factor estimate (EF Est. = 100/% observer coverage * # takes) except for years for which ME are available.

Between 2006 and 2016, the PIRO Observer Program reported interactions with green, leatherback, olive ridley, and hawksbill sea turtles, but no observed interactions were reported with loggerhead sea turtles. The highest interaction rate involved green sea turtles (2006-2016 average takes/1,000 hooks = 0.0019), whereas interactions with leatherbacks, olive ridleys, and hawksbills were less frequent (0.0005, 0.0005, and 0.00008 respectively).

Green sea turtle takes were variable year to year, ranging between 0-11 observed takes (0-39 expanded annual estimated takes). While a formal evaluation of the effects of the sea turtle conservation measure implemented under the FEP in 2011 have yet to be conducted, green turtle interactions appear to be less frequent based on the estimated total number of interactions.

All leatherback, olive ridley, and hawksbill sea turtle interactions were observed after 2010, with the first observed hawksbill interaction occurring in 2016. Observer coverage was relatively low in 2006-2010 when interactions with these species were not observed (average observer coverage = 10.8%) compared to 2011-2016 when all interactions were observed (22.2%). Since leatherback, olive ridley, and hawksbill interactions with this fishery are relatively uncommon, it is likely the recent occurrence of interactions is due to higher observer coverage as opposed to a temporal increase.

Table 79. Observed takes, mortalities (M), takes per fishing effort (1,000 hooks), estimated annual takes using expansion factor estimates and ME for sea turtles in the American Samoa longline fishery, 2006-2016[a]

				Green				Leatherback				Olive ridley				Hawksbill			
				Observed				Observed				Observed				Observed			
Year	Obs. Cov. (%)	Sets	Hooks	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME
2006	8.1	287	797,221	3(3)	0.004	37	-	0	0.000	0	-	0	0.000	0	-	0	0.000	-	-
2007	7.1	410	1,255,329	1(1)	0.001	14	-	0	0.000	0	-	0	0.000	0	-	0	0.000	-	-
2008	6.4	379	1,194,096	1(1)	0.001	16	-	0	0.000	0	-	0	0.000	0	-	0	0.000	-	-
2009	7.7	306	880,612	3(3)	0.003	39	-	0	0.000	0	-	0	0.000	0	-	0	0.000	-	-
2010	25.0	798	2,301,396	6(5)	0.003	-	50	0	0.000	-	0	0	0.000	-	0	0	0.000	-	-
2011	33.3	1,257	3,605,897	11(10)	0.003	-	32	2(1)	0.001	-	4	1	0.000	-	4	0	0.000	-	-
2012	19.8	662	1,880,525	0	0.000	-	0	1	0.001	-	6	1(1)	0.001	-	6	0	0.000	-	-
2013	19.4	585	1,690,962	2(2)	0.001	-	19	2(1)	0.001	-	13	1	0.001	-	4	0	0.000	-	-
2014	19.4	565	1,490,416	2(2)	0.001	-	17	0	0.000	-	4	2	0.001	-	5	0	0.000	-	-
2015	22.0	504	1,441,706	0	0.000	-	0	3(3)	0.006	-	22	1	0.002	-	6	0	0.000	-	-
2016	19.4	424	1,179,532	4(4)	0.003	21	-	1(1)	0.001	5	-	3(3)	0.003	15	-	1(1)	0.001	5	-

[a] Take data are based on vessel arrival dates.

Source: Take data—2006-2016 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2015a; McCracken, 2017a.

3.2.3.3.1 Comparison of Interactions with ITS

NMFS completed a Biological Opinion for the American Samoa longline fishery on October 30, 2015. The Biological Opinion includes data through June 30, 2015. NMFS began monitoring the American Samoa longline fishery ITS in the third quarter of 2015 and uses a rolling three-year period to track incidental take (Table 80). NMFS always uses the date of the interaction for tracking sea turtle interactions against the ITS, regardless of when the vessel returns to port. In the PIRO Observer Program Quarterly and Annual Reports, NMFS bases the percent observer coverage on vessel departures and bases sea turtle interactions on vessel arrivals. For this reason, the number of quarterly or annual interactions counted against an ITS may vary from those reported on the Observer Program's quarterly and annual reports. NMFS uses post-hooking mortality criteria (Ryder et al. 2006) to calculate sea turtle mortality rates.

DPS-specific ITSs for green turtles included in a Conference Opinion in the 2015 Biological Opinion became effective at the time of the final listing in 2016 (81 FR 20058, April 5, 2016). The estimated total interactions for each of the DPSs are prorated based on the estimated proportions indicated in the 2015 Biological Opinion (NMFS 2015).

Table 80. Estimated total interactions[a] (extrapolated using quarterly observer coverage) and total mortality (M) (using Ryder et al. 2006) of sea turtles in the American Samoa longline fishery compared to the 3-year Incidental Take Statement (ITS) in the 2015 Biological Opinion[a]

Species	3-year ITS Interactions (M)	Estimated total Interactions and Mortalities for Q3 2015-Q4 2016 Interactions (M)
Green turtle [b]	60(54)	22(20)
Central South Pacific DPS[b]	30(27)	11(10)[c]
Southwest Pacific DPS[b]	20(17.82)	7.26(6.61)[c]
East Pacific DPS[b]	7(6.48)	2.64(2.40)[c]
Central West Pacific DPS[b]	2(1.62)	0.66(0.60)[c]
East Indian-West Pacific DPS[b]	1(1.08)	0.44(0.40)[c]
Leatherback turtle	69(49)	6(4)
Olive Ridley turtle	33(10)	20(6)
Loggerhead turtle	6(3)	0
Hawksbill turtle	6(3)	5(3)

[a] Interactions are counted based on capture date.
[b] The green turtle DPS-specific ITSs became effective in May 2016 when the DPS listings were finalized.
[c] Estimated total interactions for the green turtle DPSs are prorated based on the estimated proportion of each green turtle DPS indicated in the 2015 BiOp (NMFS 2015).

3.2.3.4 MARINE MAMMAL INTERACTIONS IN THE AMERICAN SAMOA LONGLINE FISHERY

Table 81 summarizes the incidental take data of marine mammals from 2006 to 2016 in the American Samoa longline fishery. Observer coverage on vessels operating in this fishery ranged from 6.4% to 33.3%. The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Reported interactions listed in these tables reflect all observed interactions, including mortalities, serious injuries, and non-serious injuries. Refer to the most recent SARs for mortality and serious injury estimates and stock-specific abundance estimates and geographic range. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from the PIFSC. Observed take data were expanded to represent the estimated number of incidental takes for the entire fishery using a standard expansion factor estimate (EF Est. = 100/% observer coverage * # takes).

Observed marine mammal interactions with the American Samoa longline fishery between 2006 and 2016 were relatively infrequent. False killer whales had the highest interaction rate over this period (average takes/1,000 hooks = 0.0006), followed by rough-toothed dolphins (0.0004), 1 Cuvier's beaked whale (<0.0001), 1 short-finned pilot whale (<0.0001), and 2 unidentified cetaceans (<0.0001). Between 2006 and 2016, there were 5 years of no observed marine mammal interactions with this fishery (2006, 2007, 2009, 2010, and 2012).

Table 81. Observed takes, mortalities (M), takes per fishing effort (1,000 hooks), and estimated annual takes using expansion factor estimates for marine mammals in the American Samoa longline fishery, 2006-2016[a]

				Cuvier's beaked whale			False killer whale			Rough-toothed dolphin			Short-finned pilot whale			Unidentified cetacean		
				Observed			Observed			Observed			Observed			Observed		
Year	Obs. Cov. (%)	Sets	Hooks	Takes (M)	Takes/ 1,000 hooks	EF Est.	Takes (M)	Takes/ 1,000 hooks	EF Est.	Takes (M)	Takes/ 1,000 hooks	EF Est.	Takes (M)	Takes/ 1,000 hooks	EF Est.	Takes (M)	Takes/ 1,000 hooks	EF Est.
2006	8.1	287	797,221	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0
2007	7.1	410	1,255,329	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0
2008	6.4	379	1,194,096	0	0.000	0	2(1)	0.002	31	1	0.001	16	0	0.000	0	0	0.000	0
2009	7.7	306	880,612	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0
2010	25.0	798	2,301,396	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0
2011	33.3	1,257	3,605,897	1(1)	0.000	3	3	0.001	9	5	0.001	15	0	0.000	0	2	0.001	6
2012	19.8	662	1,880,525	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0
2013	19.4	585	1,690,962	0	0.000	0	1	0.001	5	1(1)	0.001	5	0	0.000	0	0	0.000	0
2014	19.4	565	1,490,416	0	0.000	0	0	0.000	0	0	0.000	0	1	0.001	5	0	0.000	0
2015	22.0	504	1,441,706	0	0.000	0	2(1)	0.001	9	0	0.000	0	0	0.000	0	0	0.000	0
2016	19.4	424	1,179,532	0	0.000	0	2	0.002	10	2(2)	0.002	10	0	0.000	0	0	0.000	0

[a] Take data are based on vessel arrival dates.

Source: 2006-2016 PIRO Observer Program Annual and Quarterly Status Reports

Note: McCracken (2015a) produced annual estimates for cetaceans for 2010-2013, but they are not shown in this table. The ME did not include interactions classified as non-serious injury, thus do not correspond to the observed takes included in this table.

3.2.3.4.1 Comparison of Interactions with PBR under the MMPA

SARs are only available for four species of marine mammals for which stocks have been identified around American Samoa (humpback whale, false killer whale, rough-toothed dolphin and spinner dolphin). PBR comparisons with estimates of mortality and serious injury are not available for American Samoa stocks of marine mammals due to the lack of abundance estimates.

3.2.3.5 SEABIRD INTERACTIONS IN THE AMERICAN SAMOA LONGLINE FISHERY

Table 82 summarizes the incidental take data of seabirds from 2006 to 2016 in the American Samoa longline fishery. Observer coverage on vessels operating in this fishery ranged from 6.4% to 33.3%. The incidental take data in this section were compiled from the PIRO Observer Program Annual Status Reports and are for monitoring purposes. Many of these interactions have been examined further, and updated information necessary for any data analyses can be requested from the PIFSC. Observed take data are expanded to represent the estimated number of annual incidental takes for the entire fishery by PIFSC (referred to in this document as “ME”). When ME were not available, a standard expansion factor estimate was listed in the table (EF Est. = 100/% observer coverage * # takes).

Observed seabird interactions with the American Samoa longline fishery between 2006 and 2016 were uncommon, with a total of three observed unidentified shearwater and frigate bird interactions (all released dead). The observer program report for 2015 included 13 observed interactions with black-footed albatross that occurred in the North Pacific by vessels departing American Samoa and landing in California. There were no observed seabird interactions in 2016.

Table 82. Observed takes, mortalities (M), takes per fishing effort (1,000 hooks), and estimated annual takes using expansion factor estimates and ME for seabirds in the American Samoa longline fishery, 2006-2016[a]

Year	Obs. Cov. (%)	Sets	Hooks	Black-footed Albatross				Unidentified shearwater				Unidentified frigatebird			
				Observed				Observed				Observed			
				Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME	Takes (M)	Takes/ 1,000 hooks	EF Est.	ME
2006	8.1	287	797,221	0	0.000	0	-	0	0.000	0	-	0	0.000	0	-
2007	7.1	410	1,255,329	0	0.000	0	-	1(1)	0.001	14	-	0	0.000	0	-
2008	6.4	379	1,194,096	0	0.000	0	-	0	0.000	0	-	0	0.000	0	-
2009	7.7	306	880,612	0	0.000	0	-	0	0.000	0	-	0	0.000	0	-
2010	25.0	798	2,301,396	0	0.000	0	-	0	0.000	-	0	0	0.000	-	0
2011	33.3	1,257	3,605,897	0	0.000	0	-	1(1)	0.000	-	2	0	0.000	-	0
2012	19.8	662	1,880,525	0	0.000	0	-	0	0.000	-	0	0	0.000	-	0
2013	19.4	585	1,690,962	0	0.000	0	-	0	0.000	-	0	1(1)	0.001	-	5
2014	19.4	565	1,490,416	0	0.000	-	0	0	0.000	0	-	0	0.000	-	0
2015	22.0	504	1,441,706	13(13)[b]	0.026	-	13	0	0.000	0	-	0	0.000	-	0
2016	19.4	424	1,179,532	0	0.000	0	-	0	0.000	0	-	0	0.000	0	-

[a] Take data are based on vessel arrival dates.

[b] These seabird interactions occurred in the North Pacific by vessels departing American Samoa and landing in California.

Source: 2006-2016 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2015a; McCracken, 2017a.

3.2.3.6 SCALLOPED HAMMERHEAD SHARK INTERACTIONS IN THE AMERICAN SAMOA LONGLINE FISHERY

Table 83 summarizes the incidental take data for the Indo-west Pacific DPS scalloped hammerhead shark in the American Samoa longline fishery. Observed interactions range 0-4 per year, with expanded total ranging between 0-17 per year.

The 2015 Biological Opinion includes a three-year ITS of 36 takes from the Indo-west Pacific DPS of scalloped hammerhead sharks. NMFS began monitoring the American Samoa longline fishery ITS in the third quarter of 2015 and uses a rolling three-year period to track incidental take. NMFS counts takes for the Indo-west Pacific DPS of scalloped hammerhead sharks based on the end of haul incidental take date. The observed scalloped hammerhead interaction in 2015 occurred in the first two quarters of the year, and no interactions were observed during the third and fourth quarters. There was one observed take (estimated total = 5.15) of scalloped hammerhead in 2016 counting against the ITS, and thus the ITS has not been exceeded.

Table 83. Observed and estimated total scalloped hammerhead interactions with the American Samoa longline fishery for 2006–2016.

Year	Observed	Observer Coverage (%)	Expansion Factor [a]	Expansion Factor Estimates[b]	ME
2006	1	8.1	12.35	13	-
2007	1	7.1	14.08	15	-
2008	0	6.4	15.63	0	-
2009	0	7.7	12.99	0	-
2010	4	25	-	-	17
2011	2	33.3	-	-	7
2012	0	19.8	-	-	0
2013	0	19.4	-	-	0
2014	1	19.4	-	-	6
2015	1	22.0	-	-	3
2016	1	19.4	5.15	5.15	-

[a] 100 ÷ observer coverage. E.g., for 2014, 100/19.4 = 5.15.

[b] (Observed interactions) x (Expansion factor). E.g., for 2014, 1(5.15) = 5.15.

Source: NMFS American Samoa Longline Observer Program Annual Reports 2006–2011 (NMFS 2006b, 2007, 2008b, 2009, 2010b, 2011, 2012, 2013, 2014d) and unpublished data; 2010–2016, McCracken 2015a; McCracken 2017a.

3.2.4 HAWAI`I TROLL FISHERY

3.2.4.1 INDICATORS FOR MONITORING PROTECTED SPECIES INTERACTIONS IN THE HAWAI`I TROLL FISHERY

In this report, the Council monitors protected species interactions in the Hawai`i troll fishery using proxy indicators such as fishing effort and changes in gear types as this fishery does not have observer coverage.

3.2.4.1.1 FEP Conservation Measures

The Hawai`i troll fishery has not had reported interactions with protected species, and no specific regulations are in place to mitigate protected species interactions. The Pacific Pelagic FEP prohibits the use of drift gillnets in the U.S. EEZ of the Western Pacific, and this measure provides benefits to protected species by preventing potential interactions with non-selective fishing gear. The Pacific Pelagic FEP also requires any vessel fishing under the FEP to comply with sea turtle handling and release regulations.

3.2.4.1.2 ESA Consultations

In a Biological Opinion completed on September 1, 2009 for the troll and handline fisheries in the western Pacific region, NMFS concluded that these fisheries are not likely to jeopardize the continued existence of green turtles and included an ITS of four animals killed per year from collisions with troll and handling fishing vessels (NMFS 2009). The Biological Opinion also concluded that the fisheries are not likely to adversely affect all other protected species in the region. NMFS also determined on October 6, 2014 that fisheries managed under the Pelagic FEP have no effects on ESA-listed reef-building corals.

3.2.4.1.3 Non-ESA Marine Mammals

The MMPA requires NMFS to annually publish a List of Fisheries (LOF) that classifies commercial fisheries in one of three categories based on the level of mortality and serious injury of marine mammals associated with that fishery. According to the 2017 LOF (82 FR 3655, January 12, 2016), the Hawai`i troll fishery (HI troll) is classified as a Category III fishery (i.e. a remote likelihood of or no known incidental mortality and serious injury of marine mammals). The 2017 LOF lists the following marine mammal stock that may be incidentally killed or injured in this fishery:

- Pantropical spotted dolphin, HI stock

While NMFS lists Pantropical spotted dolphin as potentially interacting with the Hawai`i troll fishery in the LOF, there is a lack of direct evidence of serious injury or mortality in this fishery (78 FR 23708, April 22, 2013).

3.2.4.2 STATUS OF PROTECTED SPECIES INTERACTIONS IN THE HAWAI`I TROLL FISHERY

NMFS has determined that the Hawai`i troll fishery operating under the Pacific Pelagic FEP is not likely to jeopardize green sea turtles and not likely to adversely affect other ESA-listed sea turtles, marine mammals, seabirds, and scalloped hammerhead shark, non ESA-listed marine mammals, and has no effects on ESA-listed reef-building corals. The Hawai`i troll fishery has minimal interactions with these protected species.

The ITS in the 2009 Biological Opinion estimates four green turtle mortalities annually in the troll and handline fisheries in the western Pacific region. There have not been any reported or observed collisions of troll and handline vessels with green turtles, and data are not available to attribute stranded turtle mortality source to troll and handline vessels.

Based on fishing effort and other characteristics described in Section 2.4.8, no notable changes have been observed in the fishery. There is no other information to indicate that impacts to protected species from this fishery have changed in recent years.

3.2.5 MHI HANDLINE FISHERY

3.2.5.1 INDICATORS FOR MONITORING PROTECTED SPECIES INTERACTIONS IN THE MHI HANDLINE FISHERY

In this report, the Council monitors protected species interactions in the MHI handline fishery using proxy indicators such as fishing effort and changes in gear types as this fishery does not have observer coverage.

3.2.5.1.1 FEP Conservation Measures

The MHI handline fishery has not had reported interactions with protected species, and no specific regulations are in place to mitigate protected species interactions. The Pacific Pelagic

FEP prohibits the use of drift gillnets in the U.S. EEZ of the Western Pacific, and this measure provides benefits to protected species by preventing potential interactions with non-selective fishing gear. The Pacific Pelagic FEP also requires any vessel fishing under the FEP to comply with sea turtle handling and release regulations.

3.2.5.1.2 ESA Consultations

In a Biological Opinion completed on September 1, 2009 for the troll and handline fisheries in the western Pacific region, NMFS concluded that these fisheries are not likely to jeopardize the continued existence of green turtles and included an ITS of four animals killed per year from collisions with troll and handling fishing vessels (NMFS 2009). The Biological Opinion also concluded that the fisheries are not likely to adversely affect all other protected species in the region. NMFS also determined on October 16, 2014 that fisheries managed under the Pelagic FEP have no effects on ESA-listed reef-building corals.

3.2.5.1.3 Non-ESA Marine Mammals

The MMPA requires NMFS to annually publish an LOF that classifies commercial fisheries in one of three categories based on the level of mortality and serious injury of marine mammals associated with that fishery. According to the 2017 LOF (82 FR 3655, January 12, 2017), the MHI handline (HI pelagic handline) fishery is classified as a Category III fishery (i.e. a remote likelihood of or no known incidental mortality and serious injury of marine mammals).

3.2.5.2 STATUS OF PROTECTED SPECIES INTERACTIONS IN THE MHI HANDLINE FISHERY

NMFS has determined that the MHI handline fishery operating under the Pacific Pelagic FEP is not likely to jeopardize green sea turtles and not likely to adversely affect other ESA-listed sea turtles, marine mammals, seabirds, and scalloped hammerhead shark, non ESA-listed marine mammals, and has no effects on ESA-listed reef-building corals. The MHI handline fishery has minimal interactions with these protected species.

The ITS in the 2009 Biological Opinion estimates four green turtle mortalities annually in the troll and handline fisheries in the western Pacific region. There have not been any reported or observed collisions of troll and handline vessels with green turtles, and data are not available to attribute stranded turtle mortality source to troll and handline vessels.

Based on fishing effort and other characteristics described in Section 2.4.9, no notable changes have been observed in the fishery. There is no other information to indicate that impacts to protected species from this fishery have changed in recent years.

3.2.6 HAWAI`I OFFSHORE HANDLINE FISHERY

3.2.6.1 INDICATORS FOR MONITORING PROTECTED SPECIES INTERACTIONS IN THE HAWAI`I OFFSHORE HANDLINE FISHERY

In this report, the Council monitors protected species interactions in the Hawai`i offshore handline fishery using proxy indicators such as fishing effort and changes in gear types as this fishery does not have observer coverage.

3.2.6.1.1 FEP Conservation Measures

The Hawai`i offshore handline fishery has not had reported interactions with protected species, and no specific regulations are in place to mitigate protected species interactions. The Pacific Pelagic FEP prohibits the use of drift gillnets in the U.S. EEZ of the Western Pacific, and this measure provides benefits to protected species by preventing potential interactions with non-selective fishing gear. The Pacific Pelagic FEP also requires any vessel fishing under the FEP to comply with sea turtle handling and release regulations.

3.2.6.1.2 ESA Consultations

In a Biological Opinion completed on September 1, 2009 for the troll and handline fisheries in the Western Pacific region, NMFS concluded that these fisheries are not likely to jeopardize the continued existence of green turtles and included an ITS of four animals killed per year from collisions with troll and handline fishing vessels. The Biological Opinion also concluded that the fisheries are not likely to adversely affect all other protected species in the region. NMFS also determined on October 16, 2014 that fisheries managed under the Pelagic FEP have no effects on ESA-listed reef-building corals.

3.2.6.1.3 Non-ESA Marine Mammals

The MMPA requires NMFS to annually publish an LOF that classifies commercial fisheries in one of three categories based on the level of mortality and serious injury of marine mammals associated with that fishery. According to the 2017 (82 FR 3655, January 12, 2017), the Hawai`i offshore handline (HI pelagic handline) fishery is classified as a Category III fishery (i.e. a remote likelihood of or no known incidental mortality and serious injury of marine mammals).

3.2.6.2 STATUS OF PROTECTED SPECIES INTERACTIONS IN THE HAWAI`I OFFSHORE HANDLINE FISHERY

NMFS has determined that the Hawai`i offshore handline fishery operating under the Pacific Pelagic FEP is not likely to jeopardize green sea turtles and not likely to adversely affect other ESA-listed sea turtles, marine mammals, seabirds, and scalloped hammerhead shark, non ESA-listed marine mammals, and have no effects on ESA-listed reef-building corals. The Hawai`i offshore handline fishery has minimal interactions with these protected species.

The ITS in the 2009 Biological Opinion estimates four green turtle mortalities annually in the troll and handline fisheries in the western Pacific region. There have not been any reported or observed collisions of troll and handline vessels with green turtles, and data are not available to attribute stranded turtle mortality source to troll and handline vessels.

Based on fishing effort and other characteristics described in Section 2.4.10, no notable changes have been observed in the fishery. There is no other information to indicate that impacts to protected species from this fishery have changed in recent years.

3.2.7 AMERICAN SAMOA, GUAM AND CNMI TROLL FISHERY

3.2.7.1 INDICATORS FOR MONITORING PROTECTED SPECIES INTERACTIONS IN THE AMERICAN SAMOA, GUAM AND CNMI TROLL FISHERY

In this report, the Council monitors protected species interactions in the American Samoa, Guam, and CNMI troll fisheries using proxy indicators such as fishing effort and changes in gear types as these fisheries do not have observer coverage.

Details of these indicators are discussed in the sections below.

3.2.7.1.1 FEP Conservation Measures

The American Samoa, Guam, and CNMI fisheries have not had reported interactions with protected species, and no specific regulations are in place to mitigate protected species interactions. The Pacific Pelagic FEP prohibits the use of drift gillnets in the U.S. EEZ of the Western Pacific, and this measure provides benefits to protected species by preventing potential interactions with non-selective fishing gear. The Pacific Pelagic FEP also requires any vessel fishing under the FEP to comply with sea turtle handling and release regulations.

3.2.7.1.2 ESA Consultations

In a Biological Opinion completed on September 1, 2009 for the troll and handline fisheries in the Western Pacific region, NMFS concluded that these fisheries are not likely to jeopardize the continued existence of green turtles and included an ITS of four animals killed per year from collisions with troll and handling fishing vessels. The Biological Opinion also concluded that the fisheries are not likely to adversely affect all other protected species in the region. NMFS also determined on October 16, 2014 that fisheries managed under the Pelagic FEP have no effects on ESA-listed reef-building corals.

3.2.7.1.3 Non-ESA Marine Mammals

The MMPA requires NMFS to annually publish an LOF that classifies commercial fisheries in one of three categories based on the level of mortality and serious injury of marine mammals associated with that fishery. According to the 2017 LOF (82 FR 3655, January 12, 2017), troll fisheries in American Samoa, Guam and CNMI are classified as Category III fisheries (i.e. a remote likelihood of or no known incidental mortality and serious injury of marine mammals).

3.2.7.2 STATUS OF PROTECTED SPECIES INTERACTIONS IN THE AMERICAN SAMOA, GUAM AND CNMI TROLL FISHERY

NMFS has determined that the American Samoa, Guam, and CNMI fisheries operating under the Pacific Pelagic FEP are not likely to jeopardize green sea turtles and not likely to adversely affect other ESA-listed sea turtles, marine mammals, seabirds, and scalloped hammerhead shark, non ESA-listed marine mammals, and have no effects on ESA-listed reef-building corals. The American Samoa, Guam, and CNMI fisheries likely have minimal interactions with these protected species.

The ITS in the 2009 Biological Opinion estimates four green turtle mortalities annually in the troll and handline fisheries in the western Pacific region. There have not been any reported or observed collisions of troll and handline vessels with green turtles, and data are not available to attribute stranded turtle mortality source to troll and handline vessels.

Based on fishing effort and other characteristics described in Sections 2.1 and 2.2, no notable changes have been observed in the American Samoa and CNMI troll fisheries. There is no other information to indicate that impacts to protected species from these fisheries have changed in recent years.

The Guam pelagic fishery data based on the offshore creel survey show a gradual increase in annual estimated total landings for tuna PMUS from 2005-2016 (Figure 50). This increase is in large part attributed to an increase in troll vessels targeting skipjack tuna (Figure 53). The increase in troll fisheries targeting skipjack tuna are unlikely to result in increased potential for protected species interactions due to rapid catch retrieval. Additionally, the estimated number of trolling boats (Figure 49) as well as the estimated number of trolling trips (Figure 60) and hours (Figure 61) over the last decade has been variable and has not exhibited an increasing trend. Therefore, available data on fishing effort and other operational characteristics do not indicate an increase in potential impacts to protected species from the Guam fishery.

3.2.8 IDENTIFICATION OF EMERGING ISSUES

Potential interactions between Hawai`i non-longline pelagic fisheries and cetaceans have been identified and are summarized in the most recent marine mammal SARs. Available information do not identify which type of fisheries may be causing injury to cetaceans nor the extent to which the cetacean populations may be impacted by such injuries. New information on this subject published in 2016 that are not included in the current SARs are summarized below.

Madge, L. 2016. Exploratory study of interactions between cetaceans and small-boat fishing operations in the Main Hawaiian Islands (MHI). Pacific Islands Fisheries Science Center, Administrative Report H-16-07, 37 p. doi:10.7289/V5/AR-PIFSC-H-16-07.

Summary: The exploratory study was aimed at improving the understanding of fishery-cetacean interactions in the main Hawaiian Islands through interviews with small-boat fishermen on Oahu and the Big Island. The study highlighted that there is considerable uncertainty in species identification by fishermen of false killer whales and other odontocetes categorized as blackfish, and respondents generally reported avoiding interactions by leaving the fishing area when a blackfish is observed. The results of this study cannot be used to estimate frequency or assess the distribution of interactions due to the small sample size and non-random sampling method.

Several species are currently candidates for listing under the ESA, and several more ESA-listed species are being evaluated for critical habitat designation (Table 84). If these species are listed or critical habitat are designated, they will be included in this SAFE report and impacts from FEP-managed fisheries will be evaluated under applicable mandates.

Table 84. Candidate ESA species, and ESA-listed species being evaluated for critical habitat designation.

Species	Listing process	Post-listing activity

Common name	Scientific name	90-day finding	12-month finding / Proposed rule	Final rule	Critical Habitat	Recovery Plan
Oceanic whitetip shark	*Carcharhinus longimanus*	Positive (81 FR 1376, 1/12/2016)	Positive, threatened (81 FR 96304, 12/29/2016)	Public comment period closed 3/29/2017, final rule expected 12/29/2017	N/A	N/A
Pacific bluefin tuna	*Thunnus orientalis*	Positive (81 FR 70074, 10/11/2016)	In progress, expected 6/2017	N/A	N/A	N/A
Chambered nautilus	*Nautilus pompilius*	Positive (81 FR 58895, 8/26/2016)	In progress, expected 5/2017	N/A	N/A	N/A
Giant manta ray	*Manta birostris*	Positive (81 FR 8874, 2/23/2016)	Positive, threatened (82 FRN 3694, 1/12/2017)	Public comment period closed 3/13/2017, final rule expected 1/2018	N/A	N/A
Reef manta ray	*Manta alfredi*	Positive (81 FR 8874, 2/23/2016)	Not warranted (82 FRN 3694, 1/12/2017)	N/A	N/A	N/A
Corals	N/A	Positive for 82 species (75 FR 6616, 2/10/2010)	Positive for 66 species (77 FR 73219, 12/7/2012)	20 species listed as threatened (79 FR 53851, 9/10/2014)	In development, proposal expected 2017	In development, expected TBA, interim recovery outline in place
False killer whale (MHI Insular DPS)	*Pseudorca crassidens*	Positive (75 FR 316, 1/5/2010)	Positive, endangered (75 FR 70169, 11/17/2010)	Listed as endangered (77 FR 70915, 11/28/2012)	In development, proposal expected fall 2017	In development, public comment expected 2017
Green sea turtle	*Chelonia mydas*	Positive (77 FR 45571, 8/1/2012)	Identification of 11 DPSs, endangered and threatened (80 FR 15271, 3/23/2015)	11 DPSs listed as endangered and threatened (81 FR 20057, 4/6/2016)	In development, proposal expected 2017	TBA

3.2.9 IDENTIFICATION OF RESEARCH, DATA AND ASSESSMENT NEEDS

The following research, data and assessment needs for pelagic fisheries were identified by the Council's Protected Species Advisory Committee and Plan Team:

- Research on at-sea foraging behavior of albatross species to improve understanding of interaction rates in the Hawai`i longline fisheries;
- Identify zones to develop a regional look at environmental and oceanographic factors for area outside of the EEZ that may focus on areas of high-interactions. Develop metrics to characterize environmental data, effort, and bycatch rates at these regional scales (e.g. leatherback, olive ridley, albatrosses);
- Ecosystem considerations on catch and bycatch in the DSLL fishery (e.g., bigeye tuna, albatross, leatherback, and olive ridley turtles) as they relate to environmental and ecological drivers of changing species distribution and aggregation; and
- Evaluation of spatial and temporal representation of observer coverage compared to non-observed effort. While vessel behavior may be motivated by various factors, an assessment of sampling bias may be warranted.

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3.3 CLIMATE AND OCEANIC INDICATORS

Over the past few years, the Council has incorporated climate change into the overall management of its managed fisheries. This 2016 Annual Report includes a now standard chapter on indicators of climate and oceanic conditions in the Western Pacific Region. These indicators reflect both global climate variability and change and trends in local oceanographic conditions.

The reasons for the Council's decision to provide and maintain an evolving discussion of climate conditions as an integral and continuous consideration in their deliberations, decisions, and reports are numerous:

- Emerging scientific and community understanding of the impacts of changing climate conditions on fishery resources, the ecosystems that sustain those resources, and the communities that depend upon them;
- Recent Federal Directives including the 2010 implementation of a National Ocean Policy that identified Resiliency and Adaptation to Climate Change and Ocean Acidification as one of nine National priorities as well as the development of a Climate Science Strategy by NMFS in 2015 and the subsequent development of the Pacific Islands Regional Action Plan for climate science; and
- The Council's own engagement with NOAA as well as jurisdictional fishery management agencies in American Samoa, CNMI, Guam, and Hawai`i as well as fishing industry representatives and local communities in those jurisdictions.

In 2013, the Council began restructuring its Marine Protected Area / Coastal and Marine Spatial Planning Committee to include a focus on climate change and renamed the committee as the Marine Planning and Climate Change (MPCC) Committee. In 2015, based on recommendations from the committee, the Council adopted its Marine Planning and Climate Change Policy and Action Plan, which provided guidance to the Council on implementing climate change measures, including climate change research and data needs. The revised Pelagic Fisheries Ecosystem Plan (FEP; February 2016) included a discussion on climate change data and research and a new objective (Objective 9) that states the Council should consider the implications of climate change in decision-making, with the following sub-objectives:

a) Identify and prioritize research that examines the effects of climate change on Council-managed fisheries and fishing communities.
b) Ensure climate change considerations are incorporated into the analysis of management alternatives.
c) Monitor climate change related variables via the Council's Annual Reports.
d) Engage in climate change outreach with U.S. Pacific Islands communities.

Beginning with the 2015 Report, the Council and its partners began providing continuing descriptions of changes in a series of climate and oceanic indicators.

This Annual Report builds on last year's inaugural effort with the addition of several new indicators of subsurface oceanic conditions and bigeye tuna recruitment strength. Future Annual Reports will include additional indicators as the information becomes available and their relevance to the development, evaluation, and revision of ecosystem-fishery plans becomes clearer. Working with national and jurisdictional partners, the Council will make all datasets used in the preparation of this and future reports available and easily accessible.

3.3.1 RESPONSE TO PREVIOUS COUNCIL RECOMMENDATIONS

At its 166th meeting in June 2016, the Council recommended the addition of several climate and ocean indicators, including wind speed and direction, oceanic currents, and the frequency of storms. The frequency of tropical cyclones is already included in the report. The Plan Teams will continue working to incorporate the recommended indicators in future Annual Reports.

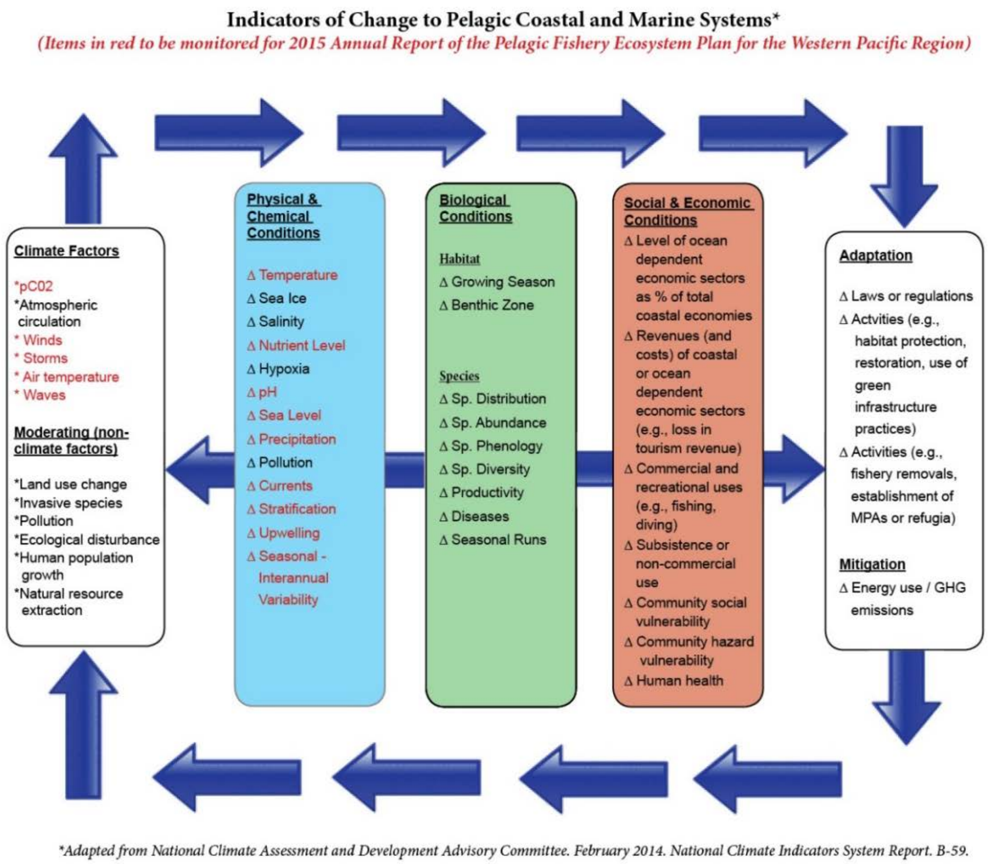
The Council also directed staff to provide comments on the draft Pacific Islands Regional Action Plan for climate science. A working group of the Council's Scientific and Statistical Committee provided comments to the Council, which were forward to NMFS Pacific Islands Fisheries Science Center on 11 July 2016.

3.3.2 CONCEPTUAL MODEL

In developing this chapter, the Council relied on a number of recent reports conducted in the context of the U.S. National Climate Assessment including, most notably, the 2012 Pacific Islands Regional Climate Assessment and the Ocean and Coasts chapter of the 2014 report on a Pilot Indicator System prepared by the National Climate Assessment and Development Advisory Committee (NCADAC).

The Advisory Committee Report presented a possible conceptual framework designed to illustrate how climate factors can connect to and interact with other ecosystem components to impact ocean and coastal ecosystems and human communities. The Council adapted this model with considerations relevant to the fishery resources of the Western Pacific Region:

Figure 135. Indicators of Change to Pelagic Coastal and Marine Systems



As described in the 2014 NCADAC report, the conceptual model presents a "simplified representation of climate and non-climate stressors in coastal and marine ecosystems." For the purposes of this Annual Report, the modified Conceptual Model allows the Council and its partners to identify indicators of interest to be monitored on a continuing basis in coming years. The indicators shown in red were considered for inclusion in the 2015 Annual Report, though the final list of indicators varied somewhat. Other indicators will be added over time as datasets become available and understanding of the nature of the causal chain from stressors to impacts emerges.

The Council also hopes that this Conceptual Model can provide a guide for future monitoring and research that will enable the Council and its partners to move from observations and correlations to understanding the specific nature of interactions and to developing capabilities to predict future changes of importance in developing, evaluating, and adapting ecosystem-fishery plans in the Western Pacific Region.

3.3.3 SELECTED INDICATORS

The primary goal for selecting the Indicators used in this and future reports is to provide fisheries-related communities, resource managers, and businesses with a climate-related situational awareness. In this context, Indictors were selected to:

- Be fisheries relevant and informative;
- Build intuition about current conditions in light of a changing climate;
- Provide historical context; and
- Allow for recognition of patterns and trends.

In this context, the Council initially included the following climate and oceanic indicators:

- Atmospheric concentration of carbon dioxide (CO_2)
- Oceanic pH at Station ALOHA;
- Oceanic Niño Index (ONI);
- Pacific Decadal Oscillation (PDO);
- Tropical cyclones;
- Sea surface temperature (SST);
- Ocean color;
- Oligotrophic area;
- North Pacific Subtropical Front (STF) and Transition Zone Chlorophyll Front (TZCF); and
- Fish community size structure.

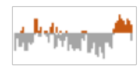
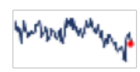
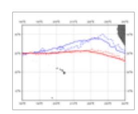
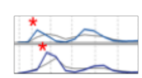
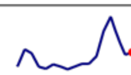
This year's Annual Report includes the addition of the following Indicators:

- Ocean temperature at 300 m depth;
- Bigeye tuna weight-per-unit-effort; and
- Bigeye tuna recruitment index;

as well as the removal of oligotrophic area due to concerns about the data used to calculate this indicator.

Table 85 provides a description of these Indicators and a summary of the key findings detailed in the following sections of the report.

Table 85. Pelagic Climate and Oceanic Indicator Summary

Indicator Definition and Rationale	Indicator Status	Quick Look
Atmospheric Concentration of Carbon Dioxide (CO_2) measured at Mauna Loa Observatory. Increasing atmospheric CO_2 is a primary measure of anthropogenic climate change.	**Trend:** increasing exponentially ***2016:** time series maximum 404.21 parts per million	
Oceanic pH measured at Station ALOHA provides a measure of ocean acidification. Increasing acidification limits the ability of marine organisms to build shells and other hard structures.	**Trend:** linear decrease of 0.0364 pH units, roughly an 8.7% increase in acidity ***2015:** average pH of 8.07	
Oceanic Niño Index (ONI) is measured as the sea surface temperature anomaly from Niño 3.4 region (5°N - 5°S, 120° - 170°W). Used to determine the phase of the El Niño - Southern Oscillation (ENSO), which has implications across the region, affecting migratory patterns of key commercial fish stocks which in turn affect the location, safety, and costs of commercial fishing.	**2016:** transitioned from strong El Niño to weak La Niña	
Pacific Decadal Oscillation (PDO) is a measure of sea surface temperature anomalies north of 20°N. The PDO can be thought of as a long-lived, multi-decadal ENSO cycle and has well-documented fishery implications related to ocean temperature and productivity.	**2016:** Positive (warm) phase	
Tropical Cyclones are measured by occurrence, strength, and energy and have the potential to significantly impact fishing operations.	**Eastern Pacific, 2016:** 21 named storms, 11 hurricanes, 5 major	
	Central Pacific, 2016: 7 named storms, 3 hurricanes, 2 major	
	Western Pacific, 2016: 28 named storms, 14 typhoons, 10 major	
	Southern Pacific, 2016: 7 named storms, 5 cyclones, 2 major	
Sea Surface Temperature (SST) is satellite remotely-sensed. SST is projected to rise, and impacts phenomena ranging from winds to fish distributions.	**Trend:** linear increase of 0.01 °C yr^{-1} ***2016:** average value of 22.4 °C	
Temperature at 300m depth from ocean reanalysis data shows trends at the depth targeted by the deep-set bigeye tuna fishery. Bigeye tuna have specific thermal habitat preferences.	***2016:** average temperature of 10.1°C	
Ocean Color is a satellite remotely-sensed measure of ocean productivity.	***2016:** time series minimum annual mean of 0.13 mg chl m^{-3}	
North Pacific Subtropical Frontal Zone (STF) marked by the 18 °C SST isotherm and **Transition Zone Chlorophyll Front (TZCF)** marked by the 0.2 mg chlorophyll-a m^{-3} surface isopleth. These fronts are targeted by the swordfish fishery.	**-STF, 2016:** average latitude west of 140°W north of average east of 140°W **-TZCF, 2016:** south of average west of 140°W north of average east of 140°W	
Fish community size structure from fish lengths as recorded by longline observers and weights as reported in dealer data. Fish size is impacted by several factors, including climate.	**Full Fishery:** *2016 median weight of 23.7 kg	
	Bigeye Tuna: *2016 median weight of 34.5 kg	
	Swordfish: *2016 median weight of 63.1 kg	
Bigeye weight-per-unit-effort for the previous three years can provide an indication of strong recruitment pulses, which may be tied to climate impacts.	***2016:** peak in 2-year-old bigeye in final two quarters of the year	
Bigeye recruitment index based on the observation that catch rates of bigeye ≤ 15 kg peak 2 years before bigeye CPUE peaks.	***2016:** model-derived CPUE of 0.32	

3.3.3.1 ATMOSTPHERIC CONCENTRATION OF CARBON DIOXIDE (CO_2) AT MAUNA LOA

Description: Monthly mean atmospheric carbon dioxide (CO_2) at Mauna Loa Observatory, Hawai`i in parts per million (ppm) from March 1958 to present. The carbon dioxide data are measured as the mole fraction in dry air, on Mauna Loa. A dry mole fraction is defined as the number of molecules of carbon dioxide divided by the number of molecules of dry air multiplied by one million (parts per million; ppm). This constitutes the longest record of direct measurements of CO_2 in the atmosphere. The measurements were started by C. David Keeling of the Scripps Institution of Oceanography in March of 1958 at a facility of the National Oceanic and Atmospheric Administration (NOAA; Keeling et al. 1976). NOAA started its own CO_2 measurements in May of 1974 and they have run in parallel with those made by Scripps since then (Thoning et al. 1989).

The observed increase in monthly average carbon dioxide concentration is due primarily to CO_2 emissions from fossil fuel burning. Carbon dioxide remains in the atmosphere for a very long time, and emissions from any location mix throughout the atmosphere in about one year. The annual oscillations at Mauna Loa, Hawai`i are due to the seasonal imbalance between the photosynthesis and respiration of plants on land. During the summer growing season photosynthesis exceeds respiration and CO_2 is removed from the atmosphere, whereas outside the growing season respiration exceeds photosynthesis and CO_2 is returned to the atmosphere. The seasonal cycle is strongest in the northern hemisphere because of this hemisphere's larger land mass.

Timeframe: Annual, monthly

Region/Location: Mauna Loa, Hawai`i but representative of global atmospheric carbon dioxide concentration

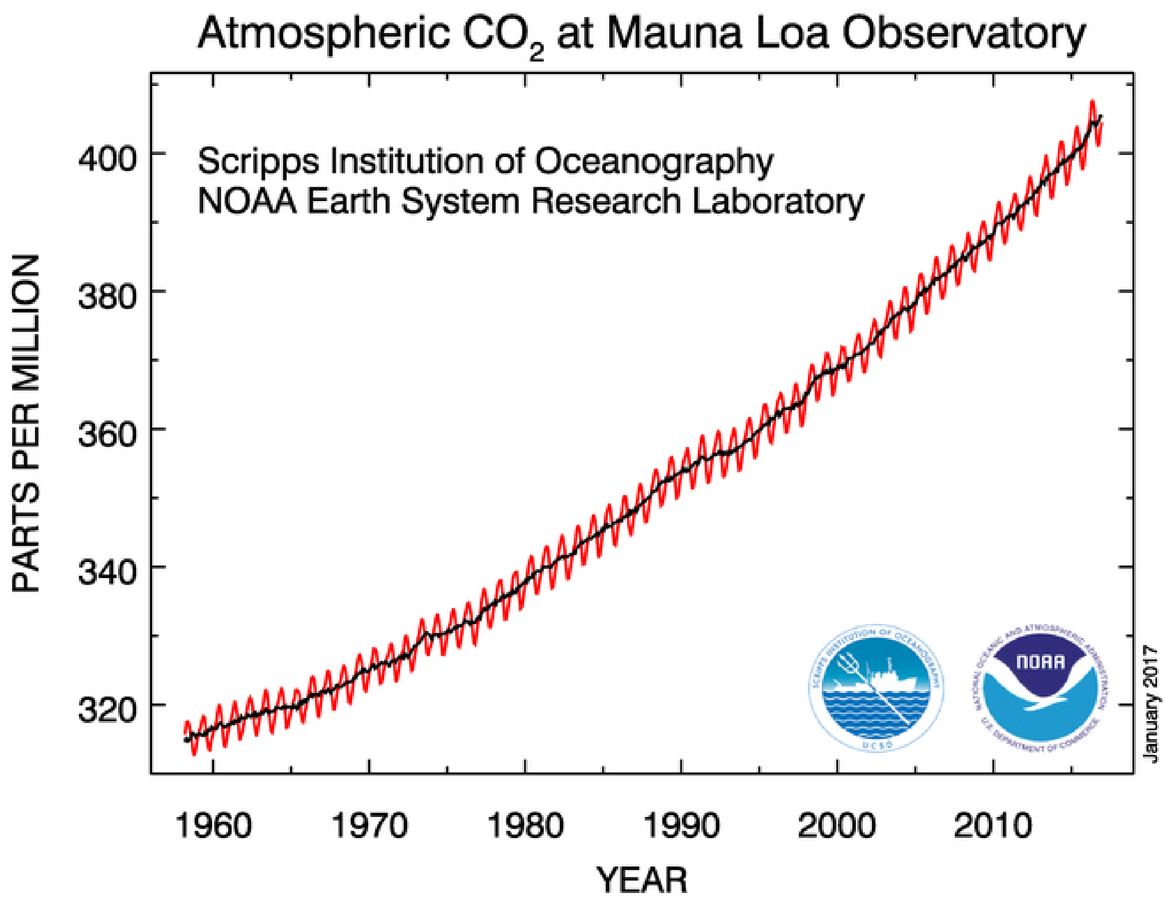
Data Source: "Full Mauna Loa CO_2 record" available at https://www.esrl.noaa.gov/gmd/ccgg/trends/full.html, NOAA Earth System Research Laboratory (ESRL) Global Monitoring Division. The NOAA Global Monitoring Division provides high-precision measurements of the abundance and distribution of long-lived greenhouse gases that are used to calculate global average concentrations.

Measurement Platform: *In-situ* station

Rationale: Atmospheric carbon dioxide is a measure of what human activity has already done to affect the climate system through greenhouse gas emissions. It provides quantitative information in a simplified, standardized format that decision makers can easily understand. This indicator demonstrates that the concentration (and, in turn, warming influence) of greenhouse gases in the atmosphere has increased substantially over the last several decades.

Status: Over the course of the time series, atmospheric CO_2 has been increasing exponentially. In 2016, the annual mean concentration of CO_2 was 404.12 ppm. In 1959, the first year of the time series, it was 315.97 ppm. The annual mean passed 350 ppm in 1988 and 400 ppm in 2015.

Figure 136. Monthly Mean Atmospheric Carbon Dioxide at Mauna Loa Observatory, Hawai`i



Note: The carbon dioxide data (red curve), measured as the mole fraction (ppm), in dry air, on Mauna Loa. The black curve represents the seasonally corrected data.

References:

Keeling CD, Bacastow RB, Bainbridge AE, Ekdahl CA, Guenther PR, Waterman LS. 1976. Atmospheric carbon dioxice variations at Mauna Loa Observator, Hawaii. *Tellus*, 28: 538-551.

Thoning KW, Tans PP, Komhyr WD. 1989. Atmospheric carbon dioxide at Mauna Loa Observatory 2. Analysis of the NOAA GMCC data, 1974-1985. *Journal of Geophysical Research*, 94: 8549-8565.

3.3.3.2 OCEANIC PH

Description: Trends in surface (5 m) pH at Station ALOHA, north of Oahu (22.75°N, 158°W), collected by the Hawai`i Ocean Time-series (HOT) from October 1988 to 2015 (2016 data are not yet available). Two measures of pH are presented: directly measured pH and pH calculated from total alkalinity (TA) and dissolved inorganic carbon (DIC). Oceanic pH is a measure of ocean acidity, which increases as the ocean absorbs carbon dioxide from the atmosphere. Lower pH values represent greater acidity. Total alkalinity represents the ocean's capacity to resist acidification as it absorbs CO_2 and the amount of CO_2 absorbed is captured through measurements of DIC. The multi-decadal time series at Station ALOHA represents the best available documentation of the significant downward trend in oceanic pH since the time series began in 1988. Oceanic pH varies over both time and space, though the conditions at Station ALOHA are considered broadly representative of those across the Western and Central Pacific's pelagic fishing grounds.

Timeframe: Monthly

Region/Location: Station ALOHA: 22.75°N, 158°W

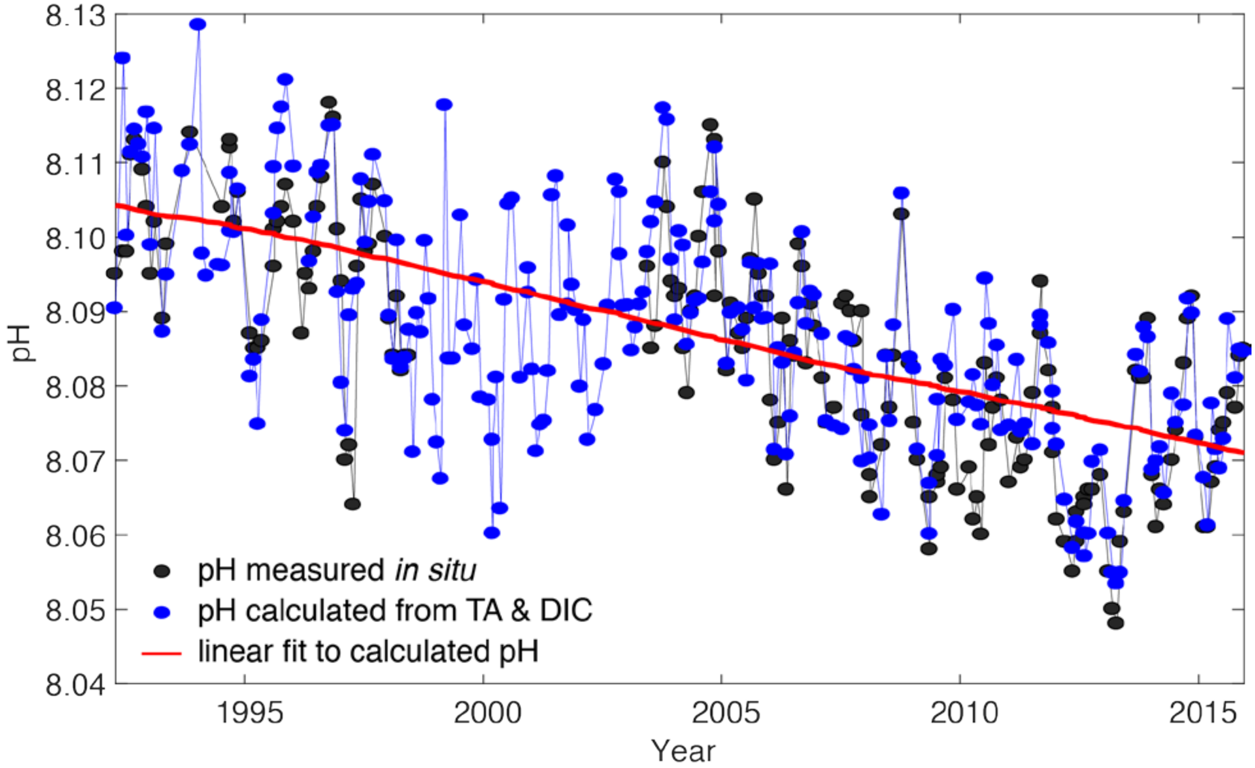
Data Source: Hawai`i Ocean Time-series at http://hahana.soest.hawaii.edu/hot/. The Hawai`i Ocean Time-series is maintained by the University of Hawai`i's School for Ocean and Earth Science and Technology.

Measurement Platform: *In-situ* station

Rationale: Ocean pH is a measure of how greenhouse gas emissions have already impacted the ocean. This indicator demonstrates that oceanic pH has decreased significantly over the past several decades (i.e., the ocean has become more acidic). Increasing ocean acidification (indicated by lower oceanic pH) limits the ability of marine organisms to build shells and other hard structures. Recent research has shown that pelagic organisms such pteropods and other prey for commercially-valuable fish species are already being negatively impacted by increasing acidification (Feely et al. 2016). The full impact of ocean acidification on the pelagic food web is an area of active research (Fabry et al. 2008).

Status: Over the nearly 30 years spanned by this time series oceanic pH has shown a significant linear decrease of 0.0364 pH units, or roughly an 8.7% increase in acidity.

Figure 137. pH Trend at Station ALOHA, 1988 - 2015



Note: The black lines and circles represent directly measured pH. The blue lines and circles represent pH calculated from total alkalinity (TA) and dissolved inorganic carbon (DIC). The linear fit to calculated pH is shown in red.

References:

An overview of the relationship between acidity and pH can be found at:

http://www.pmel.noaa.gov/co2/story/A+primer+on+pH

A detailed description of how HOT determines pH can be found at:
http://hahana.soest.hawaii.edu/hot/methods/ph.html

Methods for calculating pH from TA and DIC can be found at:

https://www.soest.hawaii.edu/oceanography/faculty/zeebe_files/CO2_System_in_Seawater/csys.html

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Feely RA, Alin SR, Carter B, Bednarsek N, Hales B, Chan F, Hill TM, Gaylord B, Sanford E, Byrne RH, Sabine CL, Greeley D, Juranek L, 2016. Chemical and biological impacts of ocean acidification along the west coast of North America. *Estuarine, Coastal and Shelf Science*, 183: 260-270. doi: 10.1016/j.ecss.2016.08.043

3.3.3.3 OCEANIC NIÑO INDEX

Description: The three-month running mean of ERSST .v4 sea surface temperature (SST) anomalies in the Niño 3.4 region (5°S – 5°N, 120° – 170°W). The Oceanic Niño Index (ONI) is a measure of the El Niño – Southern Oscillation (ENSO) phase. Warm and cool phases, termed El Niño and La Niña respectively, are based in part on an ONI threshold of ± 0.5 °C being met for a minimum of five consecutive overlapping seasons. Additional atmospheric indices are needed to confirm an El Niño or La Niña event, as the ENSO is a coupled ocean-atmosphere phenomenon. The atmospheric half of this Pacific basin oscillation is measured using the Southern Oscillation Index.

Timeframe: Every three months

Region/Location: Niño3.4 region: 5°S – 5°N, 120° – 170°W

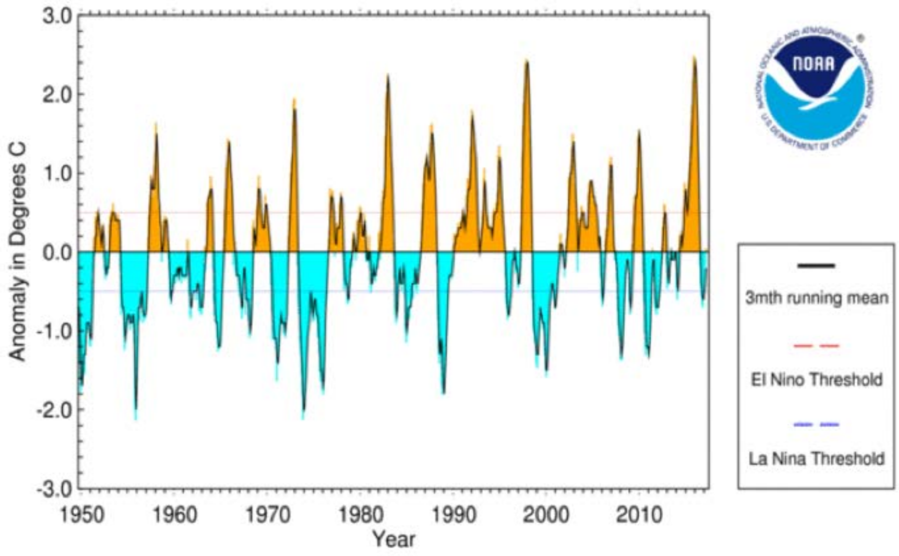
Data Source: NOAA NCEI at https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst.php. NCEI is responsible for hosting and providing access to one of the most significant archives on Earth, with comprehensive oceanic, atmospheric, and geophysical data.

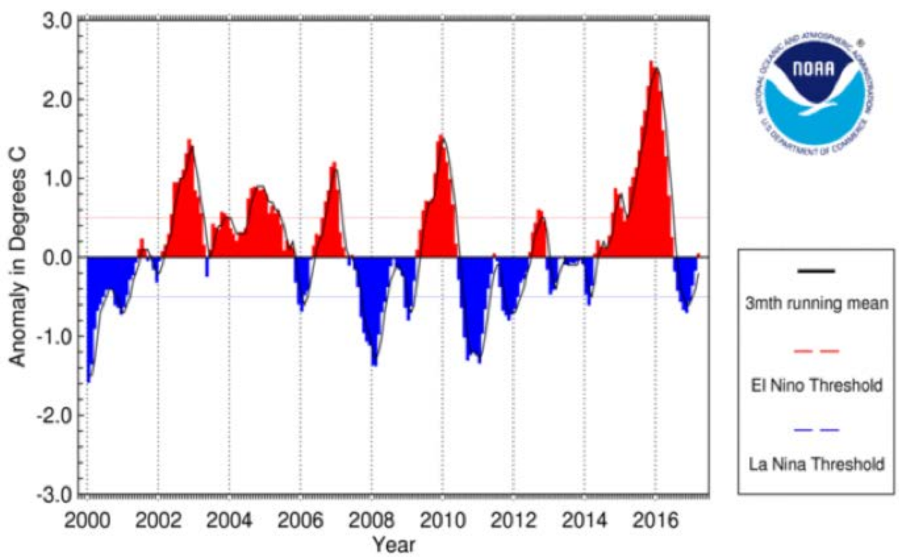
Measurement Platform: *In-situ* station, satellite, model

Rationale: The ENSO cycle is known to have impacts on Pacific fisheries targeting species including but not limited to tuna. The ONI focuses on ocean temperature which has the most direct effect on those fisheries.

Status: In 2016, the ONI fell below 0.5 °C in the May-June-July season marking the end of a strong El Niño which began in late 2014. The ONI fell below -0.5 °C in the July-August-September season marking the start of a weak La Niña which persisted through the end of the year.

Figure 138. Oceanic Niño Index, 1950 - 2016 and 2000 - 2016





References:

A full description of ENSO and its global impacts can be found at:
https://www.climate.gov/news-features/understanding-climate/el-ni%C3%B1o-and-la-ni%C3%B1a-frequently-asked-questions

3.3.3.4 PACIFIC DECADAL OSCILLATION

Description: The Pacific Decadal Oscillation (PDO) is often described as a long-lived El Niño-like pattern of Pacific climate variability. As seen with the better-known El Niño – Southern Oscillation (ENSO), extremes in the PDO pattern are marked by widespread variations in the Pacific Basin and the North American climate. In parallel with the ENSO phenomenon, the extreme cases of the PDO have been classified as either warm or cool, as defined by ocean temperature anomalies in the northeast and tropical Pacific Ocean. When sea surface temperatures (SSTs) are anomalously cool in the interior North Pacific and warm along the North American coast, and when sea level pressures are below average in the North Pacific, the PDO has a positive value. When the climate anomaly patterns are reversed, with warm SST anomalies in the interior and cool SST anomalies along the North American coast, or above average sea level pressures over the North Pacific, the PDO has a negative value.

The National Centers for Environmental Information (NCEI) PDO index is based on NOAA's extended reconstruction of SST (ERSST .v4).

Description inserted from https://www.ncdc.noaa.gov/teleconnections/pdo/.

Timeframe: Annual, monthly

Region/Location: Pacific Basin north of 20°N.

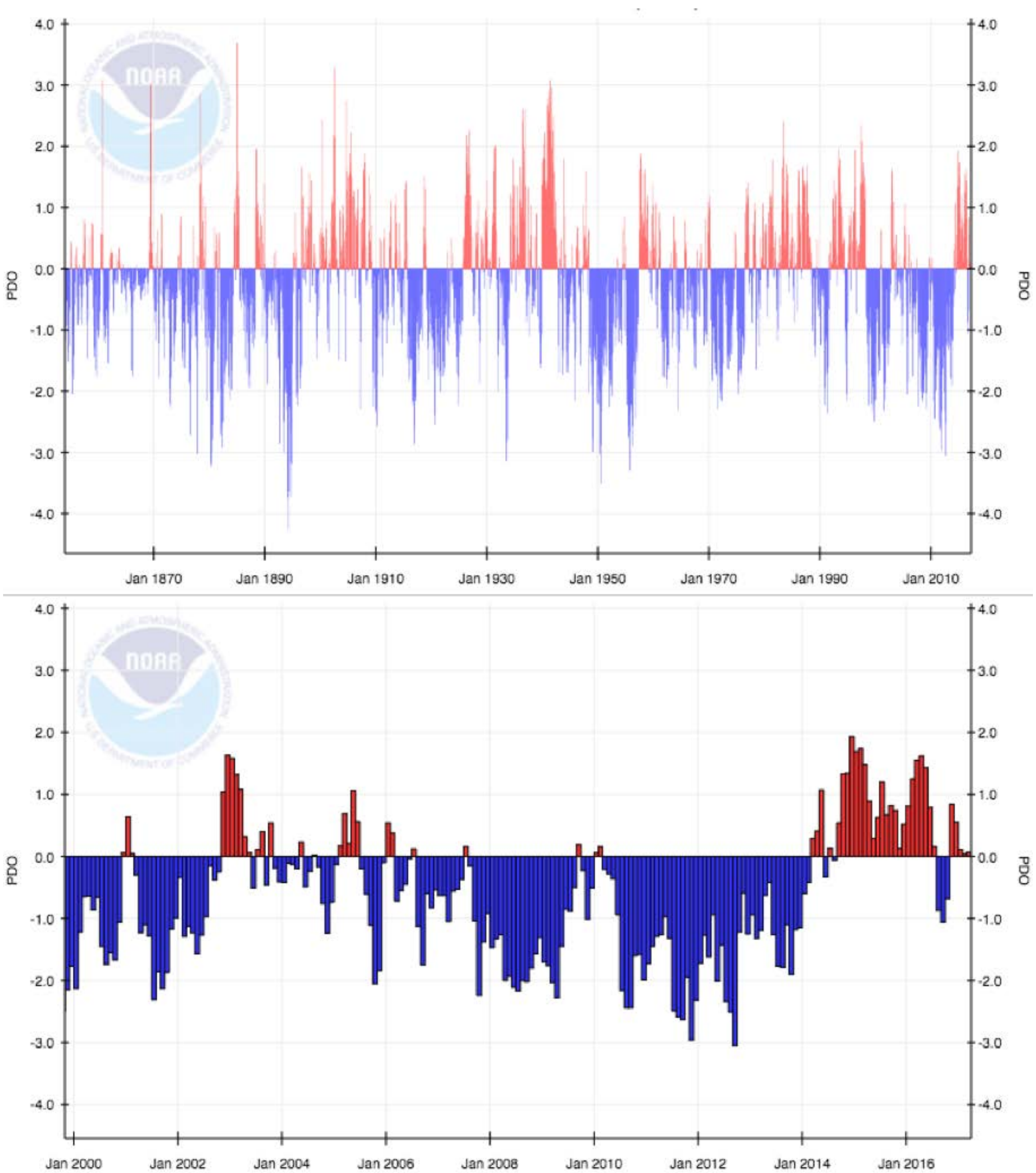
Data Source: NOAA NCEI at https://www.ncdc.noaa.gov/teleconnections/pdo/. NCEI is responsible for hosting and providing access to one of the most significant archives on Earth, with comprehensive oceanic, atmospheric, and geophysical data.

Measurement Platform: *In-situ* station, satellite, model

Rationale: The Pacific Decadal Oscillation (PDO) was initially named by a fisheries scientist, Steven Hare, in 1996 while researching connections between Alaska salmon production cycles and Pacific climate. Like the El Niño – Southern Oscillation (ENSO), the PDO reflects changes between periods of persistently warm or persistently cool ocean temperatures, but over a period of 20 – 30 years versus ENSO events which typically persist for 6 – 18 months. The climatic finger prints of the PDO are most visible in the North Pacific/North American sector, but secondary signatures exist in the tropics.

Status: Throughout 2016 the PDO was in a warm, or positive, phase.

Figure 139. Pacific Decadal Oscillation, 1854 - 2016 and 2000 - 2016



References:

Mantua, N. 2000: The Pacific Decadal Oscillation. Available at http://research.jisao.washington.edu/pdo/. Accessed Feb 2017.

3.3.3.5 TROPICAL CYCLONES

Description: This indicator uses historical data from the NOAA National Climate Data Center (NCDC) International Best Track Archive for Climate Stewardship to track the number of tropical cyclones in the western, central, eastern, and southern Pacific basins. This indicator also monitors the Accumulated Cyclone Energy (ACE) Index and the Power Dissipation Index which are two ways of monitoring the frequency, strength, and duration of tropical cyclones based on wind speed measurements.

The annual frequency of storms passing through each basin is tracked and a stacked time series plot shows the representative breakdown of Saffir-Simpson hurricane categories. Three solid lines across the graph are also plotted representing a) the long-term annual average number of named storms, b) the average annual number of hurricanes/typhoons, and c) the average annual number of major hurricanes/typhoons (category 3 and above).

Every cyclone has an ACE Index value, which is a number based on the maximum wind speed measured at six-hourly intervals over the entire time that the cyclone is classified as at least a tropical storm (wind speed of at least 34 knots; 39 mph). Therefore, a storm's ACE Index value accounts for both strength and duration. This plot shows the historical ACE values for each hurricane/typhoon season and has a horizontal line representing the average annual ACE value.

Maps of individual storms in 2016 are provided by NOAA's National Hurricane Center and Unisys.

Timeframe: Annual

Region/Location:

Eastern North Pacific: east of 140° W, north of the equator

Central North Pacific: 180° - 140° W, north of the equator

Western North Pacific: west of 180°, north of the equator

Western South Pacific: south of the equator

Data Source: Storm frequency and ACE Index values are from the National Centers for Environmental Information (NCEI)'s International Best Track Archive for Climate Stewardship at: https://www.ncdc.noaa.gov/ibtracs/. Images of 2016 eastern North Pacific storm tracks are from NCEI at: https://www.ncdc.noaa.gov/sotc/tropical-cyclones/201613. Images of 2016 storm tracks from the remaining basins are from Unisys at: http://weather.unisys.com/hurricane/.

Measurement Platform: Satellite

Rationale: The effects of tropical cyclones are numerous and well-known. At sea, storms disrupt and endanger shipping traffic as well as fishing effort and safety. The Hawai`i longline fishery, for example, has had serious problems with vessels dodging storms at sea, delayed departures, and inability to make it safely back to Honolulu because of bad weather. When cyclones encounter land, their intense rains and high winds can cause severe property damage, loss of life, soil erosion, and flooding. Associated storm surge, the large volume of ocean water pushed toward shore by cyclones' strong winds, can cause severe flooding and destruction.

Status:

Eastern North Pacific: The 2016 Eastern North Pacific hurricane season had 21 named storms, including 11 hurricanes, five of which became major. The 1981-2010 average number of named storms in the Eastern North Pacific is 16.5, with 8.9 hurricanes, and 4.3 major hurricanes. It is noteworthy that from July through September there were 18 named storms, the most for any 3-month period. The ACE index for the Eastern North Pacific during 2016 was 145 ($x10^4$ $knots^2$), which about 44 percent above the 1981-2010 mean of 104 ($x10^4$ $knots^2$).

Summary inserted from NOAA National Centers for Environmental Information, State of the Climate: Hurricanes and Tropical Storms for Annual 2016.

Central North Pacific: In 2016, the Central North Pacific had seven named storms, three of which were hurricanes and two of which were major hurricanes. Tropical storm Darby became the second tropical cyclone in three years to make landfall in Hawai`i - only the fifth landfalling cyclone since records began in 1949.

Summary inserted from NOAA National Centers for Environmental Information, State of the Climate: Hurricanes and Tropical Storms for Annual 2016.

Western North Pacific: Unisys data indicate there were 28 named storms in the Western North Pacific in 2016. Fourteen of the storms were typhoons, ten major and 2 super-typhoons.

Western South Pacific: Unisys data indicate there were 7 named storms in the Western South Pacific in 2016. Five of these storms were cyclones, two of which were major.

Figure 140. 2016 Eastern North Pacific Tropical Cyclone Tracks

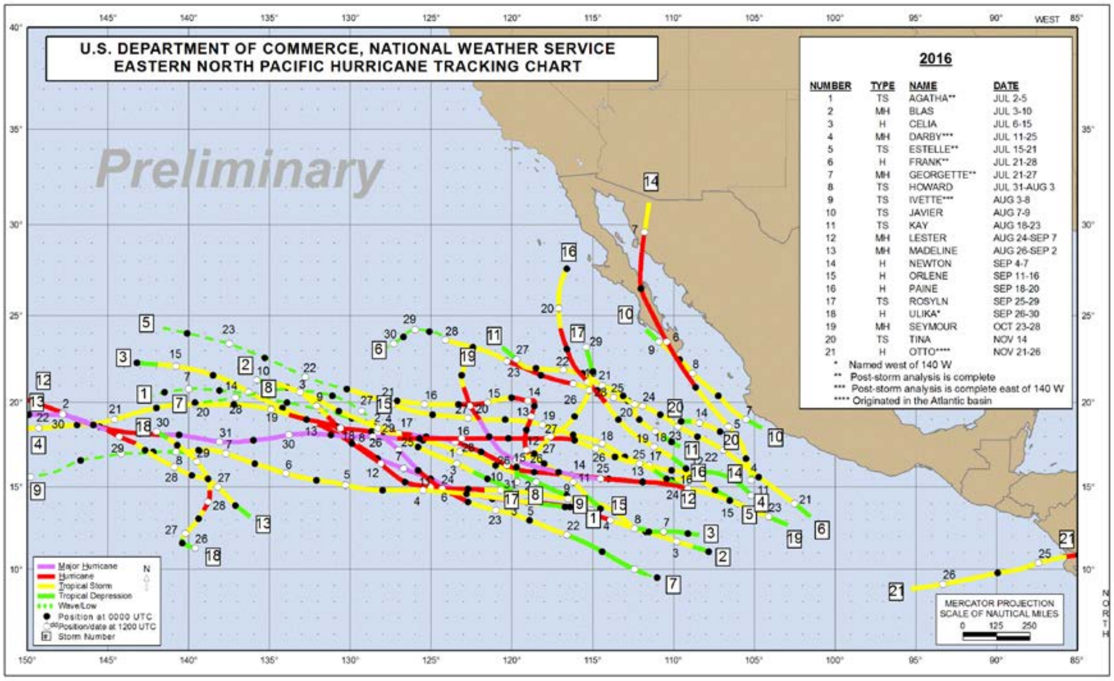
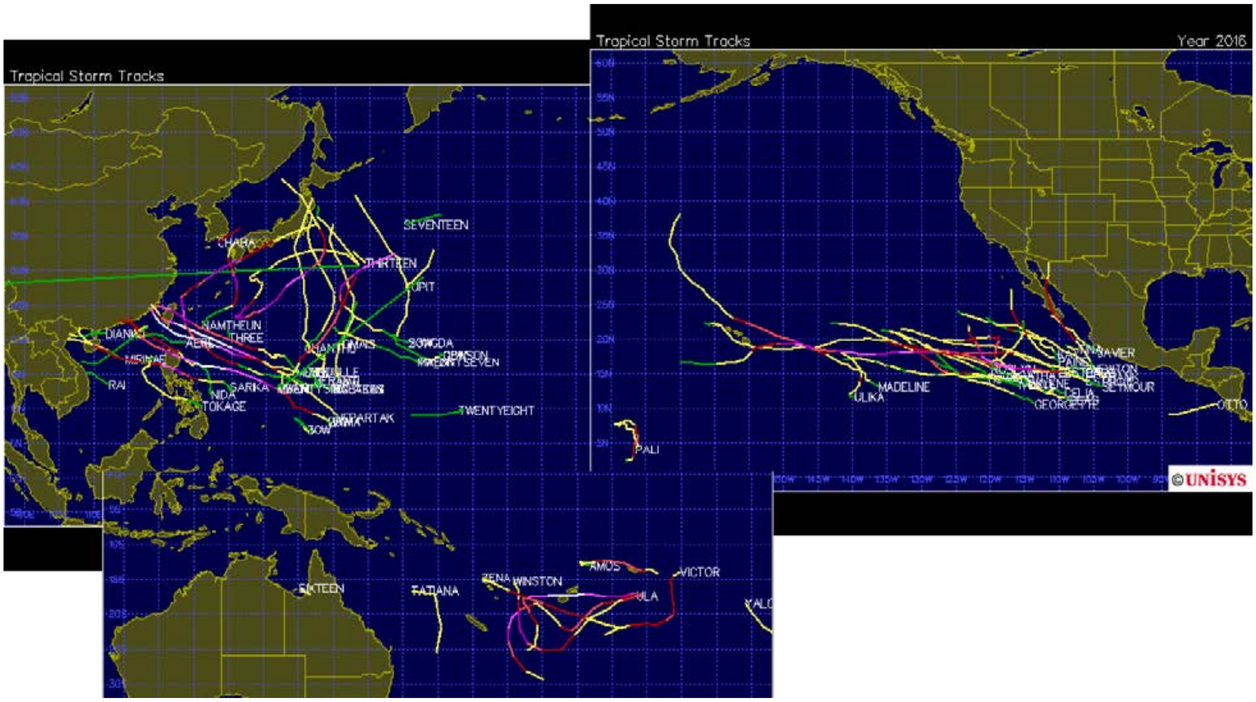
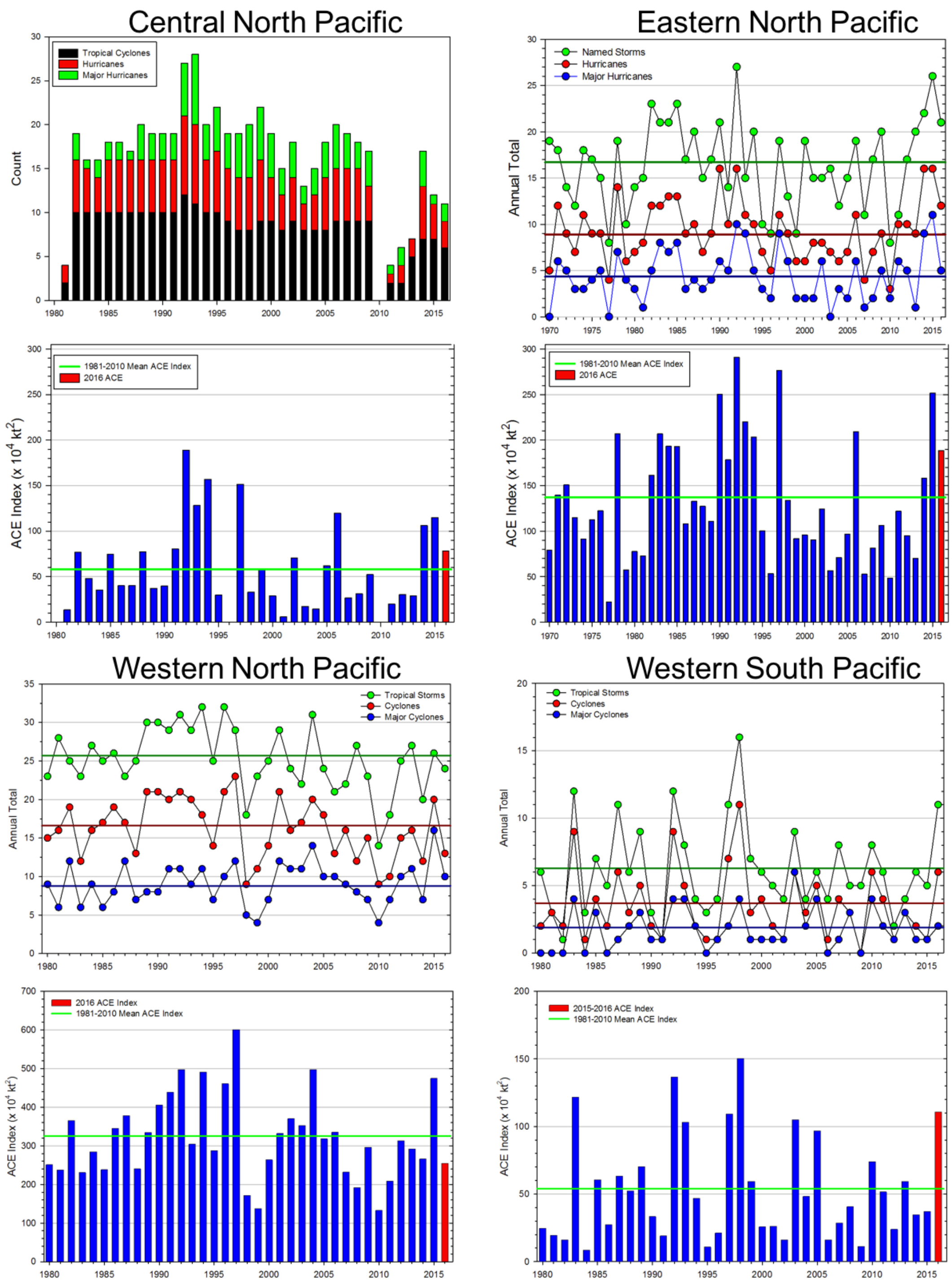


Figure 141. 2016 Pacific Basin Tropical Cyclone Tracks



Note: Tropical depressions are shown in green, tropical storms in yellow, category 1 hurricanes/typhoons/cyclones in red, category 2 in light red, category in magenta, category 4 in light magenta, and category 5 in white.

Figure 142. Annual Storm Totals and ACE Index



References:

NOAA National Centers for Environmental Information, State of the Climate: Hurricanes and Tropical Storms for Annual 2016, published online January 2017, retrieved on April 13, 2017 from https://www.ncdc.noaa.gov/sotc/tropical-cyclones/201613.

3.3.3.6 SEA SURFACE TEMPERATURE

Description: Satellite remotely-sensed monthly sea surface temperature (SST) is averaged across the Hawai`i-based longline fishing grounds (5° – 45°N, 180° – 120°W). A time series of monthly mean SST averaged over the Hawai`i longline region is presented. Additionally, spatial climatologies and anomalies are shown. NOAA Pathfinder-GAC data are used prior to 2013 and NOAA GOES-POES data are used for the remainder of the time series.

Timeframe: Monthly, quarterly

Region/Location: Hawai`i longline region: 5° – 45°N, 180° – 120°W

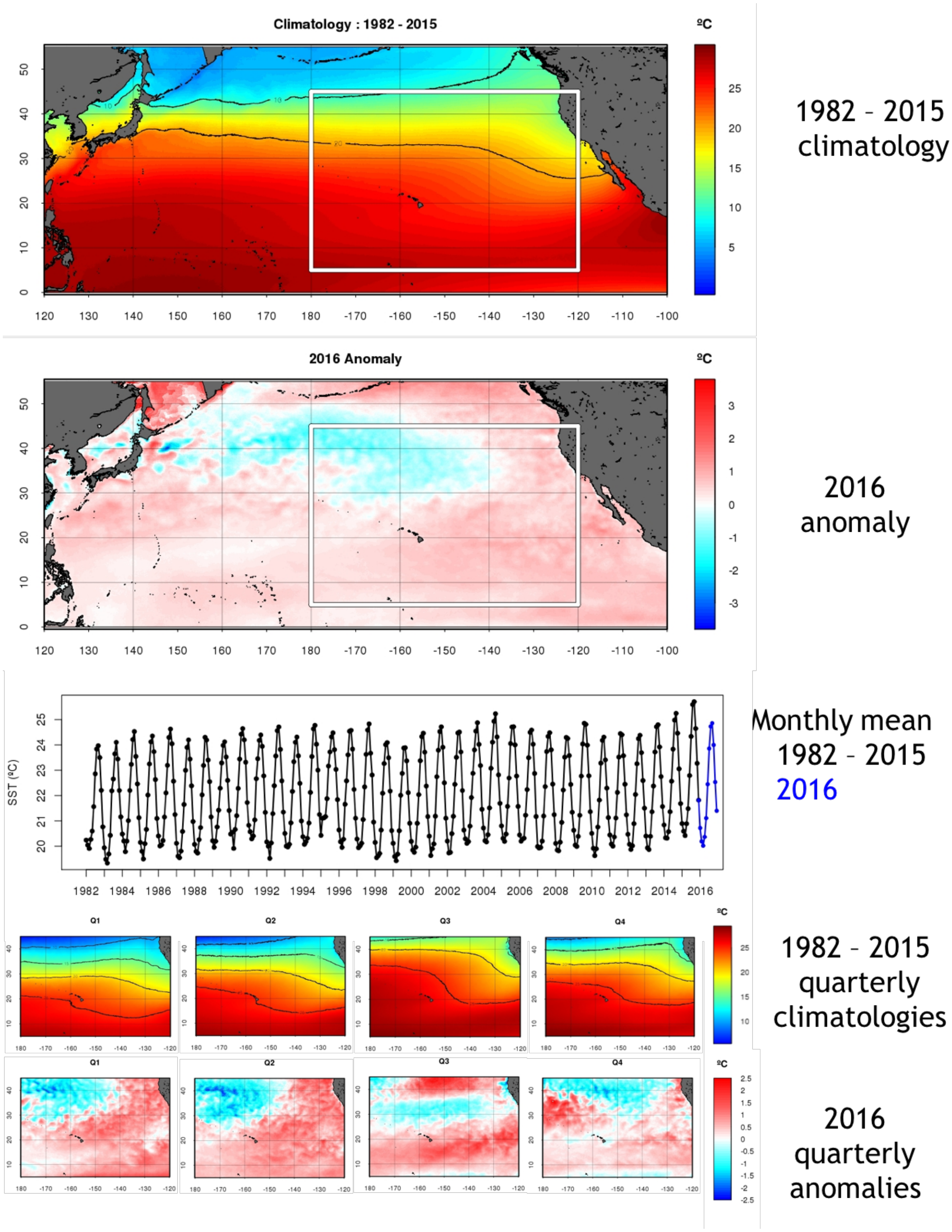
Data Source: NOAA OceanWatch SST data available at: http://oceanwatch.pifsc.noaa.gov/indicators-longline.html

Measurement Platform: Satellite

Rationale: Sea surface temperature is one of the most directly observable measures we have for tracking increasing ocean temperatures. SST varies in response to natural climate cycles such as the El Niño – Southern Oscillation (ENSO) and is projected to rise as a result of anthropogenic climate change. Both short-term variability and long-term trends in SST impact the marine ecosystem. Understanding the mechanisms through which organisms are impacted and the time scales of these impacts is an area of active research.

Status: Annual mean SST was 22.4 ºC in 2016, just under the time series maximum of 22.6 ºC observed in 2015. Over the period of record, annual SST has increased at a rate of 0.01 ºC yr^{-1}. Monthly SST values in 2016 ranged from 20.0 – 24.9 ºC, within the time series range of 19.3 – 25.7 ºC. In general, SSTs were above average to the south and east of the Hawaiian Islands and below average to the northwest of Hawai`i, though this spatial pattern did change somewhat over the latter half of the year.

Figure 143. Sea Surface Temperature



Note: Panels show, from the top: climatological SST (1982 - 2015), 2016 anomaly, monthly time series, quarterly climatologies, and quarterly anomalies. The white box indicates the area over which SST is averaged for the time series and quarterly plots.

References:

A description of the satellite remotely-sensed SST data used as well access to the data can be found at: http://oceanwatch.pifsc.noaa.gov/doc.html#sst.

3.3.3.7 TEMPERATURE AT 300M DEPTH

Description: Ocean temperature at 300m depth is averaged across the Hawai`i-based longline fishing grounds (5° – 45°N, 180° – 120°W). Global Ocean Data Assimilation System (GODAS) data are used. GODAS incorporates global ocean data from moorings, expendable bathythermographs (XBTs), and Argo floats.

Timeframe: Annual, monthly

Region/Location: Hawai`i longline region: 5° – 45°N, 180° – 120°W

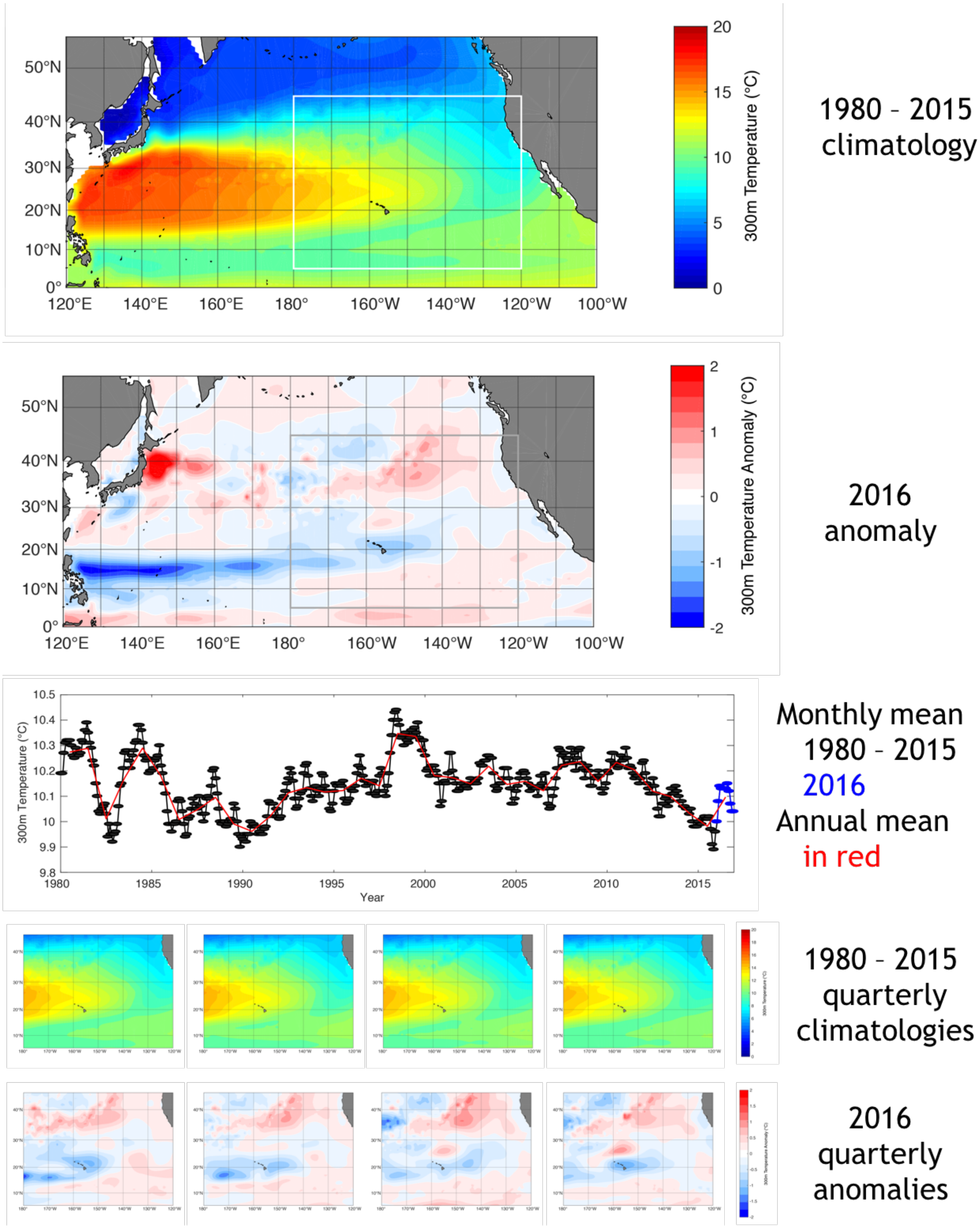
Data Source: NOAA Earth System Research Laboratory's Physical Sciences Division at https://www.esrl.noaa.gov/psd/data/gridded/data.godas.html

Measurement Platform: *In-situ* sensors, model

Rationale: The temperature at 300m reflects the temperature in the mid-range of depths targeted by the deep-set bigeye tuna fishery. Bigeye have preferred thermal habitat, generally staying within temperatures ranging from 8 – 14 °C while they are at depth (Howell et al. 2010). Changes in ocean temperature at depth will impact tuna, and in turn, potentially impact their catchability. Understanding the drivers of sub-surface temperature trends and their ecosystem impacts is an area of active research.

Status: In 2016, 300m temperatures ranged from 10.00 – 10.15 °C with an average value of 10.10 °C. These temperatures are within the range of temperatures experienced over the past several decades and are within the bounds of bigeye tuna's preferred deep daytime thermal habitat (8 – 14 °C). Throughout much of the year, 300m temperatures were below average around the main Hawaiian Islands and above average north and south of Hawai`i.

Figure 144. Ocean Temperature at 300m Depth



Note: Panels show, from the top: climatological 300m temperature (1980 - 2015), 2016 anomaly, monthly time series, quarterly climatologies, and quarterly anomalies. The white box indicates the area over which temperature is averaged for the time series and quarterly plots.

References:

A detailed description of GODAS can be found at:
http://www.cpc.ncep.noaa.gov/products/GODAS/pl/introduction_godas_web.pdf.

Howell EA, Hawn DR, Polovina JJ. 2010. Spatiotemporal variability in bigeye tuna (*Thunnus obesus*) dive behavior in the central North Pacific Ocean. *Progress in Oceanography*, 86: 81-93. doi: 10.1016/j.pocean.2010.04.013

3.3.3.8 OCEAN COLOR

Description: Satellite remotely-sensed ocean color is used to determine chlorophyll concentrations in the pelagic surface ocean. These data can be used as a proxy for phytoplankton abundance. A time series of median monthly chlorophyll-a concentrations averaged over the Hawai`i longline region is presented. Additionally, spatial climatologies and anomalies are shown. MODIS-Aqua data are used for this indicator.

Timeframe: Monthly, quarterly

Region/Location: Hawai`i longline region: 5° – 45°N, 180° – 120°W

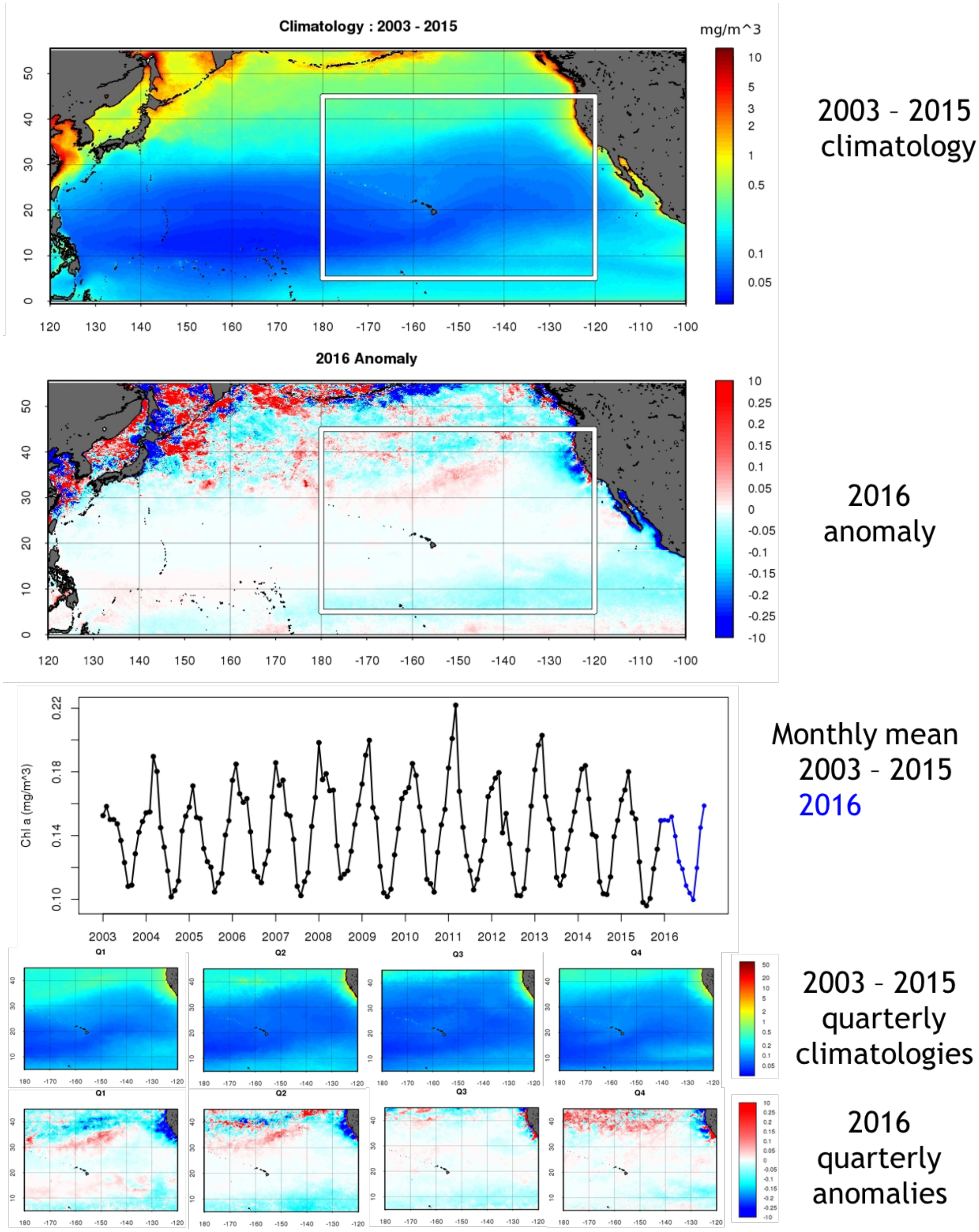
Data Source: NOAA OceanWatch ocean color data available at:
http://oceanwatch.pifsc.noaa.gov/indicators-longline.html

Measurement Platform: Satellite

Rationale: Phytoplankton are the foundational food source for the fishery. Changes in phytoplankton abundance have been linked to both natural climate variability and anthropogenic climate change. These changes have the potential to impact fish abundance, size, and catch.

Status: Annual mean chlorophyll concentration reached a time series minimum of 0.13 mg chl m^{-3} in 2016. Prior to 2016, the minimum annual mean concentration was 0.14 mg chl m^{-3}, observed in 2005. In 2016, monthly mean chlorophyll concentrations ranged from 0.10 – 0.16 mg chl m^{-3}, within the range of values observed over the period of record. Chlorophyll concentrations across the region were fairly close to the climatological average in 2016, with the exception of a region of above-average values to the north of Hawai`i.

Figure 145. Ocean Color



Note: Panels show, from the top: climatological ocean color (2003 - 2015), 2016 anomaly, monthly time series, quarterly climatologies, and quarterly anomalies. The white box indicates the area over which ocean color is averaged for the time series and quarterly plots.

References:

A description of the satellite remotely-sensed ocean color data used as well access to the data can be found at: http://oceanwatch.pifsc.noaa.gov/doc.html#chl.

3.3.3.9 OLIGOTROPHIC AREA

This indicator has been removed due to concerns that cloud cover may be obscuring the true value of oligotrophic area. Data will continue to be monitored and the indicator will be included in the future if possible.

3.3.3.10 NORTH PACIFIC SUBTROPICAL FRONT AND TRANSITION ZONE CHLOROPHYLL FRONT

Description: The subtropical front (STF) is marked by the 18 °C sea surface temperature (SST) isotherm and the transition zone chlorophyll front (TZCF) by the 0.2 mg chl-a m^{-3} isopleth (Bograd et al. 2004; Polovina et al. 2001). They roughly mark the northern boundary of the North Pacific subtropical gyre as well as the northern extent of the Hawai`i-based longline fishery. The STF is targeted by the swordfish fishery. Additionally, both the STF and the TZCF are used as migration and foraging corridors by both commercially-valuable and protected species. Both fronts migrate meridionally seasonally and their positions are impacted by the phase of the El Niño – Southern Oscillation (ENSO). Due to significant seasonal variation, the climatology and anomaly (2016) are presented for the first quarter of the year only. The STF is determined from NOAA Pathfinder-GAC and GOES-POES data (see SST indicator) and the TZCF is determined from MODIS-Aqua data (see ocean color indicator).

Timeframe: Annual, seasonal

Region: Hawai`i longline region: 5° – 45°N, 180° – 120°W

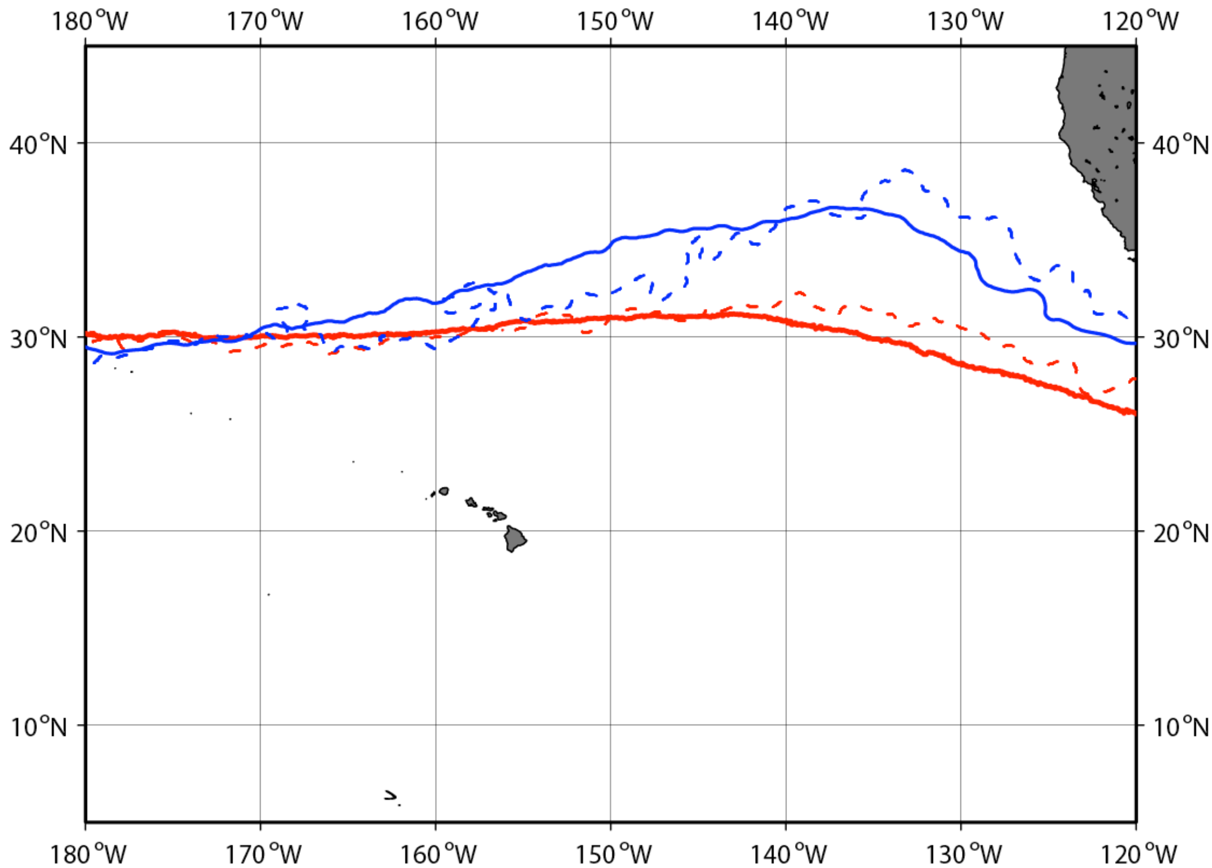
Data Source: NOAA OceanWatch sea surface temperature and ocean color data available at: http://oceanwatch.pifsc.noaa.gov/indicators-longline.html

Measurement Platform: Satellite

Rationale: Northward displacement of the frontal zone can increase the distance fishing vessels must travel to set their gear. This can, in turn, increase operational expenses. The positions of the fronts vary in response to natural climate variations. Long-term northward displacement of the frontal zone may also result from anthropogenic climate change.

Status: In 2016, the STF was located at an average latitude west of 140°W and slightly north of average between 140 – 120°W. The TZCF was farther south than average west of 140°W and north of average east of 140°W.

Figure 146. Subtropical Front and Transition Zone Chlorophyll Front



Note: The climatological (solid) and 2016 (dashed) positions of the subtropical front (red) and transition zone chlorophyll front (blue) are shown for the first quarter of the year (Jan - Mar). The climatological period for the STF is 1982 - 2015. The climatological period for the TZCF is 2003 – 2015.

References:

A description of the satellite remotely-sensed SST data as well access to the data can be found at: http://oceanwatch.pifsc.noaa.gov/doc.html#sst.

A description of the satellite remotely-sensed ocean color data as well access to the data can be found at: http://oceanwatch.pifsc.noaa.gov/doc.html#chl.

Bograd SJ, Foley DG, Schwing FB, Wilson C, Laurs RM, Polovina JJ, Howell EA, Brainard RE. 2004. On the seasonal and interannual migrations of the transition zone chlorophyll front. *Geophysical Research Letters*, 31: L17204. doi: 10.1029/2004GL020637

Polovina JJ, Howell E, Kobayashi DR, Seki ME. 2001. The transition zone chlorophyll front, a dynamic global feature defining migration and forage habitat for marine resources. *Progress in Oceanography*, 49: 469-483.

3.3.3.11 FISH COMMUNITY SIZE STRUCTURE

Description: The weight of individual fish moving through the Honolulu auction is available from 2000 through the present. Additionally, since February 2006 longline observers have measured the length of every third fish caught. Using these weights and lengths, community size structure is presented. A standardized pooled climatological distribution is presented with quarterly anomalies for 2016. Similar distributions for target species (bigeye tuna and swordfish) are also presented. Annual time series of pooled target species weights and lengths are presented as box plots. Bigeye weights and lengths are from deep sets (≥ 15 hooks per float) only. Swordfish weights and lengths are from shallow sets (< 15 hooks per float) only. The Honolulu auction reports weights for gilled and gutted fish. A conversion factor is used to calculate the whole fish weights used for this indicator (Langley et al. 2006).

Timeframe: Annual and quarterly

Region: Hawai`i-based longline fishing grounds

Data Source: Pacific Islands Region observers (fish lengths) and Hawai`i Division of Aquatic Resources (fish weights)

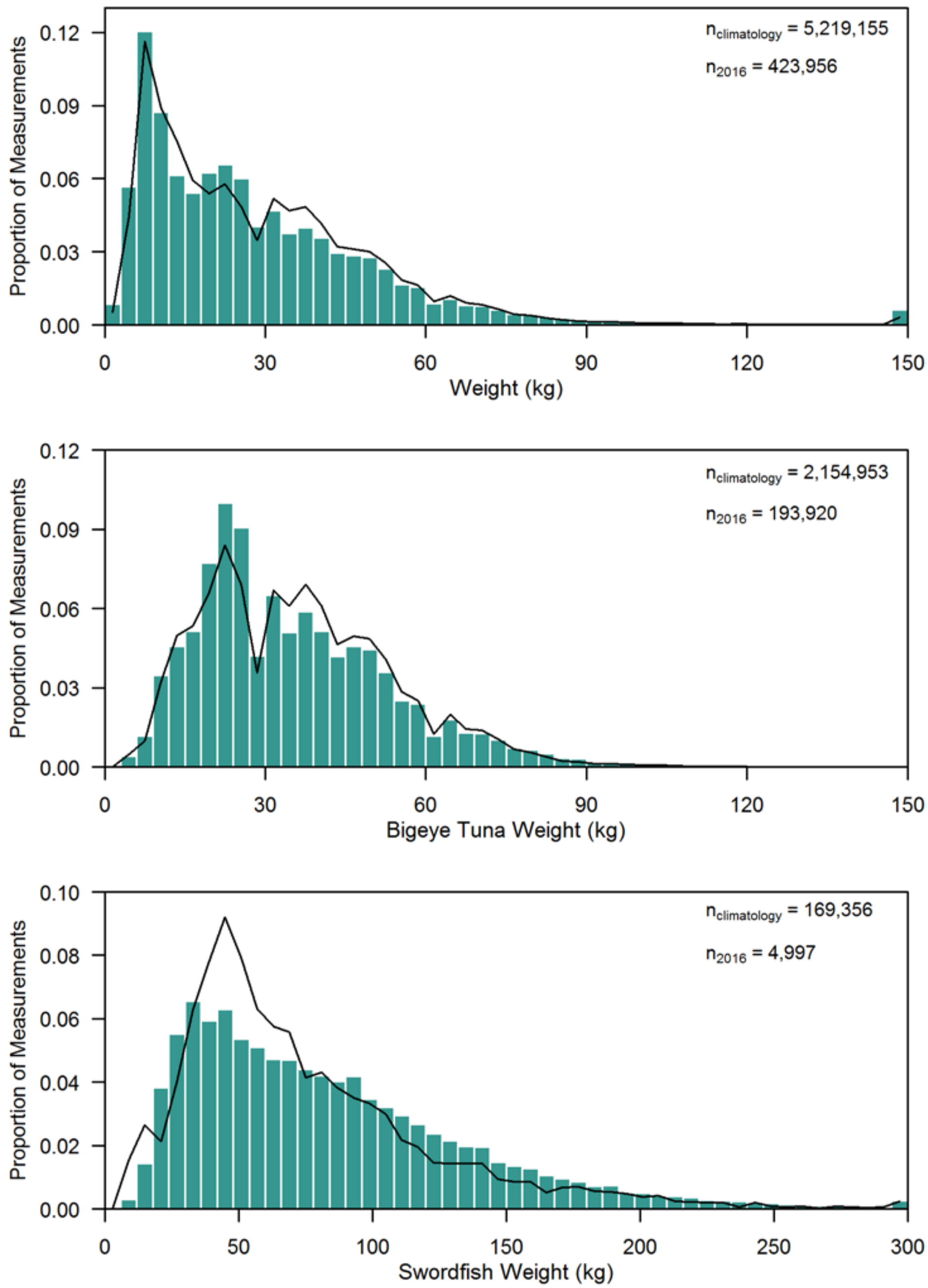
Measurement Platform: *In-situ* measurement

Rationale: Fish size can be impacted by a number of factors, including climate. Currently, the degree to which the fishery's target species are impacted by climate, and the scales at which these impacts may occur, is largely unknown. Ongoing collection of size structure data is necessary for detecting trends in community size structure and attributing causes of these trends. Understanding trends in fish size structure and how oceanographic conditions influence these trends is an area of active research.

Status: (*NOTE: additional 2016 data may become available*) There was no significant trend in median bigeye, swordfish, or full fishery fish weight (2000 – 2015 bigeye and full fishery, 2004 – 2015 swordfish). There was also no significant trend in bigeye, swordfish, or full fishery fish length (2007 – 2015). However, there were significant trends in the number of fish measured. There was an increase of roughly 687 bigeye yr^{-1} measured, a decrease of roughly 319 swordfish yr^{-1} measured, and an increase of roughly 2,100 fish yr^{-1} measured (2007 – 2015).

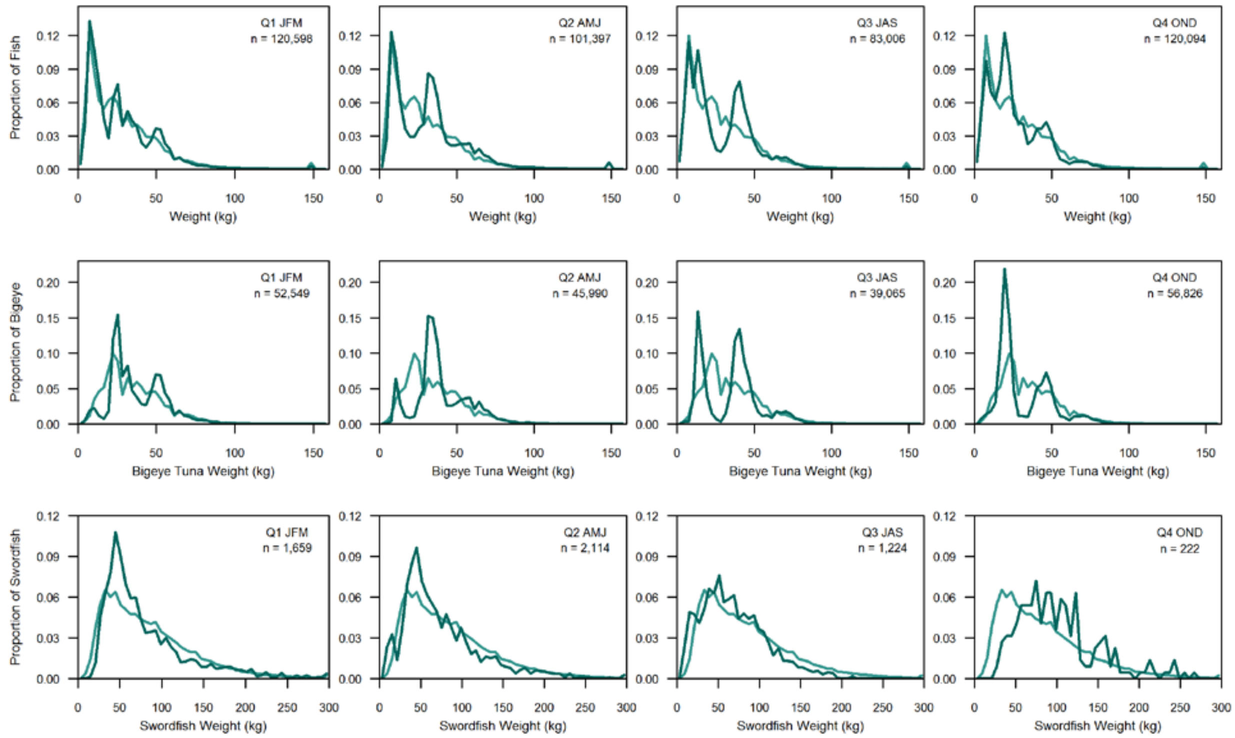
In 2016, the median bigeye weight was 34.5 kg and the median bigeye fork length was 112.0 cm. The median swordfish weight was 63.1 kg and the median swordfish eye-fork length was 144.1 cm. The median fish weight (all species caught) was 23.7 kg and the median length was 112.0 cm. These weights were within the bounds observed over the time series (2000 – 2016), as were the lengths (2006 – 2016).

Figure 147. Longline Fishery Fish Weights



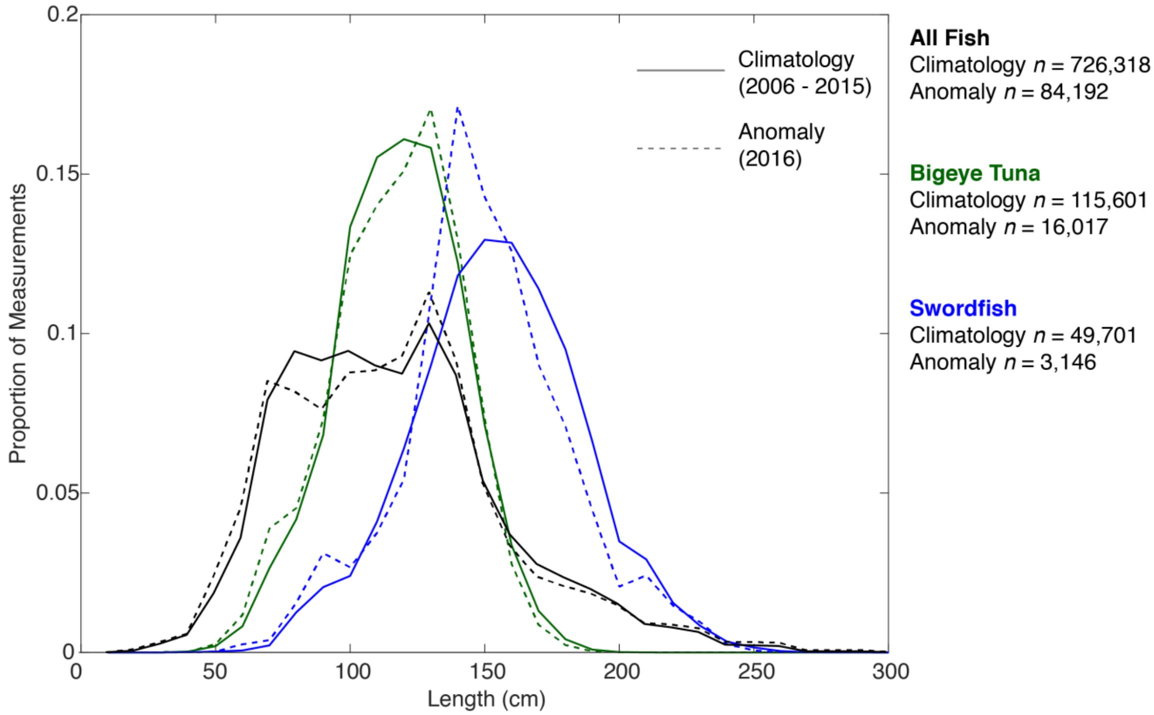
Note: The climatological (2000 - 2015) distribution of all fish weights (top), bigeye tuna weights (middle), and swordfish weights (bottom) are shown in bars, with the 2016 distribution plotted as a line. Bigeye weights are from sets using ≥ 15 hooks per float and swordfish weights are from sets using < 15 hooks per float.

Figure 148. Quarterly Longline Fishery Fish Weights



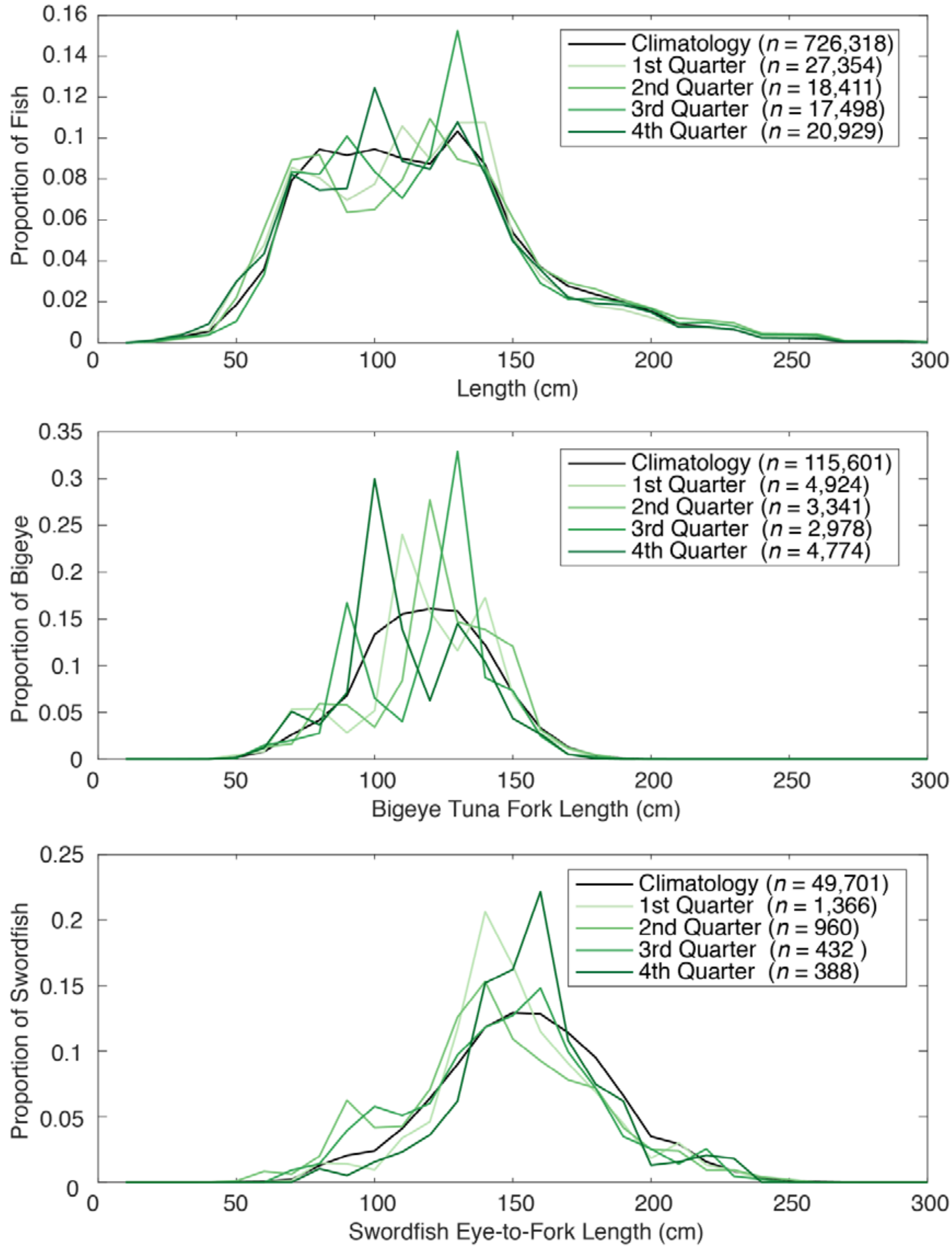
Note: Quarterly distributions of all fish weights (top row), bigeye tuna weights (middle row), and swordfish weights (bottom row) are shown (dark lines) in addition to the climatological distribution of weights (light lines). Bigeye weights are from sets using ≥ 15 hooks per float and swordfish weights are from sets using < 15 hooks per float.

Figure 149. Longline Fishery Fish Lengths



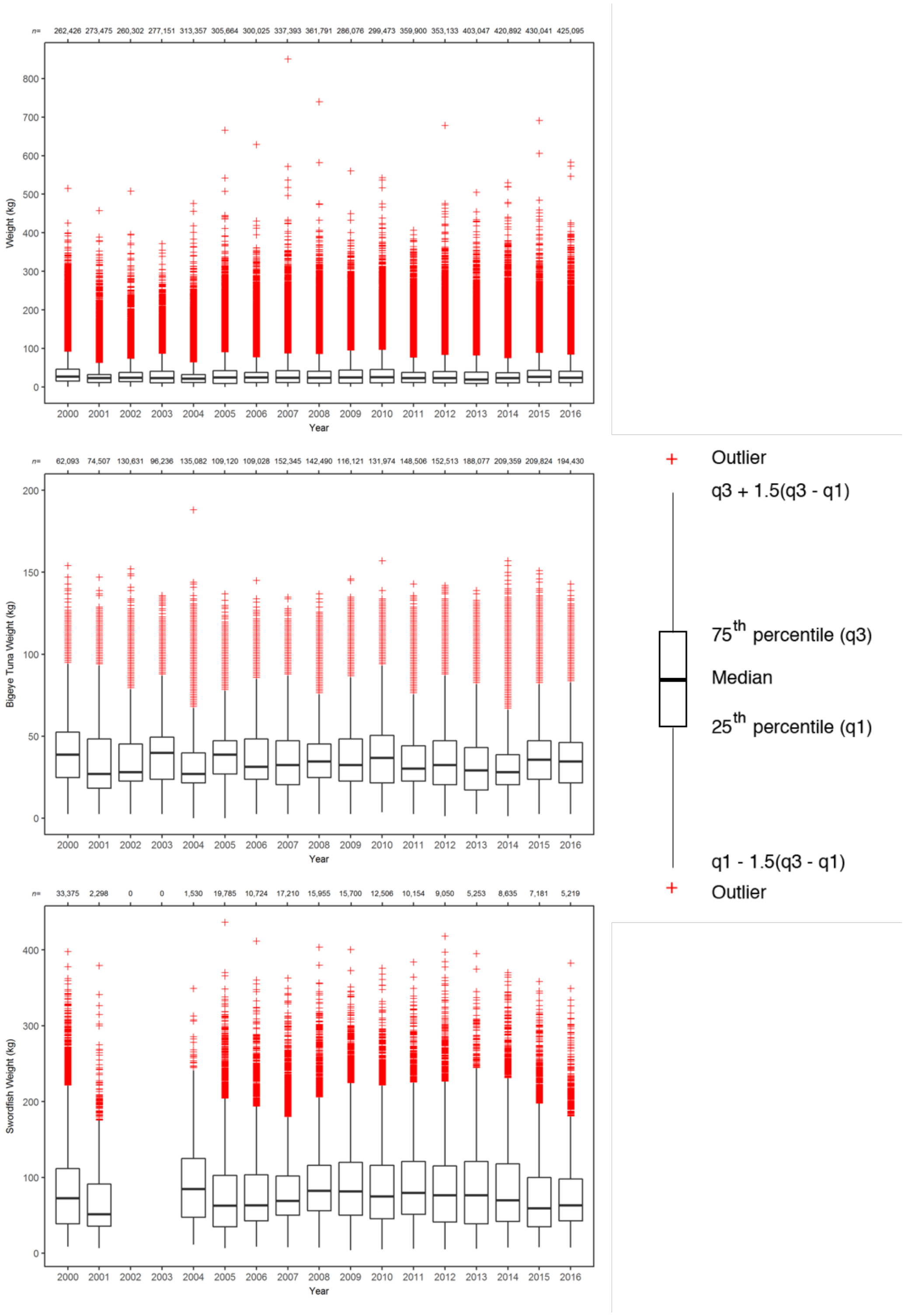
Note: The climatological (2006 - 2015) distribution of all fish lengths (black), bigeye tuna lengths (green), and swordfish lengths (blue) are shown (solid lines), along with the 2016 distributions (dashed lines). Bigeye lengths are from sets using ≥ 15 hooks per float and swordfish lengths are from sets using < 15 hooks per float.

Figure 150. Quarterly Longline Fishery Fish Lengths



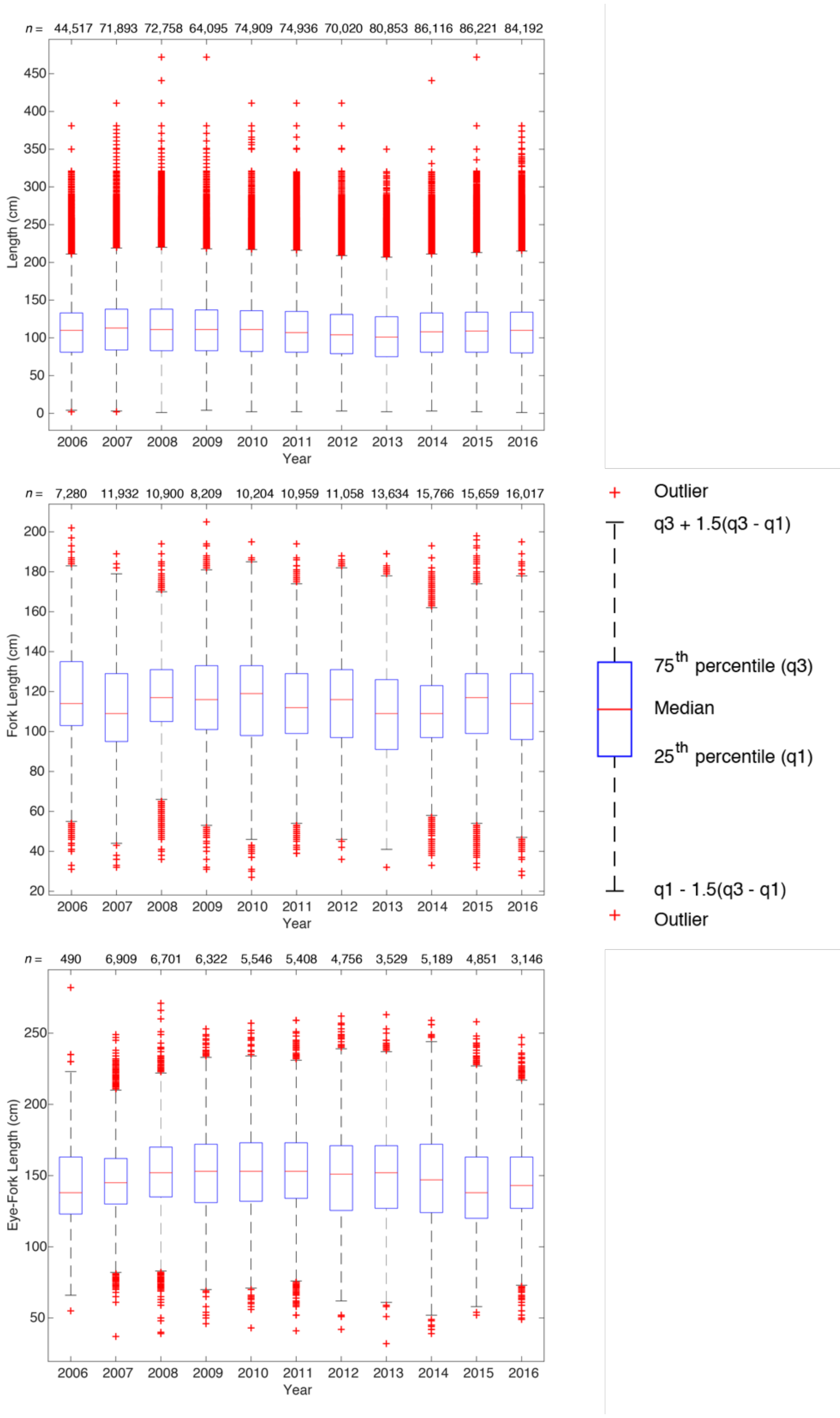
Note: Quarterly distributions of all fish lengths (top row), bigeye tuna lengths (middle row), and swordfish lengths (bottom row) are shown (green) in addition to the climatological distribution of lengths (black). Bigeye lengths are from sets using ≥ 15 hooks per float and swordfish lengths are from sets using < 15 hooks per float.

Figure 151. Distribution of Annual Longline Fishery Fish Weights



Note: Box plots show the annual distribution of all fish weights (top panel), bigeye tuna weights (middle panel), and swordfish weights (lower panel). Bigeye weights are from sets using ≥ 15 hooks per float and swordfish weights are from sets using < 15 hooks per float.

Figure 152. Distribution of Annual Longline Fishery Fish Lengths



Note: Box plots show the annual distribution of all fish lengths (top panel), bigeye tuna lengths (middle panel), and swordfish lengths (lower panel). Bigeye lengths are from sets using ≥ 15 hooks per float and swordfish lengths are from sets using < 15 hooks per float.

References:

Langley A, Okamoto H, Williams P, Miyabe N, Bigelow K (2006) A summary of the data available for the estimation of conversion factors (processed to whole fish weights) for yellowfin and bigeye tuna. ME IP-3, WCPFC-SC2, Manila, Philippines 7:18

3.3.3.12 BIGEYE WEIGHT-PER-UNIT-EFFORT

Description: Quarterly time series of bigeye weight-per-unit-effort (hooks set) is presented for the previous three years. Fish weights are those of individual bigeye tuna received at the Honolulu auction. The Honolulu auction reports weights for gilled and gutted fish. A conversion factor is used to calculate the whole fish weights used for this indicator (Langley et al. 2006).

Timeframe: Quarterly

Region: Hawai`i-based longline fishing grounds

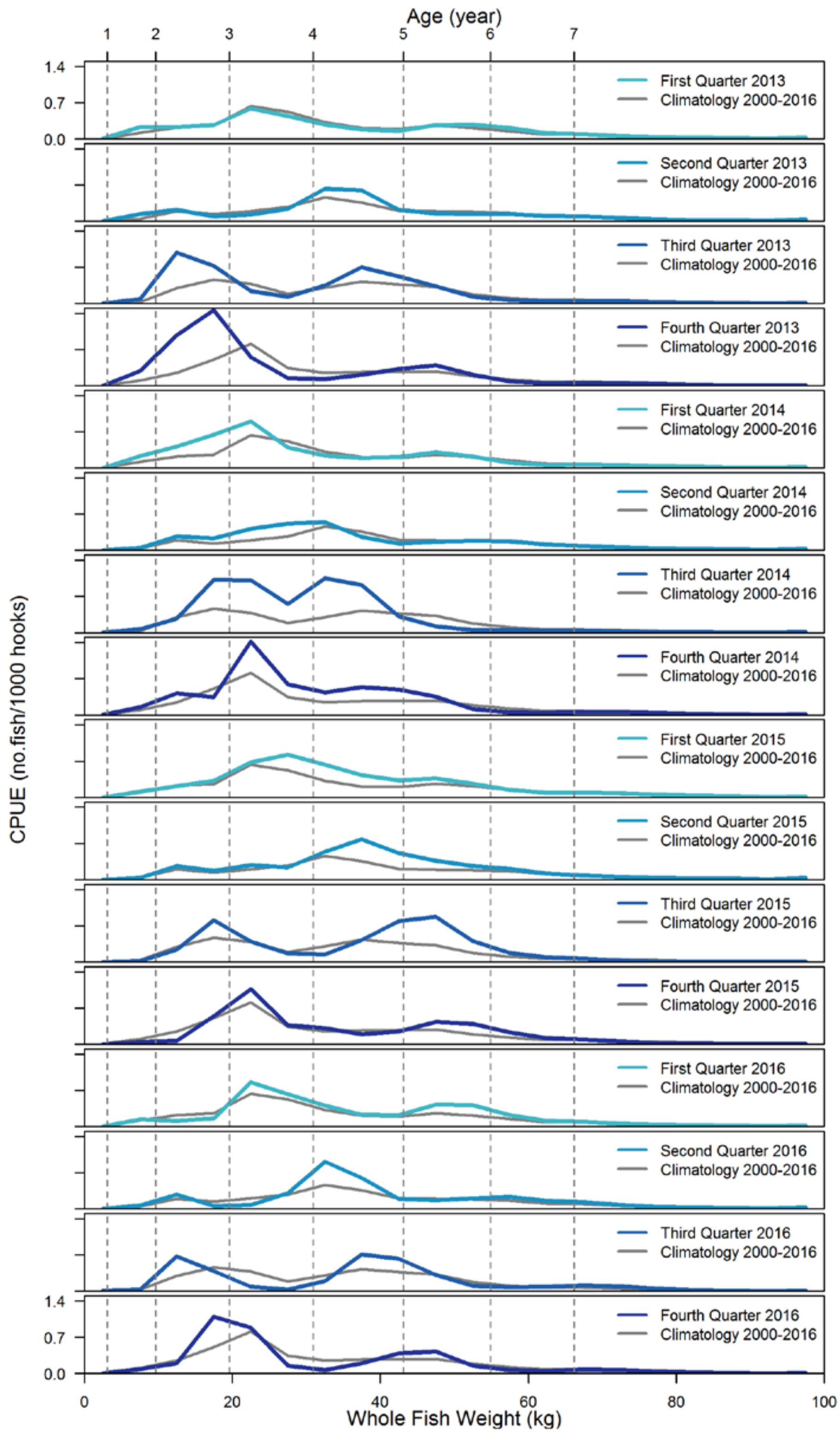
Data Source: Hawai`i Division of Aquatic Resources

Measurement Platform: *In-situ* measurement

Rationale: Tracking the progression of growing size classes through time can provide a strong indication of recruitment pulses. The timing of these pulses is not yet well understood, particularly in terms of how they relate to climate impacts such as interannual variability. Improving this understanding could lead to the ability to project future yields and is an area of active research.

Status: A peak in the CPUE of 2-year-old bigeye was observed in the second half of 2016. Based on previous years, this indicates the potential for a peak in the CPUE of 4- and 5-year-old bigeye in 2018 – 2019.

Figure 153. Bigeye Weight-Per-Unit-Effort



Note: Quarterly (shaded) and climatological (grey) distributions are shown. Dashed vertical lines show the weight ranges associated with bigeye ages. Bigeye weights are from sets using ≥15 hooks per float.

References:

Langley A, Okamoto H, Williams P, Miyabe N, Bigelow K (2006) A summary of the data available for the estimation of conversion factors (processed to whole fish weights) for yellowfin and bigeye tuna. ME IP-3, WCPFC-SC2, Manila, Philippines 7:18

3.3.3.13 BIGEYE RECRUITMENT INDEX

Description: Model-derived time series of small (≤ 15 kg) and total bigeye tuna catch-per-unit-effort (hooks set) and weight-per-unit-effort (hooks set) for all bigeye tuna is presented for the previous 16 years. Fish weights are those of individual bigeye tuna received at the Honolulu auction. The Honolulu auction reports weights for gilled and gutted fish. A conversion factor is used to calculate the whole fish weights used for this indicator (Langley et al. 2006). Because the Hawai`i-based longline fishery varies in time and space, a Generalized Additive Model (GAM) was built that accounts for seasonality, change in effort, and the geographic movement of the fishery. Catch rates of small bigeye tuna (≤ 15 kg) peak two years prior to peaks in catch rates (CPUE) and biomass (weight-per-unit-effort), indicating a recruitment pulse and allowing us to anticipate an increase in total catch rates of the fishery.

Timeframe: Annual

Region: Hawai`i-based longline fishing grounds

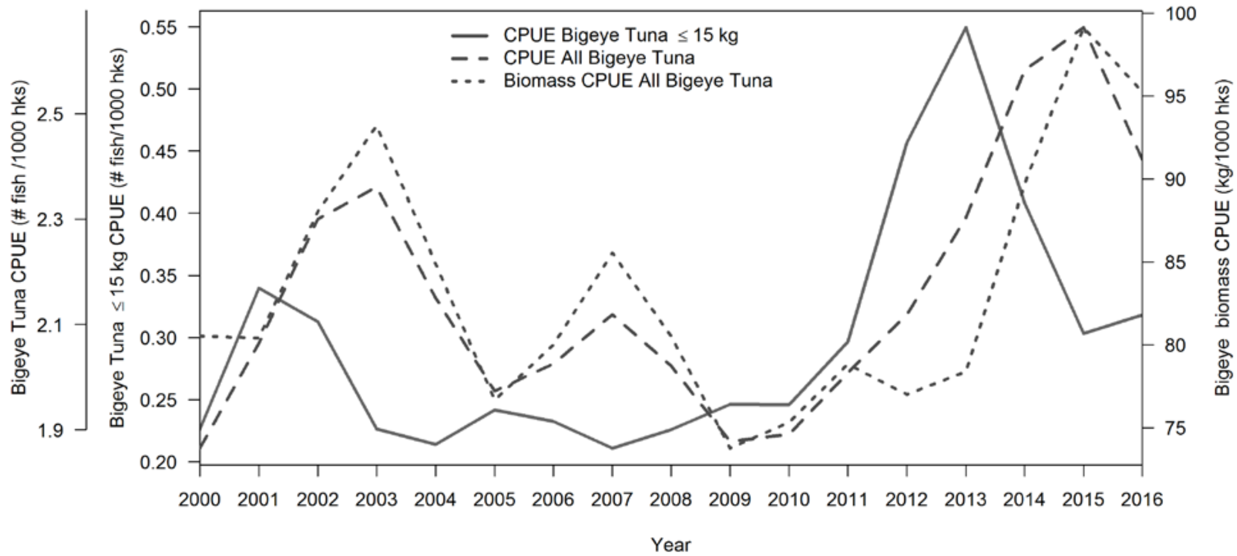
Data Source: Hawai`i Division of Aquatic Resources

Measurement Platform: Model-derived

Rationale: Tracking the progression of growing size classes through time can provide a strong indication of recruitment pulses. The timing of these pulses is not yet well understood, particularly in terms of how they relate to climate impacts such as interannual variability. Improving this understanding could lead to the ability to project future yields and is an area of active research.

Status: In 2016, the modeled CPUE of bigeye ≤ 15 kg was 0.32 fish per 1,000 hooks set. This is within the range modeled for the past 16 years (0.21 – 0.55 fish per 1,000 hooks set) and at this time does not appear indicative of a recruitment pulse such as was seen in 2001 or 2013.

Figure 154. Standardized Bigeye Catch- and Weight-Per-Unit-Effort



Note: Standardized time series of the CPUE of bigeye tuna ≤15 kg (solid line), CPUE of all bigeye tuna (dashed line), and the biomass CPUE of all tuna (dotted line).

References:

Langley A, Okamoto H, Williams P, Miyabe N, Bigelow K (2006) A summary of the data available for the estimation of conversion factors (processed to whole fish weights) for yellowfin and bigeye tuna. ME IP-3, WCPFC-SC2, Manila, Philippines 7:18

3.3.4 OBSERVATIONAL AND RESEARCH NEEDS

Through preparation of this and the previous Annual Pelagic Report, the Council has identified a number of observational and research needs that, if addressed, would improve the information content of future Ocean and Climate Indicators chapters. This information would provide fishery managers, the fishing industry, and community stakeholders with better understanding and predictive capacity that is vital to sustaining a resilient and vibrant fishery in the Western Pacific. These observational and research needs are:

- Emphasize the importance of continuing the climate and ocean indicators used in this report so that a consistent, long-term record can be maintained and interpreted;
- Develop agreements among stakeholders and research partners to ensure the sustainability, availability, and accessibility of climate and ocean indicators, associated datasets, and analytical methods used in this and future reports;
- Improve monitoring and understanding of the impacts of changes in ocean temperature, pH and ocean acidity, ocean oxygen content and hypoxia, and sea level rise through active collaboration by all fishery stakeholders and research partners;
- Develop, test, and provide access to additional climate and ocean indicators that can improve the Pelagic Conceptual Model;

- Investigate the connections between climate variables and other indicators in the Pelagic Conceptual Model to improve understanding of changes in physical, chemical, biological, and socio-economic processes and their interactions in the regional ecosystem;
- Develop predictive models that can be used for scenario planning to account for unexpected changes and uncertainties in the regional ecosystem and fisheries;
- Foster applied research in ecosystem modeling to better describe current conditions and to better anticipate the future under alternative projections of climate and ocean change including changes in expected human benefits and their variability;
- Improve understanding of the connections between the Pacific Decadal Oscillation (PDO) and fisheries ecosystems beyond the North Pacific;
- Improve understanding of mahi and swordfish size in relation to the location and orientation of the transition zone chlorophyll front (TZCF);
- Explore the connections between sea surface conditions, stratification, and mixing;
- Identify the biological implications of tropical cyclones;
- Research cultural knowledge and practices for adapting to past climate changes and investigate how they might contribute to future climate adaptation; and
- Explore additional and/or alternative climate and ocean indicators that may have important effects of pelagic fisheries systems including:
    - Ocean currents and anomalies;
    - Eddy kinetic energy (EKE);
    - Near-surface wind velocity and anomalies;
    - Wave forcing and anomalies;
    - Oceanic nutrient concentration;
    - Seasonal timing of tropical cyclones, both climatologically and for the current year;
    - South Pacific convergence zones targeted by swordfish;
    - Standardized fish community size structure data for gear types, including the troll fishery for yellowfin and blue marlin;
    - Estimates of phytoplankton abundance and size from satellite remotely-sensed sea surface temperature (SST) and ocean color measurements;
    - Additional spatial coverage for the international purse seine fishery and the American Samoa longline fishery;
    - Time series of species richness and diversity from catch data which could potentially provide insight into how the ecosystem is responding to physical climate influences; and
    - Socio-economic indicators of effects of a changing climate on fishing communities and businesses.

3.4 ESSENTIAL FISH HABITAT

3.4.1 INTRODUCTION

Per requirements of the MSA (50 CFR § 600.815), EFH information for all PMUS is found in the Pelagic FEP. The EFH Final Rule requires that the Council review and revise EFH provisions periodically and report on this review as part of the annual SAFE report, with a complete review conducted as recommended by the Secretary, but at least once every 5 years.

The habitat objective of the FEP is to refine EFH and minimize impacts to EFH, with the following sub-objectives:

a. Review EFH and Habitat Areas of Particular Concern (HAPC) designations every 5 years and update such designations based on the best available scientific information, when available.
b. Identify and prioritize research to: assess adverse impacts to EFH and HAPC from fishing (including aquaculture) and non-fishing activities, including, but not limited to, activities that introduce land-based pollution into the coastal environment.

The pelagic EFH information was not reviewed during preparation of 2016 SAFE report. Non-fishing impacts to pelagic EFH were reviewed as part of the Council's omnibus review of non-fishing effects on EFH. The Council's support of non-fishing activities research is monitored through the program plan and five-year research priorities, not the annual report.

3.4.2 RESPONSE TO PREVIOUS COUNCIL RECOMMENDATIONS

At its 168th meeting held in Honolulu, HI, the Council adopted the EFH Agreement and directed staff to incorporate it into the Regional Operating Agreement, as necessary. The habitat expert on the plan team is ideally the PIFSC staffer with 5 year EFH responsibilities outlined in the EFH Agreement. The Plan Team reviews EFH information as necessary and recommends update to the Council.

3.4.3 HABITAT USE BY MUS AND TRENDS IN HABITAT CONDITION

The geographic extent of essential fish habitat for pelagic management unit species is the shoreline to the edge of the exclusive economic zone. Egg/larval PMUS EFH is the water column to a depth of 200 m, while juvenile/adult PMUS EFH is designated to 1000 m. HAPC is designated to a depth of 1,000 m above seamounts and banks with summits shallower than 2000 m.

Because the habitat is the water column, the Climate Change Indicators (Section 4.3) provides data and trends relevant to pelagic EFH, including oceanic pH, the Oceanic Nino Index, Pacific Decadal Oscillation, tropical cyclones, North Pacific oligotrophic area, ocean color, and subtropical front/transition zone chlorophyll front indicators. Future SAFE reports may provide further interpretation of these indicators as they relate to EFH.

3.4.4 REPORT ON REVIEW OF EFH INFORMATION

The pelagics biological components of the EFH section in the pelagic FEP are scheduled for review beginning in July of 2018. The non-fishing impacts and cumulative impacts components were reviewed in 2016 through 2017, which can be found in Minton 2017. The Pelagic Plan Team recommends that Council staff explore a minimum depth for the definition of pelagic EFH that excludes depths seldom occupied by PMUS.

3.4.5 RESEARCH AND INFORMATION NEEDS

The Council identified scientific data needs to more effectively address the EFH provisions in the FEP. In subsequent SAFE reports, this section will include active research and data collection to address these needs as well as a list of revised and focused critical research needs for specific management concerns.

3.4.6 REFERENCES

Minton, Dwayne. March 29, 2017. Non-fishing effects that may adversely affect essential fish habitat in the Pacific Islands region. Prepared for NOAA NMFS PIRO. Contract AB-133F-15-CQ-0014.

Western Pacific Fishery Management Council. Amendment 8 to the Pelagic Fishery Management Plan. 64 FR 19067, April 19, 1999.

3.5 MARINE PLANNING

3.5.1 INTRODUCTION

Marine planning is a science-based tool being utilized regionally, nationally and globally to identify and address issues of multiple human uses, ecosystem health and cumulative impacts in the coastal and ocean environment. The Council's efforts to formalize incorporation of marine planning in its actions began in response to Executive Order 13547, Stewardship of the Ocean, Our Coasts, and the Great Lakes. Executive Order 13158, Marine Protected Areas (MPAs), proposes that agencies strengthen the management, protection, and conservation of existing MPAs, develop a national system of MPAs representing diverse ecosystems, and avoid causing harm to MPAs through federal activities. MPAs, or marine managed areas (MMAs) are one tool used in fisheries management and marine planning.

At its 165^{th} meeting in March 2016, in Honolulu, Hawai`i, the Council approved the following objective for the FEPs: Consider the Implications of Spatial Management Arrangements in Council Decision-making. The following sub-objectives apply:

a. Identify and prioritize research that examines the positive and negative consequences of areas that restrict or prohibit fishing to fisheries, fishery ecosystems, and fishermen, such as the Bottomfish Fishing Restricted Areas, military installations, NWHI restrictions, and Marine Life Conservation Districts.

b. Establish effective spatially-based fishing zones.

c. Consider modifying or removing spatial-based fishing restrictions that are no longer necessary or effective in meeting their management objectives.

d. As needed, periodically evaluate the management effectiveness of existing spatial-based fishing zones in Federal waters.

In order to monitor implementation of this objective, this annual report includes the Council's spatially-based fishing restrictions or marine managed areas (MMAs), the goals associated with those, and the most recent evaluation. Council research needs are identified and prioritized through the 5 Year Research Priorities and other processes, and are not tracked in this report.

In order to meet the EFH and National Environmental Policy Act (NEPA) mandates, this annual report tracks activities that occur in the ocean that are of interest to the Council and incidents or facilities that may contribute to cumulative impact. While the Council is not responsible for NEPA compliance, monitoring the environmental effects of ocean activities for the FEP's EFH cumulative impacts section is duplicative of the agency's NEPA requirement, and therefore, this report can provide material or suggest resources to meet both mandates.

3.5.2 RESPONSE TO PREVIOUS COUNCIL RECOMMENDATIONS

At its 147th meeting, the Council recommended a no-take area from 0-12 nautical miles around Rose Atoll with the Council to review the no-take regulations after three years. PIRO has received no requests for non-commercial permits to fish within the Rose Atoll MNM. Further, inquiries in American Samoa showed that there was no indication that the 12 nm closure around Rose is limiting fishing. Thus there is no interest to fish within the monument boundaries. The PPT will defer decision on Rose Atoll until after the Administration reviews and makes any decision on the monument provisions.

At its 162nd meeting, the Council recommended a regulatory amendment for the temporary exemption to the Large Vessel Protected Area (LVPA) by American Samoa longline limited entry permitted vessels greater than 50ft in length. The Council will review the LVPA exemption on an annual basis with regards, but not limited to, catch rates of fishery participants; small vessel participation; and fisheries development initiatives. The Council will hear a report on options for the LVPA at its 170th meeting.

3.5.3 MARINE MANAGED AREAS

Council-established MMAs are shown in Figure 155, and are compiled in Table 86.

Figure 155. Regulated Fishing Areas of the Western Pacific Region

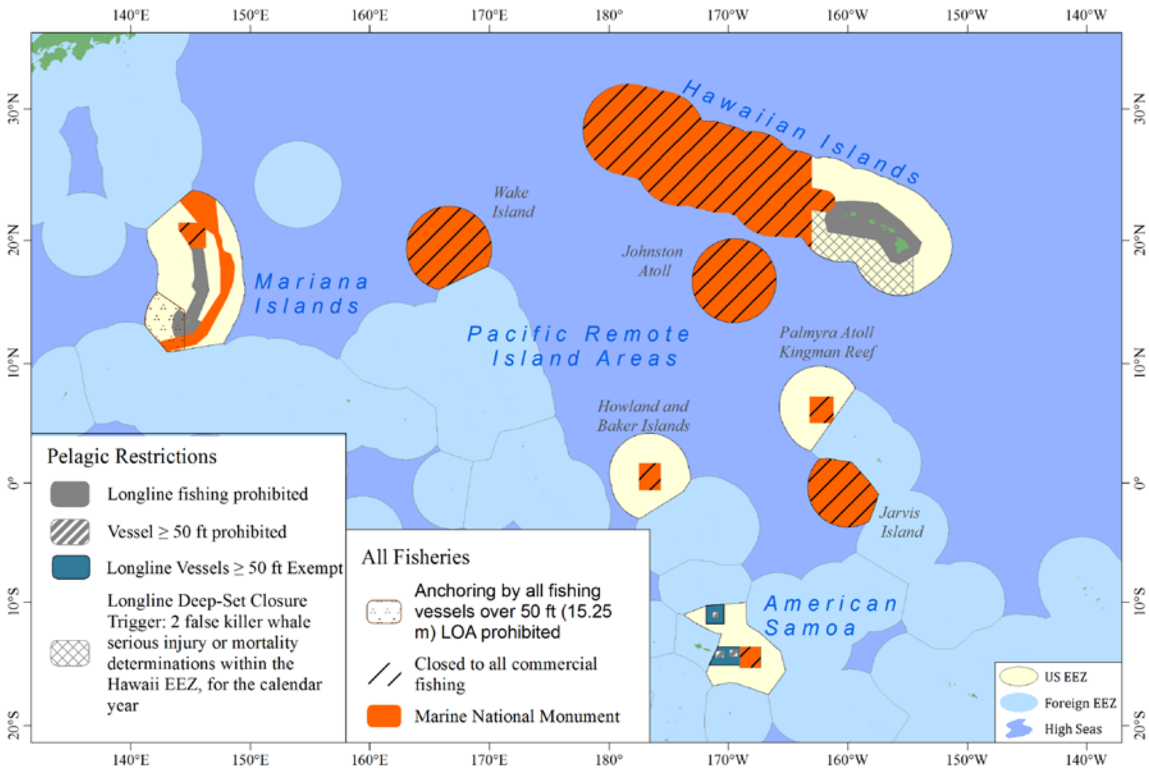


Table 86. MMAs established under FEPs from 50 CFR § 665.

Name	FEP	Island	50 CFR /FR /Amendment Reference	Marine Area (km^2)	Fishing Restriction	Goals	Most Recent Evaluation	Review Deadline
Pelagic Restrictions								
NWHI Longline Protected Species Zone	Pelagic (Hawai`i)	NWHI	665.806(a)(1) 56 FR 52214 Pelagic FEP Am. 3	351,514.00	Longline fishing prohibited	Prevent longline interaction with monk seals	1991	-
MHI Longline Prohibited Area	Pelagic (Hawai`i)	MHI	665.806(a)(2) 57 FR 7661 Pelagic FEP Am. 5	248,682.38	Longline fishing prohibited	Prevent gear conflicts between longline vessels and troll/handline vessels	1992	-
Guam Longline Prohibited Area	Pelagic	Guam	665.806(a)(3) 57 FR 7661 Pelagic FEP Am. 5	50,192.88	Longline fishing prohibited	Prevent gear conflicts between longline vessels and troll/handline vessels	1992	-
CNMI Longline Prohibited Area	Pelagic		665.806(a)(4) 76 FR 37287	88,112.68	Longline fishing prohibited	Reduce potential for nearshore localized fish depletion from longline fishing, and to limit catch competition and gear conflicts between the CNMI-based longline and trolling fleets	2011	-
Large Vessel Prohibited Area	Pelagic (American Samoa)	Tutuila, Manu'a, and Rose Atoll	665.806 (b)(1) 81 FR 5619	74,857.32	Vessels ≥ 50 ft prohibited	Prevent gear conflict with smaller alia vessels; longline vessels >50 ft exempted from 12 to 50 nm to improve the viability of the American Samoa longline fishery and achieve optimum yield from the fishery while preventing overfishing	Jan 29, 2016	Jan 29, 2017 (March meeting)

Name	FEP	Island	50 CFR /FR /Amendment Reference	Marine Area (km²)	Fishing Restriction	Goals	Most Recent Evaluation	Review Deadline
Large Vessel Prohibited Area	Pelagic (American Samoa)	Swains Island	665.806 (b)(2) 81 FR 5619 Pelagic FEP	28,352.17	Vessels ≥ 50 ft prohibited	Prevent gear conflict with smaller alia vessels; longline vessels over 50 ft exempted between 12 and 50 nm due to improve the viability of the American Samoa longline fishery and achieve optimum yield from the fishery while preventing overfishing	Jan 29, 2016	Jan 29, 2017 (March meeting)
Other Restrictions								
Howland Island No-Take Marine Protected Area (MPA)/PRI Marine National Monument	PRIA/ Pelagic	Howland Island	665.599 and 665.799(a)(1) 69 FR 8336 Coral Reef Ecosystem FEP 78 FR 32996 PRIA FEP Am. 2	-	All Take Prohibited	Minimize adverse human impacts on coral reef resources; commercial fishing prohibited within 12 nautical miles (nmi)	2013	-
Jarvis Island No-Take MPA/PRI Marine National Monument	PRIA/ Pelagic	Jarvis Island	665.599 and 665.799(a)(1) 69 FR 8336 Coral Reef Ecosystem FEP 78 FR 32996 PRIA FEP Am. 2	-	All Take Prohibited	Minimize adverse human impacts on coral reef resources; commercial fishing prohibited within 12 nmi	2013	-
Baker Island No-Take MPA/PRI Marine National Monument	PRIA/ Pelagic	Baker Island	665.599 and 665.799(a)(1) 69 FR 8336 Coral Reef Ecosystem FEP 78 FR 32996 PRIA FEP Am. 2	-	All Take Prohibited	Minimize adverse human impacts on coral reef resources; commercial fishing prohibited within 12 nmi	2013	-

Name	FEP	Island	50 CFR /FR /Amendment Reference	Marine Area (km²)	Fishing Restriction	Goals	Most Recent Evaluation	Review Deadline
Rose Atoll No-Take MPA/Rose Atoll Marine National Monument	American Samoa Archipelago/ Pelagic	Rose Atoll	665.99 and 665.799(a)(2) 69 FR 8336 Coral Reef Ecosystem FEP 78 FR 32996 American Samoa FEP Am. 3	-	All Take Prohibited	Minimize adverse human impacts on coral reef resources; commercial fishing prohibited within 12 nmi	June 3, 2013	June 3, 2016 (Council to review no-take regulations after 3 years)
Kingman Reef No-Take MPA/PRI Marine National Monument	PRIA/Pelagic	Kingman Reef	665.599 and 665.799(a)(1) 69 FR 8336 Coral Reef Ecosystem FEP 78 FR 32996 PRIA FEP Am. 2	-	All Take Prohibited	Minimize adverse human impacts on coral reef resources; all fishing prohibited within 12 nmi	2013	-
Guam No Anchor Zone	Mariana Archipelago	Guam	665.399 69 FR 8336 Coral Reef Ecosystem FEP	138,992.51	Anchoring by all fishing vessels ≥ 50 ft prohibited on the offshore southern banks located in the U.S. EEZ off Guam	Minimize adverse human impacts on coral reef resources	2004	-
Johnston Atoll Low-Use MPA/PRI Marine National Monument	PRIA/ Pelagic	Johnston Atoll	69 FR 8336 Coral Reef Ecosystem FEP 78 FR 32996 PRIA FEP Am. 2	-	Special Permit Only	Minimize adverse human impacts on coral reef resources; superseded by prohibiting fishing within 12 nmi in Am. 2	2013	-

Name	FEP	Island	50 CFR /FR /Amendment Reference	Marine Area (km^2)	Fishing Restriction	Goals	Most Recent Evaluation	Review Deadline
Palmyra Atoll Low-Use MPAs/PRI Marine National Monument	PRIA/ Pelagic	Palmyra Atoll	69 FR 8336 Coral Reef Ecosystem FEP 78 FR 32996 PRIA FEP Am. 2	-	Special Permit Only	Minimize adverse human impacts on coral reef resources; superseded by prohibiting fishing within 12 nmi in Am. 2	2013	-
Wake Island Low-Use MPA/PRI Marine National Monument	PRIA/Pelagic	Wake Island	69 FR 8336 Coral Reef Ecosystem FEP 78 FR 32996 PRIA FEP Am. 2	-	Special Permit Only	Minimize adverse human impacts on coral reef resources; superseded by prohibiting fishing within 12 nmi in Am. 2	2013	-

3.5.4 ACTIVITIES AND FACILITIES OCCURRING IN THE PIR

In the Western Pacific Region, wild fisheries compete with other activities for access to and use of fishing grounds. These activities include, but are not limited to, military bases and training activities, commercial shipping, recreational activities and off-shore energy projects. Between the Bureau of Ocean Energy Management (BOEM), the U.S. Army Corps of Engineers (USACE), and NMFS, most permits for offshore energy and aquaculture development, dredging or mooring projects that occur in the waters of the U.S., are captured. Department of Defense activities are assessed in environmental impact statements (EISs) on a five-year cycle and are available through the Federal Register. Due to the sheer volume of ocean activities and the annual frequency of this report, only major activities on multi-year planning cycles or those permitted by NMFS Sustainable Fisheries Division are tracked in this report.

3.5.4.1 AQUACULTURE FACILITIES

There are no offshore aquaculture projects in federal waters, proposed or existing, in American Samoa, Guam, CNMI, or the PRIA. Hawai`i has one permitted offshore aquaculture facility. The information in Table 87 was transferred from the Joint NMFS and USACE EFH Assessment for the Proposed Issuance of a Permit to Authorize the Use of a Net Pen and Feed Barge Moored in Federal Waters West of the Island of Hawai`i to Fish for a Coral Reef Ecosystem Management Unit Species, *Seriola rivoliana* (RIN 0648-XD961), unless otherwise noted.

Table 87. Aquaculture facilities.

Name	Size	Location	Species	Status
Kampachi Farms	Shape: Cylindrical Height: 33 ft Diameter: 39 ft Volume: 36,600 ft^3	5.5 nautical miles (nm) west of Keauhou Bay and 7 nm south-southwest of Kailua Bay, off the west coast of Hawai`i Island 19 deg 33 min N 156 deg 04 min W. mooring scope is 10,400 foot radius.	*Seriola rivoliana*	Permit authorizes culture and harvest of 30,000 kampachi over 2 years Array broke loose from mooring on Dec. 12, 2016; net pen sank in 12,000 feet of water. NMFS working with operators to understand cause of mooring line failure and plans for future activities under permit (pers. comm. David Nichols, March 1, 2017).

3.5.4.2 ALTERNATIVE ENERGY FACILITIES

There are no alternative energy facilities in state or Federal waters, proposed or existing, in American Samoa, Guam, CNMI, or the PRIA.

Hawai`i has four proposed wind energy facilities in federal waters and several existing alternative energy facilities. The information in Table 88. Alternative Energy Facilities and Development. is from various sources.

Table 88. Alternative Energy Facilities and Development.

Name	Type	Location	Impact to Fisheries	Stage of Development	Source
AWH O'ahu Northwest Project	408 MW Wind	12 miles W of Ka'ena Pt, O'ahu	Hazard to navigation; benthic impacts from cables	BOEM Area Identification and EA	BOEM Hawai`i
AWH O'ahu South Project	408 MW Wind	17 miles S of Waikiki, O'ahu	Hazard to navigation; benthic impacts from cables; close to Penguin Bank	BOEM Area Identification and EA	BOEM Hawai`i
Progression South Coast of Oahu Project	400 MW Wind	SSE of Barber's Pt and SW of Waikiki, O'ahu	Hazard to navigation; in popular trolling area; benthic impacts from cables	BOEM Area Identification and EA	Progression Energy BOEM Lease Application, BOEM Hawai`i
Statoil Wind US, LLC	-	-	-	BOEM Area Identification and EA	BOEM Hawaii
Natural Energy Laboratory of Hawai`i	120 kW OTEC Test Site/ 1 MW Test Site	West Hawai`i	Intake	120 kW operational; DEA for 1 MW Test Site using existing infrastructure submitted July 2012 HEPA Exemption List memo Dec. 27, 2016	http://nelha.Hawai`i.gov/energy-portfolio/ Final Environmental Assessment, NELHA, July 2012
Honolulu Sea Water Air Conditioning	SWAC	4 miles S of Kaka'ako, O'ahu	Benthic impacts; intake	USACE Record of Decision (ROD) signed; completion and commissioning in 2017.	http://honoluluswac.com/pressroom.html https://www.trenchlessinternational.com/2016/05/11/mapping-utilities-downtown-honolulu/
Marine	Shallow- and	1, 2 and	Hazard to	Shallow and	Final Environmental Assessment, NAVFACPAC, January

Corps Base Hawai`i Wave Energy Test Site	Deep-Water Wave Energy	2.5 km N of Mokapu, O'ahu	navigation	Deep-water wave energy units are operational	2014 http://www.eenews.net/stories/1060046254
Hawai`i Interisland Energy Transmission Cable	Transmission	Maui to O'ahu	Benthic impacts	Interisland transmission is not in near-term electric company action plans	Hawaiian Electric Companies Power Supply Improvement Plan Update Report

3.5.4.3 MILITARY TRAINING AND TESTING ACTIVITIES AND IMPACTS

The Department of Defense major activities in the region are summarized in Table 89.

Table 89. Department of Defense (DOD) major planning activities

Action	Description	Phase	Impacts
Guam and CNMI Military Relocation SEIS	Relocate Marines to Guam and build a cantonment/family housing unit on Finegayan/AAFB, a live-fire individual training range complex at the Ritidian Unit of the Guam National Wildlife Refuge	ROD published August 29, 2015 Suit filed for segmentation and range of reasonable alternatives under NEPA, requesting that DON vacate the ROD. DOJ asked US District Court for the NMI to dismiss the plaintiff's complaint with prejudice to prevent refiling (http://www.saipantribune.com/index.php/doj-federal-court-lacks-jurisdiction/).	Surface danger zone established at Ritidian – access restricted during training. Access will be negotiated between the Navy and USFWS. Northern District Wastewater Treatment Plant is non-compliant with NPDES permit; until plant is upgraded, increased wastewater discharge associated with buildup will significantly impact nearshore water quality. DOD to fund plant upgrades – see Economic Adjustment Committee Implementation Plan.
Mariana Islands Training and Testing	Continue Navy testing and training activities; include use of active sonar and explosives within the Mariana Islands Range Complex; pier-side sonar maintenance and testing in Apra Harbor	ROD Published August 4, 2015	Surface danger zones established – access restricted during training and testing Explosives and anchoring may damage shallow reef systems or hard bottom habitat.
Hawai`i-Southern California Training and Testing	Increase naval testing and training activities	DEIS Expected Summer 2017.	Likely access and habitat impacts similar to MITT
CNMI Joint Military Training	Establish unit and combined level training ranges on Tinian and Pagan	Supplemental Draft EIS expected in March 2017. Suit filed for segmentation and range of reasonable alternatives under NEPA. DOJ asked US District Court for the NMI to dismiss the plaintiff's complaint with prejudice to prevent refiling.	Significant access and habitat impacts
Divert Activities and Exercises, Air Force, Marianas	Improve airports in CNMI for expanding mission requirements in Western Pacific	ROD published December 8, 2016.	Adverse impacts to EFH minimal; access near Port of Tinian fuel transfer facility affected
Garapan Anchorage *June 2015 CNMI Advisory Panel Meeting Report*	Military Pre-Positioned Ships anchor and transit	Expired Memorandum of Understanding with the CNMI government. After transfer of submerged lands to CNMI, CNMI may be able to charge anchorage fees to the DOD. As of June 2015, MOU had not been signed.	Access, invasive species, unmitigated damage to reefs

3.5.5 PACIFIC ISLANDS REGIONAL PLANNING BODY (RPB) REPORT

The Council is a member of the Pacific Islands RPB and as such, the interests of the Council will be incorporated into the CMS plan. It is through the Council member that the Council may submit recommendations to the Pacific Islands RPB.

The Pacific Islands RPB met in Honolulu from February 15-16, 2017. The RPB's American Samoa Ocean Planning Team has developed its goals and objectives, on which the RPB provided comments and endorsement. The RPB, by consensus, decided to:

- revise its charter with select Maritime Administration comments, a glossary or terms of reference, and handle standard operating procedure concerns through internal documentation rather than amendments to the Charter;
- kick off a Marianas Ocean Planning Team later in 2017; and
- defer the decision on beginning planning in the PRIA until an update is received on the Pacific Remote Islands Marine National Monument Management Plan at the next RPB teleconference.

The American Samoa Ocean Planning Team will continue its work concurrently with a stakeholder engagement assessment. The data working group will continue its work per the work plan developed in 2016.

3.5.6 REFERENCES

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4 DATA INTEGRATION

This chapter intends to advance ecosystem-based fishery management of Western Pacific pelagic fisheries by examining the fisheries in the context of marine ecosystems. The Council convened a 2-day workshop on November 30-December 1, 2016, to identify content for this chapter. The pelagic fisheries group suggested this chapter focus on three topical issues: 1) bycatch (with a focus on protected species factors that may influence interaction rates; 2) a socioeconomics section examining fishery performance in two areas: attrition in American Samoa longline fleet and the decline of shallow-se longline swordfish fishery; and 3) the projected decrease in oceanic productivity with implications for management issues, including a discussion of factors influencing significant changes in the CPUE of target species.

Initially, this chapter will include abstracts of recent publications and a qualitative discussion of these research results with respect to data streams included in Chapters 2 and 3. In later years the subject of the publications may be updated through the SAFE report process as more data become available and an update may have significance for management.

4.1 FACTORS INFLUENCING SEABIRD INTERACTION RATES IN THE HAWAII LONGLINE FISHERY

Seabird mitigation measures implemented in the Hawaii longline fishery in the early 2000s significantly reduced Laysan and black-footed albatross interaction rates (Gilman et al. 2008). The fishery has since seen a gradual increasing trend in albatross interaction rates, especially for black-footed albatrosses (see Sections 3.2.1.5 and 3.2.2.5). Recent analysis conducted by Gilman and colleagues (2016) using data from October 2004 to May 2014 indicated that seabird interaction rates in the deep-set longline fishery significantly increased as annual mean multivariate ENSO index (MEI) values increased, suggesting that decreasing ocean productivity may have contributed to the increasing trend in seabird catch rates. The analysis also showed a significant increasing trend in the number of albatrosses following vessels, which may also be contributing to the increasing seabird catch rates. An earlier analysis of seabird interactions in the shallow-set longline fishery also indicated that catch rates significantly increased with increased albatross density (Gilman et al. 2014). The deep-set longline fishery analysis showed that both side setting and blue-dyed bait significantly reduced the seabird catch rate compared to stern setting and untreated bait, respectively (Gilman et al. 2016). Of two options for meeting regulatory requirements, side setting had a marginally significantly lower seabird catch rate than blue-dyed bait (Gilman et al. 2016).

In 2015-2016, black-footed albatross interaction rates in the deep-set and shallow-set longline fishery exhibited continued increasing trends, with substantially higher number of interactions and interaction rates in the deep-set fishery, although the estimated total interactions and interaction rates are still substantially lower than pre-seabird measure years. Laysan albatross interaction rates were similar or lower in 2015-2016 compared to previous years in both the deep-set and shallow-set longline fishery. The higher number of overall seabird interactions in 2015-2016 coincided with the strong El Niño (see Section 3.3.3.3) and the high MEI values, suggesting that the recent interaction trend is consistent with the findings of Gilman and colleagues (2016).

At the 166th Meeting in June 2016, the Council directed the Plan Team and the Protected Species Advisory Committee to continue monitoring interactions through the SAFE report to detect any future changes in albatross interactions that may be attributed to fishing operations. The Council noted that current seabird measures implemented in the Hawaii longline fishery are effective and recent increase in seabird captures are driven by non-fishery factors at this time. The Council additionally recommended research to be conducted, as appropriate, on at-sea foraging behavior of albatross species to improve understanding of interaction rates in the Hawaii longline fisheries.

The Council and NMFS Pacific Island Regional Office will be undertaking efforts in 2017 to improve the understanding of the factors underlying the higher seabird interaction rates in 2015-2016 through data analyses and an expert workshop. Results of these efforts will be considered in future editions of this SAFE report and are expected to inform this data integration chapter.

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4.2 ATTRITION IN LONGLINE FLEETS

4.2.1 AMERICAN SAMOA LONGLINE

A downward trend of economic returns to the American Samoa longline fishery for the period of 2007-2013 has been observed in a recent economic study (Pan *et al.* 2017). This decline continues based on results from ongoing Pacific Islands Fisheries Science Center (PIFSC) Socioeconomics Program economic data collection and performance indicator monitoring programs. Based on data from a 2009 cost-earnings study on the fishery researchers found that the economic performance of the American Samoa longline fleet is highly sensitive to changes in albacore price, fuel prices, and the CPUE of albacore (Pan et al. 2017). The fishery was hit hard in 2013, when all three of these elements trended in the wrong direction, resulting in negative impacts to profit (Pan 2015). In early 2014, the majority of vessels in the American Samoa longline fleet were tied up at the docks in Pago Pago, and according to the *Samoa News*, “For Sale” signs had been posted on close to 20 (of the 22) active vessels[9].

Based on the analyses, the situation in 2013 was clearly associated with poor economic performance resulting from: (a) a continuous decline in albacore CPUE, (b) increasing fuel price, (c) a sharp drop in market prices for albacore, and (d) a baseline of limited profit margins

9 http://www.samoanews.com/tri-marine-says-local-longline-fleet-vital-economy

resulting from a long term downward trend of net return since 2007 (Pan, 2015). The previous cost-earnings study indicated that the fleet in 2009 operations was barely profitable where the albacore CPUE was at 14.8 fish per 1000 hooks, the fuel price was at $2.53 (adjusted to 2013 value), and the market price for the albacore species was $1.00/lb ($2,200 per metric ton). However, in 2013, the CPUE for albacore fell to 11.9 fish per 1,000 hooks (vs. 14.8 in 2009) and the fuel price increased to $3.20 per gallon (vs, $2.53 in 2009, adjusted to 2013 value). The albacore price in 2013 was similar to the 2009 level but it was a sharp drop compared to the price of $1.47/lb in the previous year (2012). Thus, these changes yielded extensive losses across the fleet in 2013.

It is worth noting that the continuing decline of the American Samoa longline fishery during this period was not an isolated event, but was a part of a region-wide economic collapse of the South Pacific albacore fishery. According to a report of the SPC Fisheries Newsletter #142 (September–December 2013), domestic fishing fleets targeting primarily albacore in Pacific Island Countries and Territories (PICTs) had reported difficulties in maintaining profitability in recent years, probably facing the challenges in fuel price rise, and albacore CPUE and price decline[10]. Ongoing PIFSC Socioeconomics Program economic monitoring programs will allow researchers to provide timely updates on future changes in economic performance for the American Samoa longline fishery.

4.2.2 HAWAII LONGLINE: SWALLOW SET FISHERY

Gear configuration for Hawaii longline vessels is rather flexible as operations can easily be adjusted to change target species between swordfish or tuna fishing trips. Tuna fishing (deep set fishery) has shown steady increases in both effort (hooks) and catch over the past two decades, while swordfish fishing (shallow set fishery) has experienced a steady downward trend during the same period (Pan 2014). Since its closure and reopening in the early 2000s, the shallow set fishery has yet to recover even halfway to levels during its historical peak in the early 1990s.

Diminishing economic performance of shallow-set fishing may have contributed to the overall decline of the shallow set fishery, in addition to regulatory measures in controlling sea turtle interactions within the fishery. The Pacific Islands Fisheries Science Center (PIFSC) Socioeconomics Program economic data collection has documented declining net returns to the fishery during the period of 2005-2014, while the average net revenue for tuna trips has generally increased over the same period of time (Pan 2016).

Trends in swordfish and tuna trip costs have been similar over the years; however, swordfish trip revenues have fluctuated widely over the years (see Figure 98), unlike the relatively steady increase in tuna trip revenue over time (see Figure 92). As a result, the average net revenue of swordfish trips moved up and down during 2005 to 2014. Prior to 2008, the average net revenue of a tuna trip was less than 50% of the average net revenue of a swordfish trip. In 2014, the level of the average tuna trip net revenue, $32,100, was much closer to the level of the average swordfish trip net revenue, $33,446. Yet, a swordfish trip usually lasts longer than a tuna trip, so the average net returns per day at sea for a swordfish trip are lower than for a tuna trip. Thus, tuna fishing seems to have an increasing comparative advantage over swordfish fishing in terms

10 http://www.spc.int/coastfish/publications/bulletins/419-spc-fisheries-newsletter-142.html

of trip-level economic returns. Without improved economic performance for swordfish fishing, there may not be much economic incentive to increase fishing effort for swordfish in the future.

Economic performance of longline fishing is the combined effect of many factors, but the key factors that determine the net revenue of Hawaii longline fishing may include; a) prices of target species, b) CPUE of the target species, c) fuel prices, and d) regulatory effects.

Weakened swordfish market

The weakened swordfish market in recent years is a disincentive for Hawaii fishermen to reengage in the swordfish fishery. Unlike bigeye tuna, which is mainly consumed in the local market in Hawaii, the majority of the swordfish landed in Hawaii is exported to the U.S. mainland where it competes with imports from other nations as well as landings from the Atlantic. Concern over mercury contamination may have contributed to decreased demand. In early 1990, bigeye and swordfish ex-vessel prices in the Hawaii market were similar, around $4.50 per pound. From 1994 to 2009, swordfish prices declined while bigeye prices have held relatively stable. The price differential between these two species has increased in recent years. For example, in 2008 the ex-vessel price of bigeye tuna was $4.12 per pound while the ex-vessel price of swordfish was only $2.08/lb.

CPUE declines for swordfish trips

Swordfish CPUE was high in the beginning of the data series. The CPUE of swordfish was above 15 fish per 1000 hooks in the years of 2005, 2006, and 2007. It has decreased since 2007 and it went down to its lowest in 2010 with only 10 fish per 1000 hooks. The swordfish CPUE slightly increased and then stayed flat in recent years (see Figure 100). On the other hand, bigeye CPUE shows a different trend to the swordfish CPUE. Bigeye CPUE were quite steady from 2005 to 2012 and has increased continuously in the last four years, from 3.8 fish per 1000 hooks in 2012 to ~4.5 fish per 1000 hooks in 2015 (see Figure 93).

Fuel prices

While the two types of fisheries face the same fuel market, trip costs, revenues, and subsequent net revenues can vary across the deep-set and shallow-set fisheries. As previously stated, PIFSC Socioeconomics Program economic data collection programs have documented declining net returns to the swordfish fishery during the period of 2005-2014, while the average net revenue for tuna trips has generally increased over the same period of time (Pan 2016).

Sudden closures during fishing seasons

Due to hitting the sea turtle caps, the fishery experienced closures in 2006 and 2011 respectively. The sudden closures had interrupted the normal fishing trip cycle and might have resulted in economic loss to the fishermen as a fishing trip had to be ended no matter if the catch was fully loaded as planned. In the case of 2006, the closure brought back all the swordfish fishing vessels to port, flooding the swordfish market, which in turn constrained air shipping capacity and limited local consumption.

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4.3 FACTORS AFFECTING CPUE OF TARGET SPECIES

The work of PIFSC researchers in spatial and temporal changes in Hawai‘i longline fishery catch and their potential for forecasting future fishery performance are excerpted below from the briefing document provided for the 124th meeting of the Council’s Scientific and Statistical Committee. Authors include Phoebe Woodworth-Jefcoats, Johanna Wren, Jeff Drazen and Jeff Polovina[11]. Additional explanatory text was provided by Phoebe Woodworth-Jefcoats (pers. comm.)

A comprehensive examination of the spatial and temporal trends in the Hawai‘i-based longline fishery over the past 20 years was conducted using three fisheries-dependent data sets: logbook [1995-2016], observer [2006-2016] and dealer [2000-2016] data. Logbook data completed by fishermen provides catch, effort, and catch location data of landed species for all vessels in the fleet, while observer data provides lengths of every third fish caught, including discards, but only ~20% of vessels have an observer on board. Dealer data provides weight of all fish sold at the Honolulu Fish Auction and can be matched with logbook data for each vessel trip.

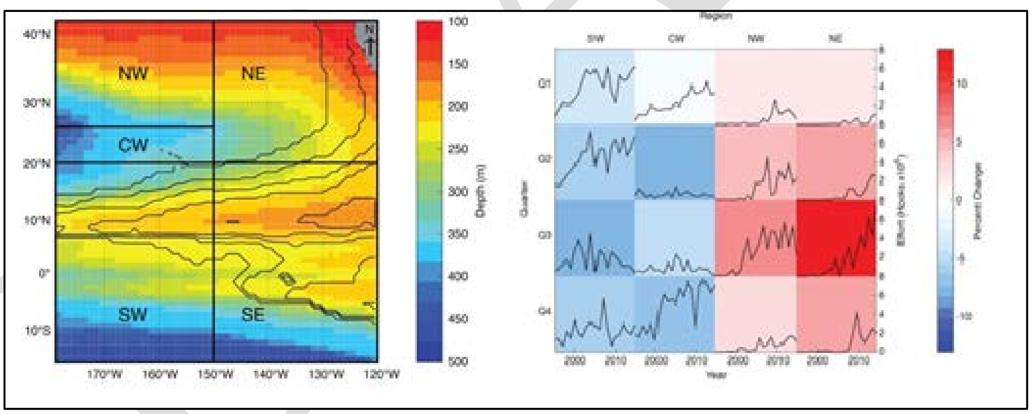

Figure 156. Left: Map depicting the five regions by which the fishery is examined overlaid on the climatological (1995 – 2015) median depth of preferred bigeye thermal habitat (8 – 14 °C, shaded) and the depth of the 1 mL/L oxygen threshold (contoured every 100 m from 100 to 500 m, with stippling where the depth is less than 100 m). Right: The difference between the proportion of total annual effort set in each region and quarter from the beginning (1995 – 1997 mean) to the end (2013 – 2015 mean) of the

11 Factors behind the recent rise in bigeye CPUE in the Hawaii longline fishery. Documented submitted for Western Pacific Fishery Regional Management Council 124th Scientific and Statistical Committee Meeting, October 4 to October 6, 2016, Honolulu, Hawaii, 4 pp.

time series is shaded. Total annual effort in each region and quarter is plotted in black. Note: nearly no effort is deployed in the SE region.

The deep-set longline fishery, which targets bigeye tuna, has expanded considerably over the past two decades. Not only has total effort increased from nearly 8.4 million hooks set in 1995 to over 47 million hooks set in 2015, but the spatial footprint of the fishery has expanded as well. At the beginning of the time series, nearly all (97%) of Hawai‘i’s deep-set effort was set in the fishery’s core operating area south of 26°N and west of 150°W, whereas in 2015 over 40% of the deep-set effort was set either north or east of these bounds. This expansion is most prominent in the third quarter of the year (Figure 156).

The marked northeastward expansion of the fishery appears to have several drivers. First, it is possible that waters closer to Hawai‘i were unable to support an increase in effort due to both Hawai‘i-based and international effort. Waters northeast of Hawai‘i had little to no international competition. Second, bigeye catch rates within the fishery’s core operating area are lowest in the third quarter of the year. However, during this quarter catch rates are still high in waters to the northeast of Hawai‘i. Finally, preferred bigeye thermal habitat and oxygen levels overlap most completely with deep-set gear in waters to the northeast of Hawai‘i (Figure 156). This overlap could act to increase bigeye’s catchability, and in turn catch rates, in northeastern waters. The fishery expanded spatially in the third quarter in response to low target catch rates. In waters to the northeast of Hawai‘i the fleet faced little competition and found a particularly efficient fishing ground due to its local oceanography.

One consequence of the fishery’s spatiotemporal expansion has been an increase in the amount of lancetfish caught. Lancetfish have no commercial value and all catches are discarded. Lancetfish catch rates are highest north of 26°N and in the third quarter. Thus, the fishery is deploying more effort both in the region where lancetfish are most commonly caught and at the time when catch rates are highest. This has resulted in lancetfish catches exceeding bigeye catches for the past decade (Figure 159).

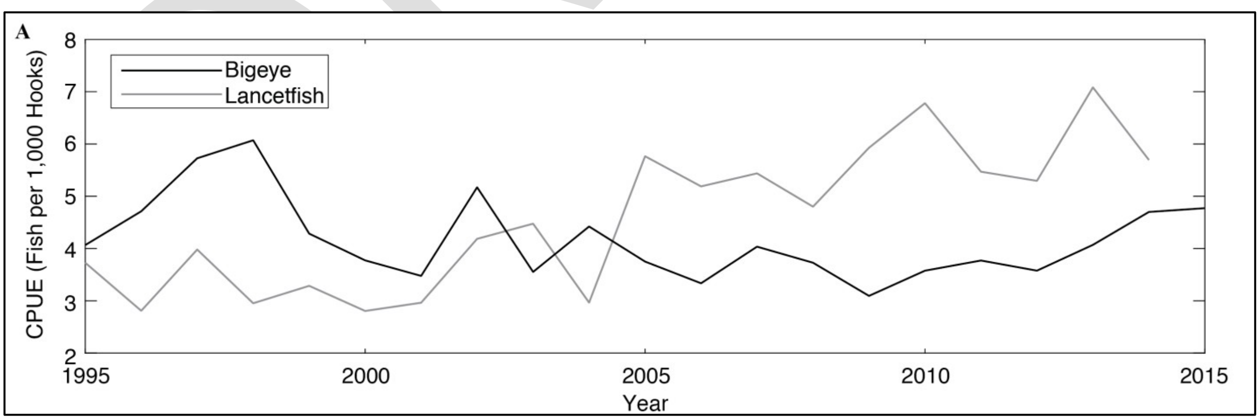

Figure 157. Annual deep-set bigeye tuna (black) and lancetfish (grey) CPUE.

Trends in productivity and catch rates in the fishery over the past decades may be caused by spatiotemporal changes in the fishery itself, changes in the stock, or both. In order to better understand these trends A General Additive Models (GAM) was built to analyze time series of mean weight, catch per unit effort (CPUE, in number of fish caught per 1000 hooks) and weight per unit effort (WPUE, in kg caught per 1000 hooks). The GAM a llowed researchers to tease apart trends caused by changes in the stock from those caused by changes in seasonality and geographic location of the fishery. Over the past 16 years, mean weights of commercially important fish in the Hawai'i- based longline fishery have declined 10%.

This is in part due to a decline in mean weight by five out of the eleven most commonly caught species, and partly due to a change in species composition of the catch. Smaller fishes, such as pomfrets and walu, are becoming more common while larger fishes, such as opah and striped marlin, make up a lesser proportion of the total catch (Figure 158A). Because more small fish, and more small fish species are caught, the productivity of the fishery (WPUE) declined by 53% since 2000, but the shift in area and seasonality of fishing effort helped maintain productivity in the fishery (Figure 158C).

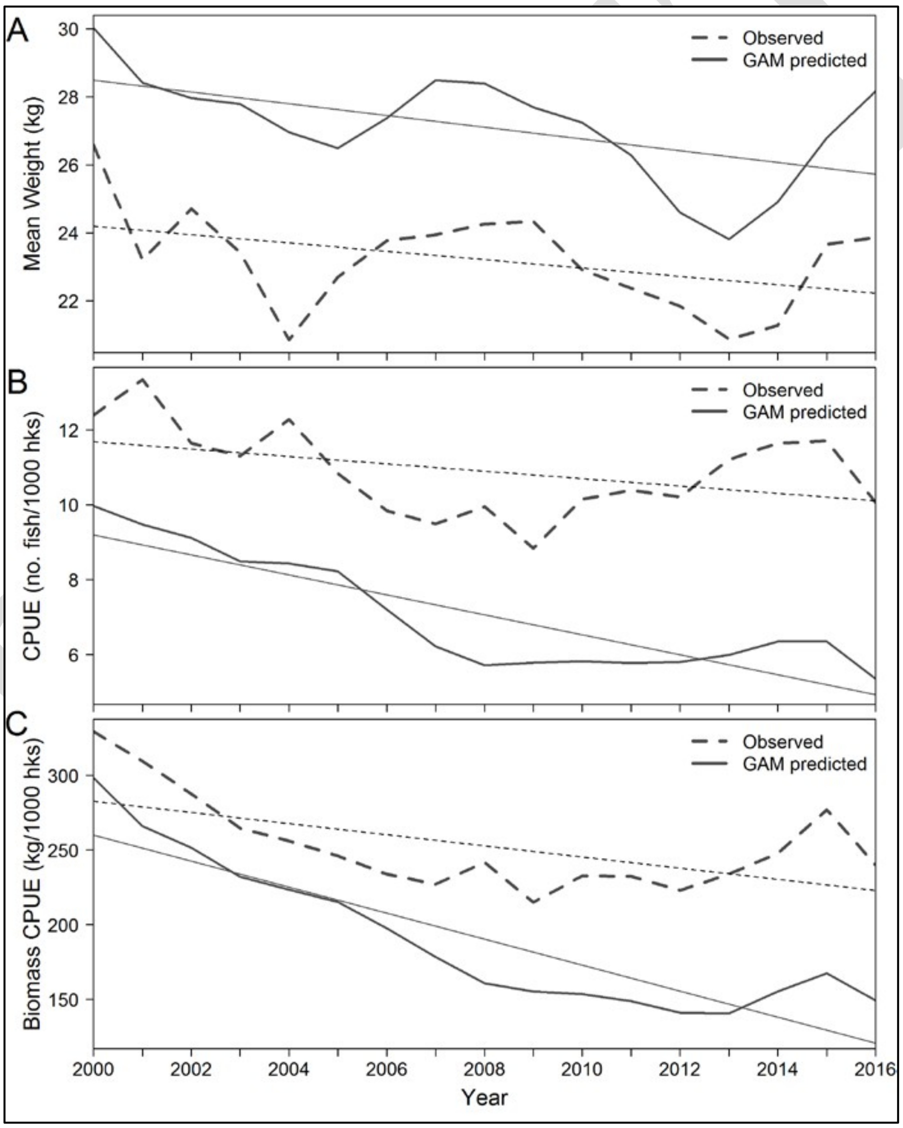

Figure 158. Mean weight (A), catch per unit effort (B) and weight per unit effort (WPUE) for all fish in the Hawai'i-based longline fishery from dealer provided data. The dashed

lines show the annual values from the dealer data with a linear trend line, and the solid line shows the GAM predicted annual values with linear trend lines.

CPUE has increased slowly since 2008, but when accounting for the increase in effort and geographic shift of the fishery, CPUE has remained stable. The recent peaks in both CPUE and WPUE are largely due to a strong recruitment pulse of bigeye tuna entering the fishery in the third quarter of 2013. This recruitment pulse in the fishery can be followed through 2016, where it provides an increase in first CPUE then WPUE. A recruitment index could be generated for bigeye tuna that provides a forecast of fishery performance. A peak in small bigeye tuna (<=15kg) is an indication that there will be an increase in CPUE and WPUE in the following two years (Figure 159).

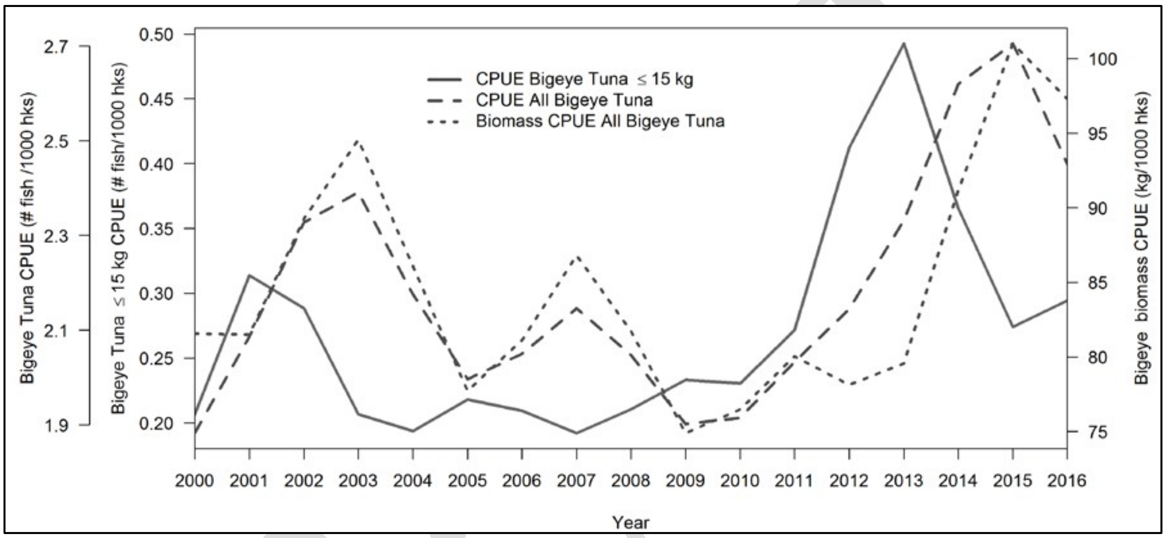

Figure 159. Temporally and spatially adjusted annual catch per 1000 hooks (CPUE; dashed line), and biomass per 1000 hooks (WPUE) for all bigeye tuna and bigeye tuna 15 kg or less (solid line) from the GAM from 2000-2016.

Additional reading on the influences of environmental impacts on tuna populations can be fiound in Lehodey *et al* (2010) and Lehodey *et al* (2013).

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APPENDIX A: SUPPORTING DATA TABLES FOR FIGURES IN CHAPTER 2 – DATA MODULES AND SECTION 3.1 – HUMAN DIMENSIONS

Table Page

TABLES FOR SECTION 2.1: AMERICAN SAMOA

Table A-1. Summary of creel survey sampling effort.

Year	Sample Days	Trolling Interviews	Troll Sampled	Expanded Trips	Trolling Percent
2007	244	82	114	133	86
2008	208	90	111	132	84
2009	172	27	30	37	81
2010	212	31	36	38	95
2011	239	67	113	119	95
2012	262	37	71	76	93
2013	259	73	114	120	95
2014	237	97	98	126	78
2015	219	51	69	104	66
2016	196	44	56	84	67

Table A-2. Supporting Data for Figure 2. Number of American Samoa boats landing any pelagic species by longlining, trolling and all methods

	Boats landing		
Year	**All Methods**	**Longline Boats**	**Trolling Boats**
2007	59	29	19
2008	53	28	16
2009	44	26	10
2010	40	26	7
2011	39	24	10
2012	38	22	9
2013	42	23	13
2014	47	21	22
2015	37	20	11
2016	33	16	12
Average	**43**	**24**	**13**
St. Dev.	**7.48**	**3.75**	**4.48**

Table A-3. Supporting Data for

Figure 3. Number of American Samoa fishing trips or sets for all pelagic species by method

	Pounds landed	
Year	**Troll Trips**	**Longline Sets**
2007	145	5,920
2008	143	4,754
2009	81	4,916
2010	53	4,540
2011	141	3,894
2012	84	4,211
2013	132	3,411
2014	157	2,689
2015	167	2,734
2016	190	2,420
Average	**129**	**3,949**
St. Dev.	**43.02**	**1,134.31**

Table A-4. Supporting Data for Figure 4. American Samoa annual estimated total landings of Tuna and Non-Tuna PMUS

	Pounds landed	
Year	**Tuna**	**Non Tuna PMUS**
2007	13,734,212	601,351
2008	9,252,263	433,254
2009	10,225,835	498,003
2010	10,336,611	453,487
2011	7,024,523	464,855
2012	8,924,346	366,328
2013	5,967,980	357,822
2014	4,434,855	288,893
2015	5,234,461	287,060
2016	4,076,578	261,296
Average	**7,921,166**	**401,235**
Std. Dev.	**3,099,965.52**	**108,298.05**

Table A-5. Supporting Data for Figure 5. American Samoa annual commercial landings of Tunas and Non-Tuna PMUS

Year	**Tuna**	**Non Tuna PMUS**

2007	13,730,465	558,696
2008	9,248,517	389,999
2009	10,155,355	357,274
2010	10,321,551	335,983
2011	7,015,245	320,184
2012	8,922,046	198,971
2013	5,899,493	230,132
2014	4,430,083	176,829
2015	5,232,196	178,012
2016	3,887,849	144,848
Average	**7,884,280**	**289,093**
Std. Deviation	**2,963,868**	**121,667**

Table A-6. Supporting Data for Figure 6. American Samoa annual estimated total landings of Yellowfin Tuna by gear

	Pounds landed	
Year	**Longline Pounds**	**Trolling Pounds**
2007	1,396,468	9,023
2008	749,825	20,089
2009	866,631	2,785
2010	975,802	2,052
2011	1,204,700	12,379
2012	828,483	8,479
2013	931,281	7,137
2014	932,544	6,617
2015	792,576	3,981
2016	504,787	9,492
Average	**918,310**	**8,203**
Std. Dev.	**245009.7**	**5268.3**

Table A-7. Supporting Data for Figure 7. American Samoa annual estimated total landings of Skipjack Tuna by gear

	Pounds landed	
Year	**Longline**	**Trolling**
2007	365,281	12,255
2008	359,568	16,294
2009	343,714	2,775
2010	251,511	2,043
2011	246,602	19,862
2012	637,502	9,703
2013	144,285	8,459
2014	241,996	12,941
2015	240,462	6,925
2016	118,188	9,817
Average	**294,911**	**10,107**
Std. Dev.	**146,357.25**	**5,557.37**

Table A-8. Supporting Data for Figure 8. American Samoa annual estimated total landings of Wahoo by gear

	Pounds landed	
Year	**Longline**	**Trolling**
2007	436,981	889
2008	299,481	165
2009	305,920	0
2010	289,524	64
2011	282,893	55
2012	187,851	597
2013	197,667	1,109
2014	157,021	1,072
2015	166,128	496
2016	108,846	13,097
Average	**243,231**	**1,754**
Std. Dev.	**97,141.67**	**4,007.75**

Table A-9. Supporting Data for Figure 9. American Samoa annual estimated total landings of Mahimahi by gear

Year	Longline Pounds	Trolling Pounds
2007	31,415	684
2008	28,027	931
2009	36,844	113

2010	18,049	0
2011	21,389	611
2012	22,645	157
2013	42,748	300
2014	21,759	2,077
2015	11,841	893
2016	9,297	1,428
Average	24,401	719
St. Dev.	9,996	617

Table A-10. Supporting Data for Figure 10. American Samoa annual estimated total landings of Blue Marlin by gear

Year	Longline Pounds	Trolling Pounds
2007	84,970	204
2008	76,297	0
2009	91,753	0
2010	98,141	0
2011	86,587	0
2012	80,606	0
2013	67,557	0
2014	57,498	2,007
2015	63,358	1,765
2016	67,965	476
Average	77,473	445
St. Dev.	12,524	737

Table A-11. Supporting Data for Figure 11. American Samoa annual estimated total landings of Sailfish by gear

Year	Longline Pounds	Trolling Pounds
2007	2,167	0
2008	1,931	148
2009	4,184	0
2010	3,404	0
2011	8,226	73
2012	3,333	0
2013	3,924	0
2014	3,370	195
2015	3,800	1,391
2016	5,035	0
Average	3,937	181
St. Dev.	1,668	409

Table A-12. Supporting Data for Figure 15. Thousands of American Samoa longline hooks set (Federal Logbook Data)

Year	**1000s of Hooks Set**
2007	17,555
2008	14,444
2009	15,086
2010	13,185
2011	11,075
2012	12,112
2013	10,184
2014	7,476
2015	7,678
2016	6,792
Average	**11,559**
Std. Dev.	**115,587**

Table A-13. Supporting Data for Figure 16. American Samoa annual estimated total landings of Bigeye Tuna by longlining

Year	Longline Pounds
2007	509,563
2008	274,482
2009	353,779
2010	387,431
2011	392,198
2012	383,023
2013	187,646
2014	172,597
2015	168,429
2016	215,481
Average	304,463
St. Dev.	111,179

Table A-14. Supporting Data for Figure 17. American Samoa annual estimated total landings of Albacore by longlining

Year	Longline Pounds
2007	11,440,920
2008	7,831,590
2009	8,655,948
2010	8,716,712
2011	5,146,519
2012	7,055,591
2013	4,688,559
2014	3,067,631
2015	4,020,598
2016	3,054,945
Average	6,367,901
St. Dev.	2,660,679

Table A-15**.** Supporting Data for Figure 18. American Samoa annual estimated total landings of Swordfish by longlining

Year	Longline Pounds
2007	28,287
2008	14,889
2009	27,615
2010	24,816
2011	28,379
2012	31,179
2013	23,818
2014	20,998
2015	18,359
2016	14,508
Average	23,285
St. Dev.	5,583

Table A-16. Supporting Data for Figure 19. Number of Fish Released by American Samoa Longline Vessels

	Number of Fish Released			
Year	**Tunas**	**Non-Tuna PMUS**	**Other Pelagics**	**Sharks**
2007	14,418	19,354	3,308	6,672
2008	5,542	13,039	2,274	5,833
2009	9,733	19,034	3,291	5,933
2010	16,703	17,957	4,576	5,108
2011	5,575	12,175	4,035	4,836
2012	6,924	16,062	3,572	6,932
2013	1,095	11,838	1,771	3,879
2014	845	6,587	770	4,946
2015	1,722	8,516	1,192	6,352
2016	997	5,523	2,517	5,345

Table A-17. Supporting Data for Figure 20. American Samoa Albacore catch per 1,000 Hooks by Monohull Vessels from Longline Logbook Data

	Number of Fish Per 1000 Hooks	
Year	**Alias**	**Monohulls**
2007	NA	18.3
2008	NA	14.2
2009	NA	14.8
2010	NA	17.4
2011	NA	12.1
2012	NA	14.8
2013	NA	11.7
2014	NA	10.6
2015	NA	13.7
2016	NA	12.5

Table A-18. Supporting Data for Figure 21. American Samoa pelagic catch per hour of trolling and number of trolling hours

Year	CPUE	Hours
2007	35	723
2008	50	808
2009	26	424
2010	20	308
2011	52	711
2012	52	389
2013	27	673
2014	25	1,063
2015	16	1,143
2016	43	981
Average	**347**	**7,223**
Std. Dev.	**13.64**	**287.06**

Table A-19. Supporting Data for Figure 22. American Samoa trolling catch rates for Skipjack and Yellowfin Tuna

	Pounds caught per Trolling Hour	
Year	**Skipjack**	**Yellowfin**
2007	18.20	13.40
2008	21.50	26.90
2009	11.70	14.00
2010	8.78	9.23
2011	30.50	19.10
2012	25.90	23.20
2013	13.10	11.40
2014	13.90	6.95
2015	7.00	5.03
2016	17.30	16.70
Average	**167.88**	**145.91**
Std. Dev.	**7.48**	**7.00**

Table A-20. Supporting Data for Figure 23. American Samoa trolling catch rates for Blue Marlin, Mahimahi, and Wahoo

	Pounds Caught per Trolling Hour		
Year	**Blue Marlin**	**Mahimahi**	**Wahoo**
2007	0.31	0.98	1.29
2008	0.00	0.90	0.22
2009	0.00	0.58	0.00
2010	0.00	0.00	0.29
2011	0.00	1.02	0.04
2012	0.00	0.44	1.67
2013	0.00	0.46	1.78
2014	2.34	2.37	0.86
2015	2.49	1.26	0.38
2016	1.09	3.28	
Average	**6.23**	**11.29**	**6.53**
Std. Dev.	**1.00**	**0.99**	**0.70**

TABLES FOR SECTION 2.2: COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Table A-21. Boat-based Survey Statistics (raw data), CNMI

Year	Survey Days	Boat Log Total Trips	Charter Trips	Non Charter Trips	Total Interviews	Charter Interviews	Non Charter Interviews
2007	63	199	6	193	194	7	187
2008	56	164	4	160	160	5	155
2009	66	140	3	137	137	5	132
2010	70	123	4	119	115	3	112
2011	73	111	5	106	105	5	100
2012	73	134	7	127	126	7	119
2013	72	163	NA	NA	149	NA	NA
2014	74	155	NA	NA	141	NA	NA
2015	68	110	NA	NA	102	NA	NA
2016	80	108	4	104	91	4	87

Table A-22. Supporting Data for Figure 24. Number of CNMI Fishermen (Boats) Making Commercial Pelagic Landings

Year	Number of Fishermen
2007	52
2008	52
2009	50
2010	40
2011	48
2012	35
2013	28
2014	21
2015	12
2016	63
Average	40
St. Dev.	16.0

Table A-23. Supporting Data for Figure 25. CNMI Numbers of Trips Catching Any Pelagic Fish from Commercial Receipt Invoices

Year	Number of Trips
2007	1,366
2008	1,192
2009	1,202
2010	791
2011	549
2012	895
2013	1,640
2014	1,229
2015	583
2016	667
Average	1,011
St. Dev.	367

Table A-24. Supporting Data for Figure 26. CNMI Boat-based Creel Estimated Number of Trolling Trips

Year	Estimated Total Trips	Non Charter	Charter
2007	4,504	4,261	242
2008	4,921	4,717	204
2009	3,674	3,533	141
2010	4,312	4,154	158
2011	3,339	3,064	275
2012	3,423	3,238	185
2013	2,492	NA	NA
2014	3,567	NA	NA
2015	2,654	NA	NA
2016	3,601	3,584	17
Average	3,649	3,793	175
St. Dev.	726	555	77

Table A-25. Supporting Data for Figure 27. CNMI Boat-based Creel Estimated Number of Trolling Hours

Year	Estimated Hours per Trip	Non Charter	Charter
2007	21,232	20,499	733
2008	26,642	25,969	673
2009	18,717	18,293	423
2010	24,473	24,000	473
2011	18,061	17,318	743
2012	17,659	17,144	516
2013	12,658	NA	NA
2014	19,489	NA	NA
2015	14,084	NA	NA
2016	19,260	19,176	84
Average	19,228	20,343	521
St. Dev.	4,003	3,162	214

Table A-26. Supporting Data for Figure 28. CNMI Boat-Based Creel Average Trip Length – Hours per Trip

Year	Estimated Hours per Trip	Non Charter	Charter
2007	4.7	4.8	3.0
2008	5.4	5.5	3.3
2009	5.1	5.2	3.0
2010	5.7	5.8	3.0
2011	5.4	5.7	2.7
2012	5.2	5.3	2.8
2013	5.1	NA	NA
2014	5.5	NA	NA
2015	5.3	NA	NA
2016	5.3	5.4	4.9
Average	5.3	5.4	3.2
St. Dev.	0.3	0.3	0.7

Table A-27. Supporting Data for Figure 29. CNMI Annual Estimated Total Landings: All Pelagics, Tunas PMUS, and Non-Tuna PMUS

Year	Total Pelagic	Non Charter	Charter
2007	610,609	600,499	10,110
2008	602,371	599,505	2,866
2009	378,203	374,509	3,694
2010	516,663	512,621	4,043
2011	335,472	325,937	9,535
2012	478,910	473,795	5,116
2013	476,955	NA	NA
2014	395,701	NA	NA
2015	411,118	NA	NA
2016	307,901	306,409	1,492
Average	451,390	456,182	5,265
St. Dev.	98,956	113,974	3,063

Table A-28. Supporting Data for Figure 30. CNMI Annual Estimated Total Pelagic Landings: Total, Non-Charter, and Charter

Year	Total Pelagic	Non Charter	Charter
2007	610,609	600,499	10,110
2008	602,371	599,505	2,866
2009	378,203	374,509	3,694
2010	516,663	512,621	4,043
2011	335,472	325,937	9,535
2012	478,910	473,795	5,116
2013	476,955	NA	NA
2014	395,701	NA	NA
2015	411,118	NA	NA
2016	307,901	306,409	1,492
Average	451,390	456,182	5,265
St. Dev.	98,956	113,974	3,063

Table A-29. Supporting Data for Figure 31. CNMI Annual Estimated Total Tuna PMUS Landings: Total, Non-Charter, and Charter

Year	Total Tunas	Non Charter	Charter
2007	485,613	484,638	975
2008	470,059	468,651	1,408
2009	301,895	299,580	2,315
2010	425,969	421,927	4,043
2011	263,340	257,823	5,518
2012	408,157	406,654	1,503
2013	389,640	NA	NA
2014	262,059	NA	NA
2015	309,485	NA	NA
2016	212,856	211,364	1,492
Average	352,907	364,377	2,465
St. Dev.	90,251	99,571	1,560

Table A-30. Supporting Data for Figure 32. CNMI Annual Estimated Total Non-Tuna PMUS Landings: Total, Non-Charter, and Charter

Year	Total Non Tuna PMUS	Non Charter	Charter
2007	124,996	115,861	9,135
2008	132,312	130,854	1,458
2009	76,308	74,929	1,379
2010	90,694	90,694	0
2011	72,131	68,114	4,017
2012	70,753	67,141	3,612
2013	87,315	NA	NA
2014	133,642	NA	NA
2015	101,633	NA	NA
2016	84,662	84,662	0
Average	97,445	90,322	2,800
St. Dev.	23,268	22,661	2,971

Table A-31. Supporting Data for Figure 33. CNMI Annual Estimated Total Skipjack Landings: Total, Non-Charter, and Charter

Year	Total Skipjack	Non Charter	Charter
2007	444,493	443,600	893
2008	419,311	417,903	1,408
2009	240,477	239,080	1,397
2010	365,636	365,192	444
2011	220,077	214,669	5,408
2012	304,529	303,281	1,247
2013	248,670	NA	NA
2014	240,823	NA	NA
2015	287,171	NA	NA
2016	191,108	189,616	1,492
Average	296,230	310,477	1,756
St. Dev.	82,091	93,497	1,530

Table A-32. Supporting Data for Figure 34. CNMI Annual Estimated Total Yellowfin Landings: Total, Non-Charter, and Charter

Year	Total Yellowfin	Non Charter	Charter
2007	35,958	35,958	0
2008	33,906	33,906	0
2009	23,833	23,833	0
2010	29,730	26,289	3,441
2011	41,159	41,159	0
2012	77,604	77,454	150
2013	23,278	NA	NA
2014	18,570	NA	NA
2015	15,760	NA	NA
2016	19,609	19,609	0
Average	31,941	36,887	513
St. Dev.	17,113	17,948	1,196

Table A-33. Supporting Data for Figure 35. CNMI Annual Estimated Total Mahimahi Landings: Total, Non-Charter, and Charter

Year	Total Mahimahi	Non Charter	Charter
2007	110,351	101,792	8,559
2008	81,912	81,025	887
2009	55,970	55,228	742
2010	73,965	73,965	0
2011	55,291	52,374	2,917
2012	41,390	40,102	1,289
2013	53,907	NA	NA
2014	87,027	NA	NA
2015	88,798	NA	NA
2016	79,656	79,656	0
Average	72,827	69,163	2,056
St. Dev.	19,832	19,490	2,807

Table A-34. Supporting Data for Figure 36. CNMI Annual Estimated Total Wahoo Landings: Total, Non-Charter, and Charter

Year	Total Wahoo	Non Charter	Charter
2007	11,023	10,447	576
2008	6,525	5,954	571
2009	11,438	11,130	308
2010	13,494	13,494	0
2011	11,853	10,753	1,101
2012	19,073	16,749	2,324
2013	7,177	NA	NA
2014	10,673	NA	NA
2015	4,264	NA	NA
2016	4,968	4,968	0
Average	10,049	10,499	697
St. Dev.	4,240	3,775	753

Table A-35. Supporting Data for Figure 37. CNMI Annual Estimated Total Blue Marlin Landings: Total, Non-Charter, and Charter

Year	Total Blue Marlin	Non Charter	Charter
2007	3,623	3,623	0
2008	42,586	42,586	0
2010	0	0	0
2011	4,987	4,987	0
2012	10,290	10,290	0
2013	1,347	NA	NA
2014	5,568	NA	NA
2015	0	NA	NA
2016	0	0	0
Average	7,600	10,248	0
St. Dev.	12,782	14,874	0

Table A-36. Supporting Data for Figure 38. CNMI Annual Commercial Landings: All Pelagics, Tuna PMUS, and Non-Tuna PMUS

Year	All Pelagics	Tuna PMUS	Non Tuna PMUS
2007	312,554	275,614	32,755
2008	219,187	192,598	18,454
2009	192,303	167,461	24,716
2010	188,351	154,871	26,978
2011	121,118	81,269	34,757
2012	155,273	125,356	29,917
2013	263,416	200,213	52,950
2014	235,092	178,712	48,456
2015	188,213	154,655	30,810
2016	125,207	115,521	6,976
Average	200,071	164,627	30,677
St. Dev.	60,037	53,406	13,309

Table A-37. Supporting Data for Figure 39. CNMI Annual Commercial Landings: Skipjack and Yellowfin

Year	Skipjack	Yellowfin
2007	238,972	34,894
2008	170,059	18,695
2009	133,794	26,463
2010	124,096	30,507
2011	60,431	19,059
2012	99,187	19,392
2013	166,969	31,278
2014	161,798	15,102
2015	139,903	14,602
2016	103,299	10,880
Average	139,851	22,087
St. Dev.	48,918	8,144

Table A-38. Supporting Data for Figure 40. CNMI Annual Commercial Landings: Mahimahi, Wahoo, and Blue Marlin

Year	Mahimahi	Wahoo	Blue Marlin
2007	26,410	2,504	76
2008	13,187	1,669	2,027
2009	20,030	3,500	82
2010	23,157	2,887	73
2011	21,821	9,606	175
2012	18,712	8,677	2,010
2013	44,889	5,345	2,091
2014	38,084	7,262	2,547
2015	30,382	428	0
2016	3,966	1,029	1,435
Average	24,064	4,291	1,052
St. Dev.	11,779	3,260	1,057

Table A-39. Supporting Data for Figure 41. CNMI Boat-based Creel Trolling Catch Rates (lbs per hour)

Year	Troll Catch Rate	Non Charter	Charter
2007	29.0	29.5	14.2
2008	22.6	23.1	4.2
2009	20.0	20.3	8.8
2010	21.7	21.9	7.0
2011	19.1	19.3	13.1
2012	27.2	27.7	10.2
2013	26.6	NA	NA
2014	19.0	NA	NA
2015	28.0	NA	NA
2016	15.9	15.8	17.8
Average	22.9	22.5	10.8
St. Dev.	4.3	4.4	4.3

Table A-40. Supporting Data for Figure 42. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Skipjack

Year	Total Skipjack	Non Charter	Charter
2007	20.9	21.6	1.2
2008	15.6	15.9	2.0
2009	14.3	14.5	4.6
2010	15.0	15.3	0.8
2011	12.2	12.4	7.3
2012	17.2	17.7	2.4
2013	19.6	NA	NA
2014	12.4	NA	NA
2015	20.4	NA	NA
2016	9.9	9.8	17.8
Average	15.8	16.0	5.2
St. Dev.	3.5	3.7	5.6

Table A-41. Supporting Data for Figure 43. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Yellowfin

Year	Total Yellowfin Tuna	Non Charter	Charter
2007	1.7	1.8	0.0
2008	1.3	1.3	0.0
2009	1.3	1.3	0.0
2010	1.2	1.1	5.9
2011	2.3	2.4	0.0
2012	4.4	4.5	0.3
2013	1.8	NA	NA
2014	1.0	NA	NA
2015	1.1	NA	NA
2016	1.0	1.0	0.0
Average	1.7	1.9	0.9
St. Dev.	1.0	1.1	2.0

Table A-42. Supporting Data for Figure 44. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Mahimahi

Year	Total Mahimahi	Non Charter	Charter
2007	5.2	5.0	11.7
2008	3.1	3.1	1.3
2009	3.4	3.4	2.3
2010	3.0	3.1	0.0
2011	3.1	3.0	3.8
2012	2.3	2.3	2.5
2013	4.3	NA	NA
2014	4.5	NA	NA
2015	6.2	NA	NA
2016	4.1	4.2	0.0
Average	3.9	3.4	3.1
St. Dev.	1.1	0.8	3.7

Table A-43. Supporting Data for Figure 45. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Wahoo

Year	Total Wahoo	Non Charter	Charter
2007	0.5	0.5	0.8
2008	0.2	0.2	0.8
2009	0.7	0.7	0.9
2010	0.6	0.6	0.0
2011	0.7	0.6	1.5
2012	1.1	1.0	4.5
2013	0.6	NA	NA
2014	0.5	NA	NA
2015	0.3	NA	NA
2016	0.3	0.3	0.0
Average	0.6	0.6	1.2
St. Dev.	0.2	0.2	1.4

Table A-44. Supporting Data for Figure 46. CNMI Boat-based Creel Trolling Catch Rates (lbs/hr): Blue Marlin

Year	Total Blue Marlin	Non Charter	Charter
2007	0.2	0.2	0.0
2008	1.6	1.6	0.0
2009	0.0	0.0	0.0
2010	0.0	0.0	0.0
2011	0.3	0.3	0.0
2012	0.6	0.6	0.0
2013	0.1	NA	NA
2014	0.3	NA	NA
2015	0.0	NA	NA
2016	0.0	0.0	0.0
Average	0.3	0.4	0.0
St. Dev.	0.5	0.5	0.0

Table A-45. Supporting Data for Figure 47. CNMI Trolling Catch Rates of Skipjack and Yellowfin Tuna (lbs/trip)

Year	Mahimahi	Wahoo	Blue Marlin
2007	12.6	1.2	0.0
2008	7.2	0.9	1.1
2009	9.6	1.7	0.0
2010	13.2	1.6	0.0
2011	15.9	7.0	0.1
2012	13.6	6.3	1.5
2013	17.8	2.1	0.8
2014	20.1	3.8	1.4
2015	15.6	0.2	0.0
2016	4.2	1.1	1.5
Average	13.0	2.6	0.7
St. Dev.	4.87	2.34	0.66

Table A-46. Supporting Data for Figure 48. CNMI Trolling Catch Rate of Mahimahi, Wahoo, and Blue Marlin (lbs/trip)

Year	Skipjack	Yellowfin	Skipjack Creel
2007	114	17	108
2008	93	10	88
2009	64	13	72
2010	71	17	95
2011	44	14	66
2012	72	14	95
2013	66	12	101
2014	86	8	74
2015	72	8	114
2016	108	11	51
Average	79	12	86
St. Dev.	21.3	3.3	20.0

TABLES FOR SECTION 2.3: GUAM

Table A-47. Numbers of Trips and Interviews for Creel Trolling Method, Guam

Year	Survey Days	Trips in Boat Log	Interviews
1982	46	392	363
1983	47	362	351
1984	54	485	366
1985	66	736	503
1986	49	627	382
1987	48	610	431
1988	51	1,031	698
1989	60	1,052	642
1990	60	1,097	804
1991	60	1,097	774
1992	60	1,169	843
1993	61	1,149	844
1994	69	1,222	878
1995	96	1,540	1,110
1996	96	1,543	1,146
1997	96	1,378	950
1998	96	1,477	1,052
1999	96	1,434	917
2000	96	1,337	854
2001	96	1,076	620
2002	84	730	396
2003	79	531	289
2004	96	715	366
2005	97	695	377
2006	96	763	413
2007	96	753	391
2008	96	784	406
2009	96	1,014	605
2010	96	1,134	684
2011	96	877	496
2012	96	498	274
2013	96	799	456
2014	90	964	511
2015	95	903	539
2016	96	1,128	715

Table A-48. Supporting Data for Figure 49. Guam Estimated Number of Trolling Boats

Year	Estimated Boat	Upper 95 Percent	Lower 95 Percent
2005	358	498	293
2006	386	527	321
2007	370	485	315
2008	385	523	322
2009	368	468	316
2010	432	508	390
2011	454	563	396
2012	351	457	298
2013	496	588	446
2014	447	537	395
2015	372	460	326
2016	535	626	482

Table A-49. Supporting Data for Figure 50. Guam Annual Estimated Total Landings: All Pelagics, Tuna PMUS, and Non-Tuna PMUS

Year	All Pelagic	Tuna PMUS	Non Tuna PMUS
2005	283,640	124,790	158,850
2006	481,497	178,224	303,272
2007	541,902	208,091	333,812
2008	542,862	320,268	222,594
2009	708,526	383,099	311,471
2010	721,804	364,390	357,414
2011	579,027	433,271	145,756
2012	394,500	271,787	122,713
2013	789,645	554,057	235,588
2014	745,934	437,867	307,088
2015	958,260	709,515	228,205
2016	836,066	565,073	254,702
Average	681,853	424,742	251,934
St. Dev.	166,755	150,694.7	775,22.22

Table A-50. Supporting Data for Figure 51. Guam Annual Estimated Total Landings by Method

Year	Total Pelagic	Non Charter	Charter
2005	283,640	225,690	57,950
2006	481,497	414,720	66,777
2007	541,902	464,093	77,809
2008	542,862	492,244	50,618
2009	708,526	654,508	54,019
2010	721,804	660,906	60,898
2011	579,027	553,768	25,260
2012	394,500	366,056	28,444
2013	789,645	740,449	49,197
2014	745,934	689,580	56,355
2015	942,572	881,574	60,999
2016	819,775	783,156	36,621
Average	681,853	631,619	50,064
St. Dev.	166,755	162,817	16,053

Table A-51. Supporting Data for Figure 52. Guam Annual Estimated Tuna PMUS Landings by Method

Year	Total Tunas	Non Charter	Charter
2005	124,790	108,340	16,450
2006	178,224	154,766	23,459
2007	208,091	190,206	17,885
2008	320,268	305,098	15,170
2009	383,099	372,928	10,172
2010	364,390	354,187	10,203
2011	433,271	422,796	10,475
2012	271,787	264,733	7,054
2013	554,057	547,425	6,633
2014	437,867	427,654	10,213
2015	709,515	703,924	5,591
2016	565,073	557,100	7,973
Average	424,742	414,605	10,137
St. Dev.	150,695	153,509	3,839

Table A-52. Supporting Data for Figure 53. Guam Annual Estimated Landings of Skipjack Tuna by Fishing by Method

Year	Total Skipjack	Non Charter	Charter
2005	99,012	84,383	14,629
2006	146,658	126,042	20,616
2007	157,699	143,170	14,529
2008	296,383	282,960	13,423
2009	330,934	322,553	8,381
2010	339,574	330,289	9,286
2011	360,360	351,101	9,259
2012	245,883	240,558	5,325
2013	501,461	494,828	6,633
2014	403,135	393,267	9,868
2015	598,502	593,698	4,804
2016	437,476	432,534	4,942
Average	367,141	358,496	8,645
St. Dev.	126,274	128,547	3,389

Table A-53. Supporting Data for Figure 54. Guam Annual Estimated Total Yellowfin Landings by Method

Year	Total Yellowfin	Non Charter	Charter
2005	24,792	23,038	1,754
2006	28,049	25,419	2,630
2007	48,084	44,900	3,184
2008	19,621	18,634	987
2009	50,276	49,062	1,214
2010	24,501	23,658	843
2011	72,261	71,210	1,051
2012	25,904	24,176	1,729
2013	52,182	52,182	0
2014	34,492	34,148	345
2015	110,458	109,671	787
2016	127,520	124,566	2,954
Average	56,530	55,221	1,309
St. Dev.	36,722	36,401	1,039

Table A-54. Supporting Data for Figure 55. Guam Annual Estimated non-Tuna PMUS Landings by Method

Year	Total Non Tuna PMUS	Non Charter	Charter
2005	158,850	117,350	41,500
2006	303,272	259,954	43,318
2007	333,812	273,887	59,924
2008	222,594	187,145	35,449
2009	311,471	267,624	43,847
2010	357,414	306,719	50,695
2011	145,756	130,972	14,784
2012	122,713	101,322	21,391
2013	235,588	193,024	42,564
2014	307,088	260,947	46,142
2015	228,205	173,271	54,935
2016	254,702	226,056	28,648
Average	251,934	212,097	39,838
St. Dev.	77,522	66,485	14,625

Table A-55. Supporting Data for Figure 56. Guam Annual Estimated Total Mahimahi Landings by Method

Year	Total Mahimahi	Non Charter	Charter
2005	104,908	77,124	27,784
2006	162,512	139,365	23,147
2007	259,657	218,350	41,307
2008	110,848	98,368	12,480
2009	146,640	124,053	22,587
2010	281,558	244,971	36,587
2011	88,537	79,291	9,245
2012	77,924	64,491	13,433
2013	164,549	133,375	31,173
2014	189,442	158,332	31,110
2015	158,534	121,620	36,915
2016	174,458	159,231	15,227
Average	165,215	140,208	25,006
St. Dev.	66,644	57,368	11,821

Table A-56. Supporting Data for Figure 57. Guam Annual Estimated Total Wahoo Landings by Method

Year	Total Wahoo	Non Charter	Charter
2005	43,730	32,026	11,704
2006	105,878	91,713	14,166
2007	44,510	31,148	13,362
2008	98,575	78,504	20,071
2009	130,894	121,860	9,034
2010	43,956	41,054	2,902
2011	37,122	32,577	4,545
2012	37,159	33,798	3,361
2013	54,202	49,646	4,556
2014	88,393	80,073	8,320
2015	31,457	23,955	7,502
2016	33,609	28,254	5,356
Average	59,988	52,087	7,901
St. Dev.	32,261	29,983	5,041

Table A-57. Supporting Data for Figure 58. Guam Annual Estimated Total Blue Marlin Landings by Method

Year	Total Blue Marlin	Non Charter	Charter
2005	9,213	7,201	2,012
2006	29,222	23,217	6,005
2007	18,970	14,124	4,846
2008	9,640	6,742	2,898
2009	32,603	20,410	12,194
2010	32,040	20,836	11,203
2011	18,858	17,864	994
2012	5,460	864	4,597
2013	15,050	8,216	6,834
2014	29,241	22,529	6,712
2015	37,509	26,992	10,517
2016	44,237	36,173	8,065
Average	24,361	17,475	6,886
St. Dev.	12,643	10,402	3,673

Table A-58. Supporting Data for Figure 59. Guam Annual Estimated Commercial Landings: All Pelagics, Tuna PMUS, and Non-tuna PMUS

Year	All Pelagic	Tuna PMUS	Non Tuna PMUS
2005	228,936	66,804	150,770
2006	203,139	63,579	125,847
2007	266,964	72,271	178,660
2008	144,110	36,009	98,207
2009	129,800	43,760	86,040
2010	219,210	27,935	191,275
2011	145,750	36,939	100,868
2012	120,210	41,004	72,849
2013	147,084	33,456	110,388
2014	105,557	43,508	62,049
2015	106,590	63,786	42,794
2016	89,977	32,247	57,716
Average	150,123	43,197	102,901
St. Dev.	55,591	14,117	50,944

Table A-59. Supporting Data for Figure 60. Guam Estimated Number of Trolling Trips

Year	Estimated Total Trips	Non Charter	Charter
2007	6,390	4,515	1,875
2008	6,925	5,034	1,891
2009	10,014	8,488	1,526
2010	10,935	9,193	1,743
2011	8,309	7,240	1,068
2012	5,060	4,241	819
2013	8,100	7,182	918
2014	9,803	8,495	1,308
2015	9,223	8,000	1,223
2016	11,215	9,948	1,267
Average	8,597	7,234	1,364
St. Dev.	2,019	2,004	384

Table A-60. Supporting Data for Figure 61. Guam Estimated Number of Trolling Hours

Year	Estimated Hours	Non Charter	Charter
2005	25,744	19,958	5,786
2006	29,250	22,987	6,263
2007	27,619	21,930	5,689
2008	32,393	26,307	6,087
2009	51,145	45,890	5,255
2010	53,667	48,295	5,372
2011	44,871	41,763	3,108
2012	27,805	24,852	2,953
2013	42,438	39,554	2,885
2014	48,889	44,501	4,388
2015	62,568	55,600	6,968
2016	62,015	57,737	4,279
Average	45,341	40,643	4,698
St. Dev.	12,859	12,580	1,413

Table A-61. Supporting Data for Figure 62. Guam Estimated Trip Length

Year	Estimated Hours per Trip	Non Charter	Charter
2007	4.3	4.9	3.0
2008	4.7	5.2	3.2
2009	5.1	5.4	3.4
2010	4.9	5.3	3.1
2011	5.4	5.8	2.9
2012	5.5	5.9	3.6
2013	5.2	5.5	3.1
2014	5.0	5.2	3.4
2015	6.8	7.0	5.7
2016	5.5	5.8	3.4
Average	5.2	5.6	3.5
St. Dev.	0.66	0.58	0.81

Table A-62. Supporting Data for Figure 63. Guam Trolling Catch Rates (lbs per hour)

Year	All Troll Catch Rate	Non Charter	Charter
2005	11.5	11.8	10.2
2006	16.8	18.5	10.6
2007	19.8	21.3	13.7
2008	16.8	18.8	8.3
2009	14.1	14.5	10.4
2010	13.7	14.0	11.4
2011	13.0	13.4	8.1
2012	14.2	14.8	9.6
2013	19.2	19.4	17.1
2014	15.7	16.0	12.8
2015	15.4	16.2	8.8
2016	13.4	13.8	8.7
Average	15.5	16.2	10.9
St. Dev.	2.39	2.71	2.90

Table A-63. Supporting Data for Figure 64. Guam Trolling Catch Rates (lbs per hour): Skipjack

Year	Total Skipjack	Non Charter	Charter
2005	3.8	4.2	2.5
2006	5.0	5.5	3.3
2007	5.7	6.5	2.6
2008	9.1	10.8	2.2
2009	6.5	7.1	1.6
2010	6.3	6.8	1.7
2011	8.0	8.4	3.0
2012	8.8	9.7	1.8
2013	11.8	12.5	2.3
2014	8.2	8.8	2.2
2015	9.6	10.7	0.7
2016	7.0	7.5	1.2
Average	8.1	8.9	1.9
St. Dev.	1.83	2.00	0.68

Table A-64. Supporting Data for Figure 65. Guam Trolling Catch Rates (lbs per hour): Yellowfin

Year	Total Yellowfin Tuna	Non Charter	Charter
2005	1.0	1.2	0.3
2006	0.9	1.1	0.4
2007	1.7	2.0	0.5
2008	0.6	0.7	0.2
2009	0.9	1.0	0.2
2010	0.5	0.5	0.2
2011	1.6	1.7	0.3
2012	0.9	1.0	0.6
2013	1.2	1.3	0.0
2014	0.7	0.8	0.1
2015	1.8	2.0	0.1
2016	2.1	2.2	0.7
Average	1.2	1.3	0.3
St. Dev.	0.56	0.61	0.23

Table A-65. Supporting Data for Figure 66. Guam Trolling Catch Rates (lbs per hour): Mahimahi

Year	Total Mahimahi	Non Charter	Charter
2005	4.1	3.9	4.8
2006	5.6	6.1	3.7
2007	9.4	10.0	7.3
2008	3.4	3.7	2.1
2009	2.9	2.7	4.3
2010	5.2	5.0	6.8
2011	2.0	1.9	3.0
2012	2.8	2.6	4.5
2013	3.9	3.4	10.8
2014	3.9	3.6	7.0
2015	2.5	2.2	5.3
2016	2.8	2.7	3.6
Average	3.9	3.8	5.5
St. Dev.	2.14	2.36	2.56

Table A-66. Supporting Data for Figure 67. Guam Trolling Catch Rates (lbs per hour): Wahoo

Year	Total Wahoo	Non Charter	Charter
2005	1.7	1.6	2.0
2006	3.6	4.0	2.3
2007	1.6	1.4	2.3
2008	3.0	3.0	3.3
2009	2.6	2.6	1.7
2010	0.8	0.9	0.5
2011	0.8	0.8	1.4
2012	1.3	1.4	1.1
2013	1.3	1.3	1.6
2014	1.8	1.8	1.9
2015	0.5	0.4	1.1
2016	0.5	0.5	1.3
Average	1.4	1.4	1.6
St. Dev.	0.85	0.86	0.77

Table A-67. Supporting Data for Figure 68. Guam Trolling Catch Rates (lbs per hour): Blue Marlin

Year	Total Blue Marlin	Non Charter	Charter
2005	0.4	0.4	0.3
2006	1.0	1.0	1.0
2007	0.7	0.6	0.9
2008	0.3	0.3	0.5
2009	0.6	0.4	2.3
2010	0.6	0.4	2.1
2011	0.4	0.4	0.3
2012	0.2	0.0	1.6
2013	0.4	0.2	2.4
2014	0.6	0.5	1.5
2015	0.6	0.5	1.5
2016	0.7	0.6	1.9
Average	0.5	0.4	1.5
St. Dev.	0.17	0.19	0.73

Table A-68. Supporting Data for Figure 69. Guam Foreign Longline Transshipment Landings: Longliners Fishing Outside the Guam EEZ

Year	Transshipment Total	Bigeye Tuna	Yellowfin Tuna
2007	5,991	3,439	2,134
2008	4,215	2,926	1,014
2009	2,904	1,827	950
2010	1,898	988	715
2011	2,016	1,343	532
2012	2,342	1,637	492
2013	2,047	1,379	436
2014	2,290	1,855	292
2015	2,093	1,358	598
2016	1,159	601	498
Average	2,696	1,735	766
St. Dev.	1,404	858	530

TABLES FOR SECTION 2.4: HAWAI`I

Table A-69. Supporting Data for Figure 70. Hawai`i commercial tuna, billfish, other PMUS and PMUS shark catch, 2006-2016.

	Hawaii pelagic catch (1,000 pounds)					
Year	**Tunas**	**Billfish**	**Other PMUS**	**PMUS Sharks**	**non-PMUS**	**Total**
2006	15,696	5,559	4,589	285	49	26,178
2007	19,058	5,689	4,814	396	23	29,980
2008	19,306	7,136	4,892	390	36	31,760
2009	15,257	6,059	5,226	332	20	26,894
2010	17,450	5,363	5,343	244	33	28,433
2011	20,235	6,234	4,936	190	51	31,646
2012	21,104	5,109	5,682	181	26	32,102
2013	21,321	5,440	6,215	131	25	33,133
2014	21,317	6,721	6,932	129	18	35,116
2015	25,515	6,928	7,186	150	23	39,802
2016	25,096	5,708	6,151	168	24	37,146
Average	**20,123.2**	**5,995.1**	**5,633.3**	**235.9**	**29.8**	**32,017.2**
SD	**3,314.5**	**679.6**	**880.6**	**100.4**	**11.3**	**4,186.9**

Table A-70. Supporting Data for Figure 71. Total commercial pelagic catch by gear type, 2006-2016.

	Hawaii pelagic total catch (1,000 pounds)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
2006	19,008	2,328	2,590	818	502	932	26,178
2007	20,967	3,644	2,835	982	598	954	29,980
2008	22,456	4,301	2,971	701	326	1,005	31,760
2009	18,071	3,833	2,958	1,067	298	667	26,894
2010	20,075	3,614	2,855	933	614	342	28,433
2011	22,796	3,500	2,966	1,129	610	645	31,646
2012	22,975	2,814	3,690	1,602	562	459	32,102
2013	25,006	2,345	3,117	1,282	831	550	33,133
2014	26,615	3,255	3,486	1,161	416	182	35,116
2015	32,136	2,778	3,094	1,200	409	184	39,802
2016	31,547	1,854	2,535	773	366	70	37,146
Average	**23,786.7**	**3,115.1**	**3,008.9**	**1,059.0**	**503.0**	**544.6**	**32,017.2**
SD	**4,691.2**	**750.0**	**342.1**	**258.8**	**158.9**	**330.0**	**4,186.9**

Table A-71. Supporting Data for Figure 72. Hawai`i commercial tuna catch by gear type, 2006-2016.

	Hawaii tuna catch by gear type (1,000 pounds)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
2006	12,454	147	979	749	485	882	15,696
2007	15,130	148	1,382	930	579	889	19,058
2008	15,723	270	1,462	607	311	933	19,306
2009	11,794	156	1,417	970	286	634	15,257
2010	14,140	200	1,381	818	597	314	17,450
2011	16,250	209	1,509	1,061	602	604	20,235
2012	16,590	131	1,926	1,496	548	413	21,104
2013	17,019	82	1,745	1,166	810	499	21,321
2014	17,898	101	1,743	1,026	403	145	21,317
2015	22,255	123	1,473	1,106	400	157	25,515
2016	22,533	110	1,348	692	362	51	25,096
Average	**16,526.1**	**152.5**	**1,487.7**	**965.6**	**489.4**	**502.0**	**20,123.2**
SD	**3,440.6**	**54.8**	**251.1**	**250.6**	**156.0**	**316.3**	**3,314.5**

Table A-72. Supporting Data for Figure 73. Species composition of the tuna catch, 2006-2016.

	Hawaii tuna catch (1,000 pounds)						
Year	Bigeye tuna	Yellowfin tuna	Skipjack tuna	Albacore	Bluefin tuna	Other tunas	Total
2006	10,606	3,211	1,090	769	0	20	15,696
2007	13,729	3,541	1,015	758	0	15	19,058
2008	13,689	3,479	1,281	843	0	14	19,306
2009	10,683	2,788	1,099	667	0	20	15,257
2010	13,052	2,747	662	963	0	26	17,450
2011	13,496	3,877	1,105	1,734	0	23	20,235
2012	14,022	4,098	907	2,009	1	67	21,104
2013	15,699	3,698	1,109	803	1	11	21,321
2014	16,564	3,522	648	552	1	30	21,317
2015	20,009	4,068	722	679	0	36	25,515
2016	18,731	4,954	791	604	1	14	25,096
Average	**14,570.8**	**3,635.0**	**948.1**	**943.8**	**0.4**	**25.1**	**20,123.2**
SD	**2,969.9**	**627.5**	**214.0**	**476.4**	**0.5**	**15.8**	**3,314.5**

Table A-73. Supporting Data for Figure 74. Hawai`i bigeye tuna catch by gear type, 2006-2016.

	Hawaii bigeye tuna catch (1,000 pounds)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
2006	9,597	126	154	135	431	163	10,606
2007	12,567	115	140	188	535	184	13,729
2008	12,858	167	166	86	245	167	13,689
2009	10,067	96	130	70	239	81	10,683
2010	11,736	143	261	212	542	158	13,052
2011	12,315	106	243	140	515	177	13,496
2012	12,741	75	341	131	491	243	14,022
2013	14,240	45	326	147	719	222	15,699
2014	15,657	65	315	105	348	75	16,564
2015	19,248	99	129	74	373	87	20,009
2016	18,137	75	74	93	310	40	18,731
Average	**13,560.2**	**101.0**	**207.2**	**125.6**	**431.6**	**145.2**	**14,570.8**
SD	**3,051.1**	**35.8**	**93.1**	**45.7**	**146.0**	**65.2**	**2,969.9**

Table A-74. Supporting Data for Figure 75. Hawai`i yellowfin tuna catch by gear type, 2006-2016.

	Hawaii yellowfin tuna catch (1,000 pounds)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
2006	2,082	10	590	414	52	63	3,211
2007	1,835	13	1,032	517	42	102	3,541
2008	1,869	56	941	437	64	112	3,479
2009	1,014	28	964	656	46	80	2,788
2010	1,202	23	881	542	49	50	2,747
2011	2,009	38	970	704	84	72	3,877
2012	1,886	29	1,304	759	53	67	4,098
2013	1,582	22	1,078	894	82	40	3,698
2014	1,407	24	1,224	795	53	21	3,522
2015	2,012	17	1,095	878	25	41	4,068
2016	3,325	32	1,007	532	51	7	4,954
Average	**1,838.4**	**26.5**	**1,007.8**	**648.0**	**54.6**	**59.5**	**3,635.0**
SD	**605.6**	**12.7**	**186.0**	**170.8**	**16.9**	**32.1**	**627.5**

Table A-75. Supporting Data for Figure 76. Hawai`i skipjack tuna catch by gear type, 2006-2016.

	Hawaii skipjack tuna catch (1,000 pounds)					
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Other gear	Total
2006	206	0	221	11	652	1,090
2007	204	1	192	15	603	1,015
2008	264	2	344	20	651	1,281
2009	298	1	303	24	473	1,099
2010	332	1	211	14	104	662
2011	453	1	279	17	355	1,105
2012	541	1	240	20	105	907
2013	515	0	328	22	243	1,109
2014	411	0	172	15	51	648
2015	467	1	213	11	30	722
2016	522	0	255	10	4	791
Average	**383.0**	**0.8**	**250.7**	**16.3**	**297.4**	**948.1**
SD	**127.1**	**0.6**	**56.6**	**4.7**	**259.6**	**214.0**

Table A-76. Supporting Data for Figure 77. Hawai`i albacore catch by gear type, 2006-2016.

	Hawaii albacore catch (1,000 pounds)					
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Other gear**	**Total**
2006	569	11	2	187	0	769
2007	524	19	7	208	0	758
2008	732	45	3	62	1	843
2009	415	31	7	214	0	667
2010	870	33	4	48	8	963
2011	1,473	64	8	186	3	1,734
2012	1,421	26	7	554	1	2,009
2013	682	14	4	101	3	803
2014	423	12	7	108	2	552
2015	529	7	4	139	0	679
2016	548	2	2	51	0	604
Average	**744.1**	**24.0**	**5.0**	**169.0**	**1.7**	**943.8**
SD	**372.1**	**18.4**	**2.3**	**141.9**	**2.4**	**476.4**

Table A-77. Supporting Data for Figure 78. Hawai`i commercial billfish catch by gear type, 2006-2016.

	Hawaii billfish catch (1,000 lbs)						
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
2006	2,987	2,158	397	12	3	2	5,559
2007	1,948	3,409	315	14	1	2	5,689
2008	2,776	3,892	445	17	0	6	7,136
2009	2,087	3,552	404	14	0	2	6,059
2010	1,710	3,305	335	11	1	1	5,363
2011	2,549	3,176	486	15	1	7	6,234
2012	2,167	2,564	346	22	1	9	5,109
2013	2,895	2,177	334	18	5	10	5,440
2014	3,282	3,033	373	21	6	6	6,721
2015	3,898	2,539	462	16	4	9	6,928
2016	3,637	1,677	374	15	1	4	5,708
Average	**2,721.5**	**2,861.9**	**388.3**	**16.0**	**2.1**	**5.2**	**5,995.1**
SD	**707.3**	**687.3**	**56.5**	**3.4**	**2.0**	**3.3**	**679.6**

Table A-78. Supporting Data for Figure 79. Species composition of the billfish catch, 2006-2016.

	Hawaii billfish catch (1,000 lbs)					
Year	Swordfish	Blue marlin	Striped marlin	Spearfish	Other marlins	Total
2006	2,552	1,223	1,382	375	27	5,559
2007	3,846	834	638	339	32	5,689
2008	4,455	1,165	969	518	29	7,136
2009	4,019	1,159	591	261	29	6,059
2010	3,700	975	376	280	32	5,363
2011	3,569	1,247	835	543	40	6,234
2012	3,094	951	648	386	30	5,109
2013	2,816	1,190	898	497	39	5,440
2014	3,690	1,511	967	501	52	6,721
2015	3,356	1,804	1,112	605	50	6,928
2016	2,418	1,556	892	784	58	5,708
Average	**3,410.5**	**1,237.8**	**846.1**	**462.6**	**38.1**	**5,995.1**
SD	**633.8**	**287.2**	**275.9**	**154.5**	**10.9**	**679.6**

Table A-79. Supporting Data for Figure 80. Hawai`i swordfish catch by gear type, 2006-2016.

	Swordfish catch (1,000 lbs)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
2006	399	2,144	1	8	0	0	2,552
2007	476	3,357	1	12	0	0	3,846
2008	689	3,749	1	14	0	2	4,455
2009	554	3,451	1	12	0	1	4,019
2010	432	3,258	1	9	0	0	3,700
2011	456	3,100	1	11	0	1	3,569
2012	566	2,508	1	18	0	1	3,094
2013	677	2,120	1	14	1	2	2,816
2014	694	2,978	2	15	0	1	3,690
2015	843	2,500	2	11	0	1	3,356
2016	794	1,615	0	9	0	1	2,418
Average	**598.1**	**2,798.2**	**1.1**	**12.0**	**0.1**	**0.9**	**3,410.5**
SD	**150.7**	**666.2**	**0.5**	**3.0**	**0.2**	**0.8**	**633.8**

Table A-80. Supporting Data for Figure 81. Hawai`i blue marlin catch by gear type, 2006-2016.

	Blue marlin catch (1,000 lbs)						
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
2006	895	0	320	4	3	1	1,223
2007	545	21	263	2	1	2	834
2008	708	62	388	3	0	4	1,165
2009	749	45	362	2	0	1	1,159
2010	657	18	296	2	1	1	975
2011	797	27	414	4	1	4	1,247
2012	630	26	285	4	1	5	951
2013	879	17	282	4	3	6	1,190
2014	1,160	19	318	4	5	4	1,511
2015	1,380	12	399	5	3	6	1,804
2016	1,217	28	303	5	1	2	1,556
Average	**874.2**	**25.0**	**329.9**	**3.6**	**1.7**	**3.3**	**1,237.8**
SD	**268.3**	**16.5**	**52.1**	**1.1**	**1.6**	**1.9**	**287.2**

Table A-81. Supporting Data for Figure 82. Hawai`i striped marlin catch by gear type, 2006-2016.

	Striped marlin catch (1,000 lbs)						
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
2006	1,320	14	47	0	0	1	1,382
2007	581	29	28	0	0	0	638
2008	866	76	27	0	0	0	969
2009	516	53	22	0	0	0	591
2010	338	26	12	0	0	0	376
2011	756	43	35	0	0	1	835
2012	596	25	25	0	0	2	648
2013	843	35	18	0	0	1	898
2014	908	31	27	1	0	0	967
2015	1,064	24	23	0	0	1	1,112
2016	836	29	26	1	0	0	892
Average	**784.0**	**34.9**	**26.4**	**0.1**	**0.1**	**0.6**	**846.1**
SD	**272.4**	**17.1**	**9.0**	**0.3**	**0.2**	**0.7**	**275.9**

Table A-82. Supporting Data for Figure 83. Hawai`i commercial catch of other PMUS by gear type, 2006-2016.

	Catch of other PMUS by gear type (1,000 lbs)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
2006	3,520	23	1,212	57	14	48	4,874
2007	3,870	87	1,136	37	18	62	5,210
2008	3,924	139	1,061	77	15	66	5,282
2009	4,173	125	1,135	82	12	31	5,558
2010	4,199	109	1,135	102	16	26	5,587
2011	3,952	115	967	52	7	33	5,126
2012	4,198	119	1,413	83	13	37	5,863
2013	5,071	86	1,036	97	16	40	6,346
2014	5,421	121	1,367	114	7	30	7,061
2015	5,964	116	1,155	78	4	18	7,336
2016	5,358	68	810	66	3	16	6,319
Average	**4,513.7**	**100.7**	**1,129.7**	**76.8**	**11.4**	**37.0**	**5,869.2**
SD	**795.7**	**32.9**	**169.3**	**22.8**	**5.2**	**16.2**	**806.1**

Table A-83. Supporting Data for Figure 84. Species composition of other PMUS catch, 2006-2016.

	Catch of other PMUS by species (1,000 lbs)						
Year	Mahimahi	Oilfish	Ono	Moonfish	Pomfret	PMUS shark	Total
2006	1,531	391	1,002	1,080	585	285	4,874
2007	1,692	425	857	1,225	615	396	5,210
2008	1,443	455	975	1,338	681	390	5,282
2009	1,473	498	748	1,897	610	332	5,558
2010	1,703	521	758	1,781	580	244	5,587
2011	1,628	589	675	1,622	422	190	5,126
2012	2,007	563	809	1,593	710	181	5,863
2013	1,588	580	883	2,073	1,091	131	6,346
2014	1,819	516	1,176	2,242	1,179	129	7,061
2015	1,495	528	1,223	2,662	1,278	150	7,336
2016	1,216	481	1,208	2,164	1,083	168	6,319
Average	**1,599.5**	**504.2**	**937.7**	**1,788.7**	**803.2**	**235.9**	**5,869.2**
SD	**209.3**	**62.8**	**195.0**	**478.5**	**294.6**	**100.4**	**806.1**

Table A-84. Supporting Data for Figure 85. Hawai`i moonfish catch by gear type, 2006-2016.

Year	Moonfish catch (1,000 lbs) Deep-set longline	Shallow-set longline	Other gear	Total
2006	1,078	2	0	1,080
2007	1,222	3	0	1,225
2008	1,332	6	0	1,338
2009	1,891	6	0	1,897
2010	1,772	9	0	1,781
2011	1,616	6	0	1,622
2012	1,574	17	2	1,593
2013	2,063	10	0	2,073
2014	2,213	28	0	2,242
2015	2,622	39	1	2,661
2016	2,145	19	0	2,164
Average	**1,775.2**	**13.2**	**0.2**	**1,788.7**
SD	**468.5**	**11.7**	**0.6**	**478.4**

Table A-85. Supporting Data for Figure 86. Hawai`i mahimahi catch by gear type, 2006-2016.

Year	Mahimahi catch (1,000 lbs) Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
2006	714	6	754	38	8	11	1,531
2007	951	26	681	21	6	7	1,692
2008	765	62	560	32	9	15	1,443
2009	686	40	696	35	7	9	1,473
2010	934	31	671	41	14	12	1,703
2011	860	60	656	30	6	16	1,628
2012	889	46	988	53	12	19	2,007
2013	846	43	639	37	12	11	1,588
2014	810	45	901	52	5	7	1,819
2015	692	30	734	27	2	9	1,495
2016	636	17	540	19	0	3	1,216
Average	**798.5**	**36.8**	**710.9**	**35.0**	**7.5**	**10.9**	**1,599.5**
SD	**107.0**	**17.0**	**133.4**	**11.1**	**4.1**	**4.6**	**209.3**

Table A-86. Supporting Data for Figure 87. Hawai`i ono (wahoo) catch by gear type, 2006-2016.

	Ono catch (1,000 lbs)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
2006	512	0	457	10	2	21	1,002
2007	380	3	454	7	1	12	857
2008	448	5	500	11	1	10	975
2009	292	2	438	12	1	3	748
2010	277	3	463	11	1	3	758
2011	352	1	309	9	1	3	675
2012	366	1	424	15	1	2	809
2013	464	1	396	16	2	4	883
2014	684	2	465	20	1	5	1,176
2015	781	1	421	17	1	3	1,223
2016	925	1	268	11	0	2	1,208
Average	**498.2**	**1.8**	**417.7**	**12.6**	**1.1**	**6.2**	**937.7**
SD	**210.8**	**1.4**	**70.0**	**3.8**	**0.5**	**5.9**	**195.0**

Table A-87. Supporting Data for Figure 88. Hawai`i pomfret catch by gear type, 2006-2016.

	Pomfret catch (1,000 lbs)					
Year	Deep-set longline	Shallow-set longline	MHI handline	Offshore handline	Other gear	Total
2006	558	2	8	3	14	585
2007	568	2	6	10	29	615
2008	616	1	31	3	30	681
2009	559	1	32	4	14	610
2010	525	1	43	1	10	580
2011	398	1	11	0	12	422
2012	682	5	11	0	12	710
2013	1,027	1	41	2	20	1,091
2014	1,118	2	41	1	18	1,179
2015	1,242	1	31	1	4	1,278
2016	1,038	0	34	2	10	1,083
Average	**757.3**	**1.6**	**26.3**	**2.3**	**15.6**	**803.2**
SD	**289.8**	**1.3**	**14.4**	**2.9**	**8.1**	**294.6**

Table A-88. Supporting Data for Figure 89. Hawai`i PMUS shark catch by gear type, 2006-2016.

	PMUS shark catch (1,000 lbs)			
Year	**Deep-set longline**	**Shallow-set longline**	**Non-longline**	**Total**
2006	276	6	3	285
2007	368	20	8	396
2008	356	28	6	390
2009	294	33	5	332
2010	210	28	6	244
2011	171	14	5	190
2012	150	26	5	181
2013	112	15	4	131
2014	106	20	3	129
2015	120	25	4	150
2016	140	24	4	168
Average	**209.4**	**21.8**	**4.8**	**235.9**
SD	**98.1**	**7.7**	**1.5**	**100.4**

Table A-89. Supporting Data for Figure 90. Number of Hawai`i-permitted deep-set longline vessels and trips, 2006-2016.

	Deep-set longline		
Year	**Vessels**	**Trips**	**Sets**
2006	128	1,392	16,450
2007	130	1,430	17,796
2008	128	1,384	17,839
2009	128	1,257	16,762
2010	123	1,211	16,065
2011	130	1,311	17,166
2012	129	1,364	18,101
2013	136	1,386	18,732
2014	140	1,355	17,756
2015	143	1,452	18,519
2016	142	1,479	19,378
Average	**132.5**	**1,365.5**	**17,687.6**
SD	**6.7**	**80.4**	**1007.1**

Table A-90. Supporting Data for Figure 91. Number of hooks set by the Hawai`i-permitted deep-set longline fishery, 2006-2016.

	Number of deep-set hooks by area (milions)				
Year	Outside EEZ	MHI EEZ	NWHI EEZ	PRIA EEZ	Total
2006	17.5	10.7	4.6	1.7	34.6
2007	22.6	11.0	2.9	2.4	38.8
2008	23.1	10.2	5.4	1.3	40.0
2009	24.3	8.5	3.7	1.1	37.7
2010	28.0	5.4	2.4	1.4	37.2
2011	26.3	8.2	5.4	0.9	40.8
2012	28.3	8.9	5.1	1.9	44.1
2013	32.8	8.7	4.1	1.2	46.8
2014	34.1	7.9	2.9	0.8	45.7
2015	33.0	11.2	3.1	0.3	47.6
2016	38.5	10.7	1.8	0.1	51.1
Average	**28.04**	**9.21**	**3.77**	**1.19**	**42.22**
SD	**6.13**	**1.75**	**1.26**	**0.66**	**5.17**

Table A-91. Supporting Data for Figure 92. Catch and revenue for the Hawai`i-permitted deep-set longline fishery, 2006-2016.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
2006	19,008	$62,529	$49,354	209.4
2007	20,967	$67,879	$56,161	219.5
2008	22,456	$76,126	$65,681	228.9
2009	18,071	$59,513	$51,594	230.0
2010	20,075	$71,185	$63,028	234.9
2011	22,796	$77,485	$71,147	243.6
2012	22,975	$91,999	$86,520	249.5
2013	25,006	$88,151	$84,376	253.9
2014	26,615	$80,966	$78,617	257.6
2015	32,136	$93,024	$91,229	260.2
2016	31,547	$99,096	$99,096	265.3
Average	**23,786.7**	**78,904.7**	**72,436.8**	
SD	**4,691.2**	**13,051.2**	**16,765.8**	

Table A-92. Supporting Data for Figure 93. Tuna CPUE for the Hawai`i-permitted deep-set longline fishery, 2006-2016.

	Deep-set longline CPUE (fish per 1,000 hooks)		
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**
2006	3.4	0.9	0.4
2007	4.1	0.7	0.3
2008	3.8	0.9	0.4
2009	3.2	0.4	0.2
2010	3.7	0.4	0.5
2011	3.9	0.8	0.8
2012	3.7	0.6	0.7
2013	4.1	0.4	0.3
2014	4.8	0.4	0.2
2015	4.8	0.6	0.2
2016	4.3	0.9	0.2
Average	**3.97**	**0.63**	**0.37**
SD	**0.52**	**0.22**	**0.20**

Table A-93. Supporting Data for Figure 94. Billfish CPUE for the Hawai`i-permitted deep-set longline fishery, 2006-2016.

	Deep-set longline CPUE (fish per 1,000 hooks)		
Year	**Swordfish**	**Striped marlin**	**Blue marlin**
2006	0.1	0.6	0.2
2007	0.1	0.2	0.1
2008	0.1	0.3	0.1
2009	0.1	0.2	0.1
2010	0.1	0.1	0.1
2011	0.1	0.4	0.1
2012	0.1	0.2	0.1
2013	0.1	0.3	0.1
2014	0.1	0.3	0.1
2015	0.1	0.3	0.2
2016	0.1	0.2	0.1
Average	**0.09**	**0.29**	**0.11**
SD	**0.01**	**0.13**	**0.03**

Table A-94. Supporting Data for Figure 95. Blue shark CPUE for the Hawai`i-permitted deep-set longline fishery, 2006-2016.

	Deep-set CPUE (fish per 1000 hooks)
Year	**Blue shark**
2006	1.4
2007	1.3
2008	1.0
2009	1.1
2010	1.1
2011	1.2
2012	1.0
2013	1.0
2014	1.2
2015	1.4
2016	1.4
Average	**1.20**
SD	**0.16**

Table A-95. Supporting Data for Figure 96. Number of Hawai`i-permitted shallow-set longline vessels and trips, 2006-2016.

	Shallow-set longline		
Year	**Vessels**	**Trips**	**Sets**
2006	35	57	848
2007	28	88	1,569
2008	27	92	1,595
2009	28	112	1,762
2010	28	114	1,871
2011	20	82	1,447
2012	18	83	1,352
2013	15	58	961
2014	20	81	1,329
2015	22	69	1,130
2016	13	46	727
Average	**23.1**	**80.2**	**1,326.5**
SD	**6.7**	**21.7**	**373.2**

Table A-96. Supporting Data for Figure 97. Number of hooks set by the Hawai`i-permitted shallow-set longline fishery, 2006-2016.

	Number of hooks set by area (milions)				
Year	**Outside EEZ**	**MHI EEZ**	**NWHI EEZ**	**PRIA EEZ**	**Total**
2006	0.7	0.0	0.0	0.0	0.7
2007	1.2	0.1	0.1	0.0	1.4
2008	1.3	0.0	0.2	0.0	1.5
2009	1.4	0.2	0.2	0.0	1.7
2010	1.4	0.2	0.3	0.0	1.8
2011	1.2	0.1	0.2	0.0	1.5
2012	1.2	0.0	0.2	0.0	1.4
2013	0.9	0.0	0.1	0.0	1.1
2014	1.3	0.0	0.1	0.0	1.5
2015	1.1	0.1	0.1	0.0	1.3
2016	0.7	0.0	0.1	0.0	0.8
Average	**1.12**	**0.07**	**0.14**	**0.00**	**1.33**
SD	**0.25**	**0.06**	**0.07**	**0.00**	**0.36**

Table A-97. Supporting Data for Figure 98. Catch and revenue for the Hawai`i-permitted shallow-set longline fishery, 2006-2016.

Year	**Catch (1,000 lbs)**	**Adjusted revenue ($1,000)**	**Nominal revenue ($1,000)**	**Honolulu CPI**
2006	2,328	$5,049	$3,985	209.4
2007	3,644	$8,544	$7,069	219.5
2008	4,301	$7,951	$6,860	228.9
2009	3,833	$7,847	$6,803	230.0
2010	3,614	$7,510	$6,649	234.9
2011	3,500	$6,628	$6,086	243.6
2012	2,814	$6,182	$5,814	249.5
2013	2,345	$3,322	$3,180	253.9
2014	3,255	$4,196	$4,074	257.6
2015	2,778	$2,865	$2,810	260.2
2016	1,854	$2,486	$2,486	265.3
Average	**3,115.1**	**5,689.0**	**5,074.1**	
SD	**750.0**	**2,210.0**	**1,783.5**	

Table A-98. Supporting Data for Figure 99. Tuna CPUE for the Hawai`i-permitted shallow-set longline fishery, 2006-2016.

	Shallow-set longline CPUE (fish per 1,000 hooks)		
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**
2006	1.7	0.2	0.6
2007	1.0	0.1	1.0
2008	1.0	0.3	2.0
2009	0.5	0.1	0.9
2010	0.9	0.1	1.0
2011	0.7	0.2	2.0
2012	0.6	0.2	0.8
2013	0.4	0.2	0.5
2014	0.6	0.1	0.5
2015	1.1	0.1	0.2
2016	1.2	0.4	0.1
Average	**0.88**	**0.19**	**0.87**
SD	**0.37**	**0.09**	**0.63**

Table A-99. Supporting Data for Figure 100. Billfish CPUE for the Hawai`i-permitted shallow-set longline fishery, 2006-2016.

	Shallow-set longline CPUE (fish per 1,000 hooks)		
Year	**Swordfish**	**Striped marlin**	**Blue marlin**
2006	19.1	0.2	0.0
2007	15.2	0.2	0.0
2008	13.6	0.6	0.2
2009	10.8	0.4	0.1
2010	9.3	0.1	0.0
2011	11.0	0.4	0.1
2012	9.8	0.2	0.1
2013	10.1	0.4	0.1
2014	10.4	0.3	0.1
2015	11.9	0.2	0.0
2016	12.4	0.4	0.1
Average	**12.14**	**0.30**	**0.08**
SD	**2.88**	**0.14**	**0.06**

Table A-100. Supporting Data for Figure 101. Blue shark CPUE for the Hawai`i-permitted shallow-set longline fishery, 2006-2016.

	Shallow-set CPUE (fish per 1000 hooks)
Year	**Blue shark**
2006	13.5
2007	11.3
2008	8.4
2009	4.8
2010	9.3
2011	5.3
2012	4.2
2013	4.9
2014	6.8
2015	10.0
2016	13.8
Average	**8.38**
SD	**3.49**

Table A-101. Supporting Data for Figure 102. Number of MHI troll fishers and days fished, 2006-2016.

Year	Fishers	Days fished
2006	1,402	29,080
2007	1,462	29,271
2008	1,546	29,938
2009	1,668	29,553
2010	1,569	29,298
2011	1,602	29,073
2012	1,698	30,232
2013	1,661	26,658
2014	1,649	26,884
2015	1,576	25,125
2016	1,401	21,956
Average	**1,566.7**	**27,915.3**
SD	**105.1**	**2,540.3**

Table A-102. Supporting Data for Figure 103. Catch and revenue for the MHI troll fishery, 2006-2016.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
2006	2,590	$6,155	$4,858	209.4
2007	2,835	$6,545	$5,415	219.5
2008	2,971	$6,324	$5,456	228.9
2009	2,958	$5,802	$5,030	230.0
2010	2,855	$6,110	$5,410	234.9
2011	2,966	$6,280	$5,766	243.6
2012	3,690	$9,138	$8,594	249.5
2013	3,117	$7,679	$7,350	253.9
2014	3,486	$8,618	$8,368	257.6
2015	3,094	$7,916	$7,763	260.2
2016	2,535	$7,540	$7,540	265.3
Average	**3,008.9**	**$7,100.6**	**$6,504.6**	
SD	**342.1**	**$1,131.2**	**$1,418.7**	

Table A-103. Supporting Data for Figure 104. Tuna CPUE for the MHI troll fishery, 2006-2016.

MHI troll tuna CPUE (pounds per day fished)		
Year	**Yellowfin tuna**	**Skipjack tuna**
2006	20.3	7.6
2007	35.3	6.6
2008	31.4	11.5
2009	32.6	10.2
2010	30.0	7.2
2011	33.5	9.6
2012	43.5	8.0
2013	40.4	12.3
2014	45.5	6.4
2015	43.6	8.5
2016	45.9	11.6
Average	**36.55**	**9.05**
SD	**8.00**	**2.11**

MHI troll tuna CPUE (pounds per hour fished)		
Year	**Yellowfin tuna**	**Skipjack tuna**
2006	3.5	1.3
2007	5.9	1.1
2008	5.4	2.0
2009	5.5	1.7
2010	5.0	1.2
2011	5.5	1.6
2012	7.0	1.3
2013	6.4	2.0
2014	7.2	1.0
2015	7.0	1.4
2016	7.4	1.9
Average	**5.98**	**1.50**
SD	**1.17**	**0.36**

Table A-104. Supporting Data for Figure 105. Marlin CPUE for the MHI troll fishery, 2006-2016.

MHI troll marlin CPUE (pounds per day fished)		
Year	Blue marlin	Striped marlin
2006	11.0	1.6
2007	9.0	1.0
2008	13.0	0.9
2009	12.3	0.7
2010	10.0	0.4
2011	14.3	1.2
2012	9.5	0.8
2013	10.6	0.7
2014	11.9	1.0
2015	15.8	0.9
2016	13.8	1.2
Average	11.93	0.95
SD	2.15	0.32

MHI troll marlin CPUE (pounds per hour fished)		
Year	Blue marlin	Striped marlin
2006	1.9	0.3
2007	1.5	0.2
2008	2.2	0.2
2009	2.1	0.1
2010	1.7	0.1
2011	2.4	0.2
2012	1.5	0.1
2013	1.7	0.1
2014	1.9	0.2
2015	2.6	0.1
2016	2.2	0.2
Average	1.97	0.16
SD	0.35	0.06

Table A-105. Supporting Data for Figure 106. Mahimahi and Ono CPUE for the MHI troll fishery, 2006-2016.

MHI troll mahimahi and ono CPUE (pounds per day fished)		
Year	Mahimahi	Ono (wahoo)
2006	25.9	15.7
2007	23.3	15.5
2008	18.7	16.7
2009	23.6	14.8
2010	22.9	15.8
2011	22.8	10.7
2012	33.0	14.2
2013	24.0	14.9
2014	33.5	17.3
2015	29.2	16.7
2016	24.6	12.2
Average	25.59	14.95
SD	4.54	1.99

MHI troll mahimahi and ono CPUE (pounds per hour fished)		
Year	Mahimahi	Ono (wahoo)
2006	4.4	2.7
2007	3.9	2.6
2008	3.2	2.9
2009	4.0	2.5
2010	3.8	2.7
2011	3.8	1.8
2012	5.3	2.3
2013	3.8	2.4
2014	5.3	2.7
2015	4.7	2.7
2016	4.0	2.0
Average	4.20	2.47
SD	0.66	0.34

Table A-106. Supporting Data for Figure 107. Number of MHI handline fishers and days fished, 2006-2016.

Year	Fishers	Days fished
2006	374	3,579
2007	420	3,592
2008	466	4,030
2009	543	5,049
2010	471	4,215
2011	495	5,141
2012	565	6,437
2013	523	5,258
2014	495	4,933
2015	472	4,702
2016	417	3,796
Average	**476.5**	**4,612.0**
SD	**57.0**	**871.8**

Table A-107. Supporting Data for Figure 108. Catch and revenue for the MHI handline fishery, 2006-2016.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
2006	818	$1,722	$1,359	209.4
2007	982	$1,902	$1,574	219.5
2008	701	$1,640	$1,415	228.9
2009	1,067	$2,019	$1,750	230.0
2010	933	$2,153	$1,906	234.9
2011	1,129	$2,322	$2,132	243.6
2012	1,602	$3,574	$3,361	249.5
2013	1,282	$3,516	$3,366	253.9
2014	1,161	$3,028	$2,940	257.6
2015	1,200	$2,953	$2,896	260.2
2016	773	$2,419	$2,419	265.3
Average	**1,059.0**	**$2,477.1**	**$2,283.5**	
SD	**258.8**	**$689.7**	**$756.3**	

Table A-108. Supporting Data for Figure 109. Tuna CPUE for the MHI handline fishery, 2006-2016.

	MHI handline CPUE (pounds per day fished)			
Year	**Yellowfin tuna**	**Albacore**	**Bigeye tuna**	**Total**
2006	115.5	48.3	37.7	201.5
2007	144.3	50.9	52.4	247.6
2008	108.7	13.7	21.1	143.5
2009	130.0	42.4	13.9	186.3
2010	128.7	11.0	50.7	190.4
2011	137.1	35.9	27.3	200.3
2012	121.8	86.5	21.9	230.2
2013	169.9	19.2	27.9	217.0
2014	161.2	21.9	21.2	204.3
2015	186.8	29.7	15.8	232.3
2016	140.2	13.6	24.5	178.3
Average	**140.38**	**33.92**	**28.58**	**202.88**
SD	**23.87**	**22.50**	**13.01**	**28.95**

	MHI handline CPUE (pounds per hour fished)			
Year	**Yellowfin tuna**	**Albacore**	**Bigeye tuna**	**Total**
2006	17.3	7.2	5.6	30.1
2007	22.5	7.9	8.2	38.6
2008	17.1	2.2	3.3	22.6
2009	19.7	6.4	2.1	28.2
2010	19.1	1.6	7.5	28.2
2011	19.8	5.2	4.0	29.0
2012	17.4	12.3	3.1	32.8
2013	24.0	2.7	3.9	30.6
2014	22.8	3.1	3.0	28.9
2015	28.0	4.4	2.4	34.8
2016	21.1	2.0	3.7	26.8
Average	**20.80**	**5.00**	**4.25**	**30.05**
SD	**3.34**	**3.26**	**2.01**	**4.23**

Table A-109. Supporting Data for Figure 110. Number of offshore handline fishers and days fished, 2006-2016.

Year	**Fishers**	**Days fished**
2006	9	159
2007	10	176
2008	9	171
2009	9	192
2010	14	449
2011	13	363
2012	15	362
2013	15	540
2014	9	292
2015	9	256
2016	6	175
Average	**10.7**	**285.0**
SD	**3.0**	**129.0**

Table A-110. Supporting Data for Figure 111. Catch and revenue for the offshore tuna handline fishery, 2006-2016.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
2006	502	$646	$510	209.4
2007	598	$968	$801	219.5
2008	326	$663	$572	228.9
2009	298	$453	$393	230.0
2010	614	$1,389	$1,230	234.9
2011	610	$908	$834	243.6
2012	562	$1,163	$1,094	249.5
2013	831	$1,878	$1,798	253.9
2014	416	$801	$778	257.6
2015	409	$828	$812	260.2
2016	366	$1,065	$1,065	265.3
Average	**503.0**	**$978.6**	**$898.9**	
SD	**158.9**	**$395.6**	**$391.6**	

Table A-111. Supporting Data for Figure 112. Tuna CPUE for the offshore tuna handline fishery, 2006-2016.

	Offshore handline CPUE (pounds per trip)			
Year	**Bigeye tuna**	**Yellowfin tuna**	**Mahimahi**	**Total**
2006	2,711	327	50	3,088
2007	3,040	239	34	3,313
2008	1,433	374	53	1,860
2009	1,245	240	36	1,521
2010	1,207	109	31	1,347
2011	1,419	231	17	1,667
2012	1,356	146	33	1,536
2013	1,331	152	22	1,505
2014	1,191	180	19	1,389
2015	1,456	98	10	1,564
2016	1,774	294	3	2,070
Average	**1,651.1**	**217.3**	**27.9**	**1,896.3**
SD	**630.0**	**89.6**	**15.7**	**678.4**

TABLES FOR SECTION 3.1: HUMAN DIMENSIONS

American Samoa

This section includes the data used to generate figures in this section.

Table 90. Data for Figure 130. American Samoa Employment Estimates, 2005-2015. Data from American Samoa Statistical Yearbook 2015, American Samoa Government (2015).

Labor force status	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Employment	17,344	17,395	17,047	16,990	14,108	18,862	18,028	14,806	16,089	17,565	17,853
Total Government	6,064	5,894	6,052	6,035	6,004	6,782	6,177	5,258	6,198	6,556	6,804
Canneries	4,546	4,757	4,633	4,861	1,562	1,553	1,815	1,827	2,108	2,500	2,759
Other/Private Sector	6,734	6,744	6,362	6,094	6,542	10,527	10,036	7,721	7,783	8,509	8,290

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APPENDIX B: LIST OF PROTECTED SPECIES AND DESIGNATED CRITICAL HABITAT

Table B-91. Protected species found or reasonably believed to be found near or in Hawai`i shallow-set longline waters.

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Seabirds					
Laysan Albatross	*Phoebastria immutabilis*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Black-Footed Albatross	*Phoebastria nigripes*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Short-Tailed Albatross	*Phoebastria albatrus*	Endangered	N/A	Breeding visitor in the NWHI	35 FR 8495, 65 FR 46643, Pyle & Pyle 2009
Northern Fulmar	*Fulmarus glacialis*	Not Listed	N/A	Winter resident	Pyle & Pyle 2009
Kermadec Petrel	*Pterodroma neglecta*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Herald Petrel	*Pterodroma arminjoniana*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Murphy's Petrel	*Pterodroma ultima*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Mottled Petrel	*Pterodroma inexpectata*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Juan Fernandez Petrel	*Pterodroma externa*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Hawaiian Petrel	*Pterodroma sandwichensis (Pterodroma phaeopygia sandwichensis)*	Endangered	N/A	Breeding visitor in the MHI	32 FR 4001, Pyle & Pyle 2009
White-Necked Petrel	*Pterodroma cervicalis*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Bonin Petrel	*Pterodroma hypoleuca*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
Black-Winged Petrel	*Pterodroma nigripennis*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Cook Petrel	*Pterodroma cookii*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Stejneger Petrel	*Pterodroma longirostris*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Pycroft Petrel	*Pterodroma pycrofti*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Bulwer Petrel	*Bulweria bulwerii*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Flesh-Footed Shearwater	*Ardenna carneipes*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Wedge-Tailed Shearwater	*Ardenna pacifica*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Buller's Shearwater	*Ardenna bulleri*	Not Listed	N/A	Migrant	Pyle & Pyle 2009

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Sooty Shearwater	*Ardenna grisea*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Short-Tailed Shearwater	*Ardenna tenuirostris*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Christmas Shearwater	*Puffinus nativitatis*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Newell's Shearwater	*Puffinus newelli (Puffinus auricularis newelli)*	Threatened	N/A	Breeding visitor	40 FR 44149, Pyle & Pyle 2009
Wilson's Storm-Petrel	*Oceanites oceanicus*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	Not Listed	N/A	Winter resident	Pyle & Pyle 2009
Band-Rumped Storm-Petrel	*Oceanodroma castro*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Tristram Storm-Petrel	*Oceanodroma tristrami*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
White-Tailed Tropicbird	*Phaethon lepturus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Red-Tailed Tropicbird	*Phaethon rubricauda*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Masked Booby	*Sula dactylatra*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Brown Booby	*Sula leucogaster*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Red-Footed Booby	*Sula sula*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Great Frigatebird	*Fregata minor*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Lesser Frigatebird	*Fregata ariel*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Laughing Gull	*Leucophaeus atricilla*	Not Listed	N/A	Winter resident in the MHI	Pyle & Pyle 2009
Franklin Gull	*Leucophaeus pipixcan*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Ring-Billed Gull	*Larus delawarensis*	Not Listed	N/A	Winter resident in the MHI	Pyle & Pyle 2009
Herring Gull	*Larus argentatus*	Not Listed	N/A	Winter resident in the NWHI	Pyle & Pyle 2009
Slaty-Backed Gull	*Larus schistisagus*	Not Listed	N/A	Winter resident in the NWHI	Pyle & Pyle 2009
Glaucous-Winged Gull	*Larus glaucescens*	Not Listed	N/A	Winter resident	Pyle & Pyle 2009
Brown Noddy	*Anous stolidus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Black Noddy	*Anous minutus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Blue-Gray Noddy	*Procelsterna cerulea*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
White Tern	*Gygis alba*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Sooty Tern	*Onychoprion fuscatus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Gray-Backed Tern	*Onychoprion lunatus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Little Tern	*Sternula albifrons*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
Least Tern	*Sternula antillarum*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
Arctic Tern	*Sterna paradisaea*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
South Polar Skua	*Stercorarius maccormicki*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Pomarine Jaeger	*Stercorarius pomarinus*	Not Listed	N/A	Winter resident in the MHI	Pyle & Pyle 2009
Parasitic Jaeger	*Stercorarius parasiticus*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Long-Tailed Jaeger	*Stercorarius longicaudus*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Sea turtles					
Green Sea Turtle	*Chelonia mydas*	Threatened (Central North Pacific DPS)	N/A	Most common turtle in the Hawaiian Islands, much more common in nearshore state waters (foraging grounds) than offshore federal waters. Most nesting occurs on French Frigate Shoals in the NWHI. Foraging and haulout in the MHI.	43 FR 32800, 81 FR 20057, Balazs et al. 1992, Kolinski et al. 2001
Green Sea Turtle	*Chelonia mydas*	Threatened (East Pacific DPS)	N/A	Nest primarily in Mexico and the Galapagos Islands. Little known about their pelagic range west of 90°W, but may range as far as the Marshall Islands. Genetic testing confirmed that they are incidentally taken in the HI DSLL fishery.	43 FR 32800, 81 FR 20057, WPRFMC 2009, Cliffton et al. 1982, Karl & Bowen 1999
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered[a]	N/A	Small population foraging around Hawai`i and low level nesting on Maui and Hawai`i Islands. Occur worldwide in tropical and subtropical waters.	35 FR 8491, NMFS & USFWS 2007, Balazs et al. 1992, Katahira et al. 1994
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered[a]	N/A	Regularly sighted in offshore waters, especially at the southeastern end of the archipelago.	35 FR 8491, NMFS & USFWS 1997

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Loggerhead Sea Turtle	*Caretta caretta*	Endangered (North Pacific DPS)	N/A	Rare in Hawai`i. Found worldwide along continental shelves, bays, estuaries and lagoons of tropical, subtropical, and temperate waters.	43 FR 32800, 76 FR 58868, Dodd 1990, Balazs 1979
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	Threatened (Entire species, except for the breeding population on the Pacific coast of Mexico, which is listed as endangered)	N/A	Rare in Hawai`i. Occurs worldwide in tropical and warm temperate ocean waters.	43 FR 32800, Pitman 1990, Balacz 1982
Marine mammals					
Blainville's Beaked Whale	*Mesoplodon densirostris*	Not Listed	Non-strategic	Found worldwide in tropical and temperate waters	Mead 1989
Blue Whale	*Balaenoptera musculus*	Endangered	Strategic	Acoustically recorded off of Oahu and Midway Atoll, small number of sightings around Hawai`i. Considered extremely rare, generally occur in winter and summer.	35 FR 18319, Bradford et al. 2013, Northrop et al. 1971, Thompson & Friedl 1982, Stafford et al. 2001
Bottlenose Dolphin	*Tursiops truncatus*	Not Listed	Non-strategic	Distributed worldwide in tropical and warm-temperate waters. Pelagic stock distinct from island-associated stocks.	Perrin et al. 2009, Martien et al. 2012
Bryde's Whale	*Balaenoptera edeni*	Not Listed	Unknown	Distributed widely across tropical and warm-temperate Pacific Ocean.	Leatherwood et al. 1982
Common Dolphin	*Delphinus delphis*	Not Listed	N/A	Found worldwide in temperate and subtropical seas.	Perrin et al. 2009
Cuvier's Beaked Whale	*Ziphius cavirostris*	Not Listed	Non-strategic	Occur year round in Hawaiian waters.	McSweeney et al. 2007
Dall's Porpoise	*Phocoenoides dalli*	Not Listed	Non-strategic	Range across the entire north Pacific Ocean.	Hall 1979
Dwarf Sperm Whale	*Kogia sima*	Not Listed	Non-strategic	Most common in waters between 500 m and 1,000 m in depth. Found worldwide in tropical and warm-temperate waters.	Nagorsen 1985, Baird et al. 2013

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
False Killer Whale	*Pseudorca crassidens*	Not Listed	Non-strategic	Found worldwide in tropical and warm-temperate waters. Pelagic stock tracked to within 11 km of Hawaiian islands.	Stacey et al. 1994, Baird et al. 2012, Bradford et al. 2015
Fin Whale	*Balaenoptera physalus*	Endangered	Strategic	Infrequent sightings in Hawai`i waters. Considered rare in Hawai`i, though may migrate into Hawaiian waters during fall/winter based on acoustic recordings.	35 FR 18319, Hamilton et al. 2009, Thompson & Friedl 1982
Fraser's Dolphin	*Lagenodelphis hosei*	Not Listed	Non-strategic	Found worldwide in tropical waters.	Perrin et al. 2009
Guadalupe Fur Seal	*Arctocephalus townsendi*	Threatened	Strategic	Extremely rare sightings. Little known about their pelagic distribution. Breed mainly on Isla Guadalupe, Mexico.	50 FR 51252, Gallo-Reynoso et al. 2008, Fleischer 1987
Hawaiian Monk Seal	*Neomonachus schauinslandi*	Endangered[a]	Strategic	Endemic tropical seal. Occurs throughout the archipelago. MHI population spends some time foraging in federal waters during the day.	41 FR 51611, Baker at al. 2011
Humpback Whale	*Megaptera novaeangliae*	Delisted Due to Recovery (Hawai`i DPS)	Strategic	Migrate through the archipelago and breed during the winter. Common during winter months, when they are generally found within the 100 m isobath.	35 FR 18319, 81 FR 62259, Childerhouse et al. 2008, Wolman & Jurasz 1976, Herman & Antinoja 1977, Rice & Wolman 1978
Killer Whale	*Orcinus orca*	Not Listed	Non-strategic	Rare in Hawai`i. Prefer colder waters within 800 km of continents.	Mitchell 1975, Baird et al. 2006
Longman's Beaked Whale	*Indopacetus pacificus*	Not Listed	Non-strategic	Found in tropical waters from the eastern Pacific westward through the Indian Ocean to the eastern coast of Africa. Rare in Hawai`i.	Dalebout 2003, Baird et al. 2013
Melon-Headed Whale	*Peponocephala electra*	Not Listed	Non-strategic	Found in tropical and warm-temperate waters worldwide, found primarily in equatorial waters. Uncommon in Hawai`i.	Perryman et al. 1994, Barlow 2006, Bradford et al. 2013

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Minke Whale	*Balaenoptera acutorostrata*	Not Listed	Non-strategic	Occur seasonally around Hawai`i	Barlow 2003, Rankin & Barlow 2005
North Pacific Right Whale	*Eubalaena japonica*	Endangered[a]	Strategic	Extremely rare in Hawai`i waters	35 FR 18319, 73 FR 12024, Rowntree et al. 1980, Herman et al. 1980
Northern Elephant Seal	*Mirounga angustirostris*	Not Listed	Non-strategic	Females migrate to central North Pacific to feed on pelagic prey.	Le Beouf et al. 2000
Northern Fur Seal	*Callorhinus ursinus*	Not Listed	Non-strategic	Occur throughout the North Pacific Ocean.	Gelatt et al. 2015
Pacific White-Sided Dolphin	*Lagenorhynchus obliquidens*	Not Listed	Non-strategic	Endemic to temperate waters of North Pacific Ocean. Occur both on the high seas and along continental margins.	Brownell et al. 1999
Pantropical Spotted Dolphin	*Stenella attenuata attenuata*	Not Listed	Non-strategic	Common and abundant throughout the Hawaiian archipelago. Pelagic stock occurs outside of insular stock areas (20 km for Oahu and 4-island stocks, 65 km for Hawai`i Island stock).	Baird et al. 2013, Oleson et al. 2013
Pygmy Killer Whale	*Feresa attenuata*	Not Listed	Non-strategic	Small resident population in Hawaiian waters. Found worldwide in tropical and subtropical waters.	McSweeney et al. 2009, Ross & Leatherwood 1994
Pygmy Sperm Whale	*Kogia breviceps*	Not Listed	Non-strategic	Found worldwide in tropical and warm-temperate waters.	Caldwell & Caldwell 1989
Risso's Dolphin	*Grampus griseus*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters worldwide.	Perrin et al. 2009
Rough-Toothed Dolphin	*Steno bredanensis*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters worldwide. Occasionally found offshore of Hawai`i.	Perrin et al. 2009, Baird et al. 2013, Barlow 2006, Bradford et al. 2013
Sei Whale	*Balaenoptera borealis*	Endangered	Strategic	Rare in Hawai`i. Generally found in offshore temperate waters.	35 FR 18319, Barlow 2003, Bradford et al. 2013

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters worldwide. Commonly observed around MHI and present around NWHI.	Shallenberger 1981, Baird et al. 2013, Bradford et al. 2013
Sperm Whale	*Physeter macrocephalus*	Endangered	Strategic	Found in tropical to polar waters worldwide, most abundant cetaceans in the region. Sighted off the NWHI and the MHI.	35 FR 18319, Rice 1960, Lee 1993, Barlow 2006, Mobley et al. 2000, Shallenberger 1981
Spinner Dolphin	*Stenella longirostris*	Not Listed	Non-strategic	Found worldwide in tropical and warm-temperate waters. Pelagic stock found outside of island-associated boundaries (10 nm).	Perrin et al. 2009
Striped Dolphin	*Stenella coeruleoalba*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters throughout the world.	Perrin et al. 2009
Sharks					
Scalloped hammerhead	*Sphyrna lewini*	Endangered (Eastern Pacific DPS)	N/A	Found in coastal areas from southern California to Peru.	Compagno 1984, Baum et al. 2007, Bester 2011
Scalloped hammerhead	*Sphyrna lewini*	Threatened (Indo-West Pacific DPS)	N/A	Occur over continental and insular shelves, and adjacent deep waters, but rarely found in waters < 22°C. Range from the intertidal and surface to depths up to 450–512 m.	Compagno 1984, Schulze-Haugen & Kohler 2003, Sanches 1991, Klimley 1993
Corals					
N/A	*Acropora globiceps*	Threatened	N/A	Not confirmed in Hawai`i waters. Occur on upper reef slopes, reef flats, and adjacent habitats in depths ranging from 0 to 8 m	Veron 2014

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
N/A	*Acropora jacquelineae*	Threatened	N/A	Not confirmed in Hawai`i waters. Found in numerous subtidal reef slope and back-reef habitats, including but not limited to, lower reef slopes, walls and ledges, mid-slopes, and upper reef slopes protected from wave action, and depth range is 10 to 35 m.	Veron 2014
N/A	*Acropora retusa*	Threatened	N/A	Not confirmed in Hawai`i waters. Occur in shallow reef slope and back-reef areas, such as upper reef slopes, reef flats, and shallow lagoons, and depth range is 1 to 5 m.	Veron 2014
N/A	*Acropora speciosa*	Threatened	N/A	Not confirmed in Hawai`i waters. Found in protected environments with clear water and high diversity of *Acropora* and steep slopes or deep, shaded waters. Depth range is 12 to 40 meters, and have been found in mesophotic habitat (40-150 m).	Veron 2014
N/A	*Euphyllia paradivisa*	Threatened	N/A	Not confirmed in Hawai`i waters. Found in environments protected from wave action on at least upper reef slopes, mid-slope terraces, and lagoons in depths ranging from 2 to 25 m depth.	Veron 2014
N/A	*Isopora crateriformis*	Threatened	N/A	Not confirmed in Hawai`i waters. Found in shallow, high-wave energy environments, from low tide to at least 12 meters deep, and have been reported from mesophotic depths (less than 50 m depth).	Veron 2014

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
N/A	*Seriatopora aculeata*	Threatened	N/A	Not confirmed in Hawai`i waters. Found in broad range of habitats including, but not limited to, upper reef slopes, mid-slope terraces, lower reef slopes, reef flats, and lagoons, and depth ranges from 3 to 40 m.	Veron 2014

[a] These species have critical habitat designated under the ESA. See Table B-94.

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Table B-92. Protected species found or reasonably believed to be found near or in Hawai`i deep-set longline waters.

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Seabirds					
Laysan Albatross	*Phoebastria immutabilis*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Black-Footed Albatross	*Phoebastria nigripes*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Short-Tailed Albatross	*Phoebastria albatrus*	Endangered	N/A	Breeding visitor in the NWHI	35 FR 8495, 65 FR 46643, Pyle & Pyle 2009
Northern Fulmar	*Fulmarus glacialis*	Not Listed	N/A	Winter resident	Pyle & Pyle 2009
Kermadec Petrel	*Pterodroma neglecta*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Herald Petrel	*Pterodroma arminjoniana*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Murphy's Petrel	*Pterodroma ultima*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Mottled Petrel	*Pterodroma inexpectata*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Juan Fernandez Petrel	*Pterodroma externa*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Hawaiian Petrel	*Pterodroma sandwichensis (Pterodroma phaeopygia sandwichensis)*	Endangered	N/A	Breeding visitor in the MHI	32 FR 4001, Pyle & Pyle 2009
White-Necked Petrel	*Pterodroma cervicalis*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Bonin Petrel	*Pterodroma hypoleuca*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
Black-Winged Petrel	*Pterodroma nigripennis*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Cook Petrel	*Pterodroma*	Not Listed	N/A	Migrant	Pyle & Pyle

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
	cookii				2009
Stejneger Petrel	*Pterodroma longirostris*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Pycroft Petrel	*Pterodroma pycrofti*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Bulwer Petrel	*Bulweria bulwerii*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Wedge-Tailed Shearwater	*Ardenna pacifica*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Buller's Shearwater	*Ardenna bulleri*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Sooty Shearwater	*Ardenna grisea*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Short-Tailed Shearwater	*Ardenna tenuirostris*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Christmas Shearwater	*Puffinus nativitatis*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Newell's Shearwater	*Puffinus newelli (Puffinus auricularis newelli)*	Threatened	N/A	Breeding visitor	40 FR 44149, Pyle & Pyle 2009
Wilson's Storm-Petrel	*Oceanites oceanicus*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	Not Listed	N/A	Winter resident	Pyle & Pyle 2009
Band-Rumped Storm-Petrel	*Oceanodroma castro*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Tristram Storm-Petrel	*Oceanodroma tristrami*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
White-Tailed Tropicbird	*Phaethon lepturus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Red-Tailed Tropicbird	*Phaethon rubricauda*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Masked Booby	*Sula dactylatra*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Nazca Booby	*Sula granti*	Not Listed	N/A	Vagrant	Pyle & Pyle 2009
Brown Booby	*Sula leucogaster*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Red-Footed Booby	*Sula sula*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Great Frigatebird	*Fregata minor*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Lesser Frigatebird	*Fregata ariel*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Laughing Gull	*Leucophaeus atricilla*	Not Listed	N/A	Winter resident in the MHI	Pyle & Pyle 2009
Franklin Gull	*Leucophaeus pipixcan*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Ring-Billed Gull	*Larus delawarensis*	Not Listed	N/A	Winter resident in the MHI	Pyle & Pyle 2009
Herring Gull	*Larus*	Not Listed	N/A	Winter resident in the	Pyle & Pyle

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
	argentatus			NWHI	2009
Slaty-Backed Gull	*Larus schistisagus*	Not Listed	N/A	Winter resident in the NWHI	Pyle & Pyle 2009
Glaucous-Winged Gull	*Larus glaucescens*	Not Listed	N/A	Winter resident	Pyle & Pyle 2009
Brown Noddy	*Anous stolidus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Black Noddy	*Anous minutus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Blue-Gray Noddy	*Procelsterna cerulea*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
White Tern	*Gygis alba*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Sooty Tern	*Onychoprion fuscatus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Gray-Backed Tern	*Onychoprion lunatus*	Not Listed	N/A	Breeding visitor	Pyle & Pyle 2009
Little Tern	*Sternula albifrons*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
Least Tern	*Sternula antillarum*	Not Listed	N/A	Breeding visitor in the NWHI	Pyle & Pyle 2009
Arctic Tern	*Sterna paradisaea*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
South Polar Skua	*Stercorarius maccormicki*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Pomarine Jaeger	*Stercorarius pomarinus*	Not Listed	N/A	Winter resident in the MHI	Pyle & Pyle 2009
Parasitic Jaeger	*Stercorarius parasiticus*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Long-Tailed Jaeger	*Stercorarius longicaudus*	Not Listed	N/A	Migrant	Pyle & Pyle 2009
Sea turtles					
Green Sea Turtle	*Chelonia mydas*	Threatened (Central North Pacific DPS)	N/A	Most common turtle in the Hawaiian Islands, much more common in nearshore state waters (foraging grounds) than offshore federal waters. Most nesting occurs on French Frigate Shoals in the NWHI. Foraging and haulout in the MHI.	43 FR 32800, 81 FR 20057, Balazs et al. 1992, Kolinski et al. 2001
Green Sea Turtle	*Chelonia mydas*	Threatened (East Pacific DPS)	N/A	Nest primarily in Mexico and the Galapagos Islands. Little known about their pelagic range west of 90°W, but may range as far as the Marshall Islands. Genetic testing confirmed that they are incidentally taken in the	43 FR 32800, 81 FR 20057, WPRFMC 2009, Cliffton et al. 1982, Karl & Bowen 1999

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
				HI DSLL fishery.	
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered[a]	N/A	Small population foraging around Hawai`i and low level nesting on Maui and Hawai`i Islands. Occur worldwide in tropical and subtropical waters.	35 FR 8491, NMFS & USFWS 2007, Balazs et al. 1992, Katahira et al. 1994
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered[a]	N/A	Regularly sighted in offshore waters, especially at the southeastern end of the archipelago.	35 FR 8491, NMFS & USFWS 1997
Loggerhead Sea Turtle	*Caretta caretta*	Endangered (North Pacific DPS)	N/A	Rare in Hawai`i. Found worldwide along continental shelves, bays, estuaries and lagoons of tropical, subtropical, and temperate waters.	43 FR 32800, 76 FR 58868, Dodd 1990, Balazs 1979
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	Threatened (Entire species, except for the breeding population on the Pacific coast of Mexico, which is listed as endangered)	N/A	Rare in Hawai`i. Occurs worldwide in tropical and warm temperate ocean waters.	43 FR 32800, Pitman 1990, Balacz 1982
Marine mammals					
Blainville's Beaked Whale	*Mesoplodon densirostris*	Not Listed	Non-strategic	Found worldwide in tropical and temperate waters	Mead 1989
Blue Whale	*Balaenoptera musculus*	Endangered	Strategic	Acoustically recorded off of Oahu and Midway Atoll, small number of sightings around Hawai`i. Considered extremely rare, generally occur in winter and summer.	35 FR 18319, Bradford et al. 2013, Northrop et al. 1971, Thompson & Friedl 1982, Stafford et al. 2001

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Bottlenose Dolphin	*Tursiops truncatus*	Not Listed	Non-strategic	Distributed worldwide in tropical and warm-temperate waters. Pelagic stock distinct from island-associated stocks.	Perrin et al. 2009, Martien et al. 2012
Bryde's Whale	*Balaenoptera edeni*	Not Listed	Unknown	Distributed widely across tropical and warm-temperate Pacific Ocean.	Leatherwood et al. 1982
Common Dolphin	*Delphinus delphis*	Not Listed	N/A	Found worldwide in temperate and subtropical seas.	Perrin et al. 2009
Cuvier's Beaked Whale	*Ziphius cavirostris*	Not Listed	Non-strategic	Occur year round in Hawaiian waters.	McSweeney et al. 2007
Dall's Porpoise	*Phocoenoides dalli*	Not Listed	Non-strategic	Range across the entire north Pacific Ocean.	Hall 1979
Dwarf Sperm Whale	*Kogia sima*	Not Listed	Non-strategic	Most common in waters between 500 m and 1,000 m in depth. Found worldwide in tropical and warm-temperate waters.	Nagorsen 1985, Baird et al. 2013
False Killer Whale	*Pseudorca crassidens*	Not Listed	Non-strategic	Found worldwide in tropical and warm-temperate waters. Pelagic stock tracked to within 11 km of Hawaiian islands.	Stacey et al. 1994, Baird et al. 2012, Bradford et al. 2015
Fin Whale	*Balaenoptera physalus*	Endangered	Strategic	Infrequent sightings in Hawai`i waters. Considered rare in Hawai`i, though may migrate into Hawaiian waters during fall/winter based on acoustic recordings.	35 FR 18319, Hamilton et al. 2009, Thompson & Friedl 1982
Fraser's Dolphin	*Lagenodelphis hosei*	Not Listed	Non-strategic	Found worldwide in tropical waters.	Perrin et al. 2009
Guadalupe Fur Seal	*Arctocephalus townsendi*	Threatened	Strategic	Rare sightings. Little known about their pelagic distribution. Breed mainly on Isla Guadalupe, Mexico.	50 FR 51252, Gallo-Reynoso et al. 2008, Fleischer 1987
Hawaiian Monk Seal	*Neomonachus schauinslandi*	Endangered[a]	Strategic	Endemic tropical seal. Occurs throughout the archipelago. MHI population spends some time foraging in federal waters during the day.	41 FR 51611, Baker at al. 2011

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Humpback Whale	*Megaptera novaeangliae*	Delisted Due to Recovery (Hawai`i DPS)	Strategic	Migrate through the archipelago and breed during the winter. Common during winter months, when they are generally found within the 100 m isobath.	35 FR 18319, 81 FR 62259, Childerhouse et al. 2008, Wolman & Jurasz 1976, Herman & Antinoja 1977, Rice & Wolman 1978
Killer Whale	*Orcinus orca*	Not Listed	Non-strategic	Rare in Hawai`i. Prefer colder waters within 800 km of continents.	Mitchell 1975, Baird et al. 2006
Longman's Beaked Whale	*Indopacetus pacificus*	Not Listed	Non-strategic	Found in tropical waters from the eastern Pacific westward through the Indian Ocean to the eastern coast of Africa. Rare in Hawai`i.	Dalebout 2003, Baird et al. 2013
Melon-Headed Whale	*Peponocephala electra*	Not Listed	Non-strategic	Found in tropical and warm-temperate waters worldwide, found primarily in equatorial waters. Uncommon in Hawai`i.	Perryman et al. 1994, Barlow 2006, Bradford et al. 2013
Minke Whale	*Balaenoptera acutorostrata*	Not Listed	Non-strategic	Occur seasonally around Hawai`i	Barlow 2003, Rankin & Barlow 2005
North Pacific Right Whale	*Eubalaena japonica*	Endangered[a]	Strategic	Extremely rare in Hawai`i waters	35 FR 18319, 73 FR 12024, Rowntree et al. 1980, Herman et al. 1980
Northern Elephant Seal	*Mirounga angustirostris*	Not Listed	Non-strategic	Females migrate to central North Pacific to feed on pelagic prey	Le Beouf et al. 2000
Northern Fur Seal	*Callorhinus ursinus*	Not Listed	Non-strategic	Range across the north Pacific Ocean.	Gelatt et al. 2015
Pacific White-Sided Dolphin	*Lagenorhynchus obliquidens*	Not Listed	Non-strategic	Endemic to temperate waters of North Pacific Ocean. Occur both on the high seas and along continental margins.	Brownell et al. 1999
Pantropical Spotted Dolphin	*Stenella attenuata attenuata*	Not Listed	Non-strategic	Common and abundant throughout the Hawaiian archipelago. Pelagic stock occurs outside of insular stock areas (20 km for Oahu and 4-island stocks, 65 km for Hawai`i Island stock)	Baird et al. 2013, Oleson et al. 2013

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Pygmy Killer Whale	*Feresa attenuata*	Not Listed	Non-strategic	Small resident population in Hawaiian waters. Found worldwide in tropical and subtropical waters.	McSweeney et al. 2009, Ross & Leatherwood 1994
Pygmy Sperm Whale	*Kogia breviceps*	Not Listed	Non-strategic	Found worldwide in tropical and warm-temperate waters.	Caldwell & Caldwell 1989
Risso's Dolphin	*Grampus griseus*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters worldwide.	Perrin et al. 2009
Rough-Toothed Dolphin	*Steno bredanensis*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters worldwide. Occasionally found offshore of Hawai`i.	Perrin et al. 2009, Bradford et al. 2013, Barlow 2006, Baird et al. 2013
Sei Whale	*Balaenoptera borealis*	Endangered	Strategic	Rare in Hawai`i. Generally found in offshore temperate waters.	35 FR 18319, Barlow 2003, Bradford et al. 2013
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters worldwide. Commonly observed around MHI and present around NWHI.	Shallenberger 1981, Baird et al. 2013, Bradford et al. 2013
Sperm Whale	*Physeter macrocephalus*	Endangered	Strategic	Found in tropical to polar waters worldwide, most abundant cetaceans in the region. Sighted off the NWHI and the MHI.	35 FR 18319, Rice 1960, Lee 1993, Barlow 2006, Mobley et al. 2000, Shallenberger 1981
Spinner Dolphin	*Stenella longirostris*	Not Listed	Non-strategic	Found worldwide in tropical and warm-temperate waters. Pelagic stock found outside of island-associated boundaries (10 nm)	Perrin et al. 2009
Striped Dolphin	*Stenella coeruleoalba*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters throughout the world	Perrin et al. 2009
Sharks					
Scalloped hammerhead	*Sphyrna lewini*	Endangered (Eastern Pacific DPS)	N/A	Found in coastal areas from southern California to Peru.	Compagno 1984, Baum et al. 2007, Bester 2011

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Scalloped hammerhead	*Sphyrna lewini*	Threatened (Indo-West Pacific DPS)	N/A	Occur over continental and insular shelves, and adjacent deep waters, but rarely found in waters < 22°C. Range from the intertidal and surface to depths up to 450–512 m.	Compagno 1984, Schulze-Haugen & Kohler 2003, Sanches 1991, Klimley 1993
Corals					
N/A	*Acropora globiceps*	Threatened	N/A	Occur on upper reef slopes, reef flats, and adjacent habitats in depths ranging from 0 to 8 m.	Veron 2014
N/A	*Acropora jacquelineae*	Threatened	N/A	Found in numerous subtidal reef slope and back-reef habitats, including but not limited to, lower reef slopes, walls and ledges, mid-slopes, and upper reef slopes protected from wave action, and depth range is 10 to 35 m.	Veron 2014
N/A	*Acropora retusa*	Threatened	N/A	Occur in shallow reef slope and back-reef areas, such as upper reef slopes, reef flats, and shallow lagoons, and depth range is 1 to 5 m.	Veron 2014
N/A	*Acropora speciosa*	Threatened	N/A	Found in protected environments with clear water and high diversity of *Acropora* and steep slopes or deep, shaded waters. Depth range is 12 to 40 meters, and it has been found in mesophotic habitat (40-150 m).	Veron 2014
N/A	*Euphyllia paradivisa*	Threatened	N/A	Found in environments protected from wave action on at least upper reef slopes, mid-slope terraces, and lagoons in depths ranging from 2 to 25 m depth.	Veron 2014

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
N/A	*Isopora crateriformis*	Threatened	N/A	Found in shallow, high-wave energy environments, from low tide to at least 12 m deep, and have been reported from mesophotic depths (less than 50 m depth).	Veron 2014
N/A	*Seriatopora aculeata*	Threatened	N/A	Found in broad range of habitats including, but not limited to, upper reef slopes, mid-slope terraces, lower reef slopes, reef flats, and lagoons, and depth ranges from 3 to 40 m.	Veron 2014

[a] These species have critical habitat designated under the ESA. See Table B-94.

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Table B-93. Protected species found or reasonably believed to be found near or in American Samoa longline waters.

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Seabirds					
Audubon's Shearwater	*Puffinus lherminieri*	Not Listed	N/A	Resident	Craig 2005
Black Noddy	*Anous minutus*	Not Listed	N/A	Resident	Craig 2005
Black-Naped Tern	*Sterna sumatrana*	Not Listed	N/A	Visitor	Craig 2005
Blue-Gray Noddy	*Procelsterna cerulea*	Not Listed	N/A	Resident	Craig 2005
Bridled Tern	*Onychoprion anaethetus*	Not Listed	N/A	Visitor	Craig 2005
Brown Booby	*Sula leucogaster*	Not Listed	N/A	Resident	Craig 2005
Brown Noddy	*Anous stolidus*	Not Listed	N/A	Resident	Craig 2005
Christmas Shearwater	*Puffinus nativitatis*	Not Listed	N/A	Resident?	Craig 2005
Collared Petrel	*Pterodroma brevipes*	Not Listed	N/A	Resident?	Craig 2005
White Tern	*Gygis alba*	Not Listed	N/A	Resident	Craig 2005
Greater Crested Tern	*Thalasseus bergii*	Not Listed	N/A	Visitor	Craig 2005
Gray-Backed Tern	*Onychoprion lunatus*	Not Listed	N/A	Resident	Craig 2005
Great Frigatebird	*Fregata minor*	Not Listed	N/A	Resident	Craig 2005
Herald Petrel	*Pterodroma*	Not Listed	N/A	Resident	Craig 2005

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
	heraldica				
Laughing Gull	*Leucophaeus atricilla*	Not Listed	N/A	Visitor	Craig 2005
Lesser Frigatebird	*Fregata ariel*	Not Listed	N/A	Resident	Craig 2005
Masked Booby	*Sula dactylatra*	Not Listed	N/A	Resident	Craig 2005
Newell's Shearwater	*Puffinus auricularis newelli*	Threatened	N/A	Visitor	40 FR 44149, Craig 2005
Red-Footed Booby	*Sula sula*	Not Listed	N/A	Resident	Craig 2005
Red-Tailed Tropicbird	*Phaethon rubricauda*	Not Listed	N/A	Resident	Craig 2005
Short-Tailed Shearwater	*Ardenna tenuirostris*	Not Listed	N/A	Visitor	Craig 2005
Sooty Shearwater	*Ardenna grisea*	Not Listed	N/A	Visitor	Craig 2005
Sooty Tern	*Sterna fuscata*	Not Listed	N/A	Resident	Craig 2005
Tahiti Petrel	*Pterodroma rostrata*	Not Listed	N/A	Resident	Craig 2005
Wedge-Tailed Shearwater	*Ardenna pacifica*	Not Listed	N/A	Resident?	Craig 2005
White-Necked Petrel	*Pterodroma cervicalis*	Not Listed	N/A	Visitor	Craig 2005
White-Faced Storm-Petrel	*Pelagodroma marina*	Not Listed	N/A	Visitor	Craig 2005
White-Tailed Tropicbird	*Phaethon lepturus*	Not Listed	N/A	Resident	Craig 2005
White-Throated Storm-Petrel	*Nesofregetta fuliginosa*	Not Listed	N/A	Resident?	Craig 2005
Laysan Albatross	*Phoebastria immutabilis*	Not Listed	N/A	Breed mainly in Hawai`i, and range across the North Pacific Ocean.	Causey 2008
Hawaiian Petrel	*Pterodroma sandwichensis (Pterodroma phaeopygia sandwichensis)*	Endangered	N/A	Breed in MHI, and range across the central Pacific Ocean.	32 FR 4001, Simons & Hodges 1998
Laysan Albatross	*Phoebastria immutabilis*	Not Listed	N/A	Breed mainly in Hawai`i, and range across the North Pacific Ocean.	Causey 2009
Northern Fulmar	*Fulmarus glacialis*	Not Listed	N/A	Breed and range across North Pacific Ocean.	Hatch & Nettleship 2012
Short-Tailed Albatross	*Phoebastria albatrus*	Endangered	N/A	Breed in Japan and NWHI, and range across the North Pacific Ocean.	35 FR 8495, 65 FR 46643, BirdLife International 2017
Sea turtles					
Green Sea Turtle	*Chelonia mydas*	Endangered (Central South Pacific DPS)	N/A	Frequently seen. Nest at Rose Atoll in small numbers.	43 FR 32800, 81 FR 20057, Balacz 1994

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered[a]	N/A	Frequently seen. Nest at Rose Atoll, Swain's Island, and Tutuila.	35 FR 8491, NMFS & USFWS 2013, Tuato'o-Bartley et al. 1993
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered[a]	N/A	Very rare. One juvenile recovered dead in experimental longline fishing.	35 FR 8491, Grant 1994
Loggerhead Sea Turtle	*Caretta caretta*	Endangered (South Pacific DPS)	N/A	No known sightings. Found worldwide along continental shelves, bays, estuaries and lagoons of tropical, subtropical, and temperate waters.	43 FR 32800, 76 FR 58868, Utzurrum 2002, Dodd 1990
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	Threatened (Entire species, except for the endangered breeding population on the Pacific coast of Mexico)	N/A	Rare. Three known sightings.	43 FR 32800, Utzurrum 2002
Marine mammals					
Blainville's Beaked Whale	*Mesoplodon densirostris*	Not Listed	Non-strategic	Found worldwide in tropical and temperate waters	Mead 1989
Blue Whale	*Balaenoptera musculus*	Endangered	Strategic	No known sightings. Occur worldwide, and are known to be found in the western South Pacific.	35 FR 18319, Olson et al. 2015
Bottlenose Dolphin	*Tursiops truncatus*	Not Listed	Non-strategic	Distributed worldwide in tropical and warm-temperate waters. Pelagic stock distinct from island-associated stocks.	Perrin et al. 2009, Martien et al. 2012
Bryde's Whale	*Balaenoptera edeni*	Not Listed	Unknown	Distributed widely across tropical and warm-temperate Pacific Ocean.	Leatherwood et al. 1982
Common Dolphin	*Delphinus delphis*	Not Listed	N/A	Found worldwide in temperate and subtropical seas.	Perrin et al. 2009
Cuvier's Beaked Whale	*Ziphius cavirostris*	Not Listed	Non-strategic	Occur worldwide.	Heyning 1989
Dwarf Sperm Whale	*Kogia sima*	Not Listed	Non-strategic	Found worldwide in tropical and warm-temperate waters.	Nagorsen 1985

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
False Killer Whale	*Pseudorca crassidens*	Not Listed	Unknown	Found in waters within the US EEZ of A. Samoa	Bradford et al. 2015
Fin Whale	*Balaenoptera physalus*	Endangered	Strategic	No known sightings but reasonably expected to occur in A. Samoa. Found worldwide.	35 FR 18319, Hamilton et al. 2009
Fraser's Dolphin	*Lagenodelphis hosei*	Not Listed	Non-strategic	Found worldwide in tropical waters.	Perrin et al. 2009
Guadalupe Fur Seal	*Arctocephalus townsendi*	Threatened	Strategic	No known sightings. Little known about their pelagic distribution. Breed mainly on Isla Guadalupe, Mexico.	50 FR 51252, Gallo-Reynoso et al. 2008, Fleischer 1987
Humpback Whale	*Megaptera novaeangliae*	Delisted Due to Recovery (Oceania DPS)	Strategic	Migrate through the archipelago and breed during the winter in American Samoan waters.	35 FR 18319, 81 FR 62259,, Guarrige et al. 2007, SPWRC 2008
Killer Whale	*Orcinus orca*	Not Listed	Non-strategic	Found worldwide. Prefer colder waters within 800 km of continents.	Leatherwood & Dalheim 1978, Mitchell 1975, Baird et al. 2006
Longman's Beaked Whale	*Indopacetus pacificus*	Not Listed	Non-strategic	Found in tropical waters from the eastern Pacific westward through the Indian Ocean to the eastern coast of Africa.	Dalebout 2003
Melon-Headed Whale	*Peponocephala electra*	Not Listed	Non-strategic	Found in tropical and warm-temperate waters worldwide, primarily found in equatorial waters.	Perryman et al. 1994
Minke Whale	*Balaenoptera acutorostrata*	Not Listed	Non-strategic	Uncommon in this region, usually seen over continental shelves in the Pacific Ocean.	Brueggeman et al. 1990
North Pacific Right Whale	*Eubalaena japonica*	Endangered[a]	Strategic	Extremely rare.	35 FR 18319, 73 FR 12024, Childerhouse et al. 2008, Wolman & Jurasz 1976, Herman & Antinoja 1977, Rice & Wolman 1978
Northern Elephant Seal	*Mirounga angustirostris*	Not Listed	Non-strategic	Females migrate to central North Pacific to feed on pelagic prey	Le Beouf et al. 2000
Pantropical Spotted Dolphin	*Stenella attenuata*	Not Listed	Non-strategic	Found in tropical and subtropical waters	Perrin et al. 2009

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
	attenuata			worldwide.	
Pygmy Killer Whale	*Feresa attenuata*	Not Listed	Non-strategic	Found in tropical and subtropical waters worldwide.	Ross & Leatherwood 1994
Pygmy Sperm Whale	*Kogia breviceps*	Not Listed	Non-strategic	Found worldwide in tropical and warm-temperate waters.	Caldwell & Caldwell 1989
Risso's Dolphin	*Grampus griseus*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters worldwide.	Perrin et al. 2009
Rough-Toothed Dolphin	*Steno bredanensis*	Not Listed	Unknown	Found in tropical to warm-temperate waters worldwide. Common in A. Samoa waters.	Perrin et al. 2009, Craig 2005
Sei Whale	*Balaenoptera borealis*	Endangered	Strategic	Generally found in offshore temperate waters.	35 FR 18319, Barlow 2003, Bradford et al. 2013
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters worldwide	Shallenberger 1981, Baird et al. 2013, Bradford et al. 2013
Sperm Whale	*Physeter macrocephalus*	Endangered	Strategic	Found in tropical to polar waters worldwide, most abundant cetaceans in the region.	35 FR 18319, Rice 1960, Barlow 2006, Lee 1993, Mobley et al. 2000, Shallenberger 1981
Spinner Dolphin	*Stenella longirostris*	Not Listed	Unknown	Common in American Samoa, found in waters with mean depth of 44 m.	Reeves et al. 1999, Johnston et al. 2008
Striped Dolphin	*Stenella coeruleoalba*	Not Listed	Non-strategic	Found in tropical to warm-temperate waters throughout the world	Perrin et al. 2009
Sharks					
Scalloped hammerhead	*Sphyrna lewini*	Threatened (Indo-West Pacific DPS)	N/A	Occur over continental and insular shelves, and adjacent deep waters, but rarely found in waters < 22°C. Range from the intertidal and surface to depths up to 450–512 m.	Compagno 1984, Schulze-Haugen & Kohler 2003, Sanches 1991, Klimley 1993
Corals					
N/A	*Acropora globiceps*	Threatened	N/A	Occur on upper reef slopes, reef flats, and adjacent habitats in depths from 0 to 8 m	Veron 2014

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
N/A	*Acropora jacquelineae*	Threatened	N/A	Found in numerous subtidal reef slope and back-reef habitats, including but not limited to, lower reef slopes, walls and ledges, mid-slopes, and upper reef slopes protected from wave action, and its depth range is 10 to 35 m.	Veron 2014
N/A	*Acropora retusa*	Threatened	N/A	Occur in shallow reef slope and back-reef areas, such as upper reef slopes, reef flats, and shallow lagoons. Depth range is 1 to 5 m.	Veron 2014
N/A	*Acropora speciosa*	Threatened	N/A	Found in protected environments with clear water and high diversity of Acropora and steep slopes or deep, shaded waters. Depth range is 12 to 40 meters, and have been found in mesophotic habitat (40-150 m).	Veron 2014
N/A	*Euphyllia paradivisa*	Threatened	N/A	Found in environments protected from wave action on at least upper reef slopes, mid-slope terraces, and lagoons in depths ranging from 2 to 25 m depth.	Veron 2014
N/A	*Isopora crateriformis*	Threatened	N/A	Found in shallow, high-wave energy environments, from low tide to at least 12 meters deep, and have been reported from mesophotic depths (less than 50 m depth).	Veron 2014

[a] These species have critical habitat designated under the ESA. See Table B-94.

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Table B-94. ESA-listed species' critical habitat in the Pacific Ocean[a].

Common name	Scientific name	ESA listing status	Critical habitat	References
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered	None in the Pacific Ocean.	63 FR 46693
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Approximately 16,910 square miles (43,798 square km) stretching along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour; and 25,004 square miles (64,760 square km) stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour.	77 FR 4170
Hawaiian Monk Seal	*Neomonachus schauinslandi*	Endangered	Ten areas in the Northwestern Hawaiian Islands (NWHI) and six in the main Hawaiian Islands (MHI). These areas contain one or a combination of habitat types: Preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas, that will support conservation for the species.	53 FR 18988, 51 FR 16047, 80 FR 50925
North Pacific Right Whale	*Eubalaena japonica*	Endangered	Two specific areas are designated, one in the Gulf of Alaska and another in the Bering Sea, comprising a total of approximately 95,200 square kilometers (36,750 square miles) of marine habitat.	73 FR 19000, 71 FR 38277

[a] For maps of critical habitat, see http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm.

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APPENDIX C: 2017 PELAGIC PLAN TEAM MEMBERS

Member	Team Role
Christofer Boggs; NMFS PIFSC Fisheries Research and Monitoring Division	Marine Ecology Pelagics
Paul Bartram; Akala Products Inc.	Pelagics
Keith Bigelow; NMFS PIFSC Fisheries Research and Monitoring Division	Chair, Pelagics
Michael Fujimoto; Hawai`i Division of Aquatic Resources	Pelagics
Tom Graham; NMFS PIRO	Pelagics
Justin Hospital; NMFS PIFSC Economics Program	Economics
Russell Ito; PIFSC Fisheries Research and Monitoring Division	Pelagics
Tepora Lavatai; A.S. Dept. of Marine & Wildlife Resources	Pelagics
Michael Tenorio; CNMI Division of Fish & Wildlife	Marianas
Brent Tibbatts; Guam Division of Aquatic & Wildlife Resources	Archipelagic Pelagics
Kimberly Lowe, NMFS PIFSC	Ex-Officio
Jon Brodziak, NMFS PIFSC	Ex-Officio
Annie Yau, NMFS PIFSC	Ex-Officio
Reginald Kokubun; Hawai`i Division of Aquatic Resources	Ex-Officio
Eileen Shea	Ex-Officio