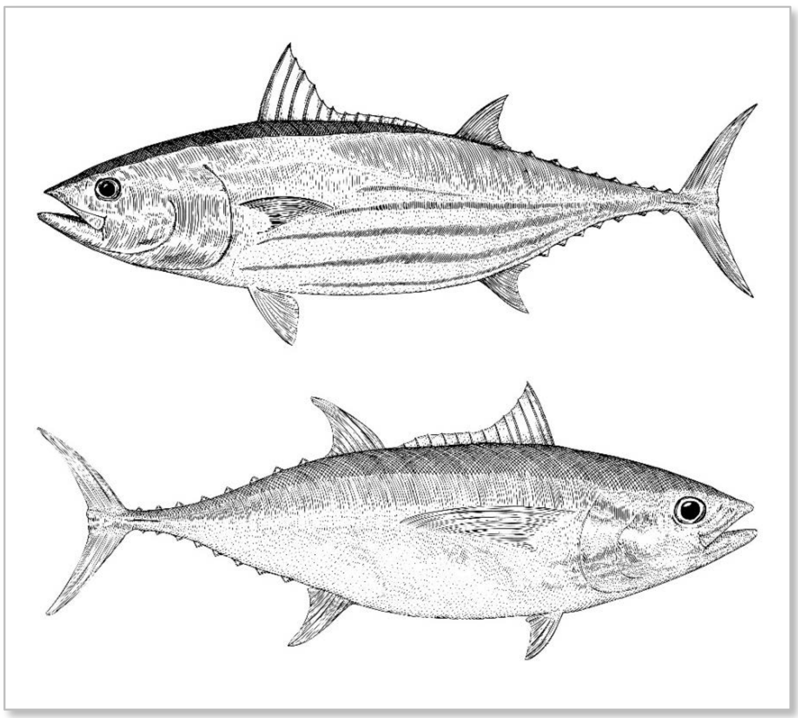
Annual Stock Assessment and Fishery Evaluation Report for U.S. Pacific Island Pelagic Fisheries Ecosystem Plan

2017



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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: sea turtles, marine mammals, seabirds.
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.
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.

Term	Definition
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 (Hawaii).
Protected Species	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, sea turtles, dolphins.
Purse Seine	Fishing for tuna by surrounding schools of fish with a 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.
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.
DPS	Distinct population segment.
EEZ	Exclusive Economic Zone, refers to waters of a nation, recognized internationally under the United Nations Convention on the Law of the Sea as extending 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 Niño –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 buoy,drifting or anchored to the sea floor, and under which, pelagic fish will concentrate.
FEP	Fisheries Ecosystem Plan.
FMP	Fishery Management Plan.
ft.	Feet.

Acronym	Meaning
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.
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.
MPCCC	Marine Planning and Climate Change Committee.
MRFSS	Marine Recreational Fishing Statistical Survey.
MSST	Minimum Stock Size Threshold.
MSY	Maximum Sustainable Yield.
mt	Metric tons.
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.
nm	Nautical miles.
NOAA	National Oceanic and Atmospheric Administration, U.S. Department of Commerce.
NESDIS	National Environmental Satellite, Data, and Information Service

Acronym	Meaning
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.
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.
TZCF	Transition Zone Chlorophyll Front.

Acronym	Meaning
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.

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EXECUTIVE SUMMARY

The Western Pacific Regional Fishery Management Council (the Council) manages the pelagic resources specified in 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.

In July 2013, NMFS issued a final rule (78 FR 43066) that revised National Standard 2 (NS2) guidelines and clarified 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), amendments, and other analytical documents needed for management decisions.

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).

Table ES-1. Fulfillment of National Standard 2 Requirements within the 2017 Annual SAFE Report Pacific Island Pelagic Fishery Ecosystem Plan.

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

Many of the 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' designations 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 123). 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.

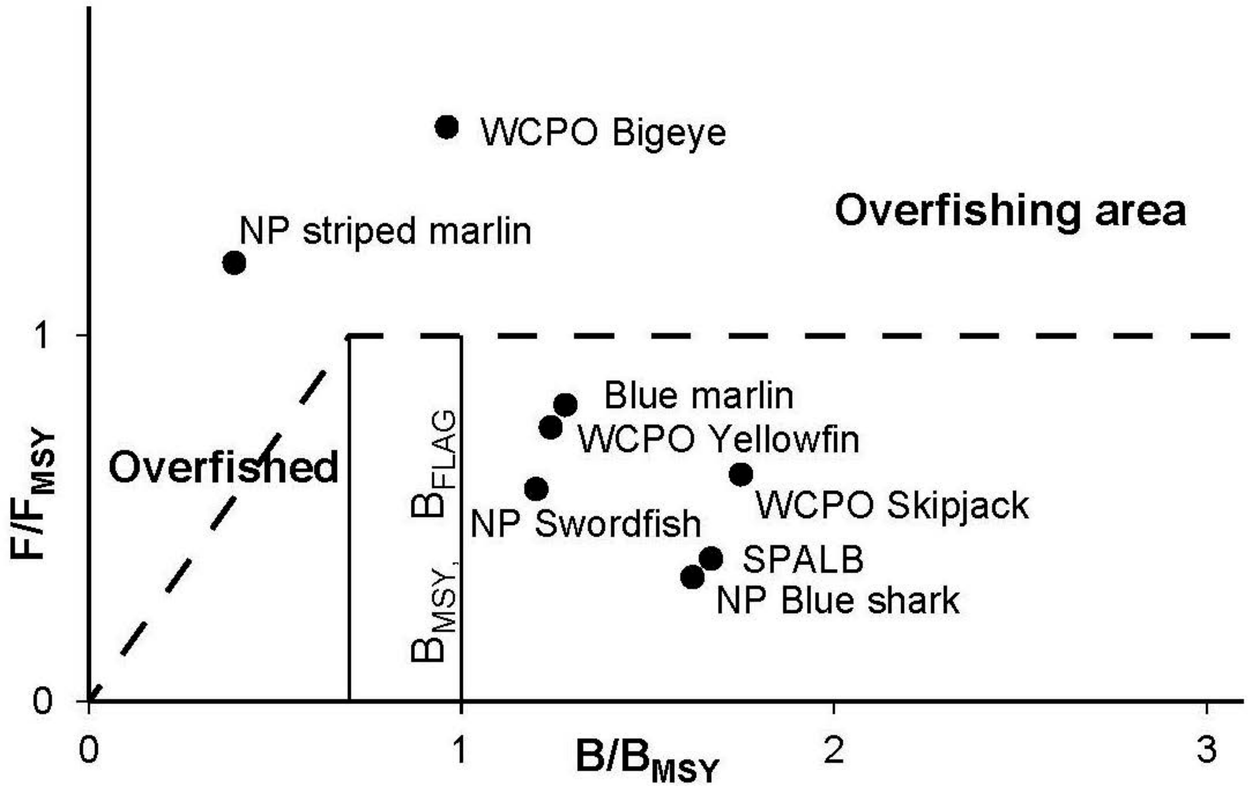
For pelagic species in the Pacific Island Region, most stock assessments are conducted by several international organizations. In the Eastern Pacific Ocean (EPO), IATTC staff conduct stock assessments for EPO bigeye, yellowfin, striped marlin, and swordfish. IATTC also includes a review of a range of 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 2017, stock assessments were completed for the WCPO bigeye tuna (McKechnie et al. 2017), WCPO yellowfin tuna (Tremblay-Boyer et al., 2017), North Pacific albacore tuna (ISC 2017a), North Pacific blue shark (ISC 2017b), EPO bigeye tuna (Xu et al. 2018), and EPO yellowfin tuna (Minte-Vera et al. 2018). Details of these stock assessments can be found in Section 2.6.7. This section also provides an overview of stock status in relation to overfishing and overfished reference points for 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 2018 will include EPO bigeye, yellowfin, and skipjack, WCPO bigeye, and South Pacific albacore.

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

Table ES-2. Summary of the total pelagic landings during 2017 in the Western Pacific and the percentage change between 2016 and 2017.

Species	American Samoa		CNMI		Guam		Hawai`i	
	Lbs.	Change	Lbs.	Change	Lbs.	Change	Lbs.	Change
Swordfish	12,347	-16.36%	0	-	0	-	3,580,000	48.06%
Blue marlin	83,603	25.63%	2,966	100.00%	42,183	-4.64%	1,815,000	17.70%
Striped marlin	3,990	0.00%	0	-	0	-	919,000	3.61%
Other billfish*	6,687	-75.68%	0	-	0	-	735,000	-12.50%
Mahimahi	33,729	222.86%	45,099	-43.38%	47,310	-72.88%	993,000	-19.40%
Wahoo	132,607	13.70%	9,811	97.48%	27,475	-18.25%	978,000	-18.77%
Opah (moonfish)	2,815	-35.96%	-	0.00%	0	-	2,289,000	5.68%
Sharks (whole wt)	780	-53.85%	-	0.00%	0	-	166,000	-1.19%
Albacore	3,045,774	-5.29%	-	0.00%	0	-	286,000	-52.49%
Bigeye tuna	142,823	-34.49%	-	0.00%	0	-	17,928,000	-3.94%
Bluefin tuna	0	-	-	0.00%	0	-	3,000	200.00%
Skipjack tuna	145,742	-33.08%	235,603	23.28%	508,840	16.31%	724,000	-9.61%
Yellowfin tuna	1,190,111	38.30%	16,968	-13.47%	67,463	-47.10%	7,518,000	51.69%
Other pelagics**	4,063	-59.48%	2,754	-73.48%	11,789	-37.18%	1,276,000	-20.40%
Total	4,807,030	10.67%	340,869	-10.71%	705,637	15.60%	39,210,000	5.74%

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 transshipment 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 2017, there were 15 active longline vessels, with nine vessels greater than 70 ft., five vessels between 50 and 70 ft., and one vessel shorter than 40 ft. Smaller longline vessels called alias (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 are the next largest fisheries with eight boats that landed pelagic species in 2017. Recreational pelagic fisheries in this region are less common.

Landings. The estimated annual pelagic landings have varied widely, from 4.5 to nearly 11 million lbs. since 2008. The total estimated 2017 landings were approximately 4.8 million lbs., which contributes to the declining trend since recent peak landings in 2009-2010 (Figure 4). Pelagic landings consist mainly of five tuna species including albacore, yellowfin, skipjack, mackerel, and bigeye, which made up approximately 95% of the total estimated landings when combined with other tuna species. Albacore made up 77% of the tuna species total estimated landings. Wahoo, blue marlin, and mahimahi made up most of the non-tuna species landings.

Bycatch. There was no recorded bycatch for the troll fishery in 2017 (Table 12). In the longline fishery, less than 1% of the tuna caught were released. Albacore and yellowfin were the most released bycatch tuna species, while sharks and oilfish had the highest numbers of non-tuna released fish accounting for 86% release of non-tuna species. In total, only 6% 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 25 vessels known to be fishing in the waters of American Samoa according to federal logbooks collected. The 15 longline vessels that fished in 2017 made 135 trips (average 9 trips/vessel), deployed 2,333 sets, (155 sets/vessel) using 6.6 million hooks (Table 5). The troll fishery conducted 179 trips that landed pelagic species.

Catch Rate. The total pelagic catch rate by all longline vessels increased by 0.1 fish per 1,000 hooks in 2017 from the previous year. The tuna catch rate also increased by 0.5 fish per 1,000 hooks in 2017. Non-tuna pelagic species showed a gradual catch rates from the beginning of available data (2003) to present. The longline catch rates for tuna species have fluctuated during the past decade ranging from 15 to nearly 30 fish per 1,000 hooks. Albacore catch rates have decreased this year by 0.2 to 11.7 fish per 1,000 hooks. Troll trips have increased by 40% while troll hours have also increased to nearly three times from their 2016 values. The average catch per troll hour for all pelagic species notably decreased from the previous year from 43 lbs. to 14 lbs.

Revenue. Commercial landings of tuna species continue to decline, with the 2017 landings the lowest in the past ten years (Figure 5). Tunas accounted for 94% of total pelagic landings with an estimated adjusted revenue of nearly $4.7 million in 2017, and an accumulated average $1.03 price per pound. Albacore accounted for over 80% of the total fleet revenue, with an estimated price of $1.16 per pound. See the Human Dimensions chapter (Section 3.1) for a full accounting of the socioeconomic data for American Samoa fisheries.

Protected Species Interactions. Protected species interactions are monitored in the American Samoa longline fishery with 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 2017 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 seabirds 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, a decade-high 63 fishermen reported landings, a significant increase from 12 in the previous year but almost twice as much as the 31 fishers in 2017.

Landings. Skipjack tuna is the principal species landed, comprising over 55% of the entire pelagic landings in 2017 based on creel survey data. Skipjack landings increased by 23% (235,063 lbs.), and total landings also increased 11% (340,896 lbs.) since 2016. Landings of mahimahi and yellowfin tuna ranked second and third, respectively, by weight of landings during 2016. Creel data estimated 45,099 lbs. of mahimahi, a 43% decrease from 2016. There was 16,968 lbs. of yellowfin landed in 2017, a 13% decrease from the 2016 landings.

Effort. In 2017, the number of trips based on commercial data receipts decreased by almost 3% from 2016. Total trolling hours were similarly lower in 2017 at 14,498 hours (a decrease of 25% from 2016). Average trip length has remained steady over the last decade, averaging between 5.1 and 5.7 hours per trip over the last decade.

Catch Rate. In 2017, trolling catch rates increased to 23.4 lbs. per trolling hour, a level closer to 2015 levels preceding a significant decrease in 2016. The catch rate for skipjack, the primary target species in CNMI, increased from 10 to 16.2 lbs. per hour fished. This catch rate is among the highest three years in the past decade. Yellowfin catch rate in 2017 was near the long-term average at 1.2 lbs. per hour, while the mahimahi catch rate decreased 28% in 2017 from the previous year.

Revenue. Commercial revenues, based on the commercial receipts, at $166,915, were near an all-time low in 2017, although as noted, not all 2017 receipts have been entered into the database. Average price per pound for all pelagics, tuna, and non-tuna pelagics, were lower than their long-term averages. The average price for all pelagics was $2.67.

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 2008-2017.

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 487 boats involved in Guam's pelagic fishery in 2017, an increase of 19.4% from 2016. 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.

Landings. The estimated annual pelagic landings have varied widely in the available 35-year time series, ranging between 383,000 and 958,000 lbs. The average total catch has shown a slowly increasing trend over the reporting period. The 2017 total expanded pelagic landings were 705,060 lbs., a decrease of 15.7 % when compared with 2016. Tuna PMUS increased 2%, while non-tuna PMUS decreased 54%. Landings consisted primarily of five major species: mahimahi, wahoo, bonita or skipjack tuna, yellowfin tuna, and Pacific blue marlin, with skipjack comprising over 81% of total landings. Other minor species caught include rainbow runner, barracudas, and pomfrets. Sharks were also caught during 2017, as they were noted in specific fishermen interviews conducted in 2017 regarding shark encounters (see 'bycatch' below). However, these species were not encountered during offshore creel surveys and were not available for expansion in 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 three of the five common species increased in 2017 from 2016 levels: Skipjack tuna increased 16.3%, wahoo increased 22.3%, and blue marlin increased 4.9%. Mahimahi catch, which accounts for the largest percentage of non-tuna PMUS landed on Guam, decreased 72.8%, while yellowfin tuna decreased 47.1%. Both mahimahi and wahoo catches fluctuate erratically from year to year, although both appear to be experiencing a long-term downward trend.

The amount of transshipped fish has ranged between 1,159 mt and 2,342 mt over the previous five years. In 2017, transshipments totaled 1,245 mt.

Effort. In 2017, the number of trolling trips decreased by 7.3%, and hours spent trolling decreased 11.7%. 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 2017 was 194, equaling 194 closure days, up from 123 in 2016.

Catch Rate. Trolling catch rates (lbs. per hour fished) showed a decrease of 9.1% from 2016 to 2017. Skipjack tuna and marlin CPUE increased, while yellowfin tuna, mahimahi, and wahoo CPUE decreased. The fluctuations in CPUE can likely be attributed to variability in the year-to-year abundance and availability of the stocks.

Revenue. Commercial revenues slightly increased in 2017, with total adjusted revenues increasing approximately 26% to $110,383. Adjusted revenue per trolling trip decreased by less than 0.1% for all pelagics, 40.2% for tuna PMUS, and increased of 26.7% 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 Guam's charter fishery. In 2017, there was 0 reported bycatch out of a total of 6,743 fish caught. Bycatch occasionally occurs in the troll fishery including sharks as well as shark-bitten and undersized fish. There was no reported bycatch in the troll fishery in 2017.

In 2017, fishers were asked if they experienced any shark interactions. There were a total of 830 interviews for boat-based fishing in 2017, with 311 of these deemed inappropriate for determining shark interactions. Of the remaining 519 interviews, 195 reported interactions with sharks and 324 reported no interactions with sharks, a 38% 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 shallow- and deep-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 2017 for about 87% 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 at 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 of the composition of the fishery.

Participation. A total of 3,744 fishermen were licensed in 2017, including 2,177 (58%) 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 (46%) and longline fishermen (41%). The remainder was issued to ika shibi and palu ahi (i.e. handline; 13%).

Landings. Hawai`i commercial fisheries landed 39,209,000 pounds of pelagic species in 2017, an increase of 6% 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 83% (32,727,000 pounds) of all pelagic fisheries. The shallow-set longline fishery targeted swordfish and its catch was 2,993,000 pounds, or 8% of the total catch. The main Hawai'i Islands trolling fishery targeted tunas, marlins, and other PMUS caught 2,146,000 pounds, or 5% of the total. MHI handline fishery targeted yellowfin tuna while the and offshore handline fishery targeted bigeye tuna. The MHI handline fishery accounted for 933,000 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 tuna, which comprised 68% of the total in 2017. Bigeye tuna alone accounted for 68% of the tunas and 46% of all pelagic catch. Billfish catch made up 18% of the total catch in 2017. Swordfish was the largest of these, at 51% of the billfish and 9% of the total catch. Catches of other PMUS represented 14% of the total catch in 2017 with moonfish being the largest component at 40% of the other PMUS and 6% of the total catch.

Bycatch. A total of 111,702 fish were released by the deep-set longline fishery in 2017. Sharks accounted for 88% 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 2% for targeted and incidentally caught pelagic species in 2017. A total of 12,008 fish were released by the shallow-set longline fishery in 2017. Sharks accounted for 85% 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, 97% 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 2017. 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 145 active Hawai`i-permitted deep-set longline vessels in 2017, three more vessel than the previous year, with 140 or more deep-set vessels in the past 4 years. The number of deep-set trips (1,539) and sets (19,647) were the highest effort over the past ten years. The number of hooks set by the deep-set longline fishery reached a record 53.5 million hooks in 2017. The Hawai`i-permitted shallow-set longline fishery operates mainly in the first half of the year. In 2017, 18 vessels completed 61 trips and made 949 sets, which was higher participation and effort for this segment of the fishery from the previous year. The number of hooks set by this fishery also increased to 1 million in 2017. The number of days fished by MHI troll fishers has been dropping since a peak in 2012, with 1,394 fishers logging 20,742 days fished around the MHI in 2017. There were 484 MHI handline fishers that fished 4,526 days in 2017, both below their respective long-term averages. The offshore handline fishery had 6 fishers and 226 days fished in 2017.

Catch Rate. The deep-set longline fishery targets bigeye tuna and this species had higher CPUE (4.2 fish per 1,000 hooks) compared to yellowfin tuna (1.5) and albacore (0.1). CPUE of billfish for the deep-set fishery is similar to that of albacore (0.1 - 0.4 fish per 1,000 hooks), while the CPUE for blue shark, a bycatch species, is second only to bigeye at 1.6 fish per 1,000 hooks. The Hawai`i-permitted shallow-set longline fishery targets swordfish and achieved a CPUE of 13.0 fish per 1,000 hooks in 2017 followed by blue shark, a bycatch species of this fishery, with a CPUE of 9.0 fish per 1,000 hooks. Mahi-mahi, 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 2017 MHI troll fishery CPUE for tunas and blue marlin were above the long-term average while CPUE for mahi-mahi and ono to decline in 2017 from their respective peaks in 2014. MHI handline CPUE for yellowfin tuna peaked in 2015 and dropped in 2016 but increased above its long-term average in 2017. 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, but dropped well below the long-term average in 2017.

Fish Size. The average weight for most species caught by the deep-set longline fishery was close to their respective long-term weights in 2017. Bigeye tuna caught in the deep-set fishery was 79 lbs. in 2017, 4% less than the long-term average. Yellowfin tuna average weight in the deep-set fishery was 71 lbs., 5% below the long-term average. 2017 saw long-term high mean weights for sailfish, black marlin, and oilfish in the deep-set fishery. All species caught by the shallow-set longline fishery were within their respective long-term mean weights except for yellowfin tuna which was 94 lbs. or 17% below its average mean weight in 2017. The shallow-set average weight of swordfish in 2017 was 199 lbs. 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 tuna species caught by the troll and handline fisheries were above their long-term average in 2017 except for bigeye tuna. Troll and handline caught blue marlin and swordfish were below their respective long-term mean weights.

Revenue. The total revenue from Hawaii's pelagic fisheries was $110.8 million in 2017, a decrease of 4% from the previous year. The deep-set longline revenue was $96.1 million in 2017. This fishery represented 87% of the total revenue for pelagic fish in Hawaii. The shallow-set longline fishery increased to $4.2 million and accounted for 4% of the revenue. The MHI troll revenue was $6.4 million or 6% of the total in 2017 and was followed by the MHI handline fishery at $2.8 million (3%). The offshore handline fishery was worth $891,000 in 2017. The trend for revenue from the deep-set longline and offshore handline fisheries was increasing while revenue of the shallow-set longline and MHI troll fisheries was decreasing. The revenue from the offshore handline fishery was steady for the past four years.

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

In 2017, there were 973 sets and 1,328,806 hooks observed in the shallow-set fishery. Since the most recent Biological Opinion for the shallow-set fishery in 2012 through the end of 2017, 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 2009 leading to an all-time high in recorded takes this year.

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 2017, there were 3,832 sets and 10,148,195 hooks observed in the deep-set fishery at 20.4% 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.

OCEANIC AND CLIMATE 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 2017 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
- Temperature at 300 m Depth
- 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 3.3.3 provides a description of each of these indicators, a 2017 snapshot of the current conditions, and a rationale for how these data may progress ecosystem-based fishery management. Ideally in the future, Chapter 4 will include 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 to report on this review as part of the annual SAFE report process, 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 2018, though ongoing Council actions may affect this schedule. The non-fishing impacts and cumulative impacts components were reviewed in 2016 through 2017 (see Minton 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, the 2017 Annual SAFE Report includes the Council’s spatially-based fishing restrictions (or MMAs), the goals associated with them, and the most recent evaluation. In addition, to meet EFH and National Environmental Policy Act (NEPA) mandates, this annual report monitors activities of interest to the Council, as well as incidents that may contribute to cumulative impact. This includes observing 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 which includes management measures and strives to integrate 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.

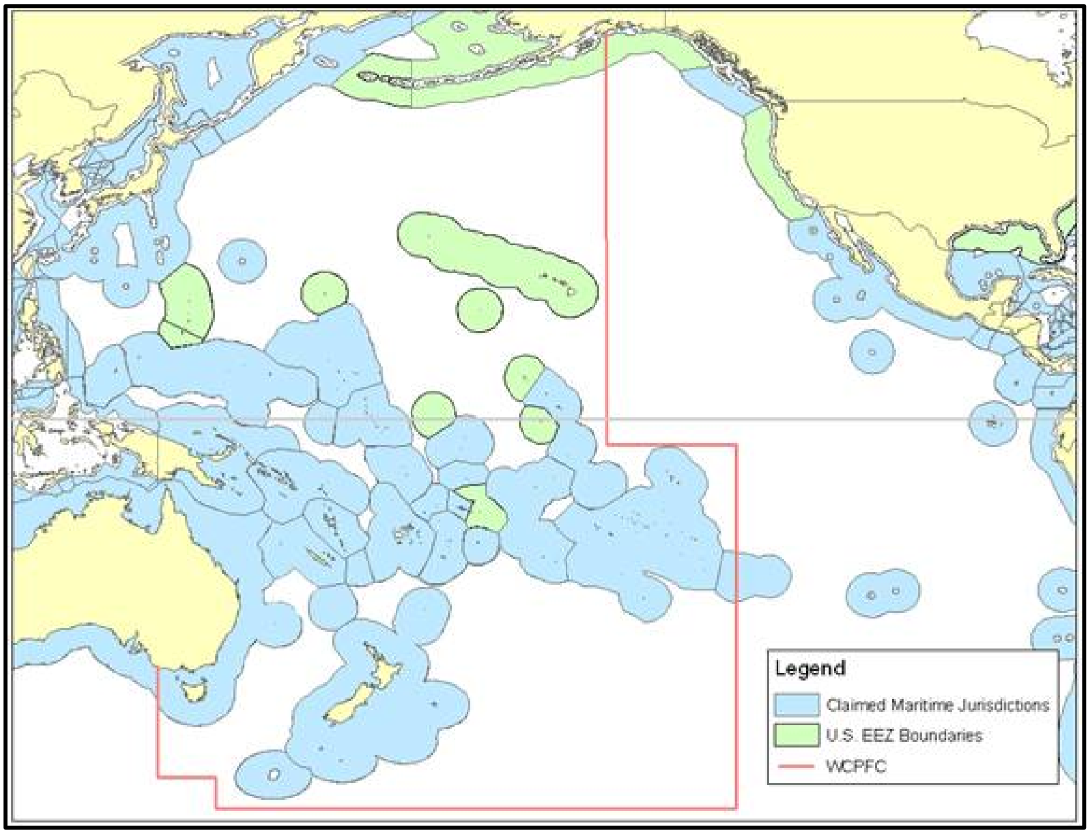
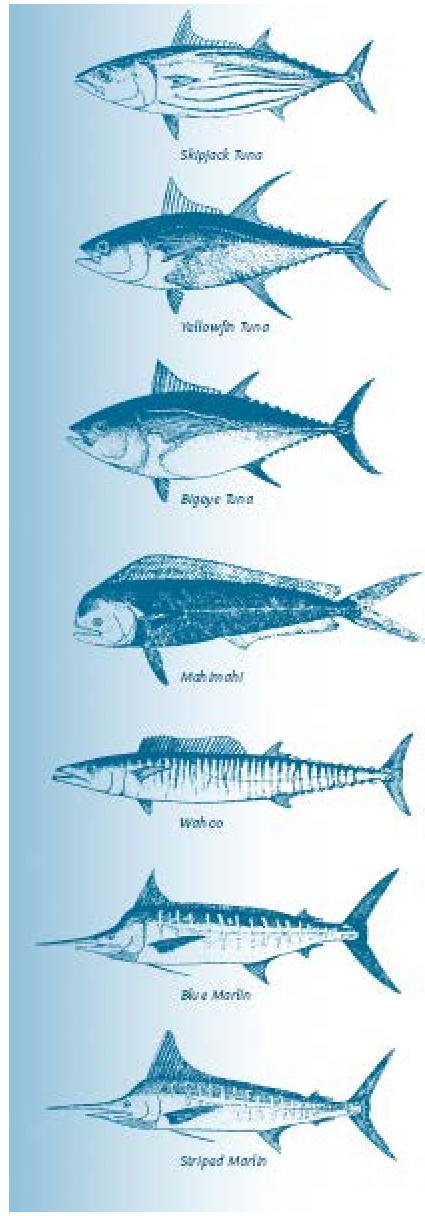


Figure 1. Map of the Western Pacific region.

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

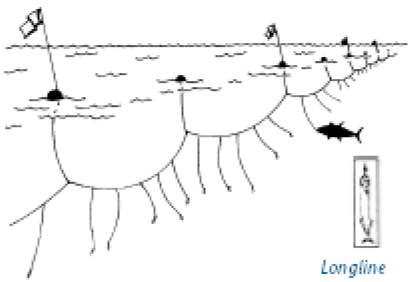
The Management Unit Species (MUS) managed under the Pelagic FEP include large pelagic species such as tunas (tribe Thunnini), billfishes (Istiophoridae and Xiphiidae), and other harvested species with distribution straddling domestic and international waters. The MUS excludes some scombrids found predominantly 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 (class Cephalopoda) except those listed in Table 1. Although caught frequently, most shark MUS are discarded alive and with fins attached in U.S. fisheries managed under the FEP. Shark finning is illegal in U.S. fisheries.

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	*Makaira mazara*	Sa'ula	A'u, Kajiki	Batto'	Taghalaar	Taghalaar
Black marlin	*Makaira indica*					
Striped marlin	*Tetrapturus audax*		Nairagi			
Shortbill spearfish	*Tetrapturus 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	*Alopias pelagicus*	Malie	Mano	Halu'u	Paaw	Paaw
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*					
Albacore	*Thunnus alalunga*	Apakoa	'Ahi palaha, Tombo	Albacore	Angaraap	Hangaraap
Bigeye tuna	*Thunnus obesus*	Asiasi, To'uo	'Ahi po'onui, Mabachi	Bigeye tuna	Toghu, Sangir	Toghu, Sangir
Yellowfin tuna	*Thunnus albacares*	Asiasi, To'uo	'Ahi shibi	'Ahi, Shibi	Yellowfin tuna	Toghu
Northern bluefin tuna	*Thunnus 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			

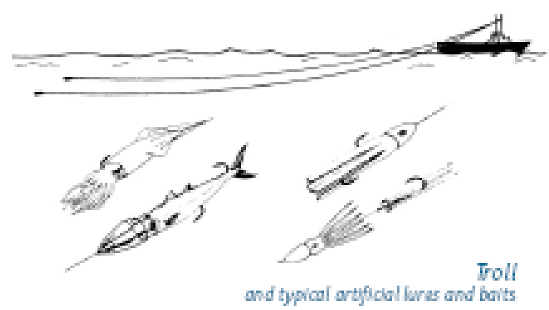
1.3 SUMMARY OF PELAGIC FISHERIES/GEAR TYPES MANAGED UNDER THE FEP

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.



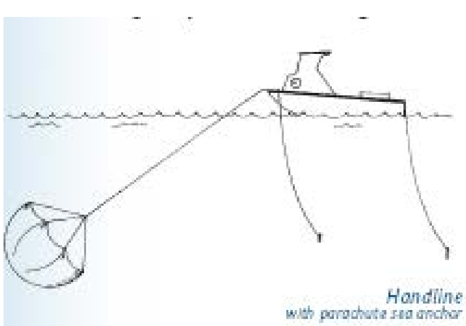
U.S. longline vessels in the Western Pacific Region are based primarily in Hawai`i and American Samoa, although Hawai`i-based vessels targeting swordfish and bigeye tuna have also fished seasonally out of California. The Hawai`i fishery, with 145 active vessels, targets a range of species, with vessels 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 American Samoa longline fleet fishes almost exclusively for albacore, which is landed at the cannery in American Samoa. 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 compared to longline and purse seine gears. 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.



The WCPO supports the world's largest tuna fishery, with around with at a total tuna catch of 3.0 million mt of fish annually. Most of the catch is taken by fleets of longliners and purse seiners from countries such as Japan, Taiwan, United States (when including the U.S. purse seine fleet), Korea and China; however, around a third of purse seine vessels operating in the WCPO are flagged to Pacific Island countries. Small scale artisanal longlining is also conducted in Pacific Island countries like Samoa.

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 surrounding environment.

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 depth, approx. 328 ft.) but the thermocline itself is diffuse (lower boundary at 300 m depth, approx. 984 ft.).

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

The small-scale longline fishery is almost defunct with only one or 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.

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 2017, there were 15 active longline vessels. Poor economic conditions have plagued the large vessel feet for several years the lowest effort and catch was observed in 2017 since the start of the fishery.

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.

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

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 community residents of American Samoa or charter businesses established legally under the laws of American Samoa.

1.3.2 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.

1.3.2.1 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.

1.3.2.2 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.

1.3.3 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.

1.3.3.1 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.

1.3.3.2 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.

1.3.4 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.

1.3.4.1 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.

1.3.4.2 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 39 million lbs. of commercial landings with a total ex-vessel value of $110.8 million in 2017. The deep-set longline fishery was the largest of all commercial pelagic fisheries in Hawai`i and represented 83% of the total commercial pelagic catch and 87% 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 2017. Bigeye tuna alone accounted for 68% of the tunas and 46% of all pelagic catch. Billfish catch made up 18% of the total catch in 2017. Swordfish was the largest of these, at 51% of the billfish and 9% of the total catch. Catches of other PMUS represented 14% of the total catch in 2017 with moonfish being the largest component at 40% of the other PMUS and 6% of the total catch.

The Hawai`i longline fishery is by far the most important economically, accounting in 2017 for about 87% 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 (latest data available)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.

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, the 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, the average mixed layer depth is around 80 m.

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

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, the 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 ADMINISTRATIVE AND REGULATORY ACTIONS

This summary describes management actions for the pelagic fisheries that NMFS implemented after the April 2017 Joint FEP Plan Team meeting.

On April 11, 2017 (82 FR 17382), NMFS issued a final rule under the Tuna Conventions Act to implement Resolution C-17-01 (Conservation of Tuna in the Eastern Pacific Ocean During 2017), which was adopted by the Inter-American Tropical Tuna Commission (IATTC or Commission) in February 2017. Applicable to 2017 only, most provisions of Resolution C-17-01 are identical in content to the previous resolution on tropical tuna management that expired at the end of 2016. The provisions that are maintained in Resolution C-17-01 from the previous resolution include a 500 metric ton (mt) bigeye tuna (*Thunnus obesus*) calendar year catch limit applicable to longline vessels greater than 24 meters (m) in overall length and a 62-day closure period applicable each year to purse seine vessels of class size 4 to 6 (greater than 182 mt carrying capacity). In addition, the resolution included a new requirement for total allowable catch limits (TACs) for yellowfin (*Thunnus albacares*) and bigeye tuna harvested in purse seine sets on floating objects (97,711 mt) and in sets involving chase and encirclement of dolphins (162,182 mt). This rule implements all of those requirements and revised related regulations for clarification purposes. This rule is necessary for the conservation of tropical tuna stocks in the eastern Pacific Ocean (EPO) and for the United States to satisfy its obligations as a member of the Inter-American Tropical Tuna Commission (IATTC).

For August 28, 2017, through December 31, 2017 (82 FR 40720), NMFS temporarily closed the U.S. commercial fishery for Pacific bluefin tuna in the EPO because the 2017 catch limit of 425 metric tons was exceeded. This action was necessary to prevent the fishery from further exceeding the applicable catch limit established by IATTC in Resolution C-16-08 (Measures for the Conservation and Management of Pacific Bluefin Tuna in the Eastern Pacific Ocean).

For September 1, 2017, through December 31, 2017 (82 FR 37824, August 14, 2017), NMFS closed the U.S. pelagic longline fishery for bigeye tuna in the western and central Pacific Ocean because the fishery had reached the 2017 catch limit of 3,138 mt of bigeye tuna (*Thunnus obesus*). This action was necessary to ensure compliance with NMFS regulations that implement decisions of the Western and Central Pacific Fisheries Commission (WCPFC).

On September 29, 2017 (82 FR 45514), NMFS issued regulations under the Tuna Conventions Act to implement amendments to Resolution C-17-01 per Resolution C-17-02 (Conservation Measures for Tropical Tunas in the Eastern Pacific Ocean During 2018-2020 and Amendment to Resolution C-17-01) which the IATTC adopted in July 2017. Applicable to the purse seine fleet fishing for tropical tunas in the EPO for the remainder of 2017, the amendments to Resolution C-17-01 removed the TACs for bigeye tuna and yellowfin tuna, and replaced them with an extension in the purse seine closure period from 62 days to 72 days. Additionally, this ensured that the time/area closure, known as the corralito, would not overlap with the extended closure periods, the amendments also shifted the dates for the corralito closure. This rule was necessary for the conservation of tropical tuna stocks in the EPO and for the United States to satisfy its obligations as a member of the IATTC.

For October 10, 2017, through December 31, 2017 (82 FR 47642, October 13, 2017), NMFS specified a 2017 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.

On October 23, 2017 (82 FR 49143), NMFS announced a valid specified fishing agreement that allocates up to 1,000 metric tons (t) of the 2017 bigeye tuna limit for the Commonwealth of the Northern Mariana Islands (CNMI) to identified U.S. longline fishing vessels. The agreement supports the long-term sustainability of fishery resources of the U.S. Pacific Islands, and fisheries development in the CNMI.

On December 1, 2017 (82 FR 57551), NMFS announced a valid specified fishing agreement that allocates up to 1,000 metric tons (t) of the 2017 bigeye tuna limit for the Territory of American Samoa 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 American Samoa.

For December 6, 2017 through December 31, 2017 (82 FR 56747, November 11, 2017), NMFS closed the U.S. pelagic longline fishery for bigeye tuna in the western and central Pacific Ocean because the fishery would reach the 2017 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.

For December 24, 2017 through December 31, 2017 (82 FR 58564, December 13, 2017), NMFS temporarily closed the U.S. purse seine fleet from fishing on fish aggregating devices (FADs) 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 (Convention) in the area between the latitudes of 20° north and 20° south. NMFS took action to enable 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. In addition, this action satisfied the obligations of the United States under the Convention, to which it is a Contracting Party.

1.5 TOTAL PELAGIC LANDINGS IN WPR FOR ALL FISHERIES

A summary of the 2017 total pelagic landings in the Western Pacific and the change between 2016 and 2017 are shown in Table 2.

Table 2. Total pelagic landings in the Western Pacific Region in 2017.

Species	American Samoa			CNMI			Guam			Hawai`i		
	2016	2017	Change	2016	2017	Change	2016	2017	Change	2016	2017	Change
Swordfish	14,762	12,347	-16.36%	0	0	-	0	0	-	2,418,000	3,580,000	48.06%
Blue marlin	66,549	83,603	25.63%	0	2,966	100.00%	44,237	42,183	-4.64%	1,542,000	1,815,000	17.70%
Striped marlin	3,990	3,990	0.00%	0	0	-	0	0	-	887,000	919,000	3.61%
Other billfish*	27,497	6,687	-75.68%	0	0	-	0	0	-	840,000	735,000	-12.50%
Mahimahi	10,447	33,729	222.86%	79,656	45,099	-43.38%	174,458	47,310	-72.88%	1,232,000	993,000	-19.40%
Wahoo	116,624	132,607	13.70%	4,968	9,811	97.48%	33,609	27,475	-18.25%	1,204,000	978,000	-18.77%
Opah (moonfish)	4,396	2,815	-35.96%	0	-	0.00%	0	0	-	2,166,000	2,289,000	5.68%
Sharks (whole wt)	1,690	780	-53.85%	0	-	0.00%	0	0	-	168,000	166,000	-1.19%
Albacore	3,215,860	3,045,774	-5.29%	0	-	0.00%	0	0	-	602,000	286,000	-52.49%
Bigeye tuna	218,022	142,823	-34.49%	0	-	0.00%	0	0	-	18,663,000	17,928,000	-3.94%
Bluefin tuna	0	0	-	0	-	0.00%	0	0	-	1,000	3,000	200.00%
Skipjack tuna	217,787	145,742	-33.08%	191,108	235,603	23.28%	437,476	508,840	16.31%	801,000	724,000	-9.61%
Yellowfin tuna	860,557	1,190,111	38.30%	19,609	16,968	-13.47%	127,520	67,463	-47.10%	4,956,000	7,518,000	51.69%
Other pelagics**	10,028	4,063	-59.48%	10,383	2,754	-73.48%	18,765	11,789	-37.18%	1,603,000	1,276,000	-20.40%
Total	4,343,453	4,807,030	10.67%	307,901	340,869	-10.71%	836,065	705,637	15.60%	37,083,000	39,210,000	5.74%

Note: Total Pelagic Landings based on commercial reports and/or creel surveys; % change based on 2016 landings relative to 2017 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 AND PLAN TEAM RECOMMENDATIONS

Regarding the Pelagic annual SAFE report, the Council:

1) Recommended PIFSC conduct an economic cost-benefit analysis on the use of large circle hooks in the American Samoa longline fishery to determine whether modifying the green turtle mitigation measures in the fishery may contribute to further reductions in interactions in the fishery without significant negative impacts on fishery operations and revenue.

2) Directed staff to work with the PIRO Observer Program to streamline the process of accessing observer data to facilitate data access for annual SAFE report development and other purposes.

3) Directed staff to further develop a standardized metric for monitoring protected species interactions in the annual SAFE report.

4) Directed staff to determine the utility of the having species level data in the Hawaiian and American Samoa recreational fisheries modules of the Pelagic annual SAFE report.

5) Requested WPacFIN work with local territory agencies to develop an automated module to estimate pounds sold versus not sold for expanded creel survey catch of PMUS in the Pelagic annual SAFE report.

6) Requested that Guam Bureau of Statistics and Plans report on their import-export data base project, which received funding from the Saltonstall-Kennedy Grant Program, and directed Council staff to evaluate the inclusion of PLUS import data into the Socioeconomic module of the Pelagic annual SAFE report.

Regarding the Pelagic annual SAFE report, in addition to Action Items for Pelagic Plan Team members on improvements to report modules, the following recommendation was forwarded to the Council:

1) The Pelagic Plan Team recommends that, if the American Samoa Large Vessel Prohibited Area is modified, the Council request monitoring potential fisheries interactions, levels of participation, and catch rates between small- and large-vessel sectors.

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2 DATA MODULES

2.1 AMERICAN SAMOA

2.1.1 DATA SOURCES

T his 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). Data collected by NMFS PIFSC from American Samoa longline logbooks are also included. 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 Tutuila and Manu'a boat-based creel surveys to collect information on subsistence, recreational, as well as commercial pelagic troll and handline 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 increased 2% from 2016 to 2017 (from 196 to 200 days, see Table A-1), with nearly 55% of days sampled. The survey sampled approximately 52% of the total estimated trolling trips and interviewed nearly 30% of small-boat fishermen. Surveyors have noted that fishermen may not accurately report the number of fish released at sea, although the troll fishery in American Samoa is not 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 as there has been fewer than 3 alia longline vessels operating since 2006. 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 2017, except that the number of vendors participating in the Commercial Purchase System has increased.

Participation (number of boats, fishers) is determined through both logbook entries and creel interviews. Effort (number of trips or hooks) is determined by direct reporting for longline trips, but is indirectly calculated for trolling trips based on total reported pounds landed, average hourly catch rate, and duration for trip based on creel surveys.

DMWR implemented a fuel subsidy program from 2015 through 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, fish weight was determined for cannery landings based on a length to weight conversion from cannery sampling data; longline boats have been landing their catches gilled and gutted since 1999. The cannery sampling program was discontinued in 2015, thus average weight data from vessels landing at the cannery are no longer available. For 2017, WPacFIN used length-weight proxies in order to estimate the weight and value of fish landings for the longline fishery in American Samoa.

For non-longline estimated weights, the current summaries are based on the best available average weight data for 2017, which come from DMWR's boat-based creel surveys. Fish caught on small boats are generally smaller than fish caught on larger ocean-going vessels, contributing to a relatively lower weight estimate for the fishery in a given year. Over the course of 2017, PIFSC FRMD's International Fisheries Program (IFP) began estimating the average weight of fish kept in the longline fishery from observer data. This alternative source of data provides trip-level average weights for vessels with observer coverage. These weights are expected to be more representative of the longline fishery, but will not be available for trips that do not carry observers. The protocol for handling unobserved trips has been developed by IFP, which provided the data for this 2017 report.

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 generally lower than non-cannery markets. Another portion of the catch is given away or taken home. In the absence of a cannery sampling program in 2017, WPacFIN had to apply a number of estimates. For the top five cannery species (albacore, skipjack, yellowfin and bigeye 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 they enter the commercial market or not. Commercial landings cover the portion of the total landings that were sold either to the cannery and/or smaller local markets. The difference between total landings and commercial landings is the non-commercial 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 2017 landings were just over 4.5 million pounds, further contributing to the declining catch trend (Figure 4). Pelagic landings consist mainly of four tuna species – albacore, yellowfin, skipjack, and bigeye – which, when combined with other tuna species, comprise over 94% of the total landings. Albacore made up approximately 68% of the tuna species. Wahoo and blue marlin made up most of the non-tuna species landings, with a notable contribution from mahimahi as well (Table 3).

Longline Effort. There were 15 vessels that fished in the U.S. EEZ around American Samoa in 2017 according to the PIRO Sustainable Fisheries Division permit program, a decrease from the 20 vessels that fished in 2016. The following number of vessels were active in each class: nine Class D vessels (> 70 foot), five Class C (50-60 foot), zero Class B vessels (40-50 foot), and one Class A (< 40 foot). The vessels that fished in 2017 made 135 trips (averaging nine trips per vessel), deployed 2,333 sets, (155 sets/vessel) using 6.6 million hooks (Table 5).

Longline Catch-Per-Unit-Effort (CPUE). The total pelagic catch rate by all longline vessels increased by 0.1 fish/1,000 hooks in 2017 as compared to 2016. The tuna catch rate also increased by 0.5 fish/1,000 hooks in 2017. Non-tuna pelagic management unit species have all shown relatively constant catch rates from 2009 to 2017, though 2017 had the lowest catch rate at 2.0 fish/1,000 hooks. The longline catch rate for tuna species has fluctuated over the past decade. The catch rate for albacore, the primary species targeted by longline boats, slightly decreased this year (by 0.2 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. From this point, the catch rate continued to decrease every year until a 2016 spike before returning to lower values in 2017. Troll trips increased by 29% from 2016 to 2017 (128 trips to 179 trips), and troll hours have reportedly tripled. The average catch per troll hour for all pelagic species, however, decreased to a decadal low (Figure 19). The catch rate for blue marlin, skipjack, and yellowfin have all notably decreased (Figure 20 and Figure 21).

Fish Size. Since the last year of available data from the cannery sampling program was 2015 average weight-per-fish is not reported for the past two years. Average albacore weight ranged from 38-39 lbs. in 2015. There was a slight variation for yellowfin and bigeye tuna size in the last five years of data collected. For yellowfin, weight varied from 50-60 lbs., and varied from 45-54 lbs. for bigeye tuna. 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 2017 landings reaching an all-time-low (Figure 5). Tunas accounted for nearly 95% of total pelagic landings with an estimated adjusted revenue of $4.7 million in 2017, and an accumulated average $0.99 price per pound. In 2017, the average albacore price was $1.16 per pound (whole weight), or $0.01 per pound higher than that in the previous year. See the Human Dimensions (Section 3.1) section for socioeconomic data on American Samoa pelagic fisheries.

Bycatch. There was no recorded bycatch for the troll fishery in 2017 (Table 12). In the longline fishery, less than 1% of the tuna catch was released. Albacore and yellowfin were the most released bycatch tuna species. Conversely, sharks and oilfish had the highest release numbers of non-tunas, having 99.7% and 98.5% of each species released, respectively (Table 6). In total, only 6% of all pelagic species caught were released. Fish are released for various reasons including quality, handling and storage difficulties, and marketing problems.

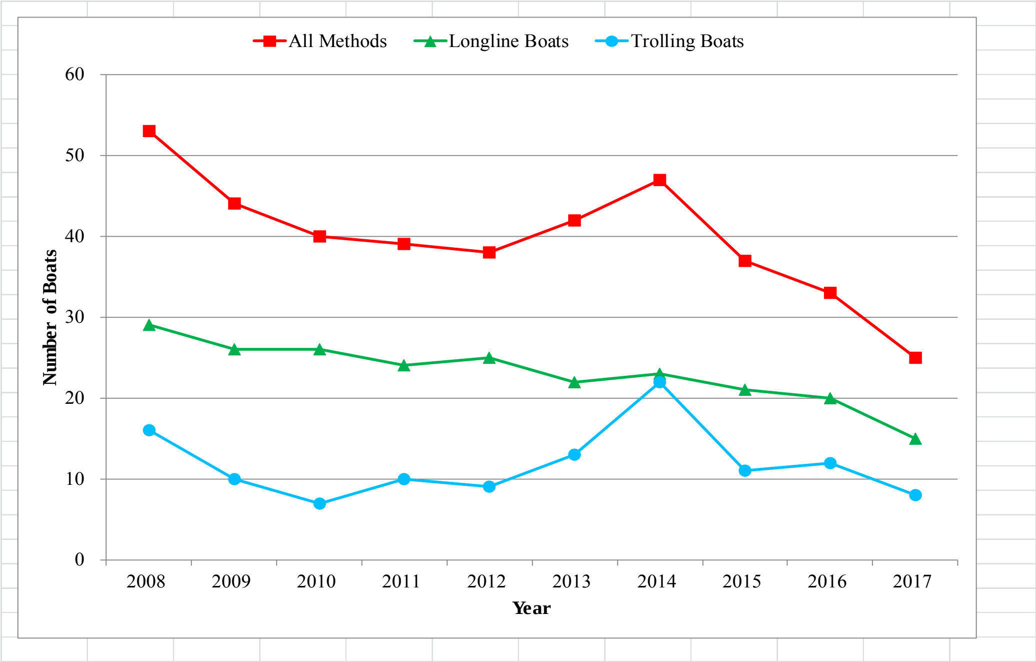
2.1.3 PLAN TEAM RECOMMENDATIONS

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

The Pelagic Plan Team recommends that, if the American Samoa Large Vessel Prohibited Area is modified, the Council request monitoring potential fisheries interactions, levels of participation, and catch rates between small- and large-vessel sectors.

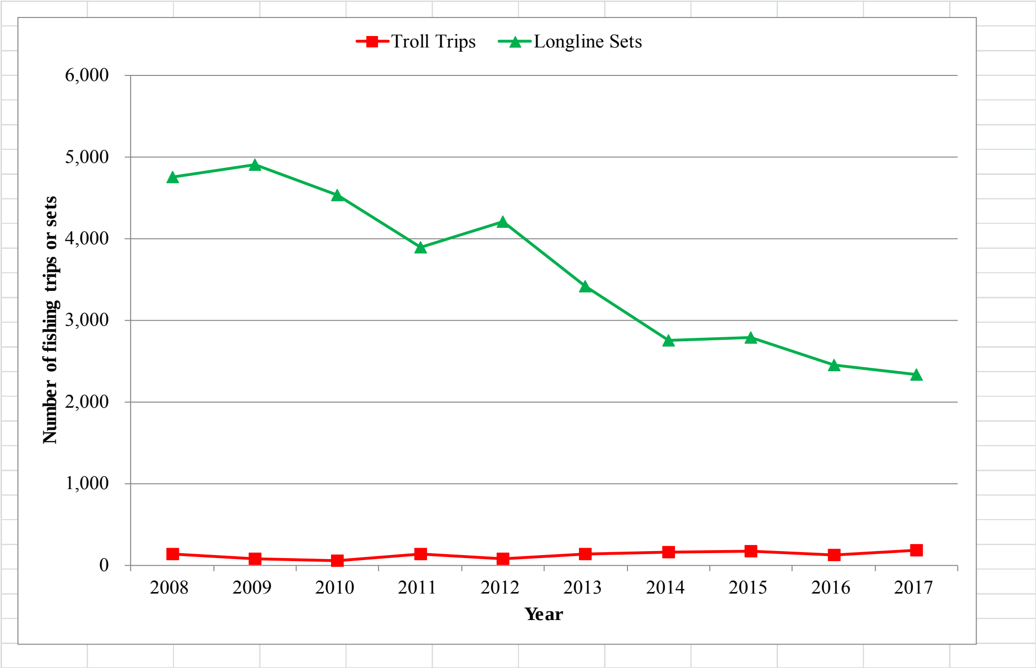
2.1.4 OVERVIEW OF PARTICIPATION – ALL FISHERIES

Figure 2. Number of American Samoa boats landing any pelagic species by longlining, trolling, and all methods from 2008-2017.



Supporting data shown in Table A-2.

Figure 3. Number of American Samoa fishing trips or sets for all pelagic species from 2008-2017.



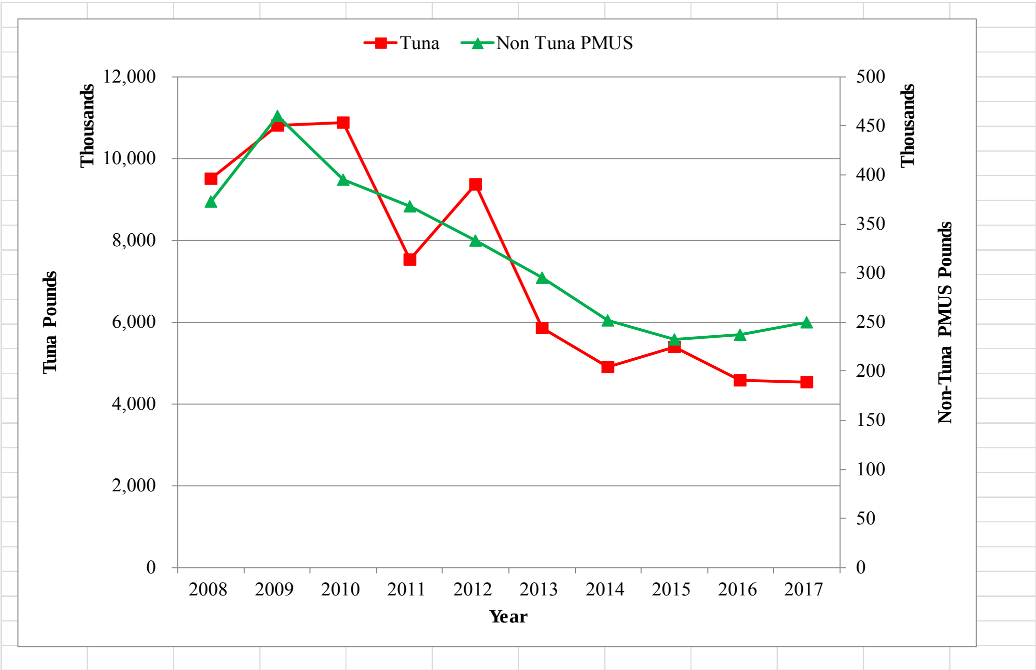
Supporting data shown in Table A-3.

2.1.5 OVERVIEW OF LANDINGS – ALL FISHERIES

Table 3. 2017 Estimated total landings (lbs.) of pelagic species by gear in American Samoa.

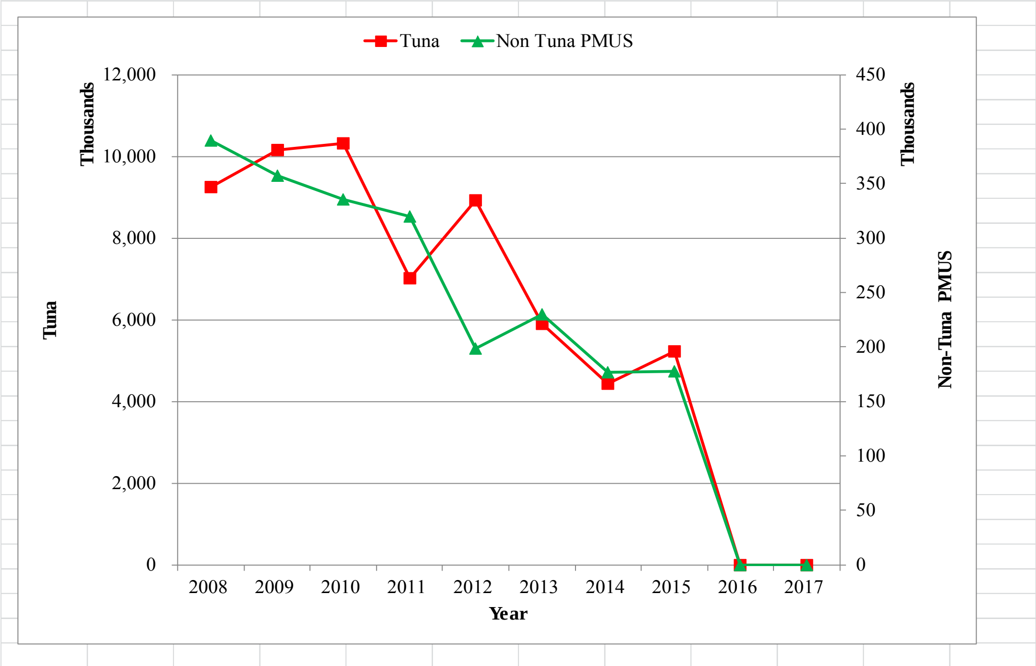
Species	Longline Pounds	Troll Pounds	Other Pounds	Total Pounds
Skipjack tuna	138,684	7,058	0	145,742
Albacore tuna	3,045,774	0	0	3,045,774
Yellowfin tuna	1,175,128	14,983	0	1,190,111
Kawakawa	0	101	43	144
Bigeye tuna	141,008	1,815	0	142,823
Bluefin tuna	0	0	0	0
Tunas (unknown)	144	0	0	144
Tuna PMUS Total	**4,500,738**	**23,957**	**43**	**4,524,738**
Mahimahi	29,907	1,381	0	31,288
Black marlin	113	0	0	113
Blue marlin	82,791	812	0	83,603
Striped marlin	3,990	0	0	3,990
Wahoo	105,789	890	116	106,795
Sharks (unknown coastal)	780	0	0	780
Swordfish	12,347	0	0	12,347
Sailfish	3,262	0	0	3,262
Spearfish	3,312	0	0	3,312
Moonfish	2,815	0	0	2,815
Oilfish	568	0	177	745
Pomfret	810	0	0	810
Non-Tuna PMUS Total	**246,484**	**3,083**	**293**	**249,860**
Barracudas	941	13	246	1,200
Great barracuda	0	0	0	0
Small barracudas	0	0	0	0
Rainbow runner	0	765	217	982
Dogtooth tuna	0	593	1,288	1,881
Pelagic fishes (unknown)	0	0	0	0
Non-PMUS Pelagics Total	**941**	**1,371**	**1,751**	**4,063**
Total Pelagics	**4,748,163**	**28,411**	**2,087**	**4,778,661**

Figure 4. American Samoa annual estimated total landings of tuna species and non-tuna PMUS from 2008-2017.



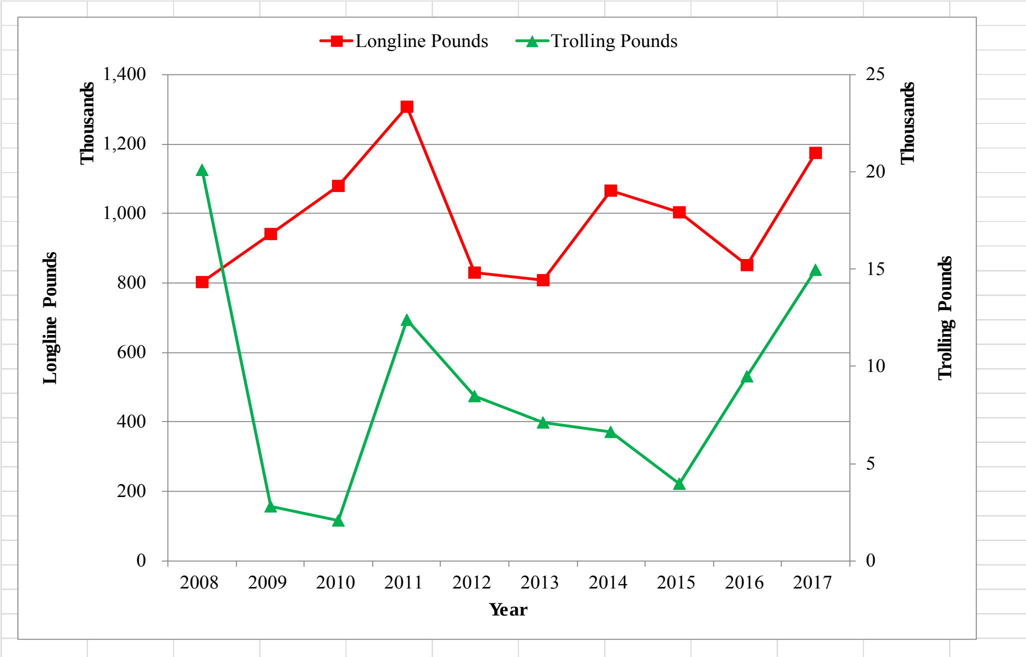
Supporting data shown in Table A-4.

Figure 5. American Samoa annual commercial landings of tuna species and non-tuna PMUS from 2008-2015.



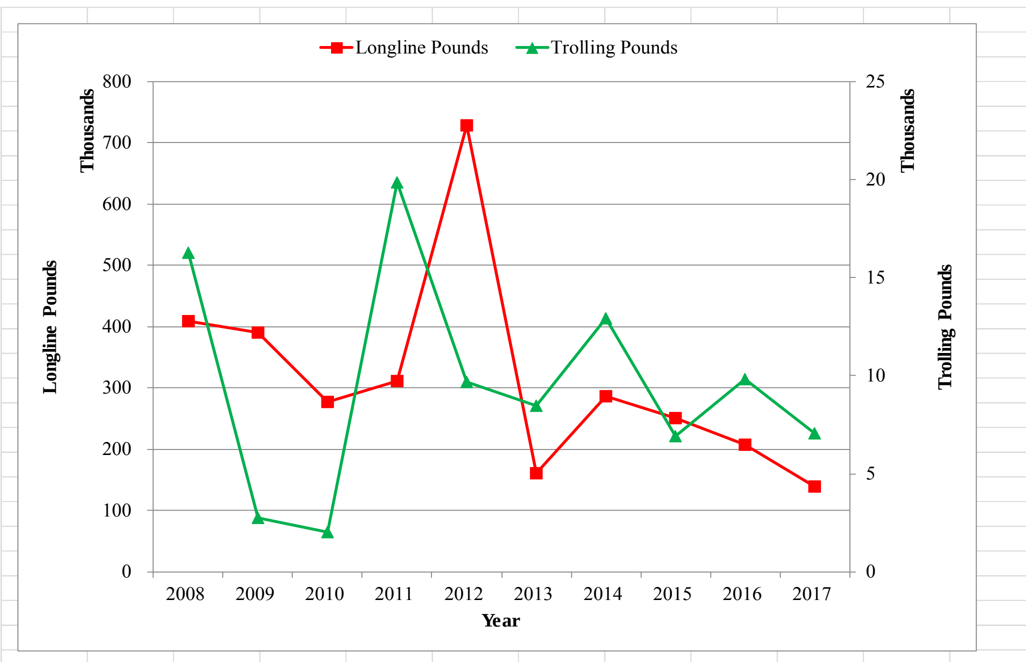
Supporting data shown in Table A-5.

Figure 6. American Samoa annual estimated total landings of yellowfin tuna from 2008-2017.



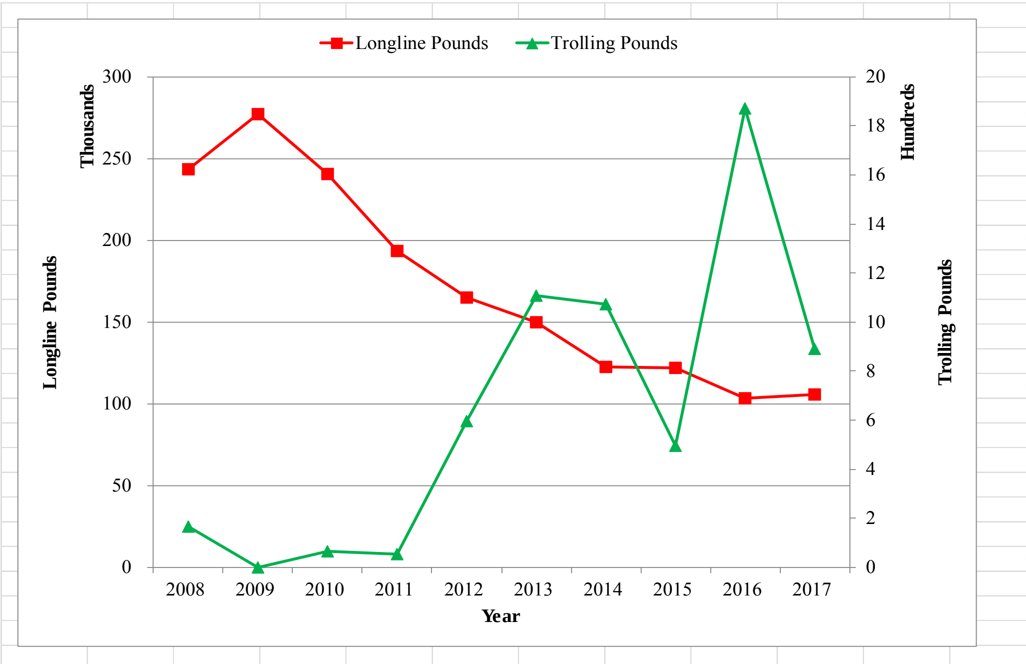
Supporting data shown in Table A-6.

Figure 7. American Samoa annual estimated total landings of skipjack tuna from 2008-2017.



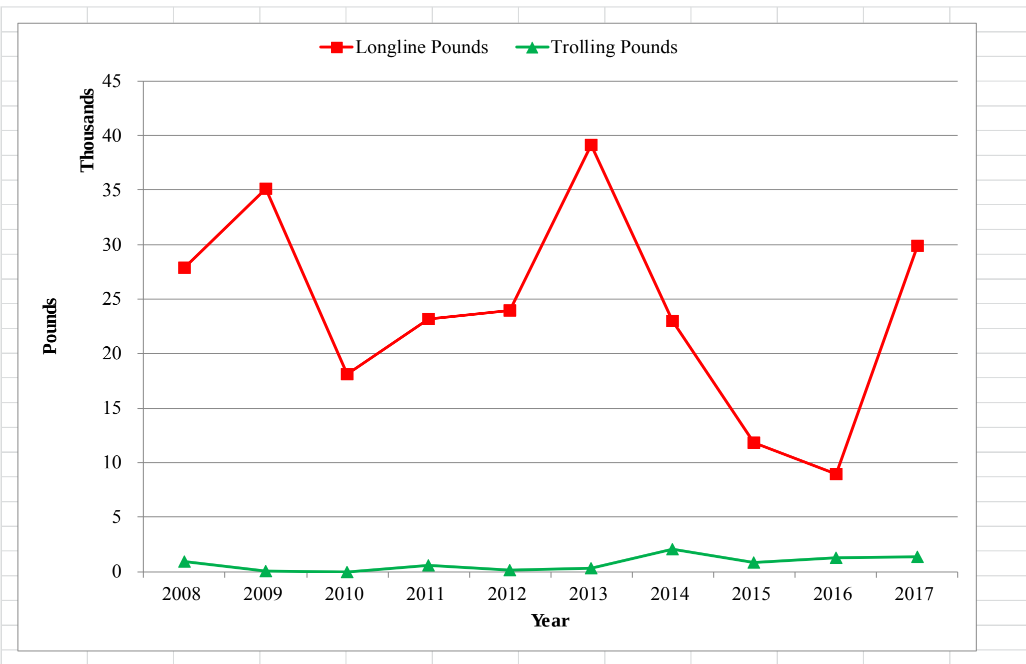
Supporting data shown in Table A-7.

Figure 8. American Samoa annual estimated total landings of wahoo from 2008-2017.



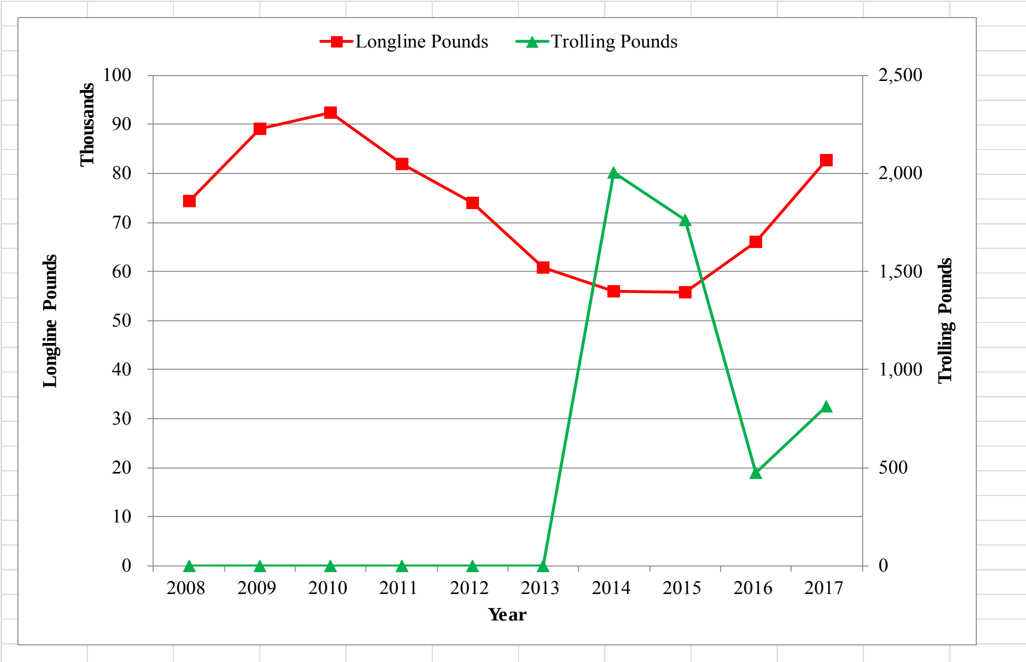
An unrepresentative amount of wahoo were caught on one day in the troll fishery in 2016. The supporting data is shown in Table A-8.

Figure 9. American Samoa annual estimated total landings of mahimahi from 2008-2017.



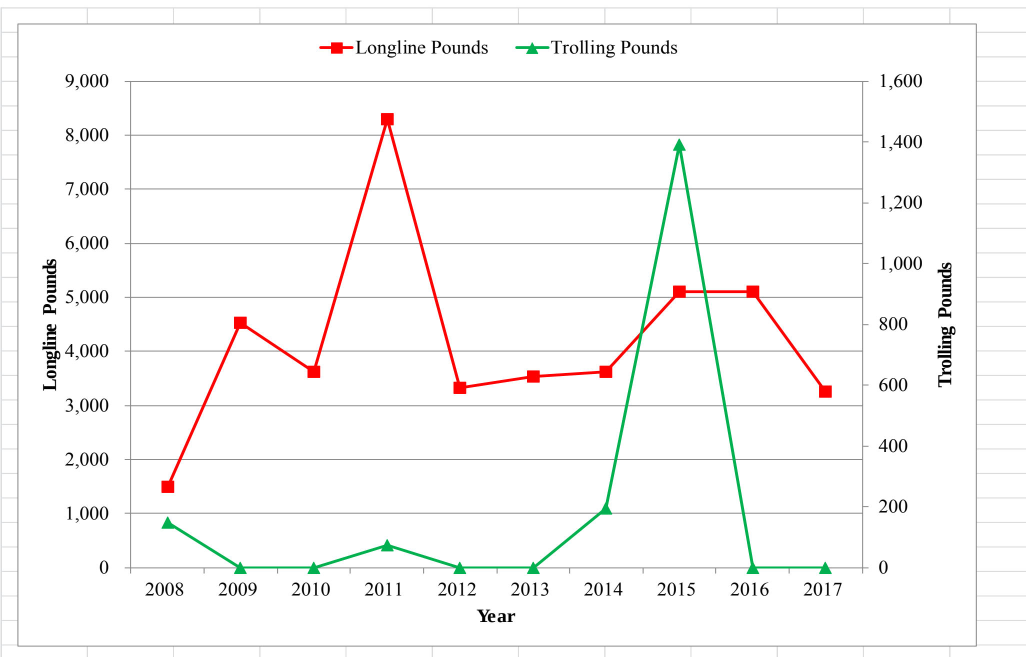
Supporting data shown in Table A-9.

Figure 10. American Samoa annual estimated total landings of Blue Marlin from 2008-2017.



Supporting data shown in Table A-10.

Figure 11. American Samoa annual estimated total landings of Sailfish from 2008-2017.



Supporting data shown in Table A-11.

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

Table 4. Number of permitted and active longline fishing vessels by size class from 2008-2017.

Year	Class A Permits	Class A Active	Class B Permits	Class B Active	Class C Permits	Class C Active	Class D Permits	Class D Active
2008	17	1	6	0	9	8	26	20
2009	16	1	5	0	8	8	26	17
2010	12	1	5	0	12	7	26	18
2011	12	1	5	0	12	8	27	15
2012	5	3	5	0	11	8	27	14
2013	5	1	5	0	11	7	26	14
2014	14	2	5	0	12	7	26	14
2015	7	3	3	0	12	6	27	12
2016	7	2	4	0	12	5	27	13
2017	7	1	3	0	11	5	27	9

Note: These data are used for Figure 12 that follows.

Figure 12. Number of active longline fishing vessels in size classes A (< 40 ft.), B (40-50 feet), C (51-70 feet) and D (> 70 ft.) from 2008-2017.

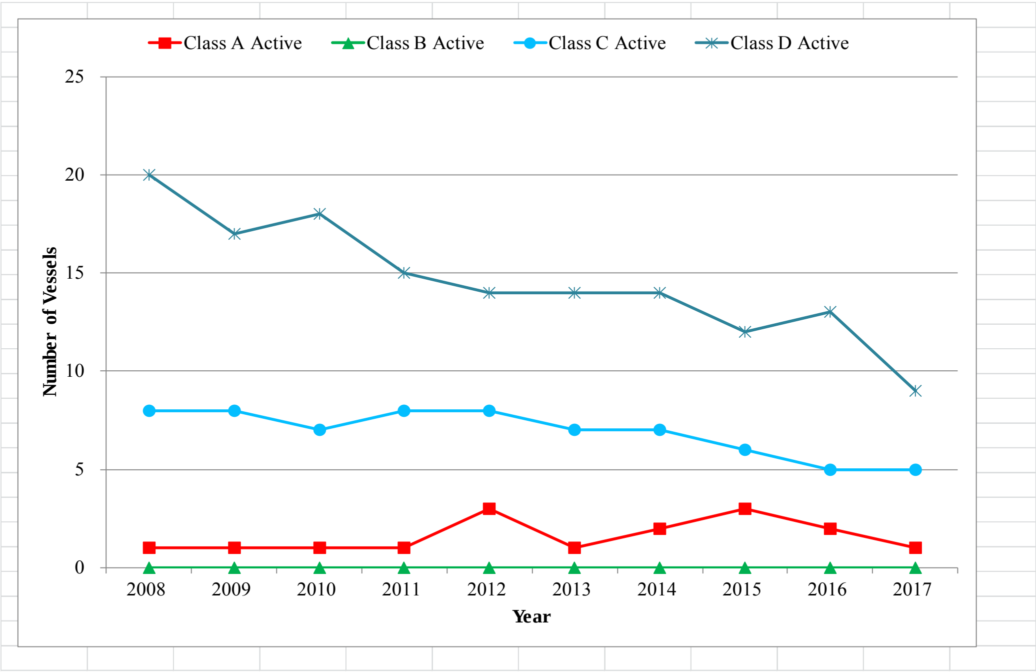
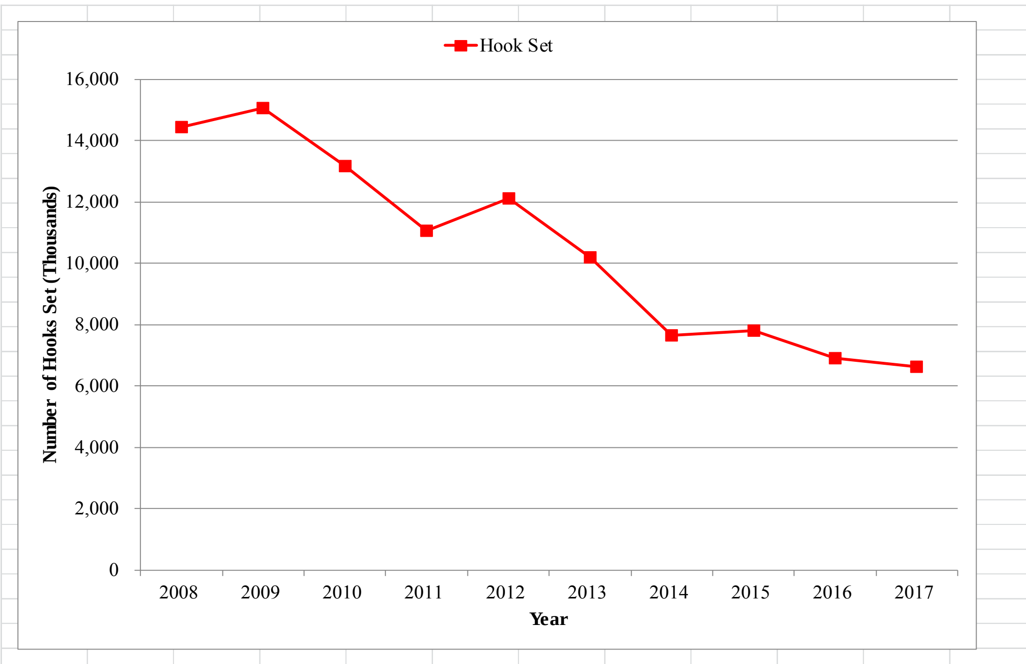


Table 5. Longline Effort by American Samoan Vessels during 2017.

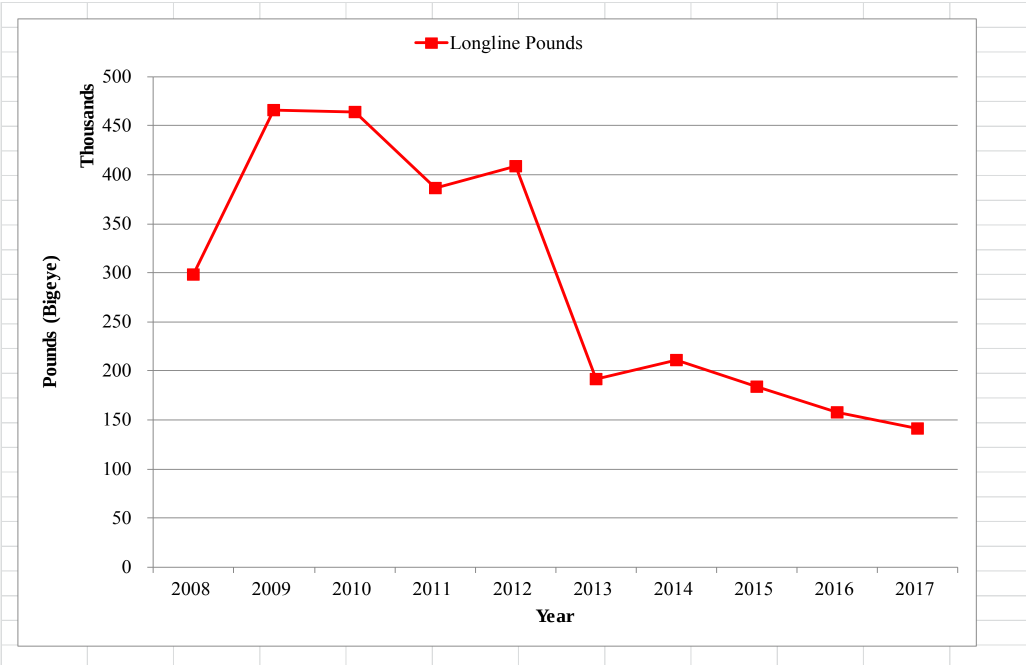
EFFORTS	ALL VESSELS
Boats	15
Trips	135
Sets	2,333
1000 Hooks	6,623

Figure 13. Thousands of American Samoa longline hooks set (Federal Logbook Data) from 2008-2017.



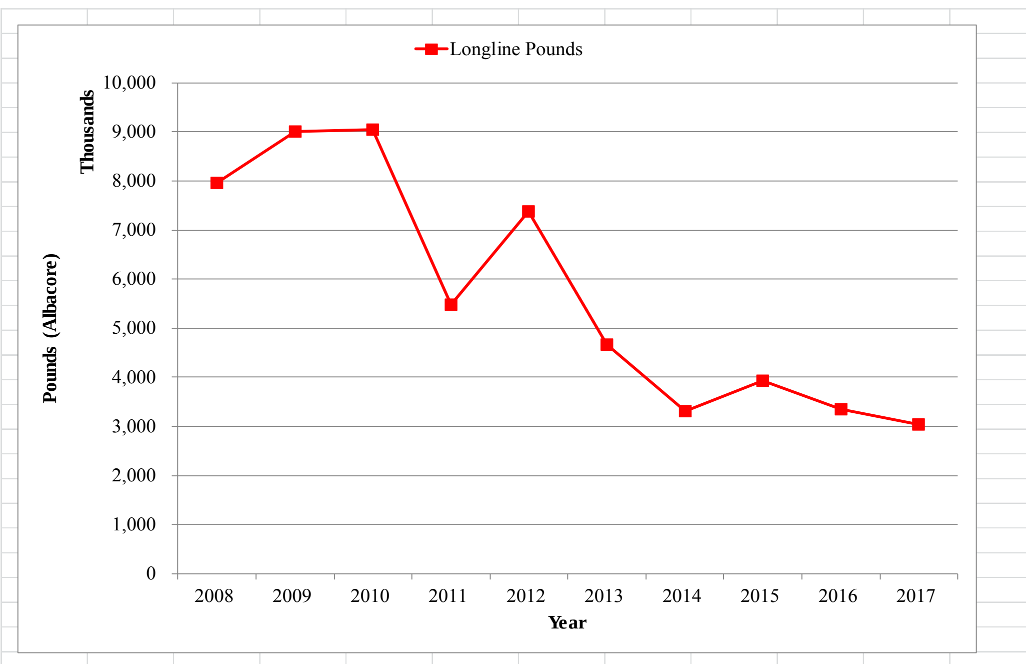
Supporting data shown in Table A-12.

Figure 14. American Samoa annual estimated total landings of bigeye tuna by longlining from 2008-2017.



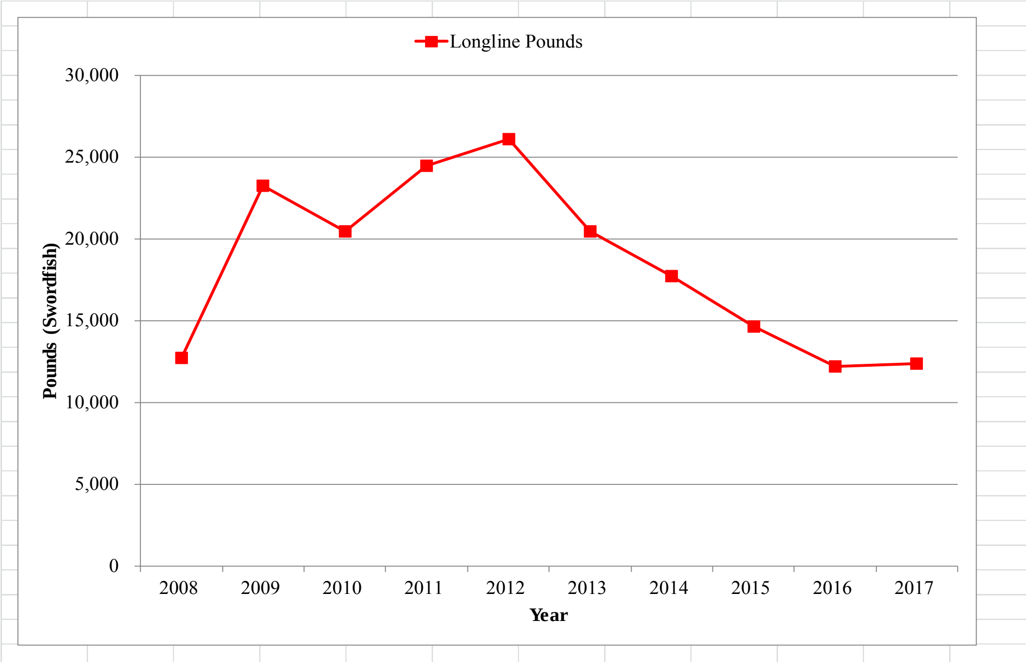
Supporting data shown in Table A-13.

Figure 15. American Samoa annual estimated total landings of albacore by longlining from 2008-2017.



Supporting data shown in Table A-14.

Figure 16. American Samoa total annual estimated landings of swordfish by longlining from 2008-2017.

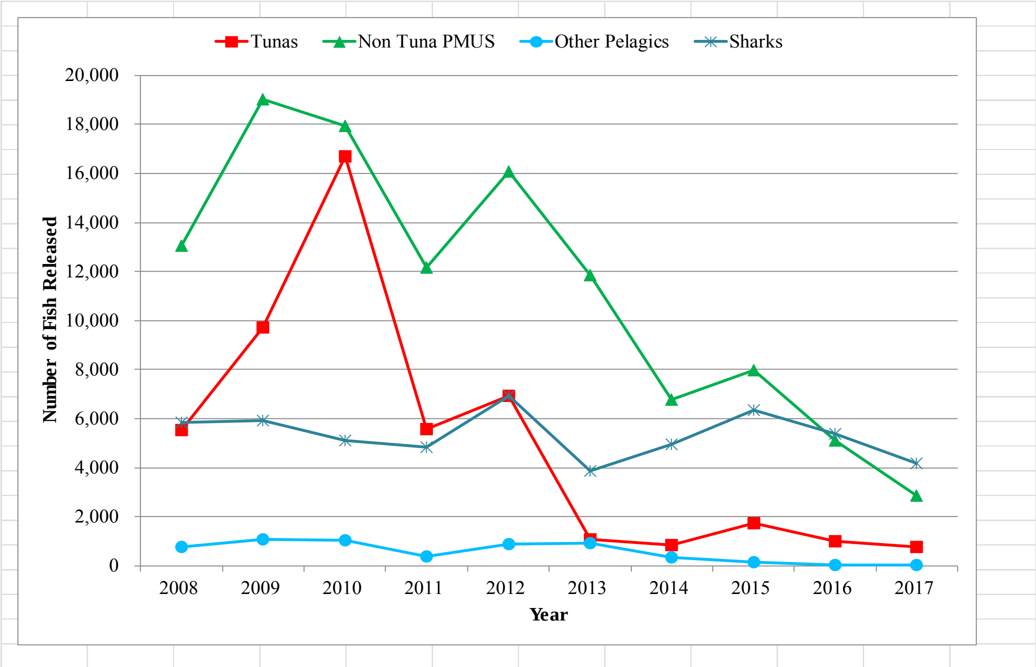


Supporting data shown in Table A-15.

Table 6. Number of fish kept, released, and percent released for all American Samoa longline vessels in 2017.

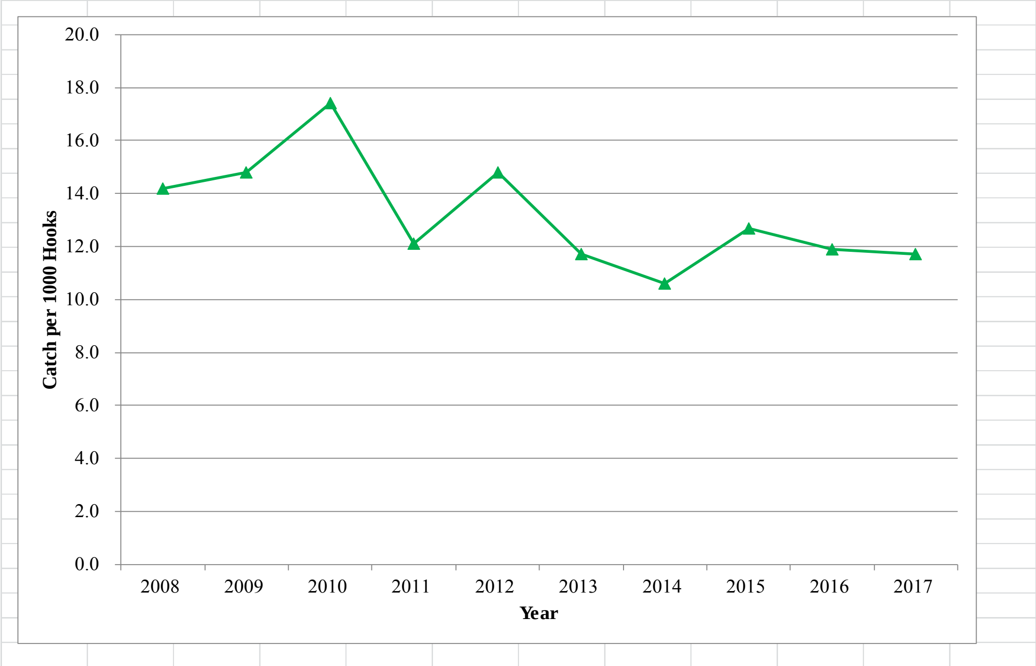
Species	Number Kept	Number Released	Total Caught	Percent Released
Skipjack tuna	10,228	52	10,280	0.5
Albacore tuna	76,857	490	77,347	0.6
Yellowfin tuna	24,855	216	25,071	0.9
Kawakawa	0	0	0	0.0
Bigeye tuna	2,483	9	2,492	0.4
Tunas (unknown)	8	0	8	0.0
Tuna PMUS Total	**114,431**	**767**	**115,198**	**0.7**
Mahimahi	1,399	17	1,416	1.2
Black marlin	1	1	2	50.0
Blue marlin	648	45	693	6.5
Striped marlin	58	16	74	21.6
Wahoo	4,718	35	4,753	0.7
Sharks (unknown coastal)	12	4,177	4,189	99.7
Swordfish	122	44	166	26.5
Sailfish	46	53	99	53.5
Spearfish	72	126	198	63.6
Moonfish	57	41	98	41.8
Oilfish	30	1,974	2,004	98.5
Pomfret	92	500	592	84.5
Non-Tuna PMUS Total	**7,255**	**7,029**	**14,284**	**49.2**
Barracudas	83	38	121	31.4
Rainbow runner	0	0	0	0.0
Dogtooth tuna	0	0	0	0.0
Non-PMUS Pelagics Total	**83**	**38**	**121**	**31.4**
Total Pelagics	**121,769**	**7,834**	**129,603**	**6.0**

Figure 17. Number of Fish Released by American Samoa Longline Vessels from 2008-2017.



Supporting data shown in Table A-16.

Figure 18. American Samoa Albacore catch/1,000 hooks by Monohull Vessels from Longline Logbook Data from 2008-2017.



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 7. American Samoa catch/1,000 hooks for alia vessels from 1996-1998.

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 8. American Samoa catch/1,000 hooks for two types of longline vessels from 1999-2002.

Species	Alias 1999	Monohulls 1999	Alias 2000	Monohulls 2000	Alias 2001	Monohulls 2001	Alias 2002	Monohulls 2002
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 Total	**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 9. American Samoa catch/1,000 hooks for two types of longline vessels from 2003-2005.

Species	Alias 2003	Monohulls 2003	Alias 2004	Monohulls 2004	Alias 2005	Monohulls 2005
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 10. American Samoa Catch/1,000 Hooks for all vessels from 2006-2011.

Species	All Vessels 2006	All Vessels 2007	All Vessels 2008	All Vessels 2009	All Vessels 2010	All Vessels 2011
Skipjack tuna	3.2	2.3	2.4	2.3	2.4	2.5
Albacore tuna	18.4	18.4	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**	**23.5**	**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	0.0	0.0	0.0	0.1	0.0
Non-PMUS Pelagic Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**
Total Pelagics	**27.5**	**25.8**	**20.1**	**21.3**	**25.0**	**19.7**

Table 11. American Samoa Catch/1,000 Hooks for all types of longline vessels from 2012-2017.

Species	All Vessels 2012	All Vessels 2013	All Vessels 2014	All Vessels 2015	All Vessels 2016	All Vessels 2017
Skipjack tuna	4.3	1.1	2.5	2.0	2.0	1.6
Albacore tuna	14.8	11.7	10.6	12.7	11.9	11.7
Yellowfin tuna	1.2	1.9	2.5	2.6	2.6	3.8
Bigeye tuna	0.6	0.4	0.7	0.6	0.5	0.4
Tuna PMUS Total	**20.9**	**15.1**	**16.3**	**17.9**	**17.0**	**17.5**
Mahimahi	0.1	0.2	0.2	0.1	0.1	0.2
Blue marlin	0.1	0.1	0.1	0.1	0.1	0.1
Wahoo	0.7	0.7	0.7	0.7	0.7	0.7
Sharks (unknown coastal)	0.6	0.4	0.6	0.8	0.8	0.6
Spearfish	0.1	0.1	0.1	0.1	0.0	0.0
Moonfish	0.1	0.0	0.0	0.0	0.0	0.0
Oilfish	0.8	0.7	0.6	0.8	0.6	0.3
Pomfret	0.1	0.1	0.1	0.1	0.1	0.1
Non-Tuna PMUS Total	**2.6**	**2.3**	**2.4**	**2.7**	**2.4**	**2.0**
Non-PMUS Pelagic Total	**0.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**
Total Pelagics	**23.6**	**17.5**	**18.7**	**20.6**	**19.4**	**19.5**

2.1.7 AMERICAN SAMOA TROLLING BYCATCH AND CPUE

Data for participation, effort, landings, and revenue are found in previous sections of this chapter. Statistics summarizing bycatch for the American Samoan trolling fishery are shown in (Table 12).

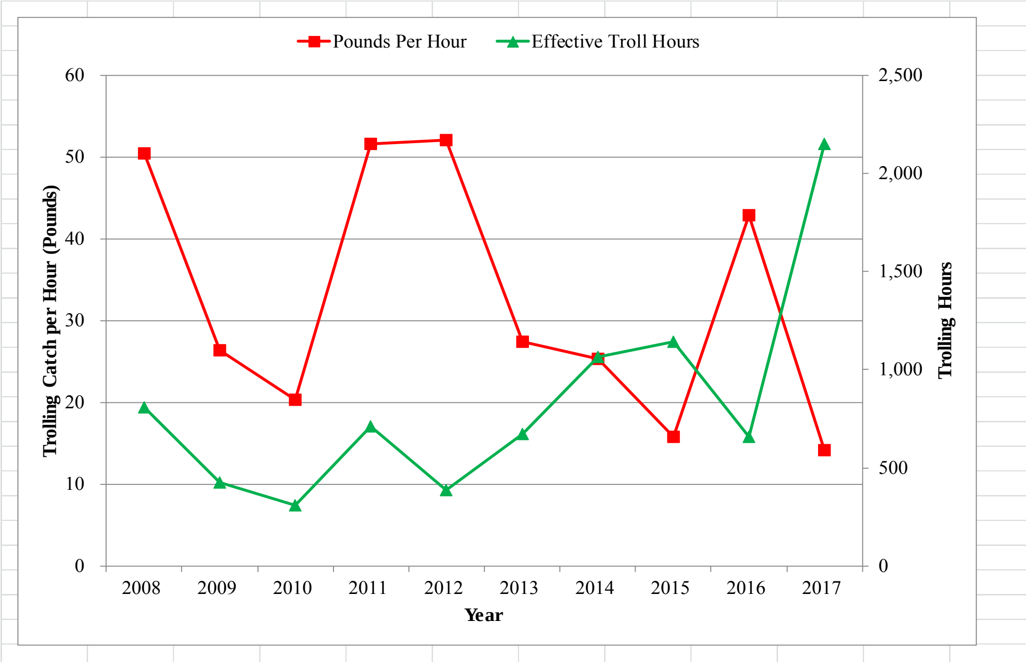
Table 12. American Samoa 2017 Trolling Bycatch Summary (Released Fish).

Year	Release Alive	Release Injured	Release Unknown	Total Bycatch	Total Catch	Percent Bycatch	Bycatch Interview	Total Interview	Percent Bycatch Interview
2017	0	0	0	0	915	0.0	0	41	0.0

Notes:

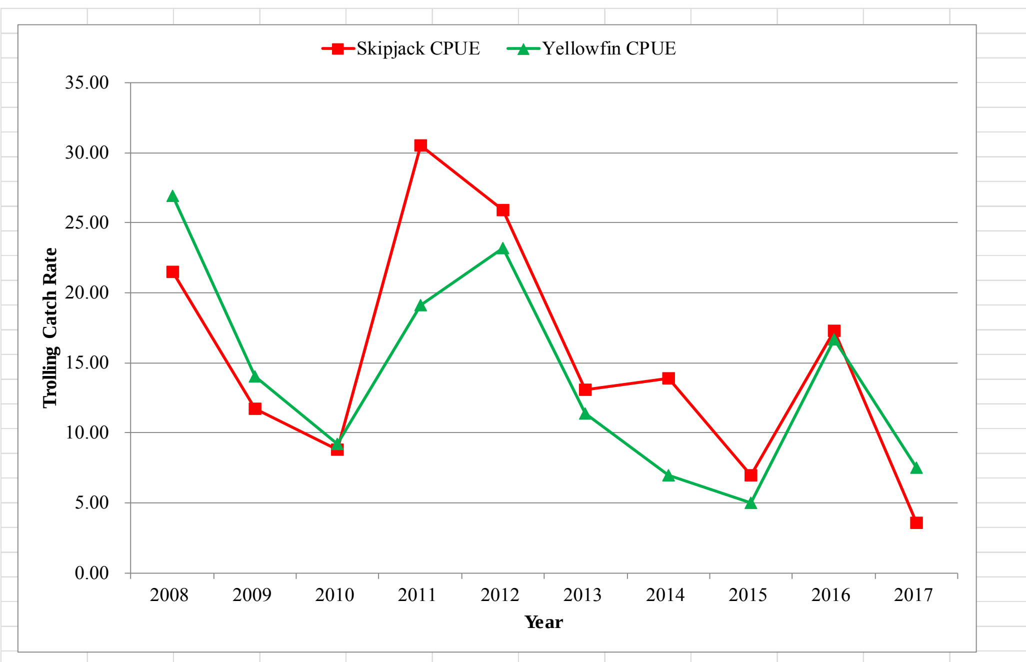
1. "Catch" is the total number of fish counted and estimated in interviews (Tutuila & Manu'a islands) for trolling method.
2. Bycatch information is calculated from raw interview data and represents the % of fish caught or % of interviews (trolling trips) with bycatch.
3. Abbreviations: Dead Inj; released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

Figure 19. American Samoa pelagic catch-per-hour of trolling and number of trolling hours from 2008-2017.



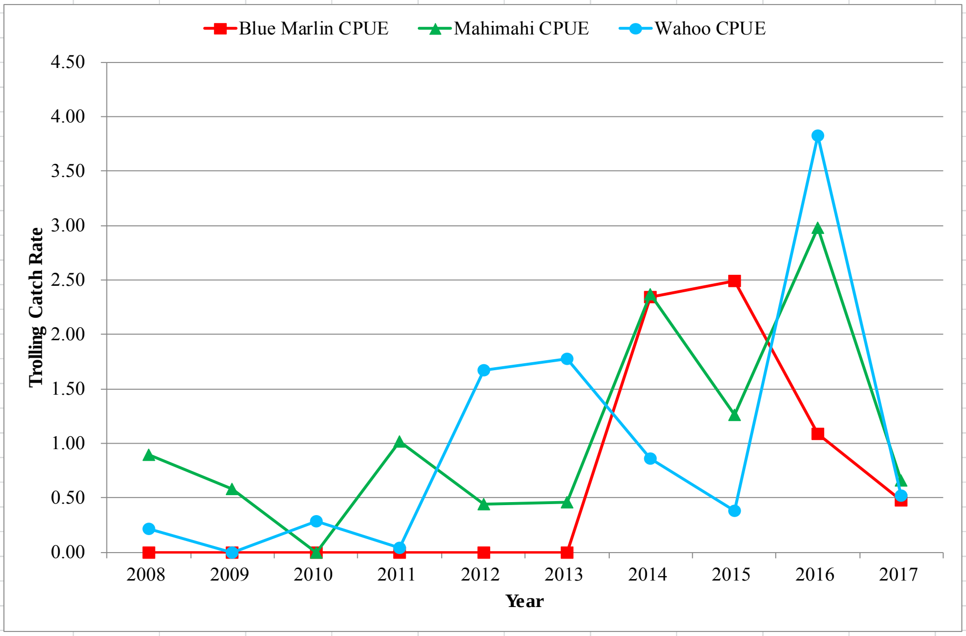
Supporting data shown in Table A-18.

Figure 20. American Samoa trolling CPUE for Skipjack and Yellowfin Tuna from 2008-2017.



Supporting data shown in Table A-19.

Figure 21. American Samoa trolling CPUE for Blue Marlin, Mahimahi, and Wahoo (creel survey) from 2008-2017.



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 were recently conducted on Tinian and Rota, although these data are incomplete and not included in this analysis. These creel efforts were mainly focused on shore-based fisheries. The Rota pilot study during over a year and a half of data collection did not collect enough pelagic data to warrant analysis in the project report.

The Saipan creel survey targets both charter and non-charter vessels. DFW staff conducted 73 survey days in 2017 (see Table A-21). Total trips in 2017 was roughly the same as recent years, but staff were able to conduct 109 interviews, which was a 20% increase in interview numbers from 2016. This may be due to new staff being engaged in the interview process. Between 2013 and 2015, DFW staff intercepted fewer than 3 charter vessels for interviews. Four were intercepted in 2016, and three were intercepted in 2017. In 2017, no charter interviews for pelagic gears were completed. 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 increased in 2017 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 69% of the entire pelagic landings in 2017 based on creel survey data. Skipjack landings increased 23% (235,063 lbs.) and total landings increased 11% (340,869 lbs.) from 2016 landings.

Landings of Tuna (misc.), mahimahi and yellowfin tuna ranked second, third, and forth respectively, by weight of landings during 2017. Creel data estimated 27,260 lbs. of Tuna (misc.) which is likely mis-categorized skipjack tuna. Creel data estimated 45,099 lbs. of mahimahi, a 43% decrease from 2016. After 3 years of high poundage of mahimahi landings, landed pounds returned to 2011-2013 level. There were 16,968 lbs. of yellowfin landed in 2017, a 13% decrease from the 2016 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 from 2001, when there were 113 fishermen reporting commercial pelagic landings, to 2015 when there were 12. In 2016, 63 fishermen reported landings, a significant increase, but in 2017 the number of fisherman decreased by over 50% to 31. The number of trips, based on both the commercial data receipts and the creel survey, has also steadily declined since the late 1990s. In 2017, 649 trips were recorded in the database (3%from 2016), and 2,599 trips estimated from the creel survey (28% decrease from 2016. Total hours trolling was similar in 2017, with 14,498 hours (decrease of 25% from 2016). Average trip length increased slightly to 5.6 hours per trip which is the highest since 2010. As noted above, charter fishing is a very small overall component of the trolling fishery, and no charter trips were reported. This is likely a sampling issue as there are known charter operators but they infrequently operate and can be difficult to catch in normally scheduled surveys.

Boat Ramps. There are several boat ramps in the CNMI most of which are found on Saipan. The main boat ramp used for the largest towable boats is north of Garapan at Smiling Cove Mariana. The is a convenience and transient dock as well as slips that can be rented for long term boat storage. There are small boat ramps further north in Saipan in Tanapag and Lower Base. The Tanapag boat ramp is frequently used for small fishing and recreational vessels. The Lower Base boat ramp is used by 20-30ft commercial tourism operators during the day, but at night is common launching point for subsistence fishermen with small (8-12 ft.) vessels. In Garapan, Fishing Base has a small boat ramp that is used by tourism operators, recreational boaters, subsistence fishermen and commercial fishermen. In the south, the boat ramp at Sugar Dock is used by commercial fishermen, tourism operators, recreational boaters, and subsistence fishermen. This boat ramp is frequently covered in sand by beach erosion from further north in the lagoon and has to be dredged periodically. It is still frequently used when the ramp is covered in sand as it is an important launching site.

Weather. Weather was relatively similar to recent years. There were no major typhoons.

Fish Aggregating Devices (FADs). FADs were not deployed again in 2017 because the USFWS Sportfish Restoration Grant was not approved for in-water work. There have been no FAD deployments in the previous years because of this issue and the remaining FADs were gradually lost to wear and storm events. The grant approval for in water work was gained in the beginning of 2018 and two FADs have been deployed around Saipan. As soon as the calmer summer months begin, a trip to Rota to deploy three FADs is planned.

CPUE. In 2017, trolling catch rates increased to 23.4 lbs. per trolling hour, a level similar to the 10 year average (23.0 lbs./hr.). The skipjack catch rate, the primary target species in CNMI, increased to 16.2 lbs. per hour fished. This catch rate is a 62% increase, but is now slightly higher than the 10 year average (15.9 lbs/hr.). Yellowfin catch rate in 2017 was near the long-term average at 1.2 lbs. per hour, while the mahimahi catch rate decreased 29% to 3.0 lbs/hr. in 2017, down from a peak in 2015. This mahimahi catch rate is near the 10 year average of 3.1 lbs/hr.

Revenues. Commercial revenues, based on the commercial receipts, at $203,789.60, were up 4% from the all-time low in 2016 (at $195,155), although, as noted, not all 2016 receipts were entered into the database when revenues were calculated. Average price per pound for all pelagics, tuna and non-tuna pelagics, was all lower than the long-term average. The average price for all pelagics was $2.66 driven by the low price ($2.54) for skipjack.

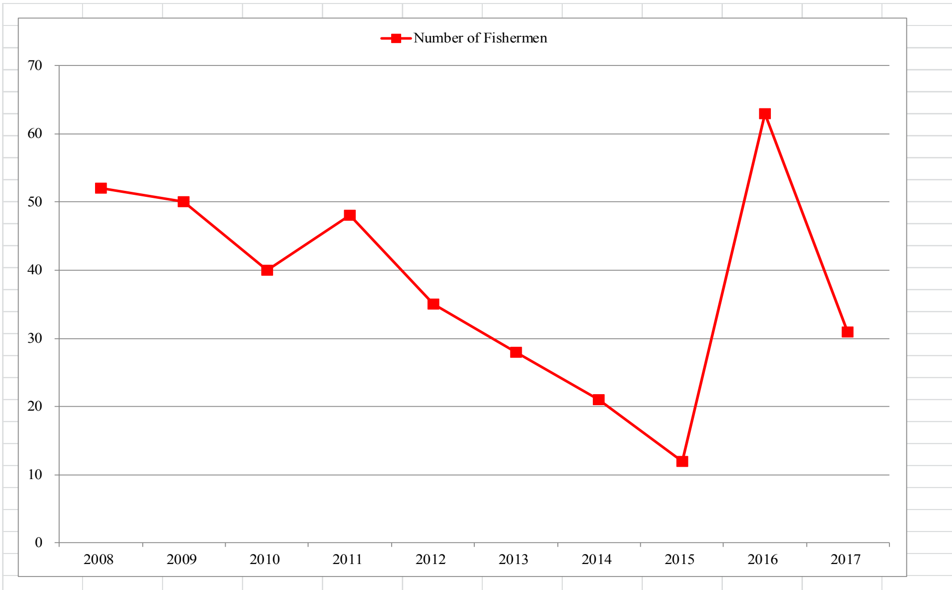
Bycatch. Bycatch is not a significant issue in the CNMI, as fishermen retain their catch regardless of species, size or condition. Based on creel survey interviews, no fish were caught as bycatch in the trolling fisheries in the years 2008-2017.

2.2.3 PLAN TEAM RECOMMENDATIONS

The CNMI had no recommendations in 2017 to be forwarded to the Council.

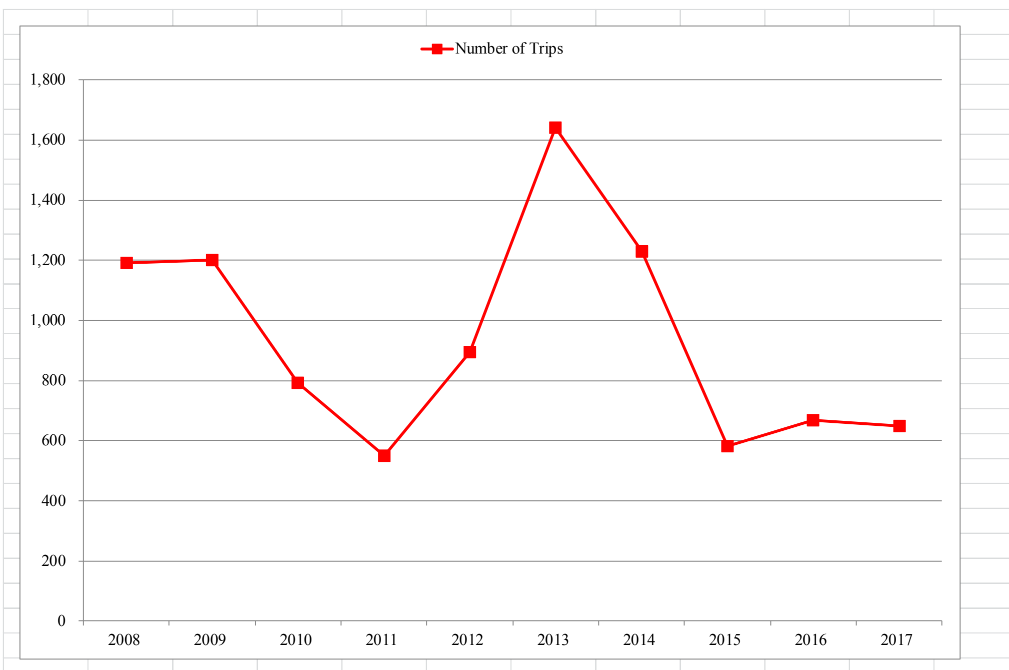
2.2.4 OVERVIEW OF PARTICIPATION AND EFFORT – NON-CHARTER AND CHARTER

Figure 22. CNMI Fishermen (Boats) with Commercial Pelagic Landings from 2008-2017.



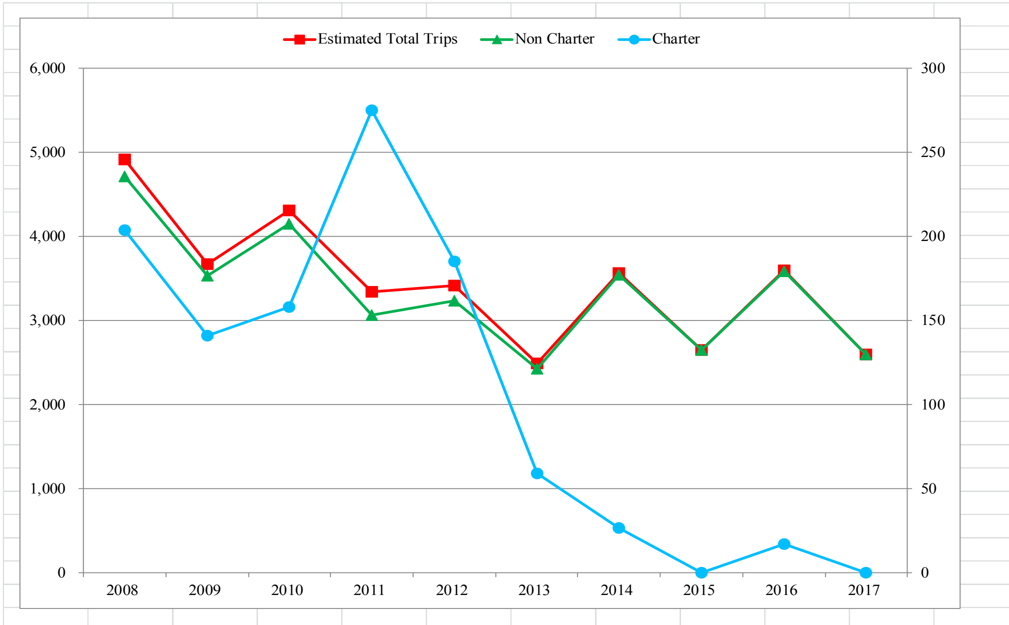
Note: Due to data reporting methods, the number of fishermen may include duplicate counts. Supporting data shown in Table A-22.

Figure 23. Numbers of Trips Catching Any Pelagic Fish from Commercial Receipt Invoices.



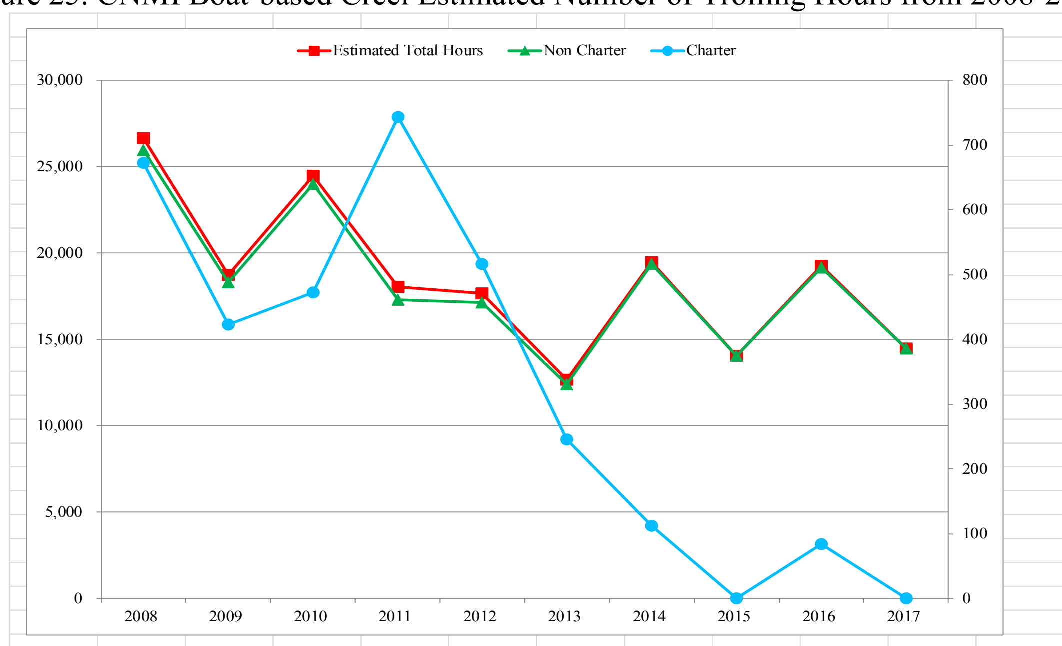
Supporting data shown in Table A-23.

Figure 24. CNMI Boat-based Creel Estimated Number of Trolling Trips from 2008-2017.



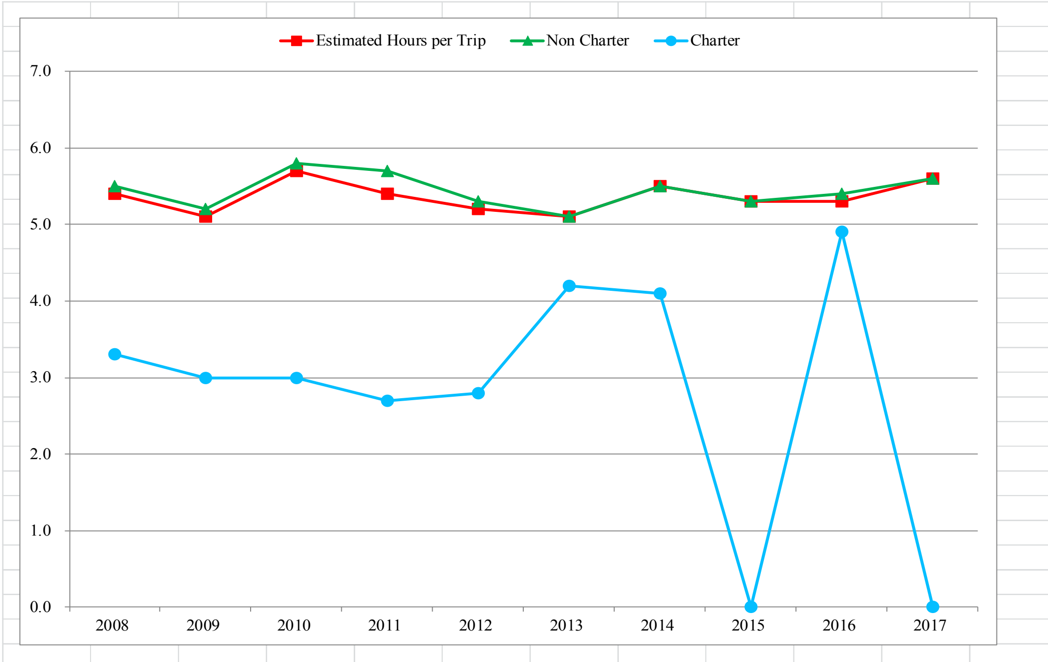
Supporting data shown in Table A-24.

Figure 25. CNMI Boat-based Creel Estimated Number of Trolling Hours from 2008-2017.



Supporting data shown in Table A-25.

Figure 26. CNMI Boat-Based Creel Average Trip Length – Hours per Trip from 2008-2017.



Supporting data shown in Table A-26.

2.2.5 OVERVIEW OF LANDINGS – NON-CHARTER AND CHARTER

Table 13. Pelagic species composition of creel surveys performed in the CNMI, 2017.

Species	Total Landings	Non Charter	Charter
Saba (Kawakawa)	948	948	0
Yellowfin tuna	16,968	16,968	0
Skipjack tuna	235,063	235,063	0
Tunas (misc.)	27,260	27,260	0
Tuna PMUS Total	**280,239**	**280,239**	**0**
Sailfish	0	0	0
Spearfish	0	0	0
Blue Marlin	2,966	2,966	0
Mahimahi	45,099	45,099	0
Sickle Pomfret	0	0	0
Sharks	0	0	0
Wahoo	9,811	9,811	0
Non-Tuna PMUS Total	**57,876**	**57,876**	**0**
Rainbow Runner	2,016	2,016	0
Barracuda	439	439	0
Troll fish (misc.)	0	0	0
Dogtooth tuna	299	299	0
Non-PMUS Pelagics Total	**2,754**	**2,754**	**0**
Total Pelagics	**340,869**	**340,869**	**0**

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 14. Commercial pelagic landings (lb.), revenues ($), and average prices ($) in the CNMI, 2017.

Species	Pounds	Value	Average Price
Skipjack tuna	47,198.3	126,765.7	2.69
Yellowfin tuna	13,555.0	36,098.1	2.66
Saba (Kawakawa)	116.0	309.8	2.67
Tunas (misc.)	3,685.5	9,353.5	2.54
Tuna PMUS Average Price	**64,554.7**	**172,527.1**	**2.67**
Mahimahi	4,832.7	12,058.2	2.50
Wahoo	1,716.7	4,991.1	2.91
Blue Marlin	548.0	1,370.0	2.50
Sickle Pomfret	98.0	294.0	3.00
Non-Tuna PMUS Average Price	**7,195.4**	**18,713.3**	**2.60**
DOGTOOTH TUNA	3,924.2	10,352.3	2.64
RAINBOW RUNNER	652.0	1,626.5	2.49
TROLL FISH (MISC.)	245.5	570.5	2.32
Non-PMUS Pelagic Average Price	**4,821.7**	**12,549.3**	**2.60**
Pelagic Average Price	**76,571.8**	**203,789.6**	**2.66**

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.

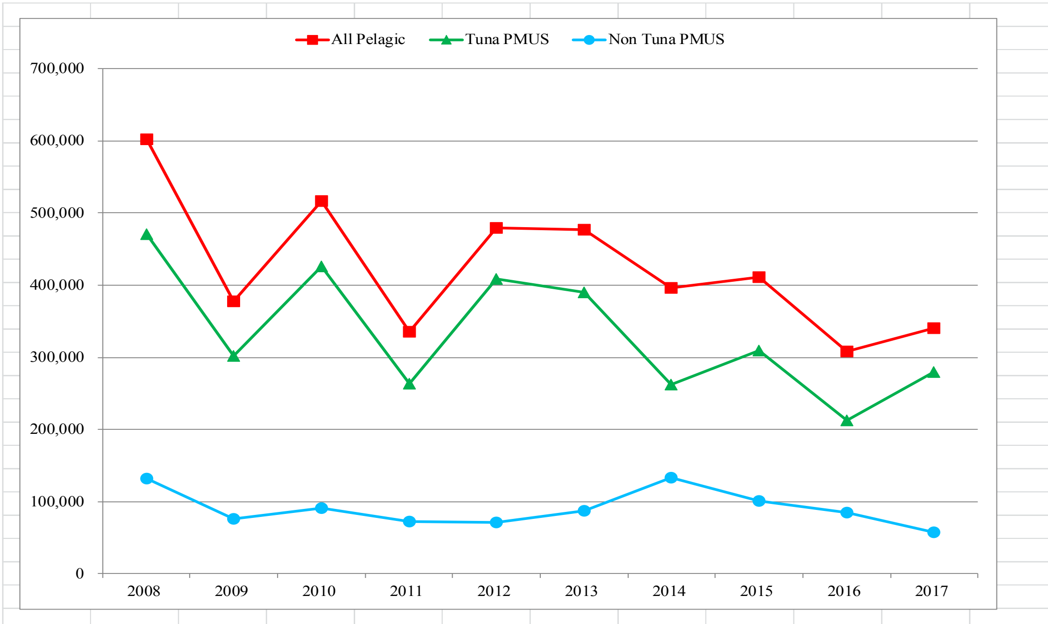
Table 15. Bycatch summary of offshore daytime creel surveys in the CNMI, 2017.

Year	Release Alive	Release Injured	Total Bycatch	Total Catch	Percent Bycatch	Bycatch Interview	Total Interview	Percent Bycatch Interview
2017	0	0	0	2,284	N/A	0	109	N/A

Notes:

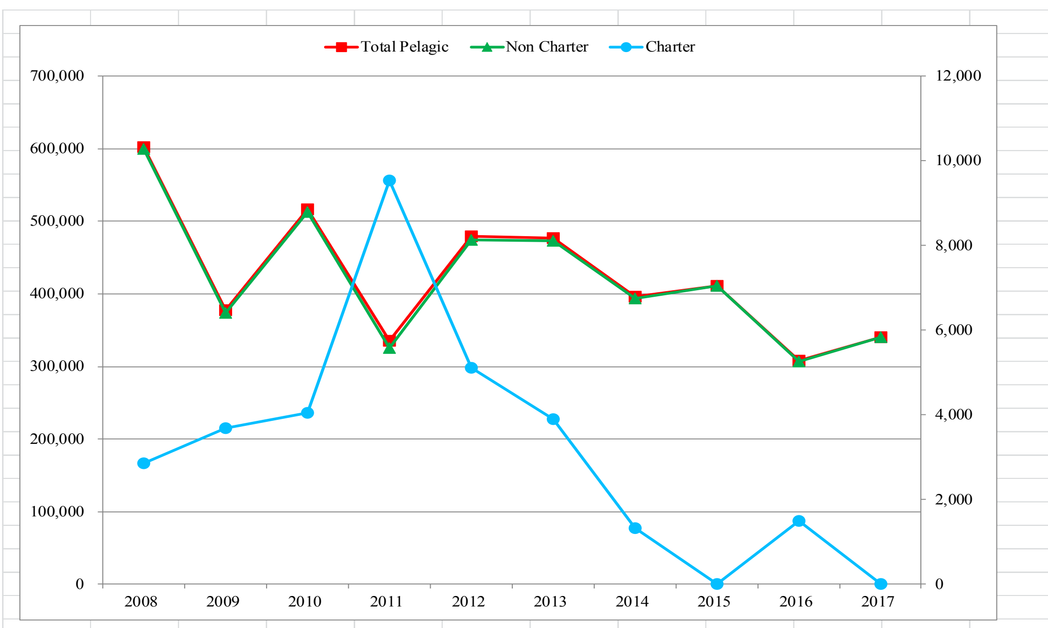
1. “Catch” is the total number of fish counted and estimated in interviews for trolling method.
2. Bycatch information is calculated from raw interview data and represents the percent of fish caught or percent of interviews (trolling trips) with bycatch.
3. “With BC”: Number of fisherman interviewed during creel survey who reported bycatch.

Figure 27. Total estimated annual catch for all pelagics, tuna PMUS, and non-tuna PMUS in the CNMI from 2008-2017.



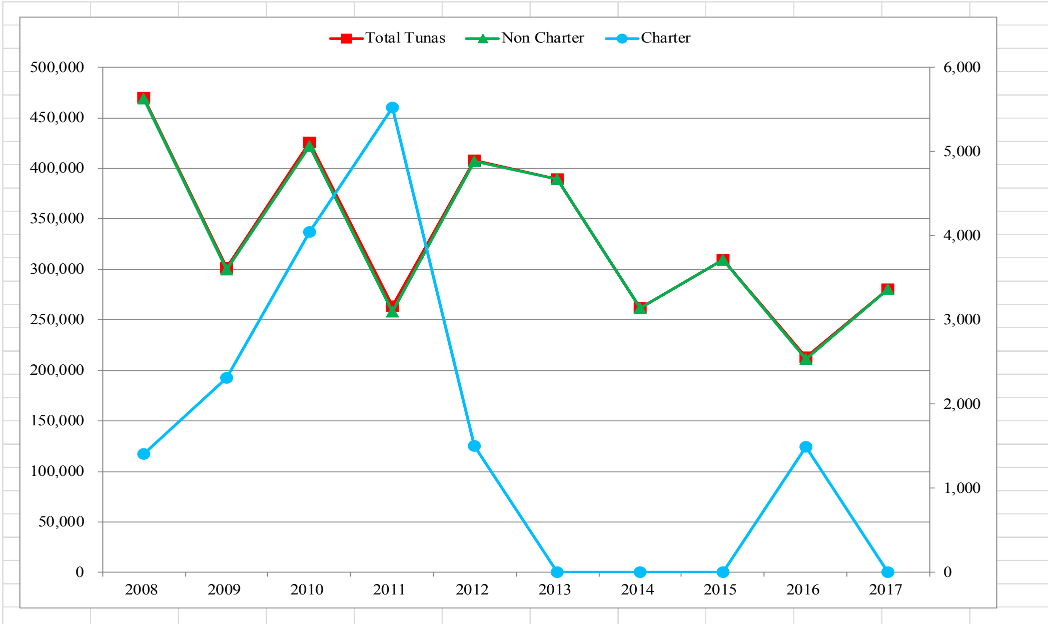
Supporting data shown in Table A-27.

Figure 28. Total estimated annual catch for all pelagics in the CNMI from 2008-2017.



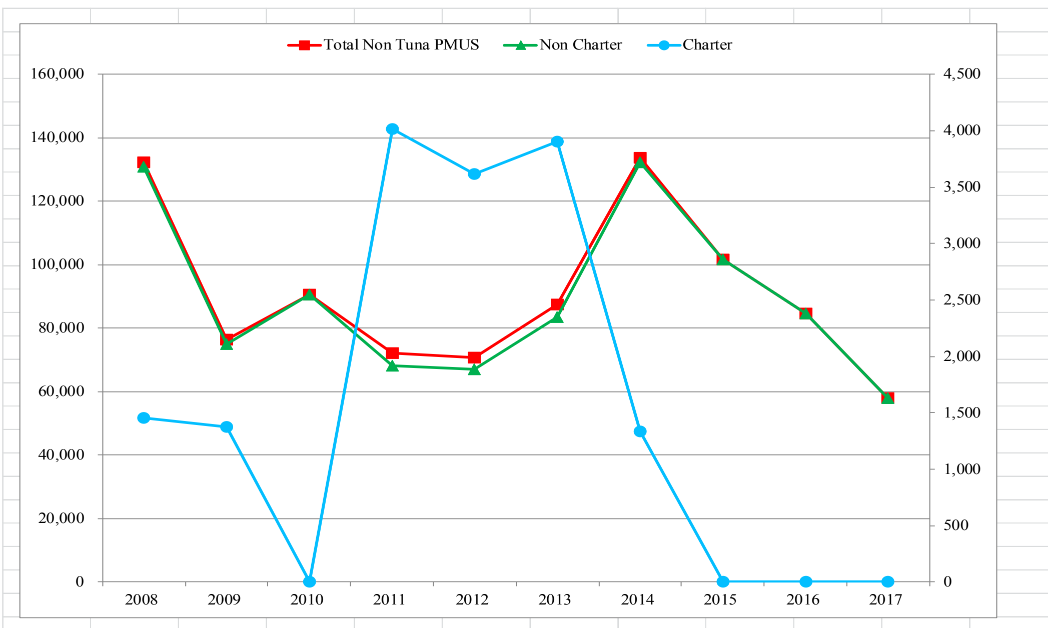
Supporting data shown in Table A-28.

Figure 29. Total estimated annual catch for tuna PMUS in the CNMI from 2008-2017.



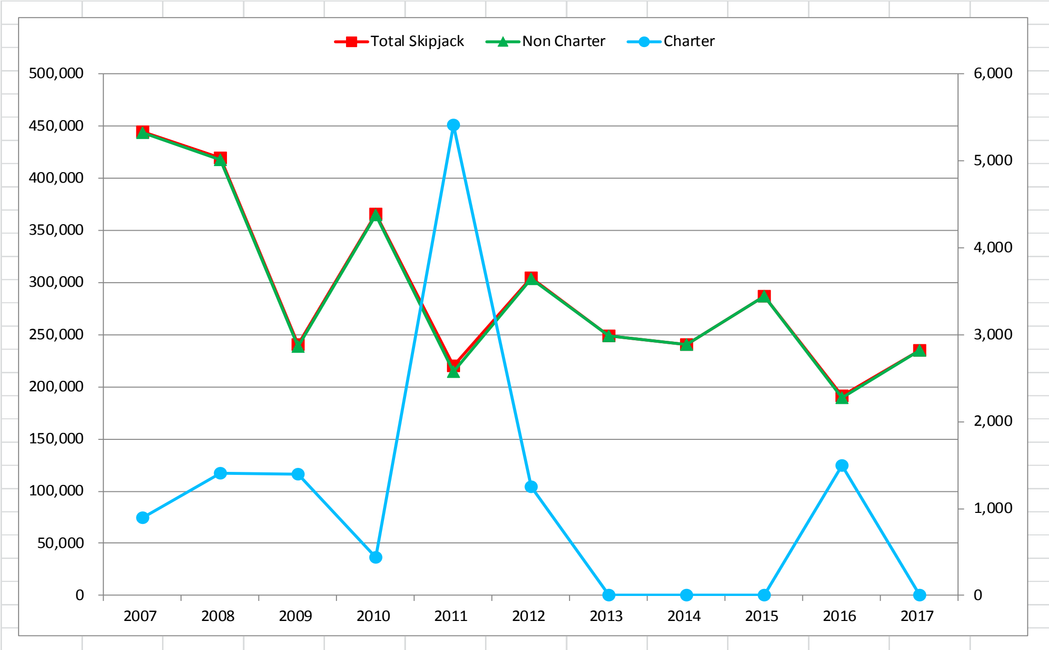
Supporting data shown in Table A-29.

Figure 30. Total estimated annual catch for non-tuna PMUS in the CNMI from 2008-2017.



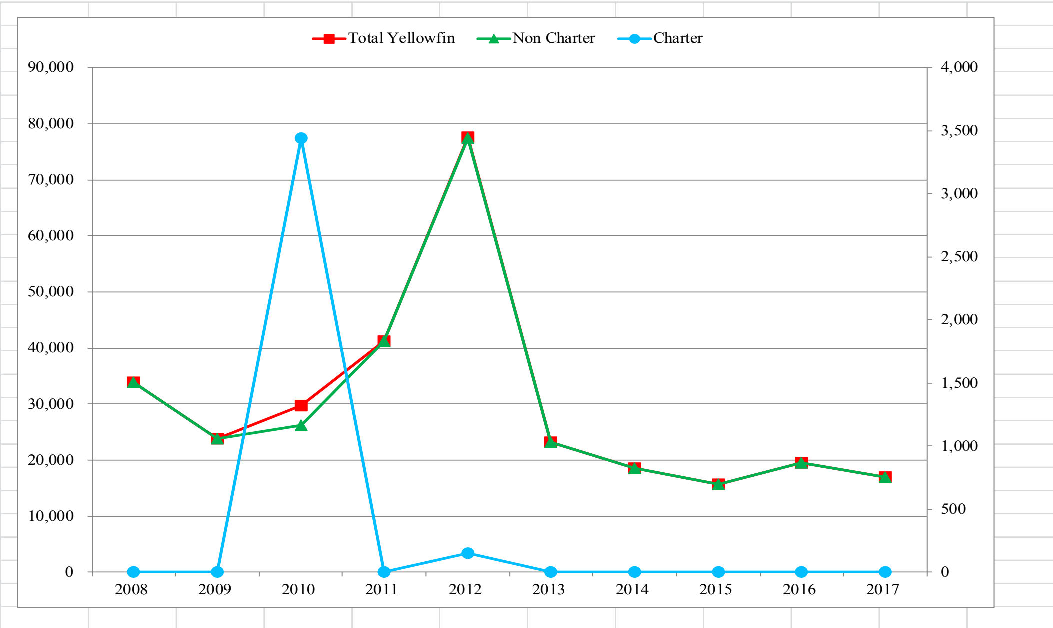
Supporting data shown in Table A-30.

Figure 31. Total estimated annual catch for skipjack in the CNMI from 2008-2017.



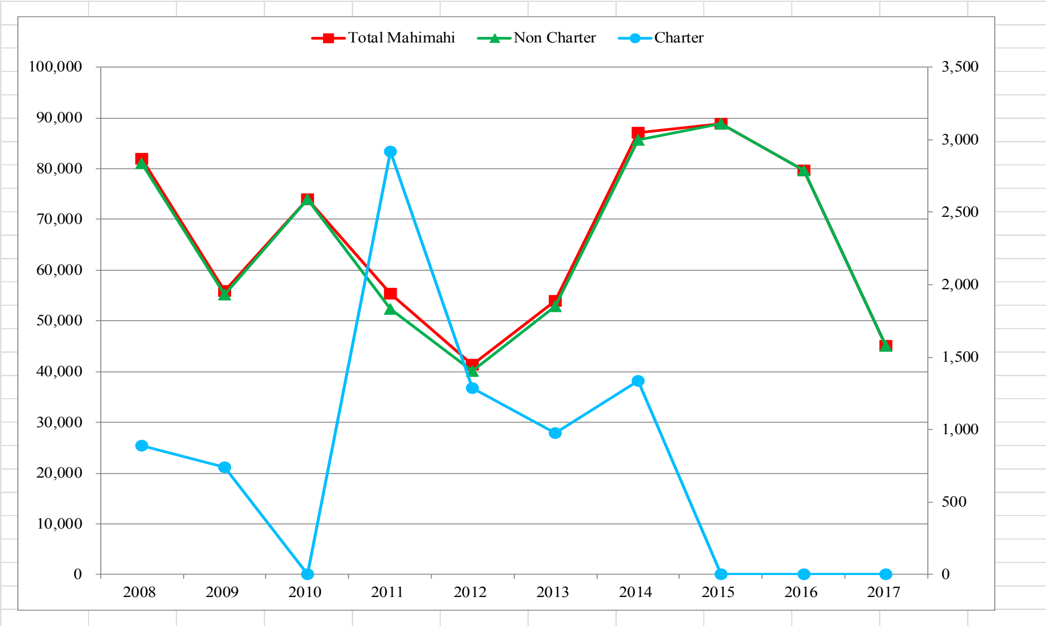
Supporting data shown in Table A-31.

Figure 32. Total estimated annual catch for yellowfin in the CNMI from 2008-2017.



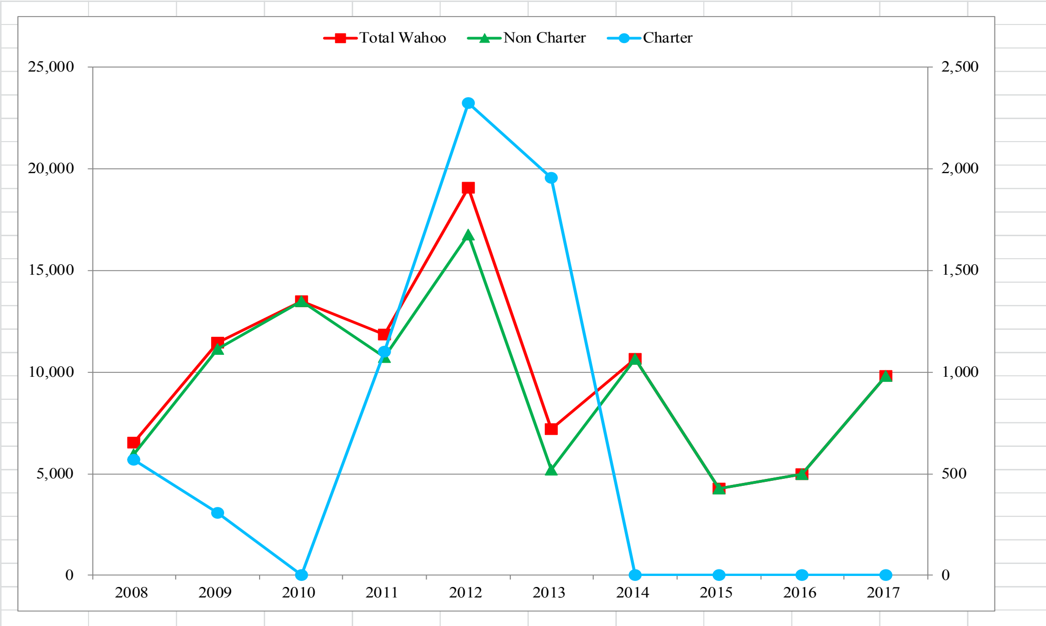
Supporting data shown in Table A-32.

Figure 33. Total estimated annual catch for mahimahi in the CNMI from 2008-2017.



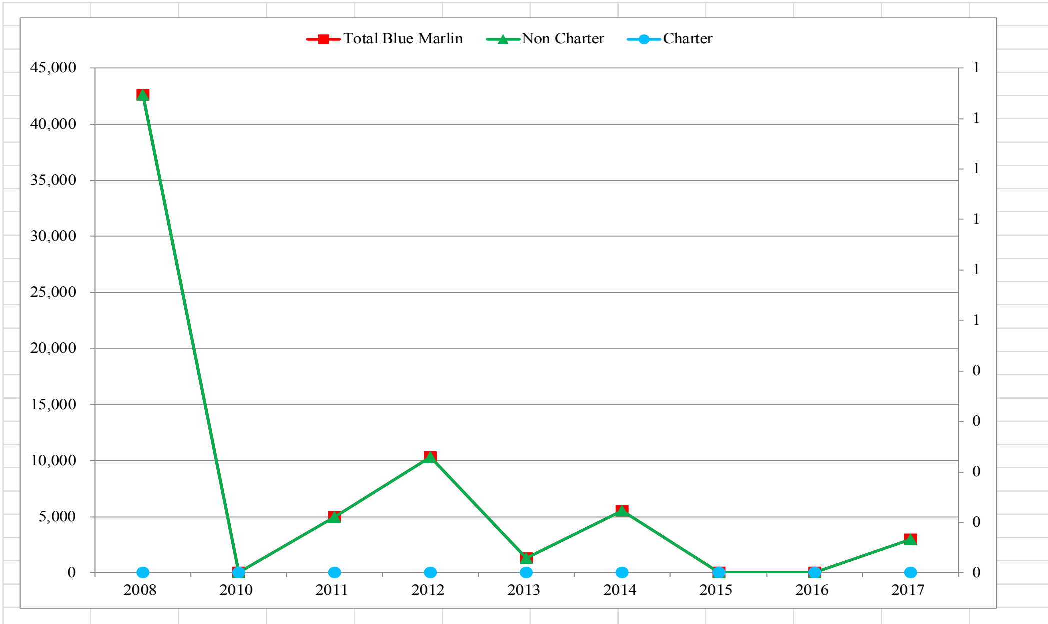
Supporting data shown in Table A-33.

Figure 34. Total estimated annual catch for wahoo in the CNMI from 2008-2017.



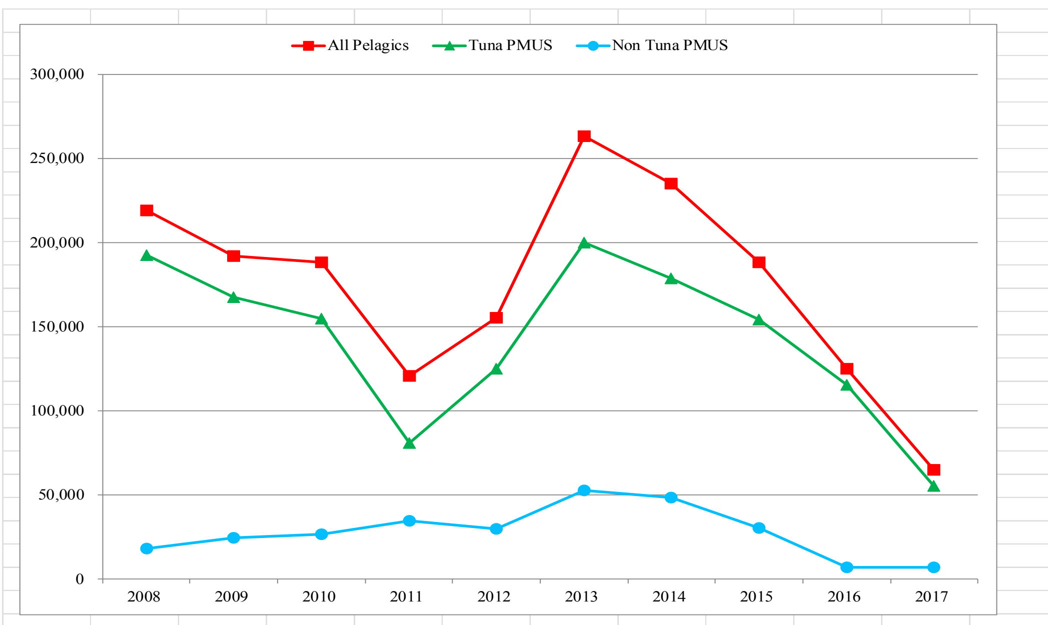
Supporting data shown in Table A-34.

Figure 35. Total estimated annual catch for blue marlin in the CNMI from 2008-2017.



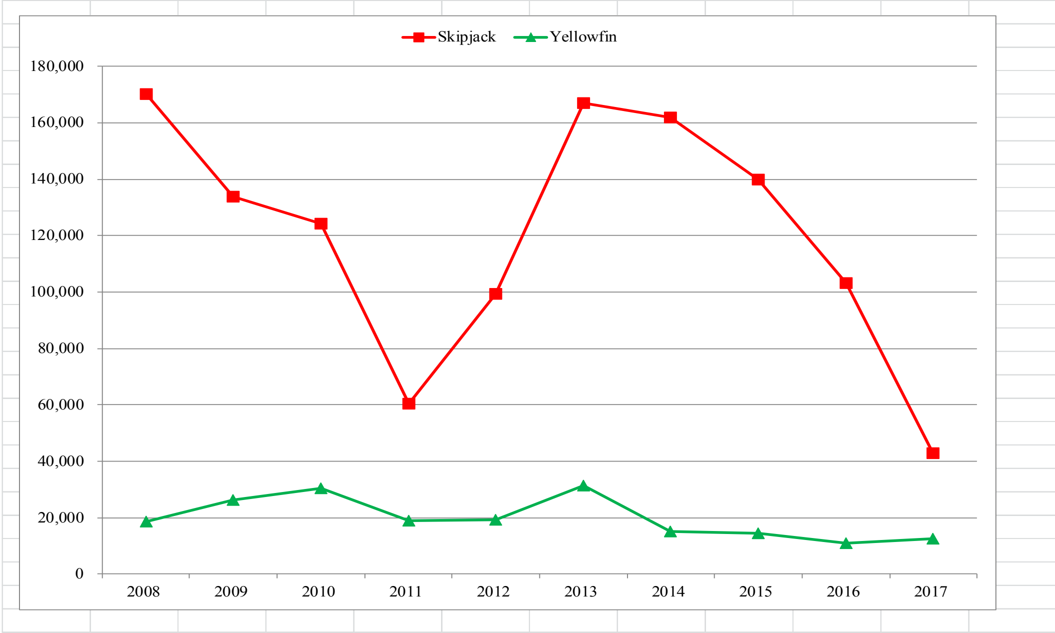
Supporting data shown in Table A-35.

Figure 36. Annual commercial landings for all pelagics, tuna PMUS, and non-tuna PMUS in the CNMI from 2008-2017.



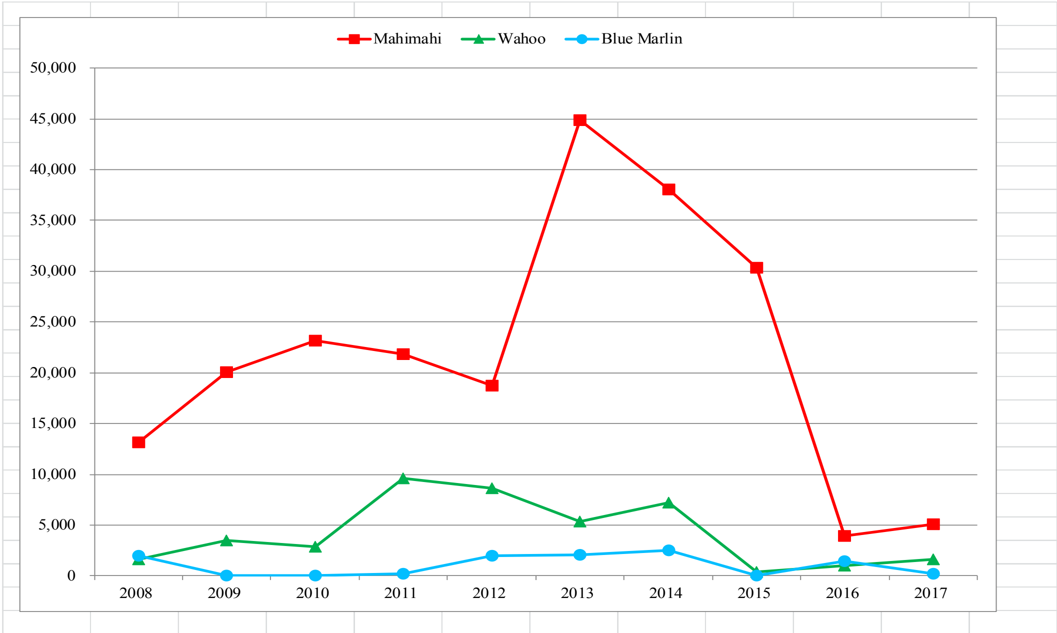
Supporting data shown in Table A-36.

Figure 37. Annual commercial landings for skipjack and yellowfin in the CNMI from 2008-2017.



Supporting data shown in Table A-37.

Figure 38. Annual commercial landings for mahimahi, wahoo, and blue marlin in the CNMI from 2008-2017.

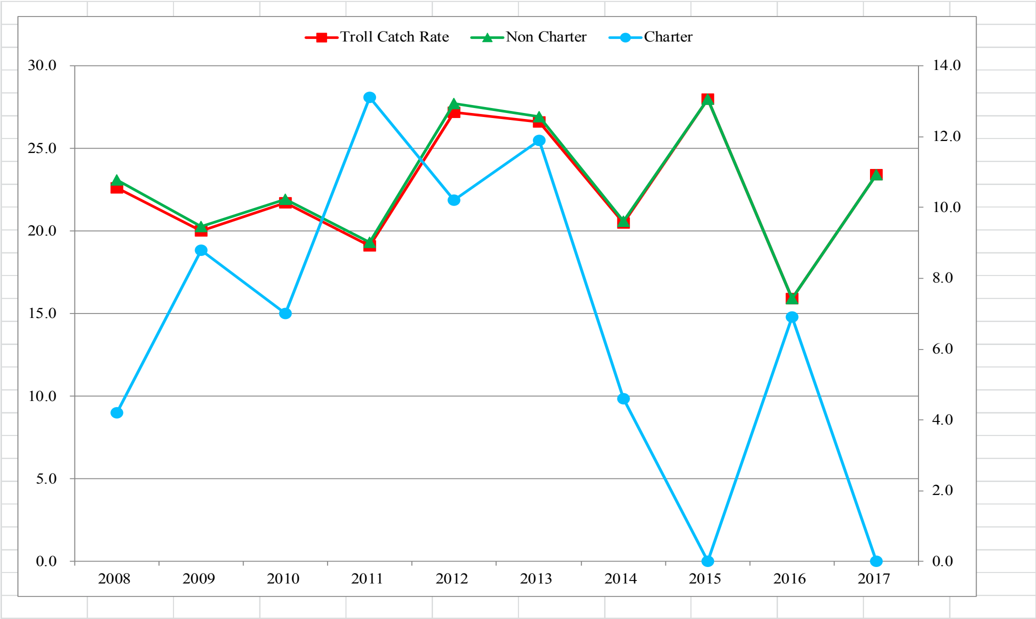


Supporting data shown in Table A-38.

2.2.6 OVERVIEW OF CATCH PER UNIT EFFORT – ALL FISHERIES

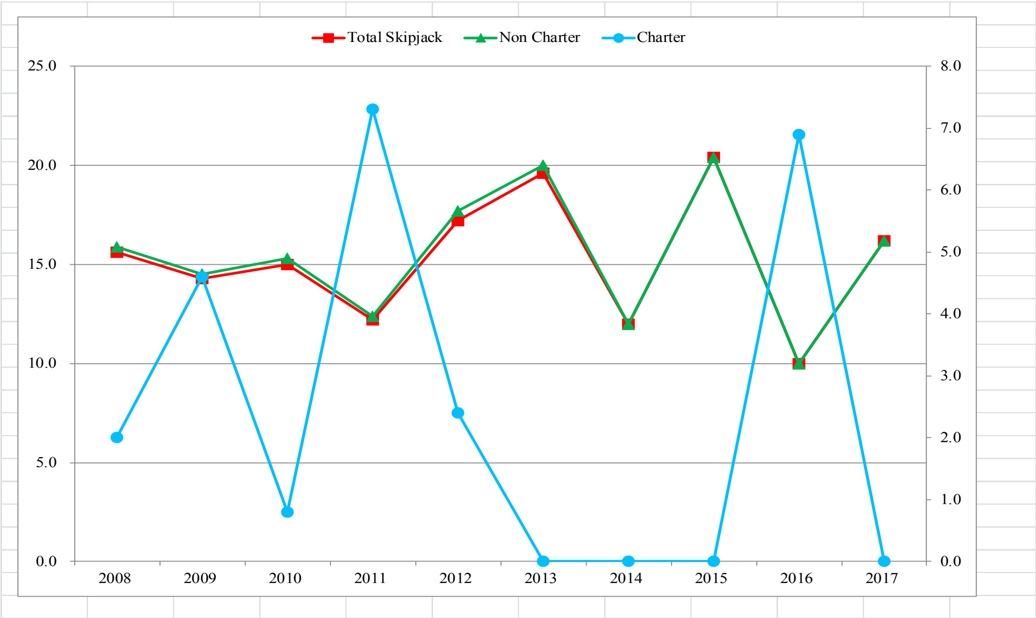
This section provides catch rates for the five main species landed by trolling. "Pounds per hour trolled" is determined from creel survey interviews and include charter and non-charter sectors, while "pounds per trip" is determined from commercial invoice receipts.

Figure 39. Estimated trolling catch rates (lbs. /trip) from creel surveys in the CNMI, 2008-2017.



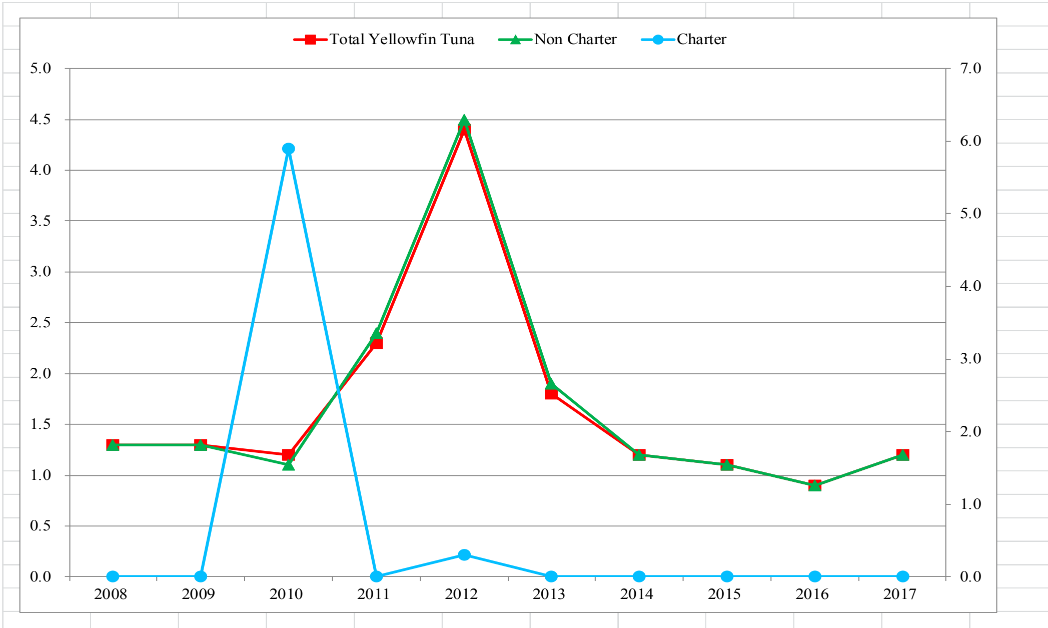
Supporting data shown in Table A-39.

Figure 40. Estimated trolling catch rates (lbs. /trip) for skipjack from creel surveys in the CNMI from 2008-2017.



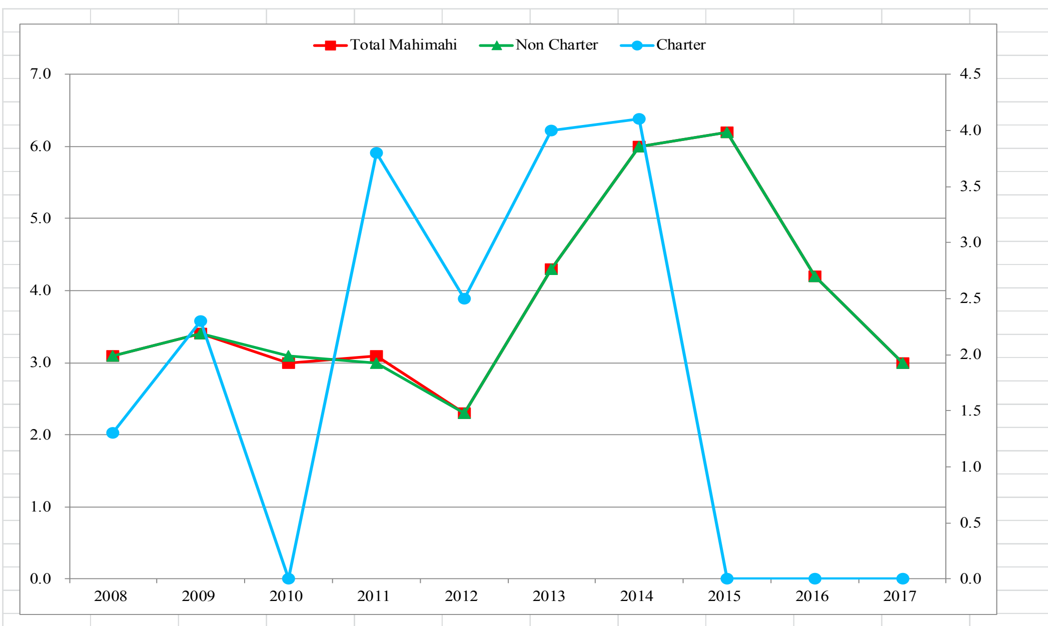
Supporting data shown in Table A-40.

Figure 41. Estimated trolling catch rates (lbs. /trip) for yellowfin from creel surveys in the CNMI from 2008-2017.



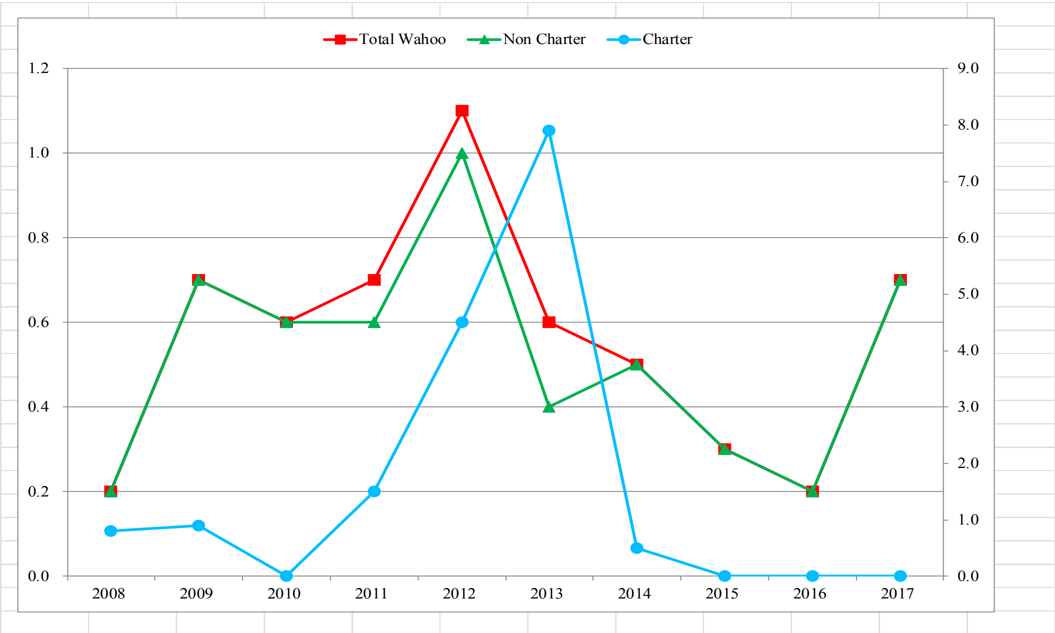
Supporting data shown in Table A-41.

Figure 42. Estimated trolling catch rates (lbs. /trip) for mahimahi from creel surveys in the CNMI from 2008-2017.



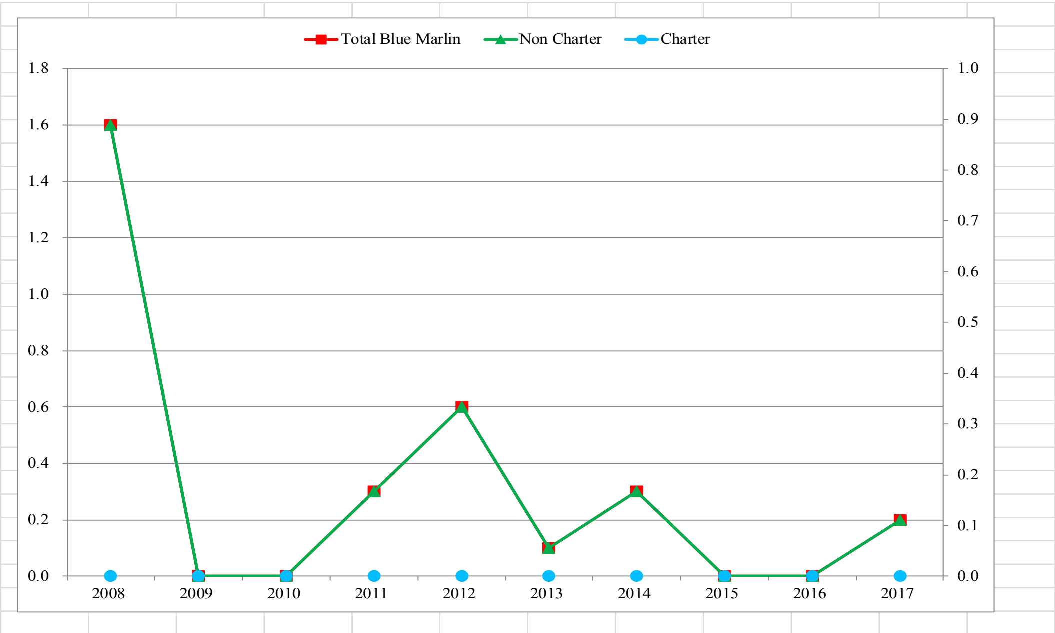
Supporting data shown in Table A-42.

Figure 43. Estimated trolling catch rates (lbs. /trip) for wahoo from creel surveys in the CNMI from 2008-2017.



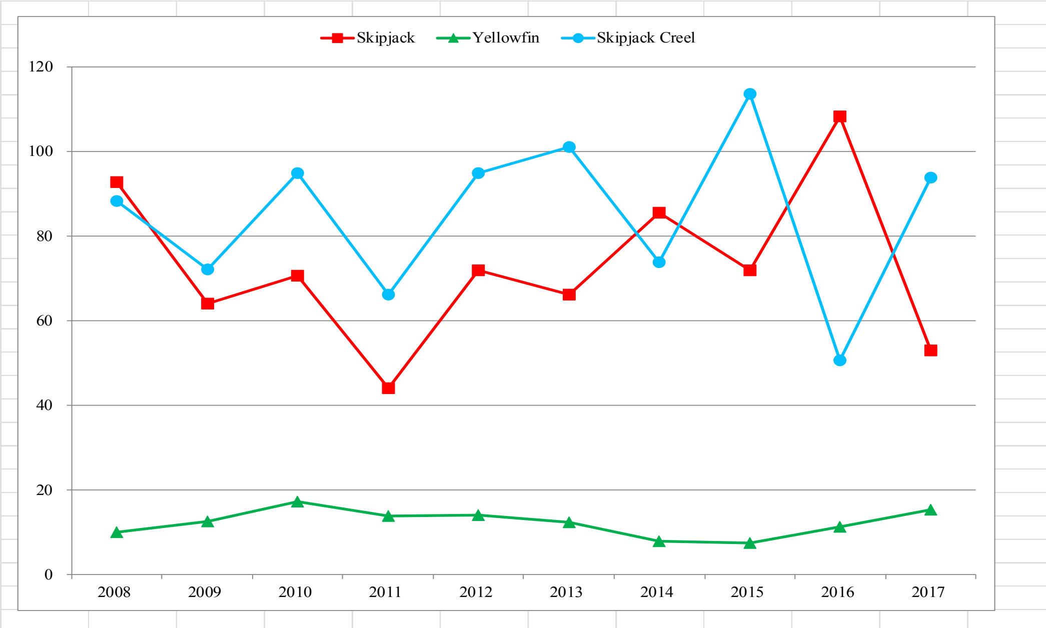
Supporting data shown in Table A-43.

Figure 44. Estimated trolling catch rates (lbs. /trip) for blue marlin from creel surveys in the CNMI from 2008-2017.



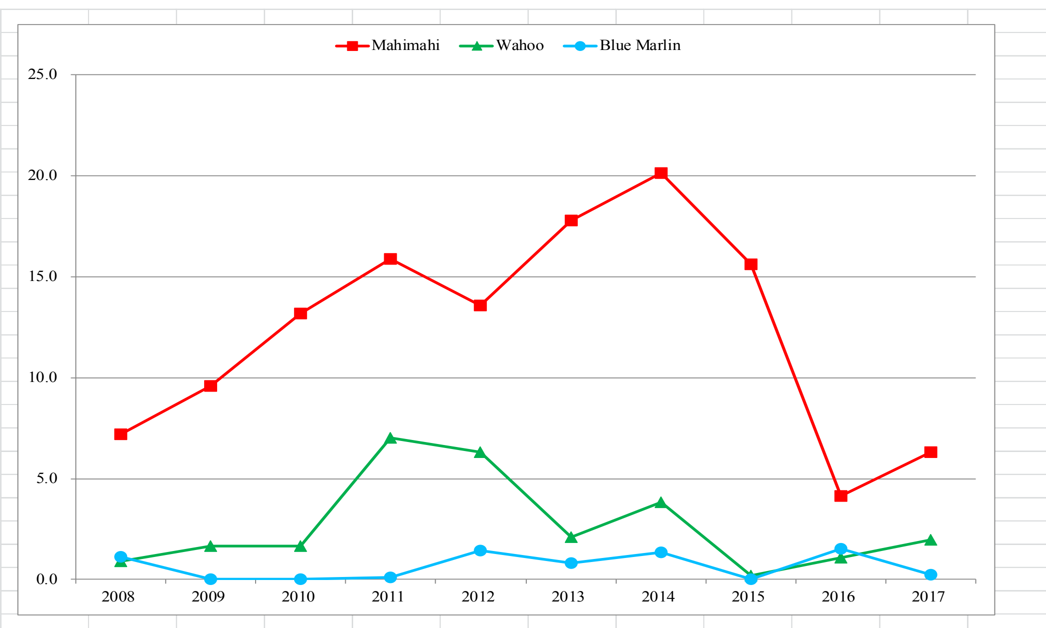
Supporting data shown in Table A-44.

Figure 45. Estimated trolling catch rates (lbs. /trip) for skipjack and yellowfin tuna in the CNMI from 2008-2017.



Supporting data shown in Table A-45.

Figure 46. Estimated trolling catch rates (lbs. /trip) for mahimahi, wahoo, and blue marlin in the CNMI from 2008-2017.



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 1,134 during that period, with the number of interviews slightly greater than half of that year's total trips. In 2017, DAWR logged 94 survey days, noting 1,018 trips during that time, and conducted 643 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 in the available 35-year time series, ranging between 383,000 and 958,000 lbs. The average total catch has shown a slowly increasing trend over the reporting period. The 2017 total expanded pelagic landings were 705,060 lbs., a decrease of 15.7 % when compared with 2016. Tuna PMUS increased 2%, while non-tuna PMUS decreased 54%. Landings consisted primarily of five major species: mahimahi, wahoo, bonita or skipjack tuna, yellowfin tuna, and Pacific blue marlin, with skipjack comprising over 81% of total landings. Other minor species caught include rainbow runner, barracudas, and pomfrets. Sharks were also caught during 2017, as they were noted in specific fishermen interviews conducted in 2017 regarding shark encounters (see ‘bycatch’ below). However, these species were not encountered during offshore creel surveys and were not available for expansion in 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 three of the five common species increased in 2017 from 2016 levels: Skipjack tuna increased 16.3%, wahoo increased 22.3%, and blue marlin increased 4.9%. Mahimahi catch, which accounts for the largest percentage of non-tuna PMUS landed on Guam, decreased 72.8%, while yellowfin tuna decreased 47.1%. 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 1,159 mt and 2,342 mt over the previous five years. In 2017, transshipments totaled 1,245 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 487 boats involved in Guam’s pelagic fishery in 2017, an increase of 19.4% from 2016. 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, but economically significant, segment (~5%) 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.

In 2017, the number of trolling trips decreased by 7.3%, and hours spent trolling decreased 11.7%. 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 2017 was 194, equaling 194 closure days, up from 123 in 2016. 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 removed in 2010 due to widening of the main road on the southeast coast. 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 of 9.1% from 2016 to 2017. Skipjack tuna and marlin CPUE increased, while yellowfin tuna, mahi, and wahoo CPUE decreased. The fluctuations in CPUE are probably due to variability in the year-to-year abundance and availability of the stocks.

Revenues. Commercial revenues increased in 2017, with total adjusted revenues for pelagics increasing 26.0% to $110,383. Adjusted revenue per trolling trip decreased by less than 0.1% for all pelagics, increased 40.2% for tuna PMUS, and decreased 26.7% 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, 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 has 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 Guam’s charter fishery. In 2017, there was 0 reported bycatch out of a total of 6,743 fish caught. Bycatch occasionally occurs in the troll fishery including sharks as well as shark-bitten and undersized fish. There was no reported bycatch in the troll fishery in 2017.

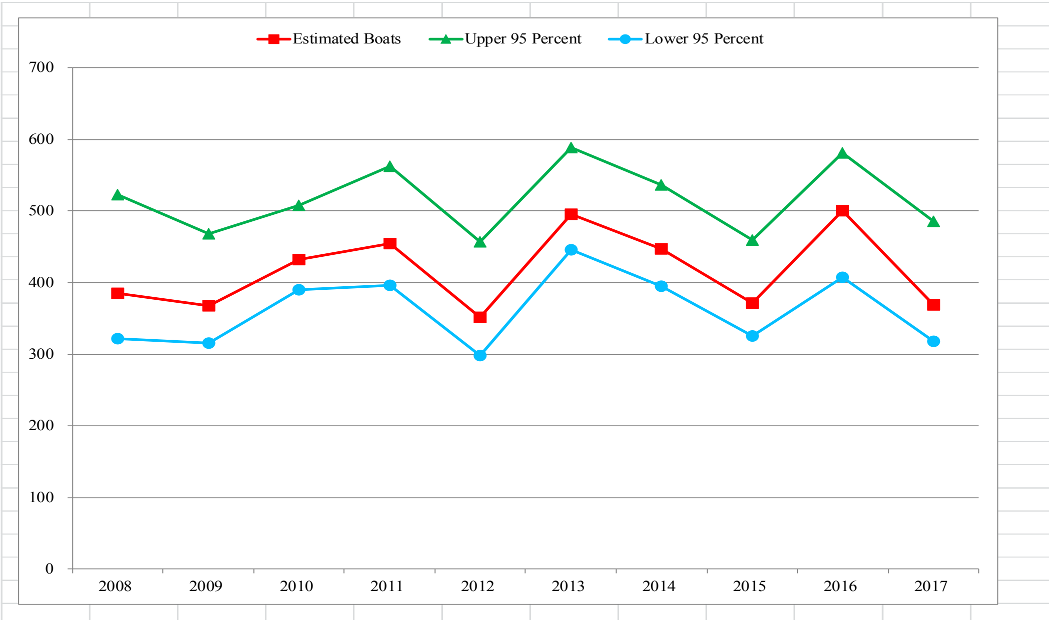
In 2017, fishers were asked if they experienced any shark interactions. There were a total of 830 interviews for boat-based fishing in 2017, with 311 of these deemed inappropriate for determining shark interactions. Of the remaining 519 interviews, 195 reported interactions with sharks and 324 reported no interactions with sharks, a 38% 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 47. Total estimated vessles in Guam pelagic fisheries from 2008-2017.



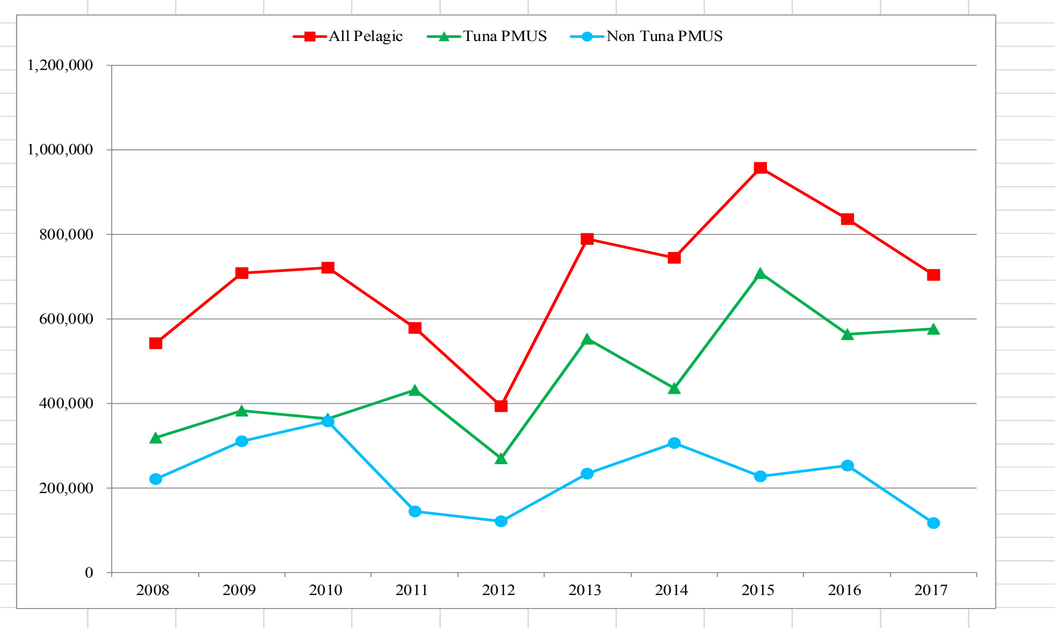
Supporting data shown in Table A-48.

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

Table 16. Total estimated, non-charter, and charter landings for Guam in 2017.

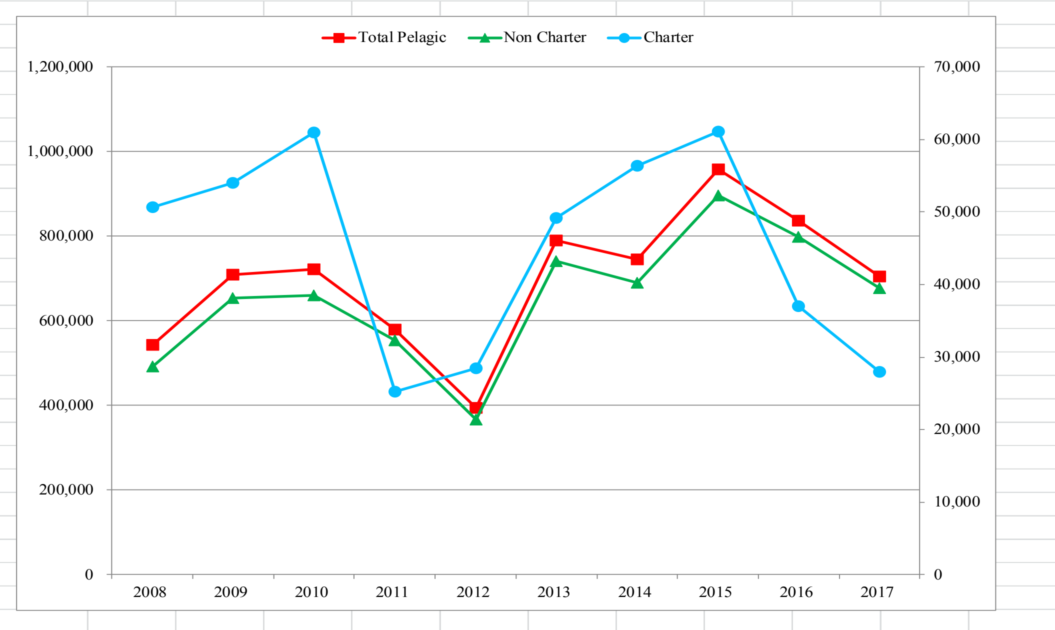
Species	Total Landings	Non-Charter	Charter
Skipjack tuna	508,840	502,706	6,134
Yellowfin tuna	67,463	65,947	1,516
Kawakawa	49	49	0
Albacore	0	0	0
Bigeye tuna	0	0	0
Other tuna PMUS	47	47	0
Tuna PMUS Total	**576,399**	**568,749**	**7,650**
Mahimahi	47,310	40,005	7,305
Wahoo	27,475	24,525	2,950
Blue Marlin	42,183	32,894	9,289
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	0	0	0
Oilfish	0	0	0
Non-Tuna PMUS Total	**116,968**	**97,424**	**19,544**
Dogtooth tuna	173	173	0
Rainbow Runner	8,032	7,207	824
Barracudas	3,315	3,315	0
Double-lined Mackerel	173	173	0
Troll fish (misc.)	0	0	0
Non-PMUS Pelagics Total	**11,693**	**10,868**	**824**
Total Pelagics	**705,060**	**677,041**	**28,018**

Figure 48. Total estimated annual landings in Guam for all pelagics, tuna PMUS, and non-tuna PMUS from 2008-2017.



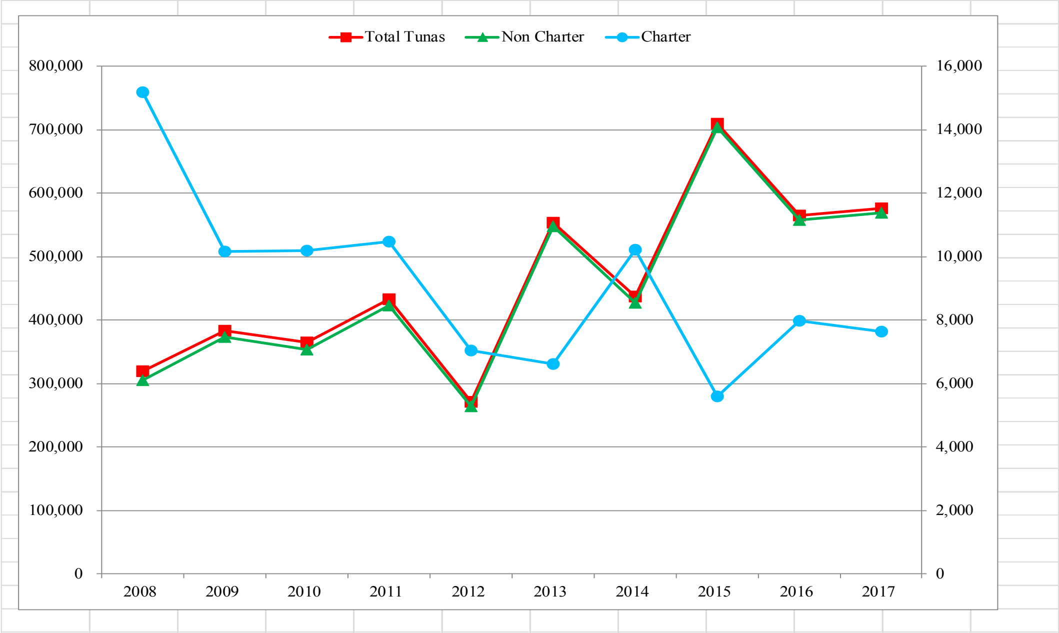
Supporting data shown in Table A-49.

Figure 49. Total estimated annual pelagic landings in Guam from 2008-2017.



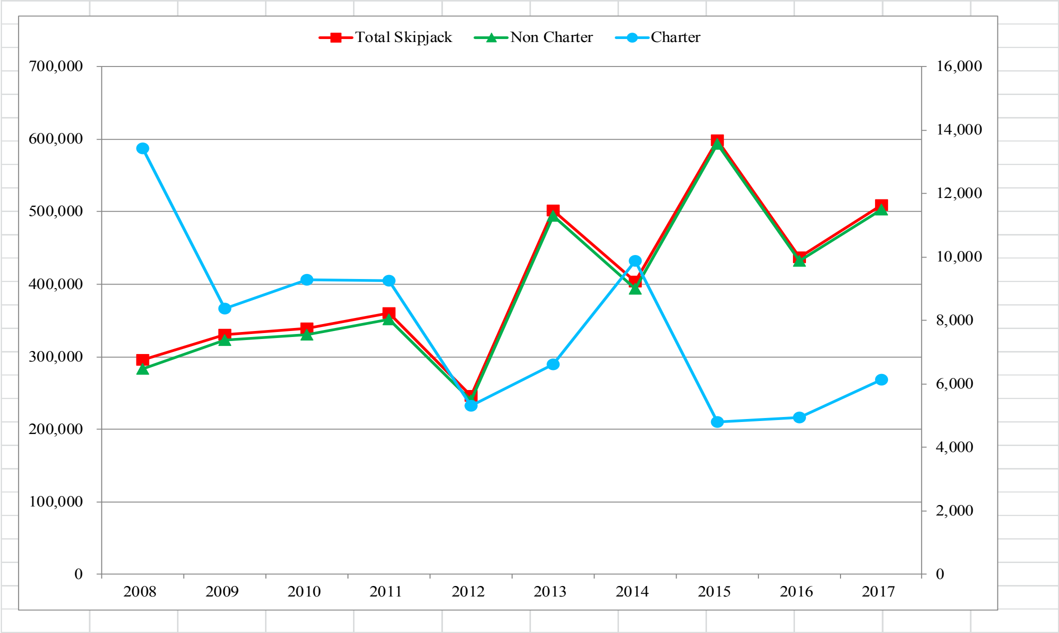
Supporting data shown in Table A-50.

Figure 50. Total estimated annual tuna PMUS landings in Guam from 2008-2017.



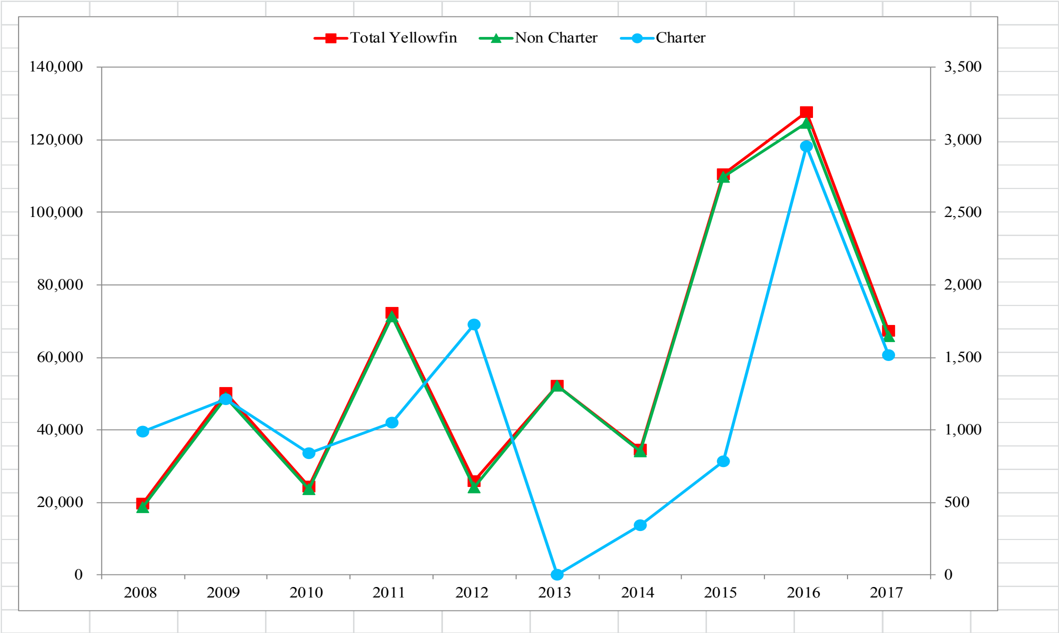
Supporting data shown in Table A-51.

Figure 51. Total estimated annual skipjack tuna landings in Guam from 2008-2017.



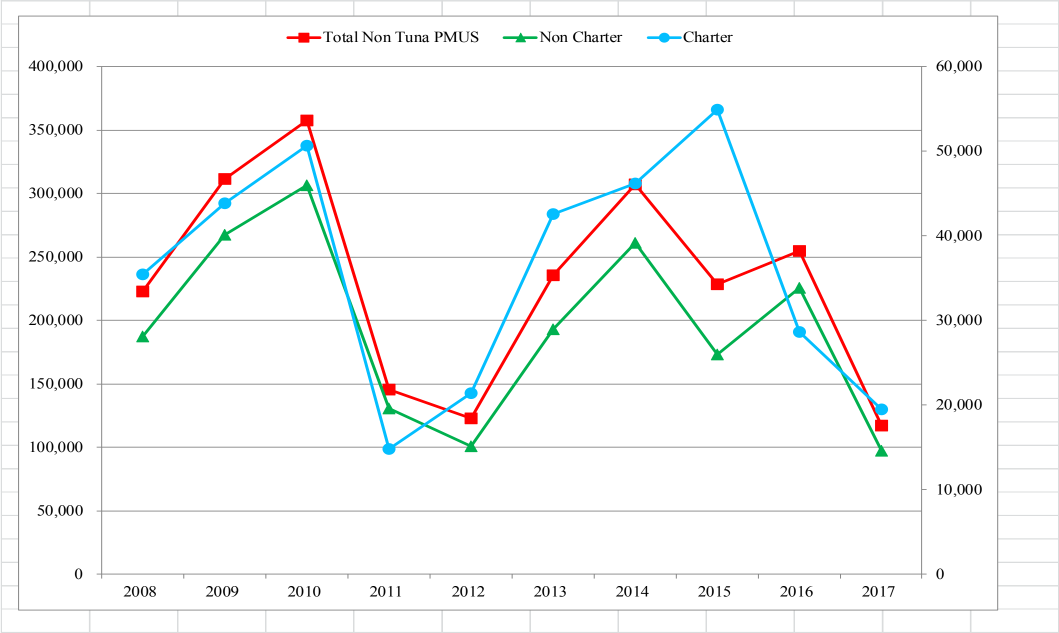
Supporting data shown in Table A-52.

Figure 52. Total estimated annual yellowfin landings in Guam from 2008-2017.



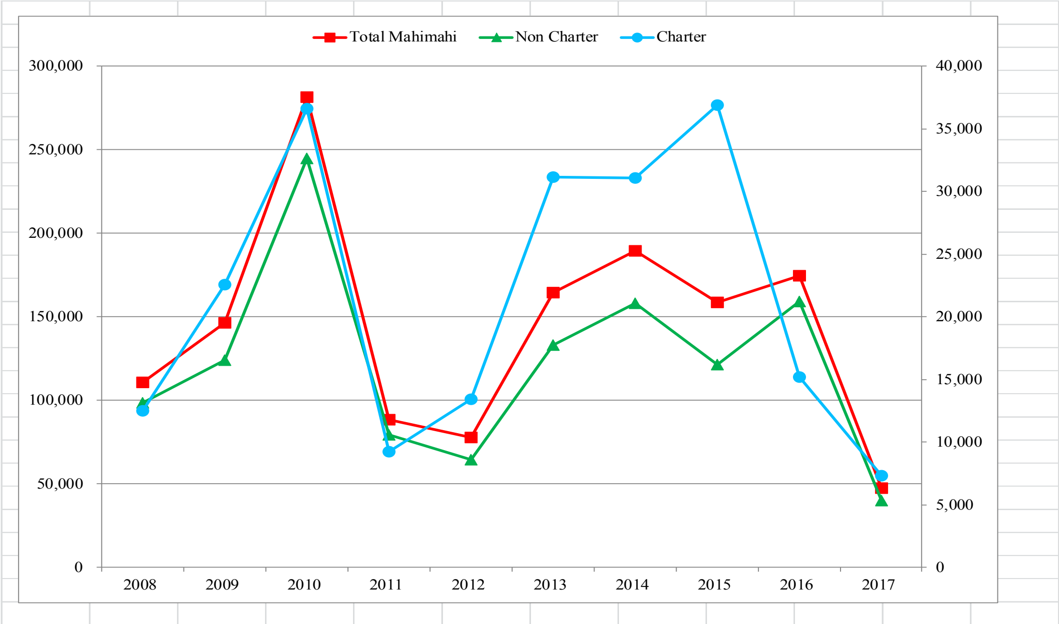
Supporting data shown in Table A-53.

Figure 53. Total estimated annual non-tuna PMUS landings in Guam from 2008-2017.



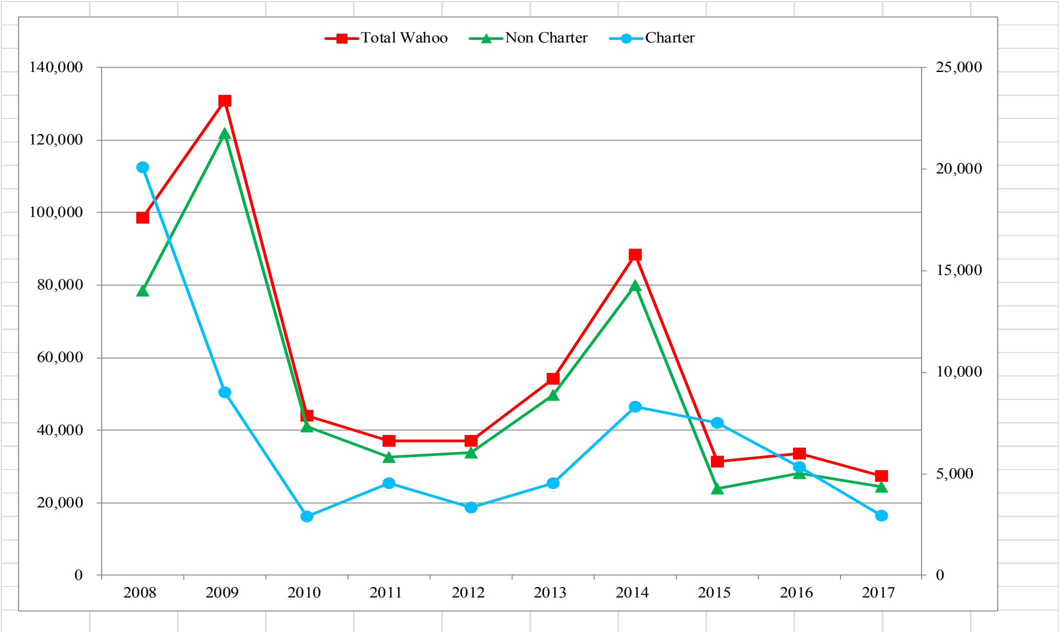
Supporting data shown in Table A-53.

Figure 54. Total estimated annual mahimahi landings in Guam from 2008-2017.



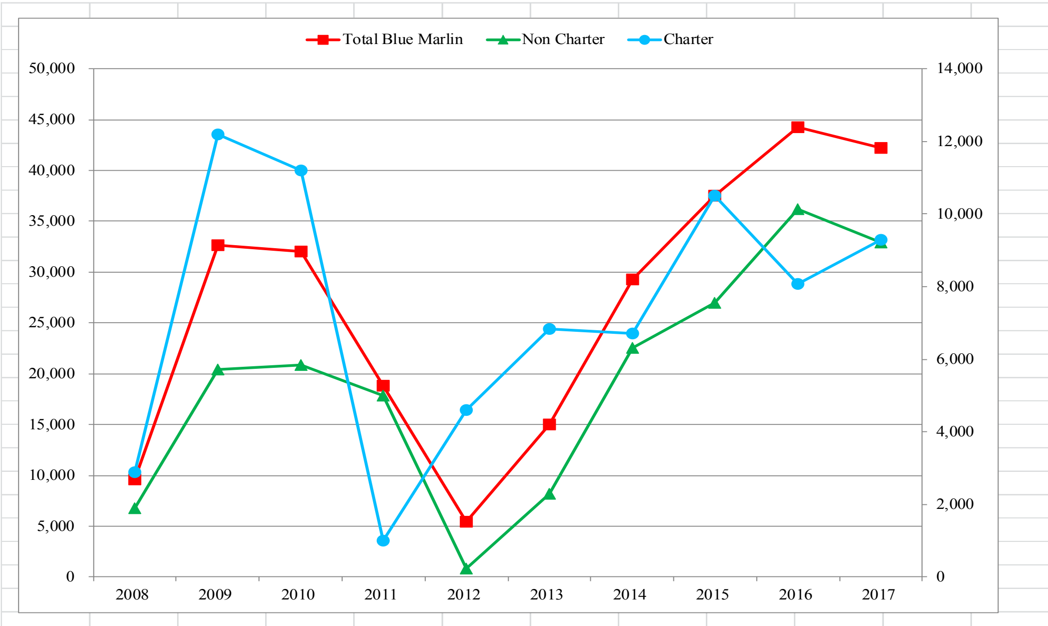
Supporting data shown in Table A-55.

Figure 55. Total estimated annual wahoo landings in Guam from 2008-2017.



Supporting data shown in Table A-56.

Figure 56. Total estimated annual blue marlin landings in Guam from 2008-2017.



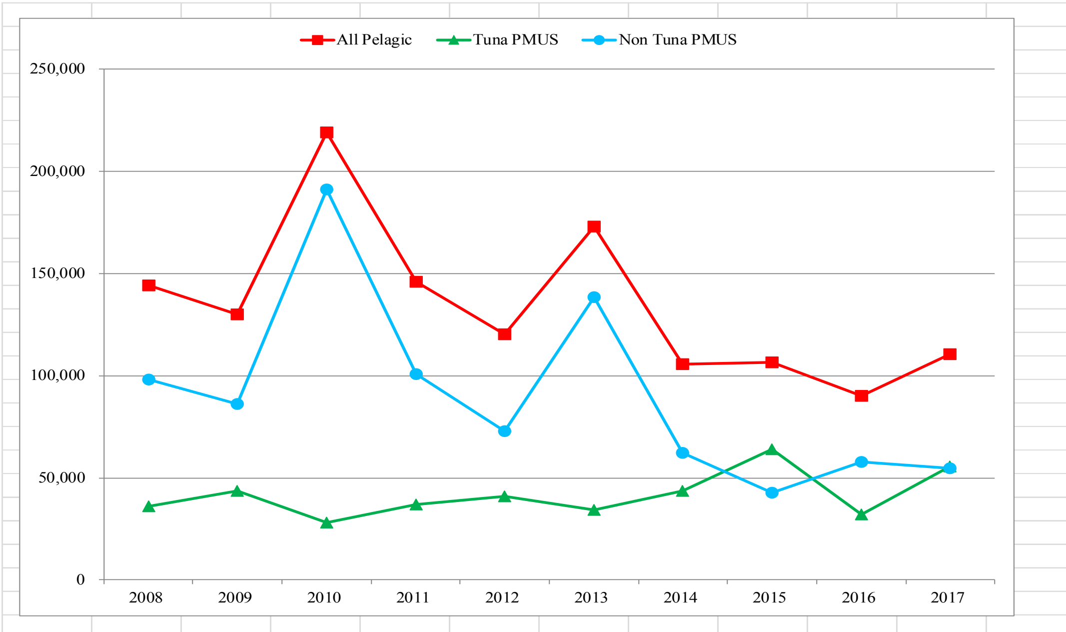
Supporting data shown in Table A-57.

Table 17. Bycatch summary for Guam charter and non-charter trolling fisheries in 2017

Year	Release Alive	Release Injured	Total Bycatch	Total Catch	Percent Bycatch	Bycatch Interview	Total Interview	Percent Bycatch Interview
2017	28	0	0	6,743	0.0	0	643	0.0

"Percent Bycatch" 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.

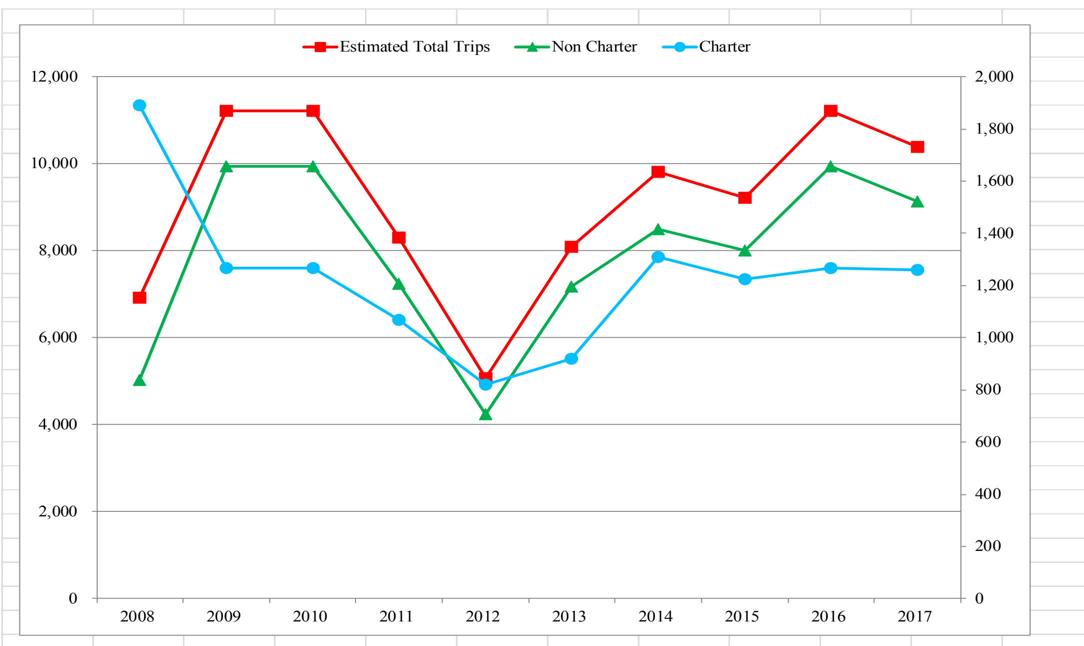
Figure 57. Annual estimated commercial landings for all pelagics, tuna PMUS, and non-tuna PMUS in Guam from 2008-2017.



Supporting data shown in Table A-58.

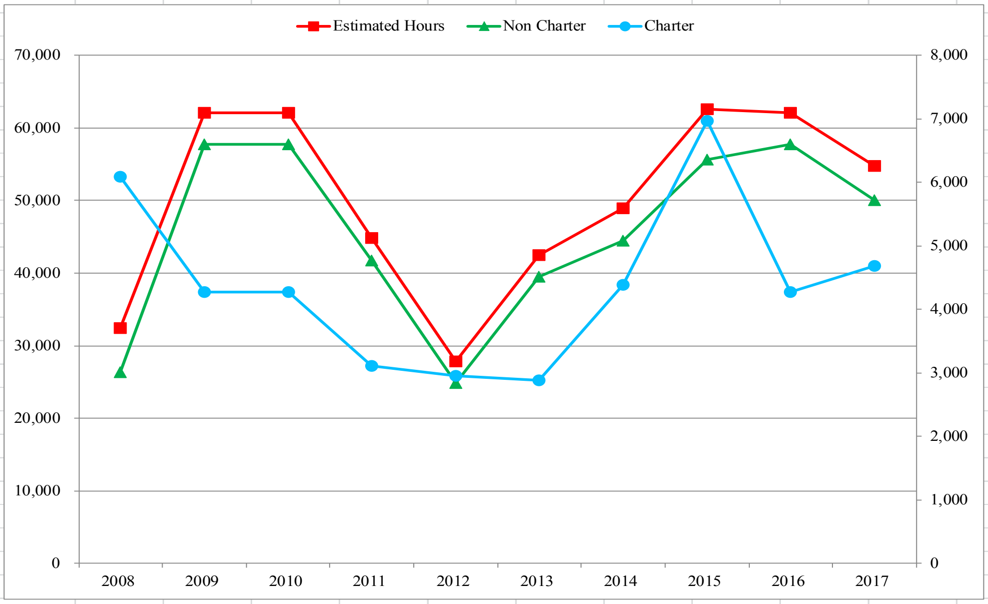
2.3.6 OVERVIEW OF EFFORT AND CPUE – NON-CHARTER AND CHARTER FISHERIES

Figure 58. Total estimated number of trolling trips in Guam from 2008-2017.



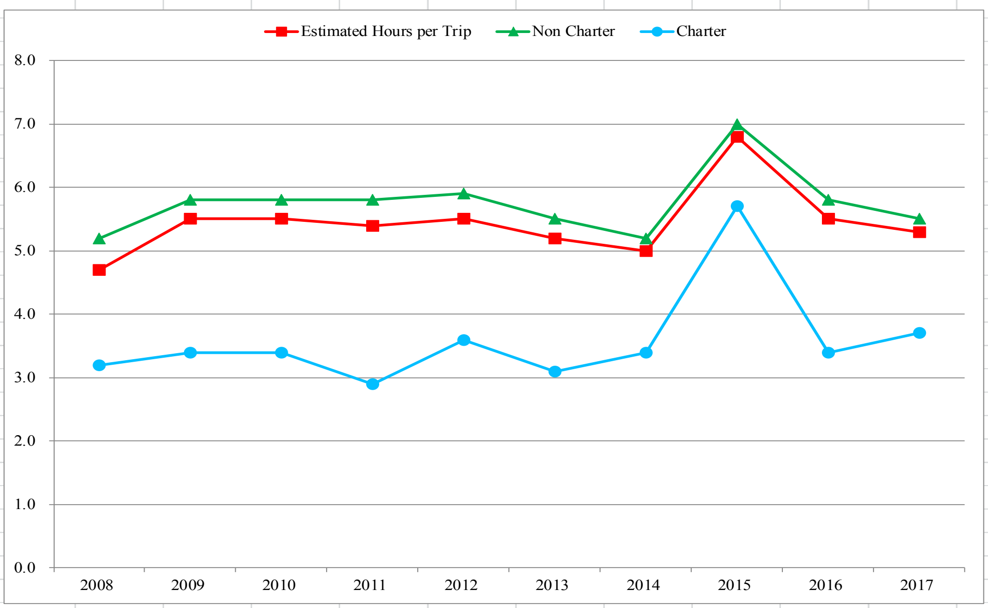
Supporting data shown in Table A-59.

Figure 59. Total estimated number of trolling hours in Guam from 2008-2017.



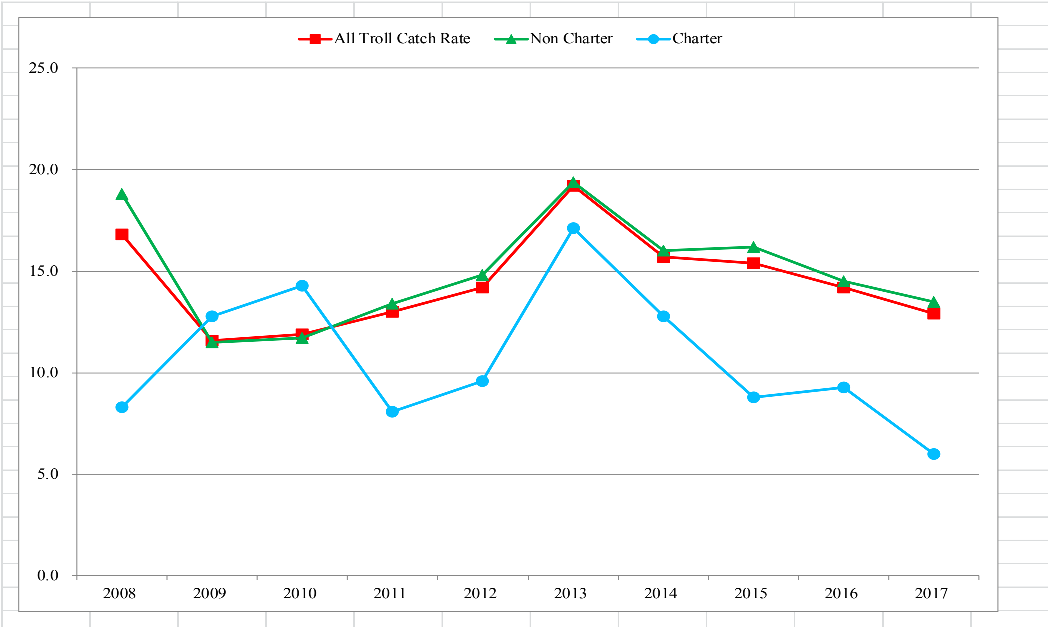
Supporting data shown in Table A-60.

Figure 60. Estimated fishing trip length (hrs.) in Guam from 2008-2017.



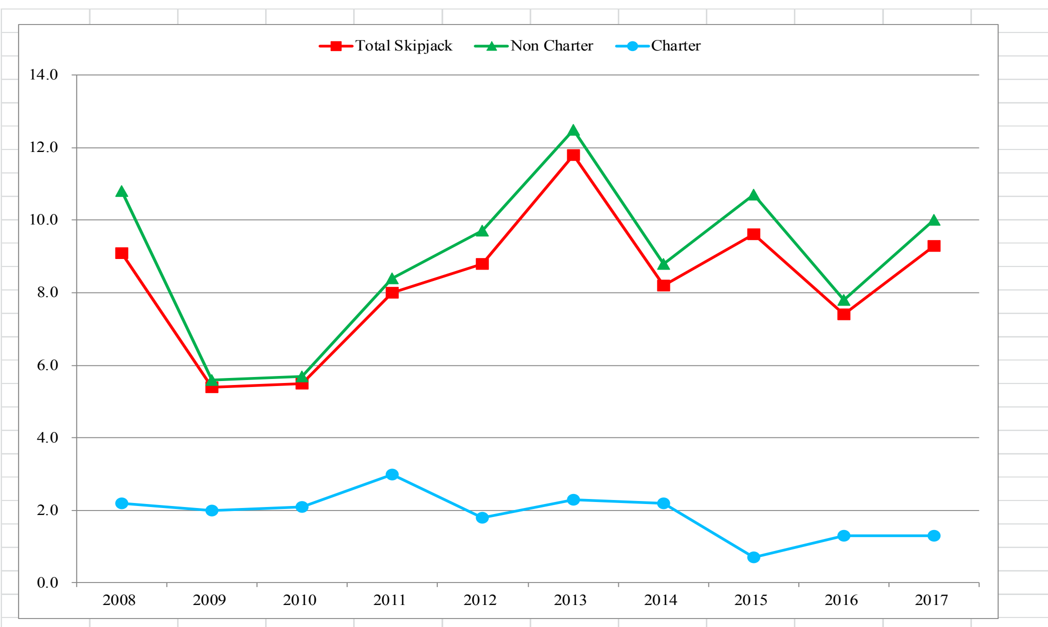
Supporting data shown in Table A-61.

Figure 61. Trolling catch rates (lbs./hr.) in Guam from 2008-2017.



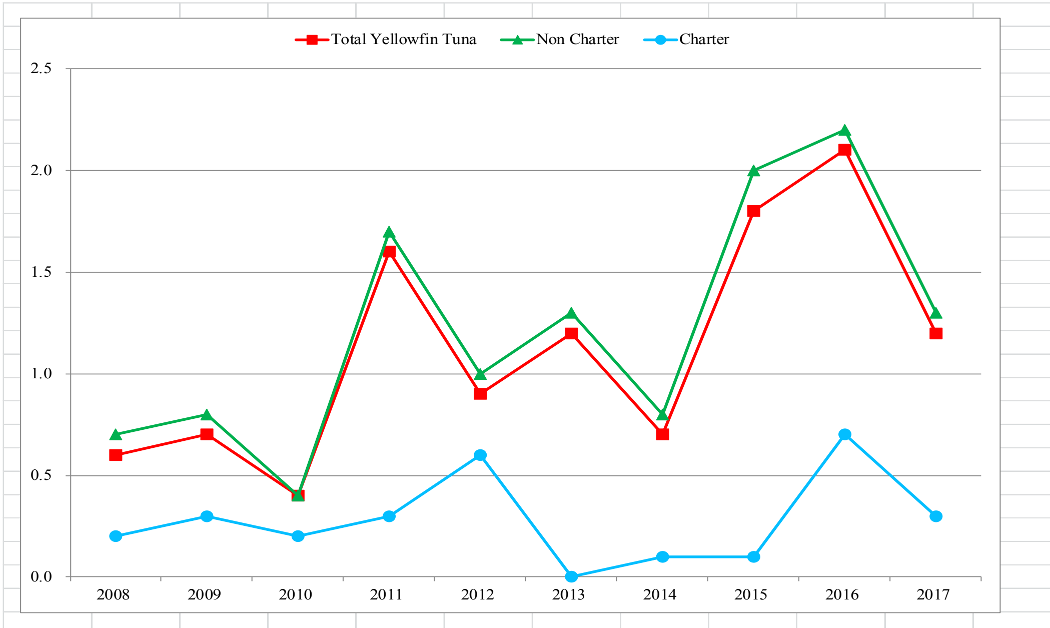
Supporting data shown in Table A-62.

Figure 62. Trolling catch rates (lbs./hr.) for skipjack tuna in Guam from 2008-2017.



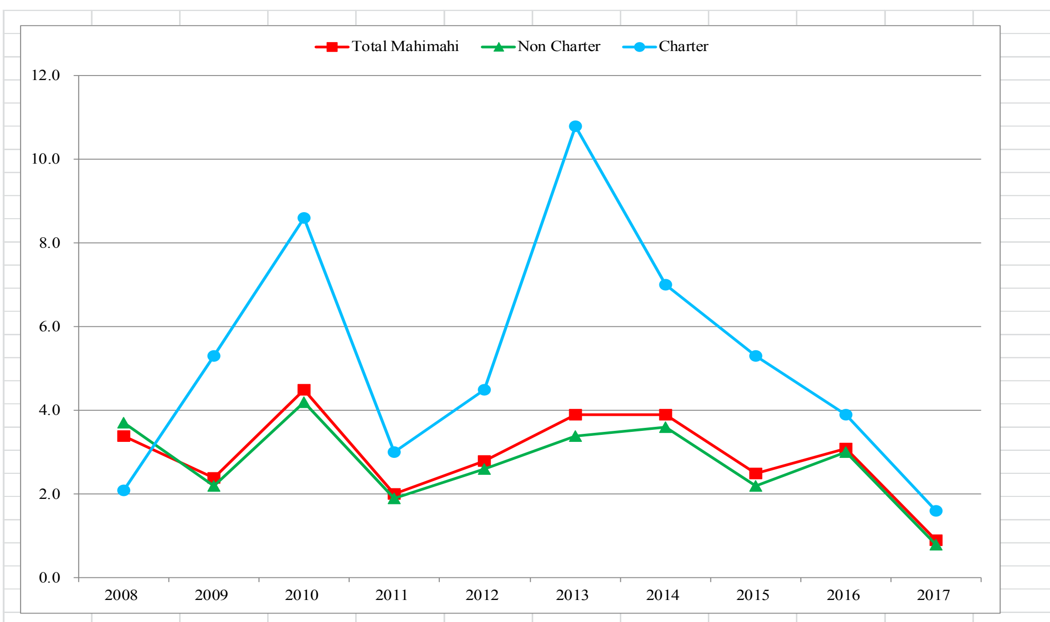
Supporting data shown in Table A-63.

Figure 63. Trolling catch rates (lbs./hr.) for yellowfin tuna in Guam from 2008-2017.



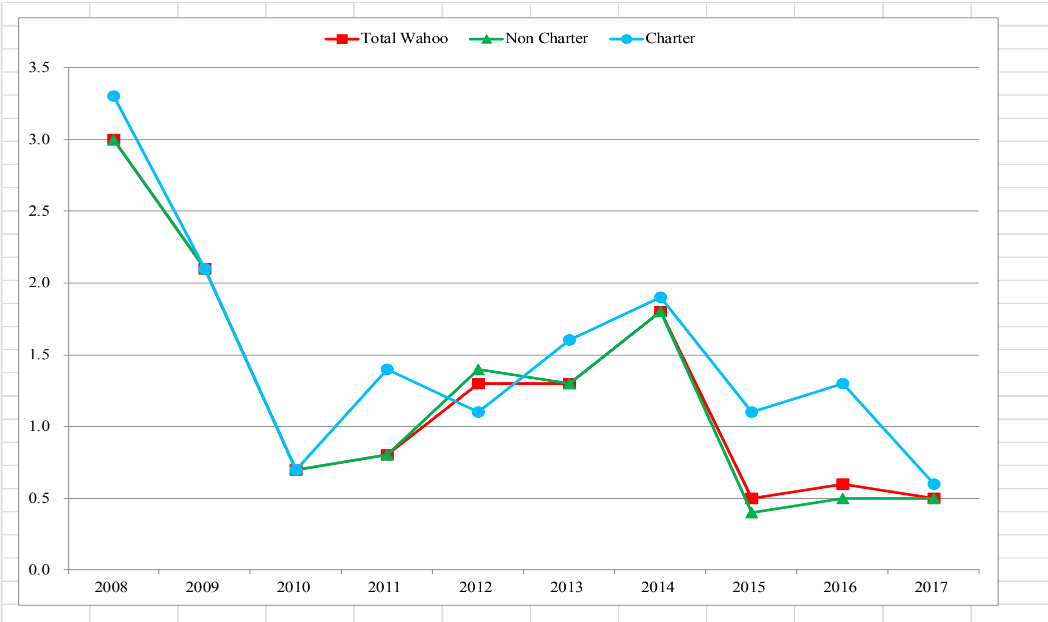
Supporting data shown in Table A-64.

Figure 64. Trolling catch rates (lbs./hr.) for mahimahi in Guam from 2008-2017.



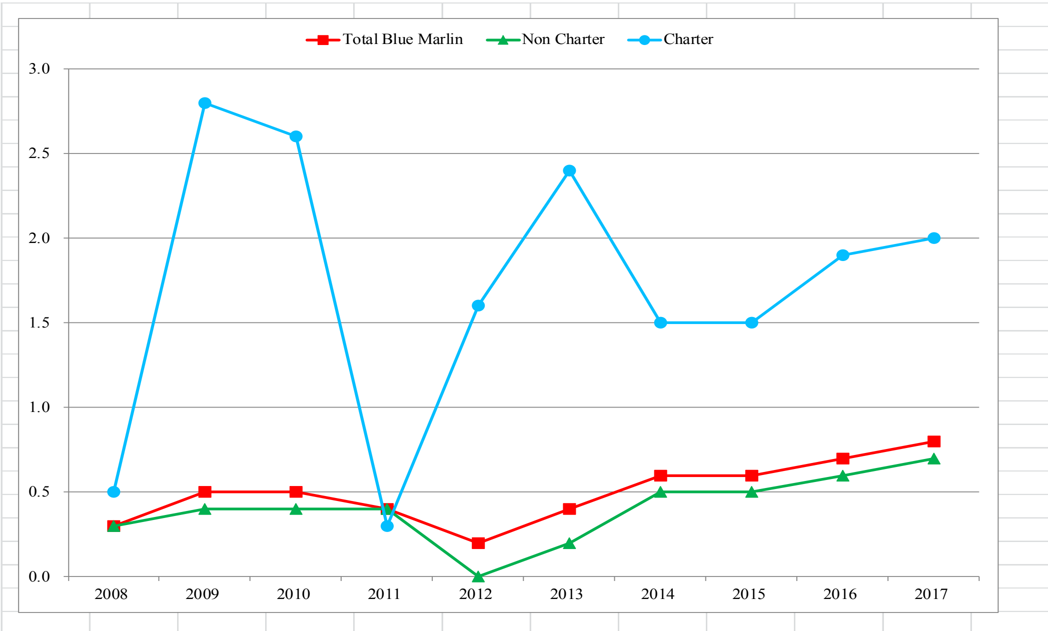
Supporting data shown in Table A-65.

Figure 65. Trolling catch rates (lbs./hr.) for wahoo in Guam from 2008-2017.



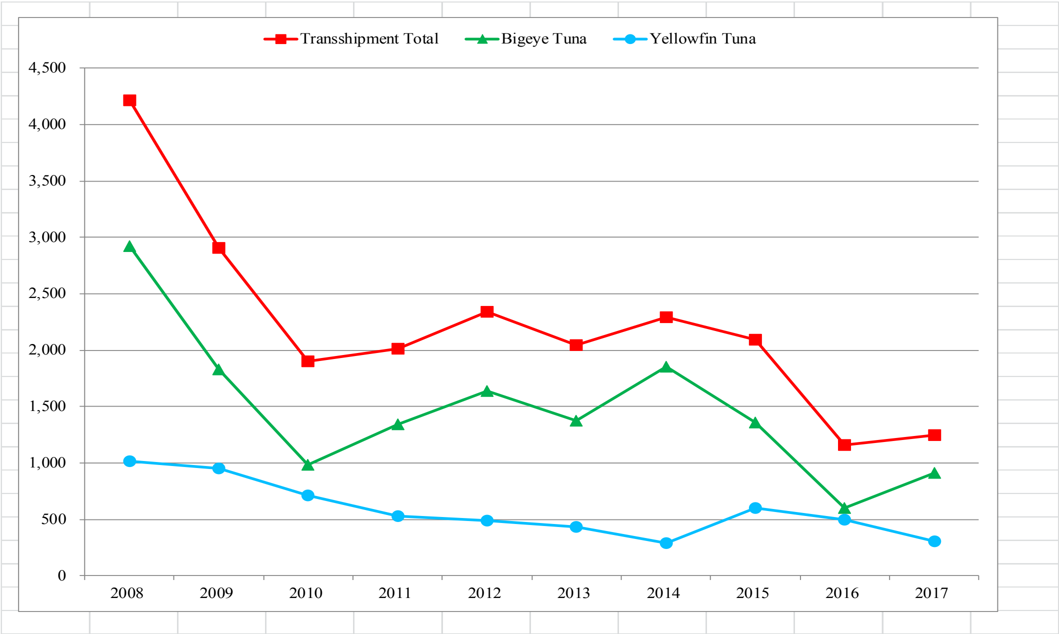
Supporting data shown in Table A-66.

Figure 66. Trolling catch rates (lbs./hr.) for blue marlin in Guam from 2008-2017.



Supporting data shown in Table A-67.

Figure 67. Guam foreign longline transshipment landings for longliners fishing outside the Guam EEZ from 2008-2017.



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 (CML) data, Commercial Fishing Report (Fishing Report) data, HDAR Commercial Marine Dealer's Report (Dealer) data, and NMFS, Pacific Islands Fisheries Science Center's (PIFSC) longline logbook data.

Any fisherman who takes marine species for commercial purposes is required by HDAR to have 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 it is the main source of data used to determine longline vessel activity, effort, fish catches, and catch-per-unit-effort (CPUE). 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.

The logbook and Dealer data were used to calculate the weight of longline catch. Longline purchases in the Dealer data were 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 being landed, headed, and gutted. Tuna and mahi-mahi that weighed more than 20 lbs. and marlins greater than 40 lbs. are required to 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 for 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 that were landed in low numbers needed to be aggregated into 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 module were based on RFMO standards and business rules. Longline catch and effort statistics in this module consist of U.S. longline fisheries in the North Pacific Ocean as well as attributions from the 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 exceptions to summaries using RFMO standards were 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.

MHI Trolling Fishery. Catch and effort by the MHI troll fishery was described 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 include 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-mile 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), Kaka line (5), 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 Gears. 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.

Data Aggregation. Pelagic catch by the MHI trolling, inshore handline, offshore handline, and other gear types were calculated by summing “Lbs. Landed” from the HDAR Fishing Report data. The percent of catch for each pelagic species was calculated from the "Lbs. Landed" by the gear types used to estimate the "Lbs. Sold" and revenue for each fishery.

Catch in the HDAR Dealer data, referred to as "Lbs. Bought" by each fishery, were 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 and 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 all gears. "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 "Lbs. Bought" and "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 3,744 fishermen were licensed in 2017, including 2,177 (58%) 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 (46%) and longline fishermen (41%). The remainder was issued to ika shibi and palu ahi (handline) (13%).

Landings. Hawai`i commercial fisheries landed 39,209,000 pounds of pelagic species in 2017, an increase of 6% 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 83% (32,727,000 pounds) of all pelagic fisheries. The shallow-set longline fishery targeted swordfish and its catch was 2,993,000 pounds, or 8% of the total catch. The main Hawai'i Islands troll fishery targeted tunas, marlins and other PMUS caught 2,146,000 pounds or 5% of the total. MHI handline fishery targeted yellowfin tuna while the and offshore handline fishery targeted bigeye tuna. The MHI handline fishery accounted for 933,000 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 2017. Bigeye tuna alone accounted for 68% of the tunas and 46% of all pelagic catch. Billfish catch made up 18% of the total catch in 2017. Swordfish was the largest of these, at 51% of the billfish and 9% of the total catch. Catches of other PMUS represented 14% of the total catch in 2017 with moonfish being the largest component at 40% of the other PMUS and 6% of the total catch.

Effort. There were 145 active Hawai`i-permitted deep-set longline vessels in 2017, three more vessel than the previous year, with 140 or more deep-set vessels in the past 4 years. The number of deep-set trips (1,539) and sets (19,647) were the highest effort over the past ten years. The number of hooks set by the deep-set longline fishery reached a record 53.5 million hooks in 2017. The Hawai`i-permitted shallow-set longline fishery operates mainly in the first half of the year. In 2017, 18 vessels completed 61 trips and made 949 sets, which was higher participation and effort for this segment of the fishery from the previous year. The number of hooks set by this fishery also increased to 1 million in 2017. The number of days fished by MHI troll fishers has been dropping since a peak in 2012, with 1,394 fishers logging 20,742 days fished around the MHI in 2017. There were 484 MHI handline fishers that fished 4,526 days in 2017, both below their respective long-term averages. The offshore handline fishery had 6 fishers and 226 days fished in 2017.

CPUE. The deep-set longline fishery targets bigeye tuna and this species had higher CPUE (4.2 fish per 1,000 hooks) compared to yellowfin tuna (1.5) and albacore (0.1). CPUE of billfish for the deep-set fishery is similar to that of albacore (0.1 - 0.4 fish per 1,000 hooks), while the CPUE for blue shark, a bycatch species, is second only to bigeye at 1.6 fish per 1,000 hooks. The Hawai`i-permitted shallow-set longline fishery targets swordfish and achieved a CPUE of 13.0 fish per 1,000 hooks in 2017 followed by blue shark, a bycatch species of this fishery, with a CPUE of 9.0 fish per 1,000 hooks. 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 2017 MHI troll fishery CPUE for tunas and blue marlin were above the long-term average while CPUE for mahimahi and ono to decline in 2017 from their respective peaks in 2014. MHI handline CPUE for yellowfin tuna peaked in 2015 and dropped in 2016 but increased above its long-term average in 2017. 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, but dropped well below the long-term average in 2017.

Fish Size. The average weight for most species caught by the deep-set longline fishery was close to their respective long-term weights in 2017. Bigeye tuna caught in the deep-set fishery was 79 lbs. in 2017, 4% less than the long-term average. Yellowfin tuna average weight in the deep-set fishery was 71 lbs., 5% below the long-term average. 2017 saw long-term high mean weights for sailfish, black marlin, and oilfish in the deep-set fishery. All species caught by the shallow-set longline fishery were within their respective long-term mean weights except for yellowfin tuna which was 94 lbs. or 17% below its average mean weight in 2017. The shallow-set average weight of swordfish in 2017 was 199 lbs. 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 tuna species caught by the troll and handline fisheries were above their long-term average in 2017 except for bigeye tuna. Troll and handline caught blue marlin and swordfish were below their respective long-term mean weights.

Revenue. The total revenue from Hawaii's pelagic fisheries was $110.8 million in 2017, a decrease of 4% from the previous year. The deep-set longline revenue was $96.1 million in 2017. This fishery represented 87% of the total revenue for pelagic fish in Hawaii. The shallow-set longline fishery increased to $4.2 million and accounted for 4% of the revenue. The MHI troll revenue was $6.4 million or 6% of the total in 2017 and was followed by the MHI handline fishery at $2.8 million (3%). The offshore handline fishery was worth $891,000 in 2017. The trend for revenue from the deep-set longline and offshore handline fisheries was increasing while revenue of the shallow-set longline and MHI troll fisheries was decreasing. The revenue from the offshore handline fishery was steady for the past four years.

Bycatch. A total of 111,702 fish were released by the deep-set longline fishery in 2017. Sharks accounted for 88% 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 2% for targeted and incidentally caught pelagic species in 2017. A total of 12,008 fish were released by the shallow-set longline fishery in 2017. Sharks accounted for 85% 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, 97% 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 2017. 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

The recommendations by the Pelagic Plan Team for the Hawaii Module in the 2017 SAFE Report were:

- Move economic tables and figures to the economic section of the SAFE Report.
- The criteria for the “Hawaii-permitted” longline fisheries needs a more thorough description.

2.4.4 OVERVIEW OF PARTICIPATION – ALL FISHERIES

Table 18. Number of HDAR Commercial Marine Licenses for 2016 and 2017.

	Number of licenses	
Primary Fishing Method	**2016**	**2017**
Trolling	949	998
Longline	775	896
Ika Shibi & Palu Ahi	295	279
Aku Boat (Pole and Line)	11	4
Total Pelagic	2,030	2,177
Total All Methods	3,669	3,744

2.4.5 OVERVIEW OF LANDINGS AND ECONOMIC DATA

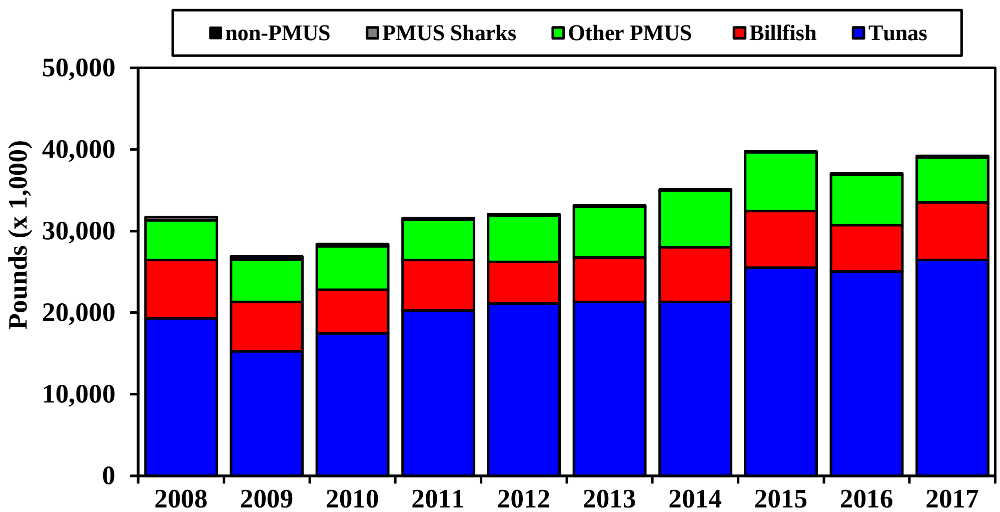
Table 19. Hawai`i commercial pelagic catch, revenue, and avg. price for 2016 and 2017.

	2016			2017		
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	602	$1,118	$1.85	286	$505	$1.83
Bigeye tuna	18,663	$73,871	$4.23	17,928	$64,547	$3.82
Bluefin tuna	1	$3	$4.81	3	$3	$8.25
Skipjack tuna	801	$800	$1.46	724	$768	$1.57
Yellowfin tuna	4,956	$14,487	$3.15	7,518	$21,118	$2.92
Other tunas	14	$34	$2.97	11	$49	$3.29
Tuna PMUS subtotal	**25,038**	**$90,312**	**$3.89**	**26,470**	**$86,989**	**$3.49**
Billfish PMUS						
Swordfish	2,418	$4,933	$3.01	3,580	$5,817	$2.27
Blue marlin	1,542	$2,138	$1.68	1,815	$2,114	$1.37
Spearfish (hebi)	784	$844	$1.09	688	$787	$1.14
Striped marlin	887	$1,981	$1.99	919	$1,683	$1.65
Other marlins	56	$75	$1.35	47	$81	$1.46
Billfish PMUS subtotal	**5,687**	**$9,972**	**$2.10**	**7,050**	**$10,482**	**$1.79**
Other PMUS						
Mahimahi	1,232	$4,603	$3.89	993	$3,438	$3.62
Ono (wahoo)	1,204	$3,346	$2.93	978	$3,060	$3.15
Opah (moonfish)	2,166	$3,386	$2.18	2,289	$3,192	$1.77
Oilfish	481	$258	$0.59	334	$262	$0.83
Pomfrets (monchong)	1,084	$3,586	$3.08	920	$3,256	$3.35
PMUS Sharks	168	$85	$0.72	166	$72	$0.77
Other PMUS subtotal	**6,335**	**$15,264**	**$2.73**	**5,679**	**$13,280**	**$2.60**
Other pelagics	**24**	**$18**	**$0.91**	**11**	**$14**	**$1.17**
Total pelagics	**37,083**	**$115,566**	**$3.44**	**39,209**	**$110,766**	**$3.09**

Table 20. Hawai`i commercial pelagic catch, revenue, and average price for 2016 and 2017.

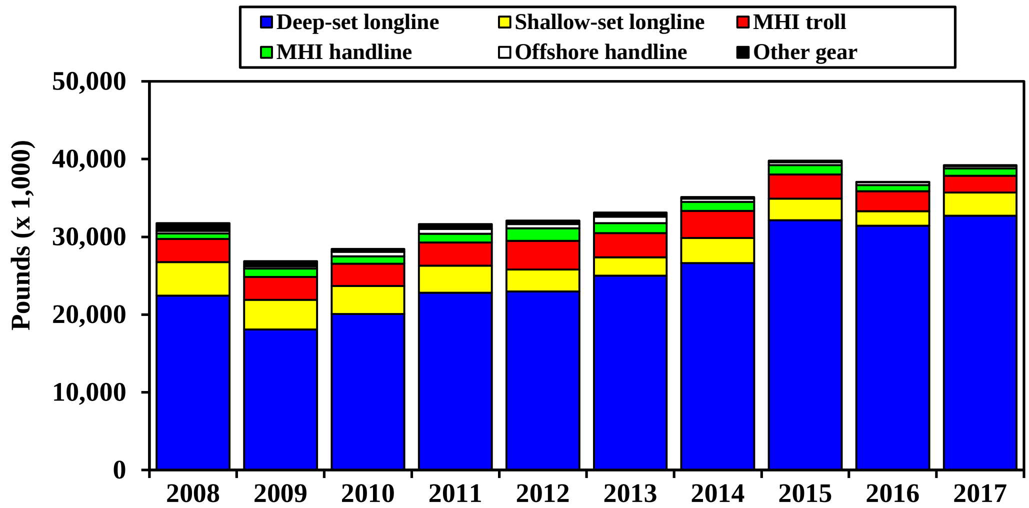
	2016			2017		
Fishery	**Catch (1,000 lbs)**	**Ex-vessel revenue ($1,000)**	**Average price ($/lb)**	**Catch (1,000 lbs)**	**Ex-vessel revenue ($1,000)**	**Average price ($/lb)**
Deep-set longline	31,434	$101,707	$3.48	32,727	$96,135	$3.10
Shallow-set longline	1,849	$2,549	$2.72	2,993	$4,229	$2.38
MHI trolling	2,582	$7,750	$3.50	2,146	$6,419	$3.40
MHI handline	785	$2,424	$3.33	933	$2,835	$3.25
Offshore handline	366	$946	$2.57	318	$891	$2.90
Other gear	67	$190	$2.90	92	$256	$2.99
Total	**37,083**	**$115,566**	**$3.44**	**39,209**	**$110,766**	**$3.09**

Figure 68. Hawai`i commercial tuna, billfish, other PMUS and PMUS shark catch from 2008-2017.



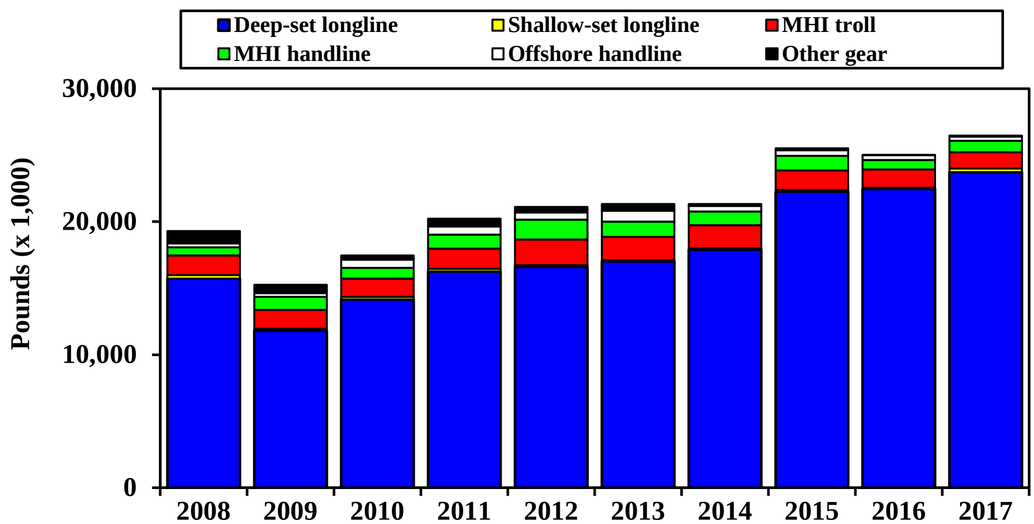
Supporting data shown in Table A-69.

Figure 69. Total commercial pelagic catch by gear type from 2008-2017.



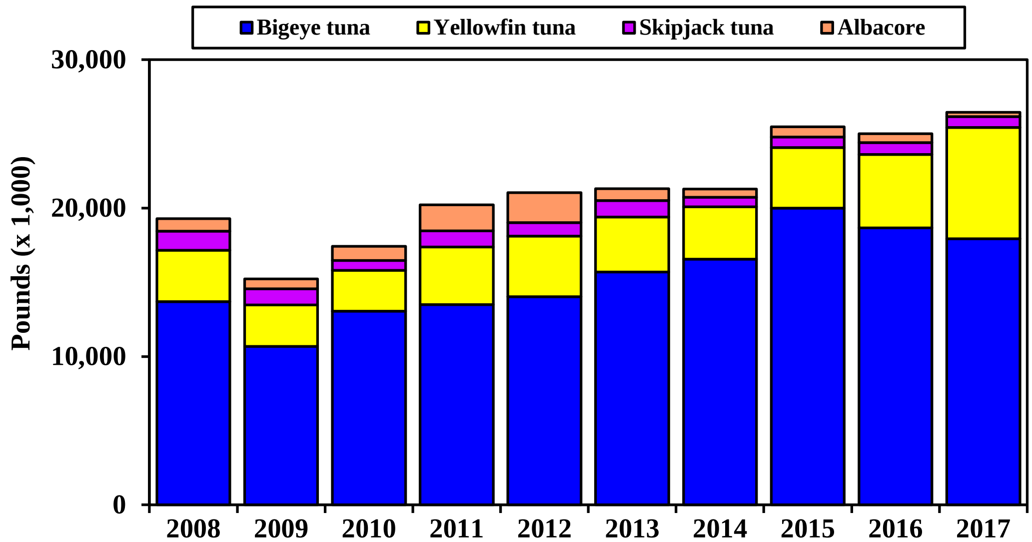
Supporting data shown in Table A-70.

Figure 70. Hawai`i commercial tuna catch by gear type from 2008-2017.



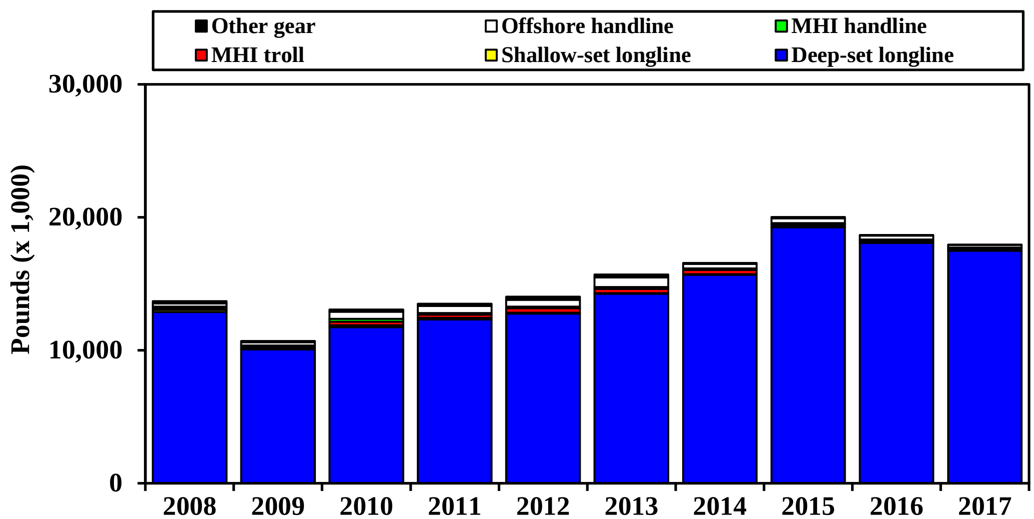
Supporting data shown in Table A-71.

Figure 71. Species composition of the tuna catch from 2008-2017.



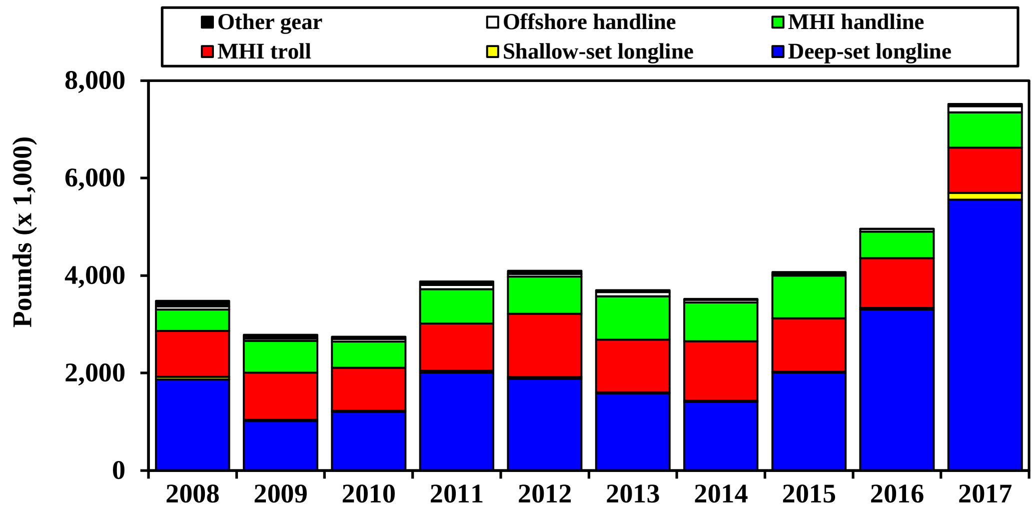
Supporting data shown in Table A-72.

Figure 72. Hawai`i bigeye tuna catch by gear type from 2008-2017.



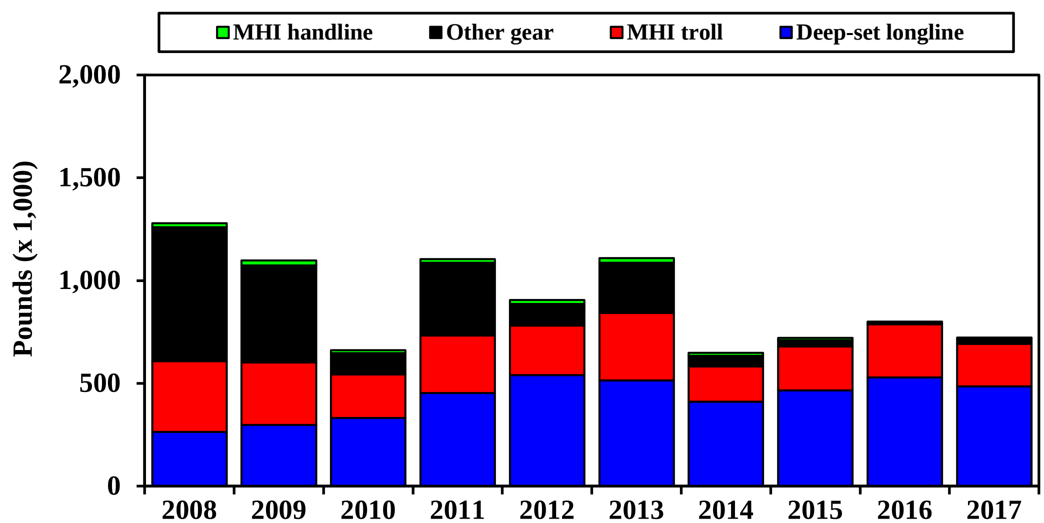
Supporting data shown in Table A-73.

Figure 73. Hawai`i yellowfin tuna catch by gear type from 2008-2017.



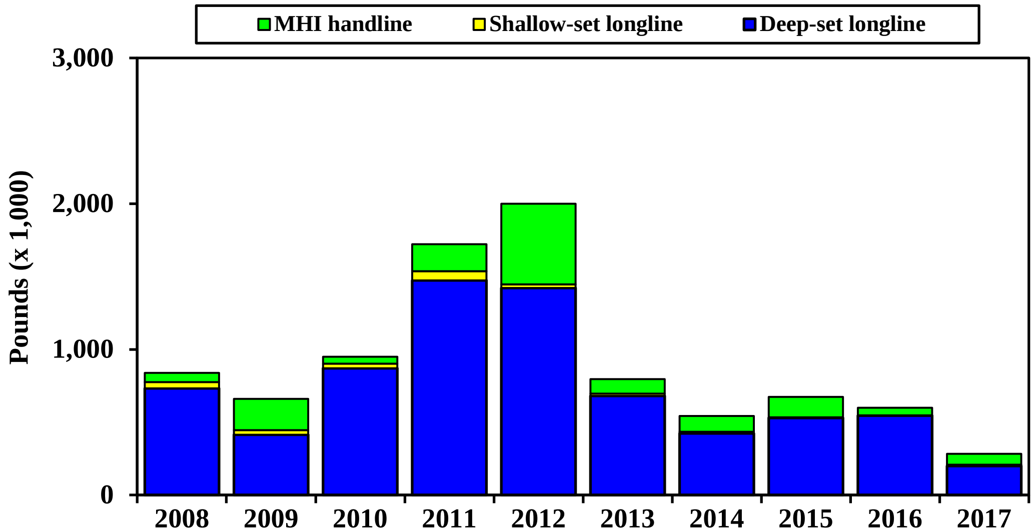
Supporting data shown in Table A-74.

Figure 74. Hawai`i skipjack tuna catch by gear type from 2008-2017.



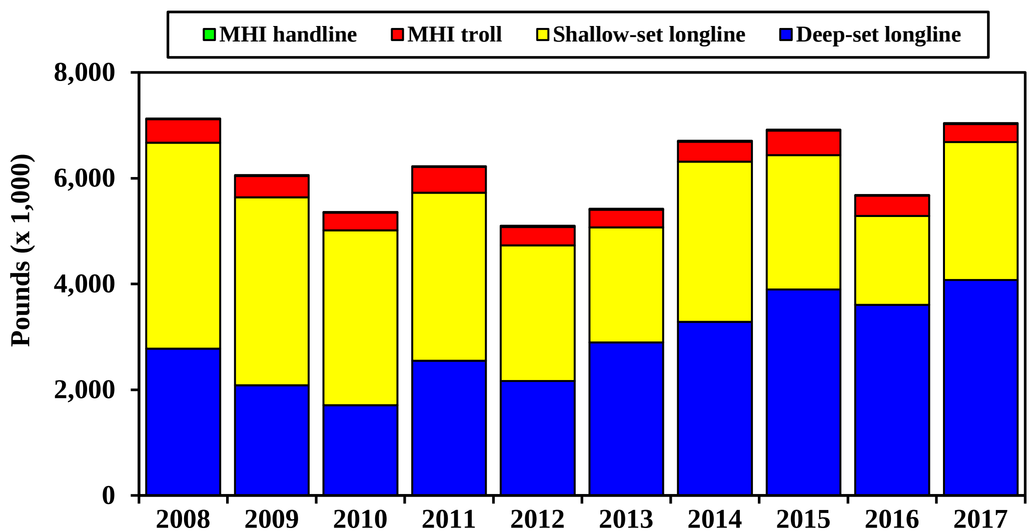
Supporting data shown in Table A-75.

Figure 75. Hawai`i albacore catch by gear type from 2008-2017.



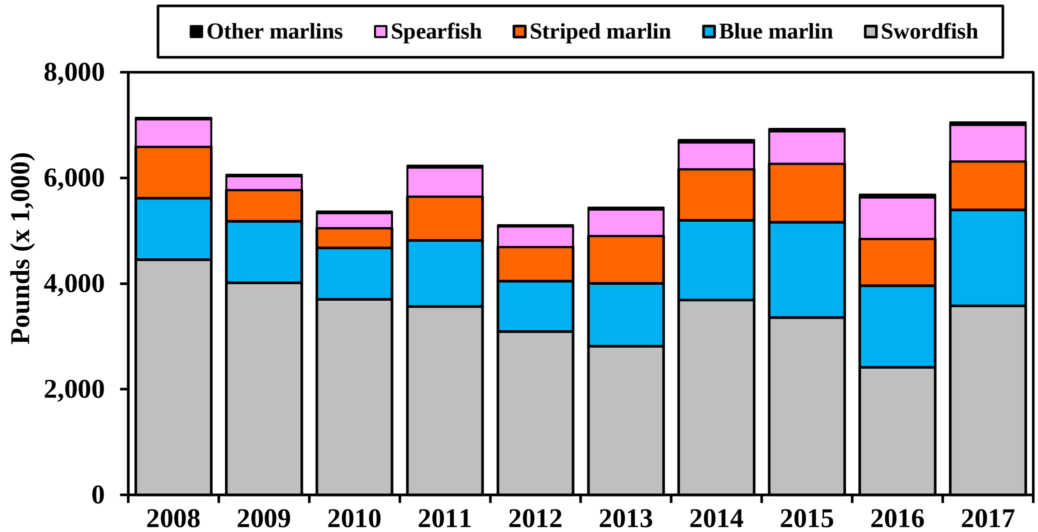
Supporting data shown in Table A-76.

Figure 76. Hawai`i commercial billfish catch by gear type from 2008-2017.



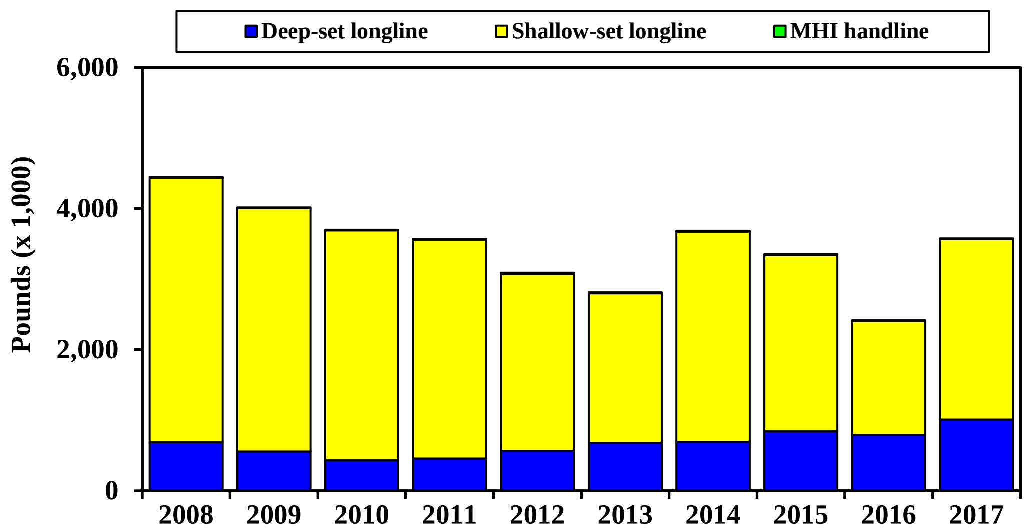
Supporting data shown in Table A-77.

Figure 77. Species composition of the billfish catch from 2008-2017.



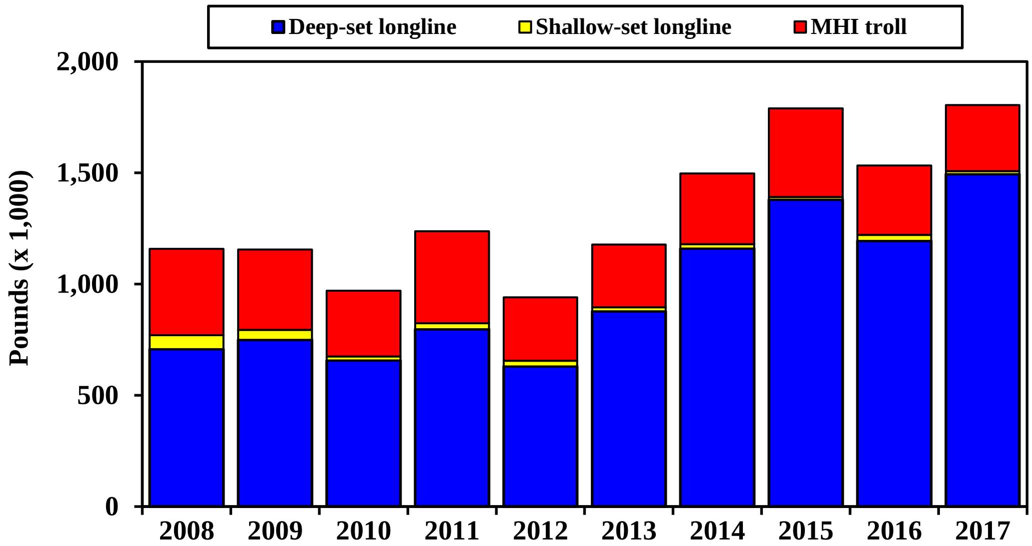
Supporting data shown in Table A-78.

Figure 78. Hawai`i swordfish catch by gear type from 2008-2017.



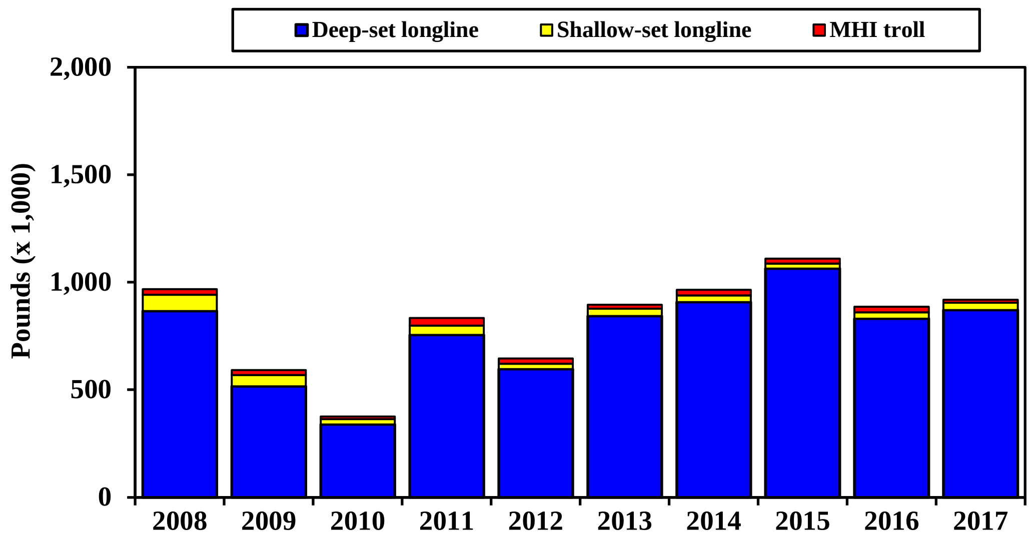
Supporting data shown in Table A-79.

Figure 79. Hawai`i blue marlin catch by gear type from 2008-2017.



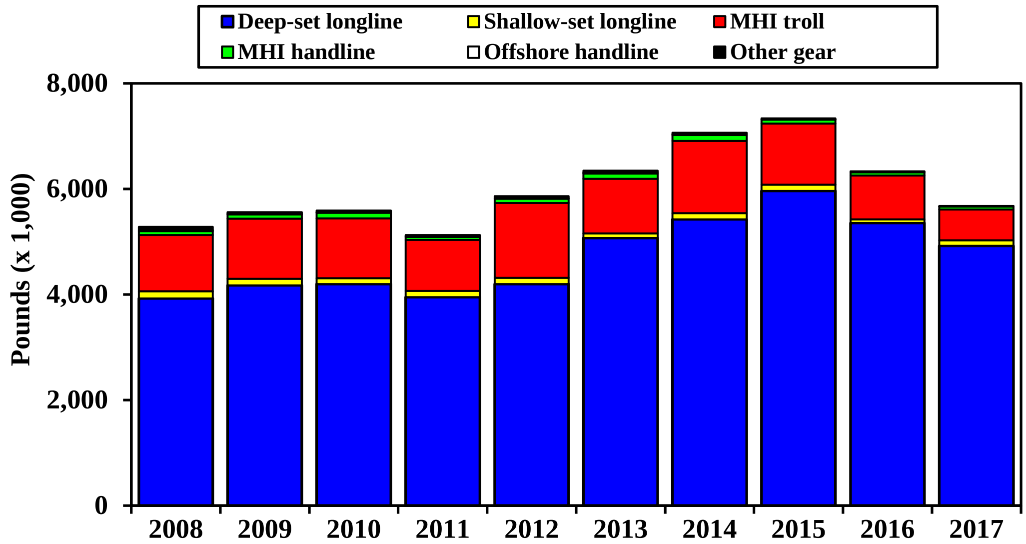
Supporting data shown in Table A-80.

Figure 80. Hawai`i striped marlin catch by gear type from 2008-2017.



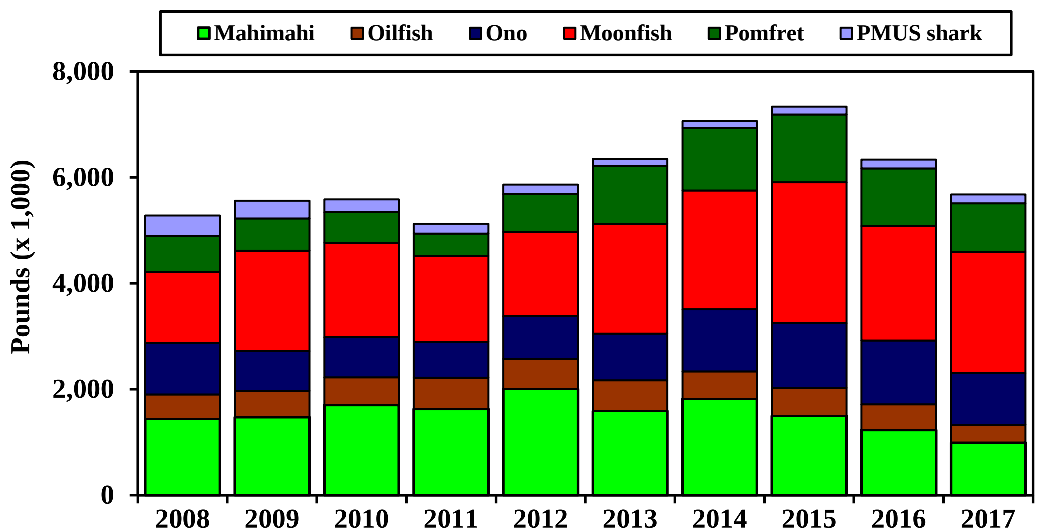
Supporting data shown in Table A-81.

Figure 81. Hawai`i commercial catch of other PMUS by gear type from 2008-2017.



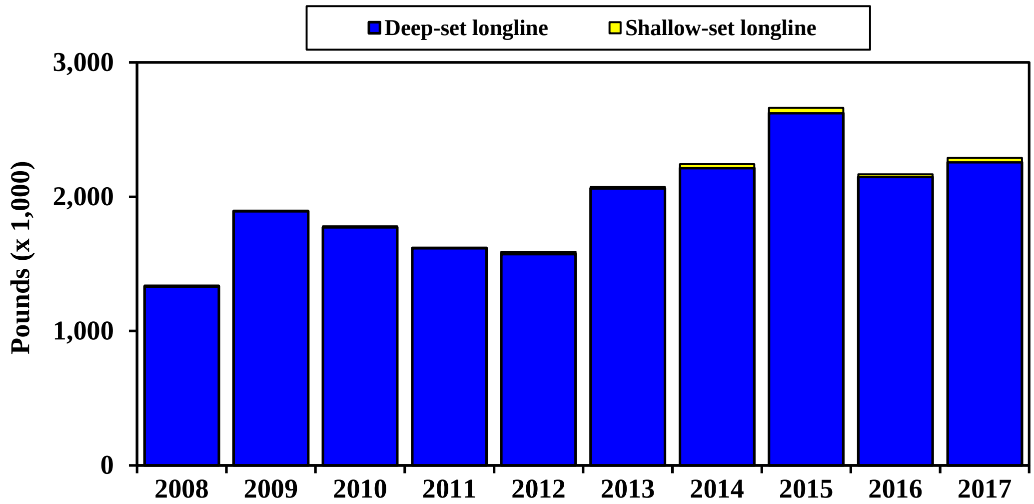
Supporting data shown in Table A-82.

Figure 82. Species composition of other PMUS catch from 2008-2017.



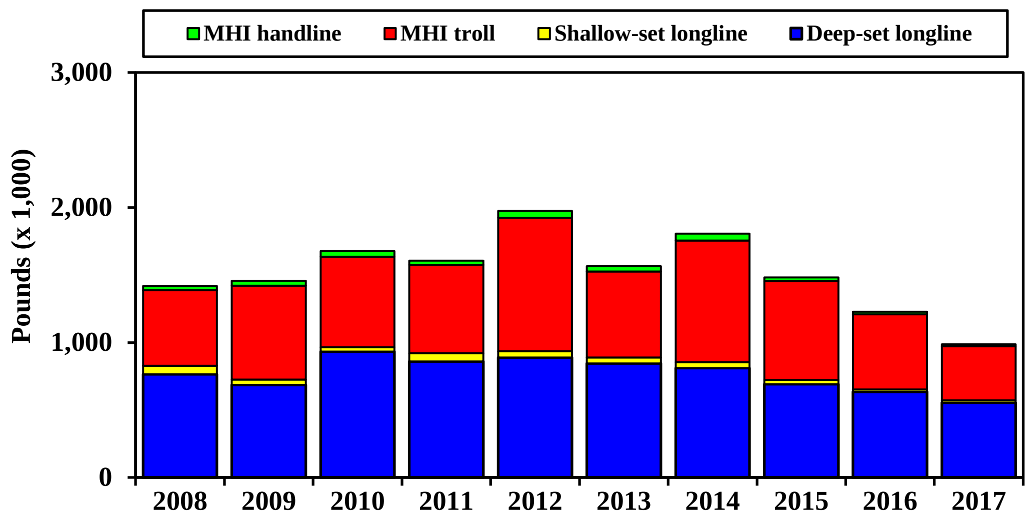
Supporting data shown in Table A-83.

Figure 83. Hawai`i moonfish catch by gear type from 2008-2017.



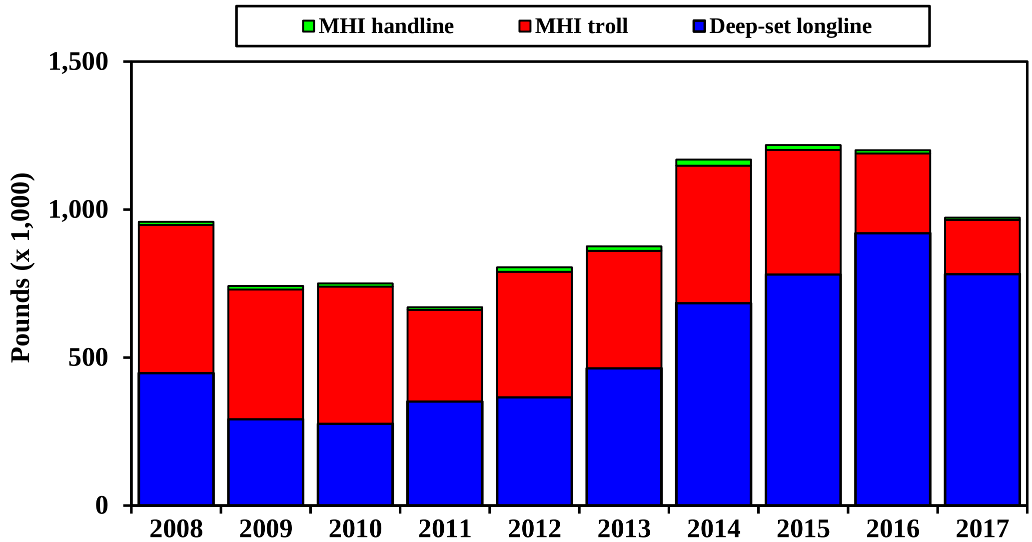
Supporting data shown in Table A-84.

Figure 84. Hawai`i mahimahi catch by gear type from 2008-2017.



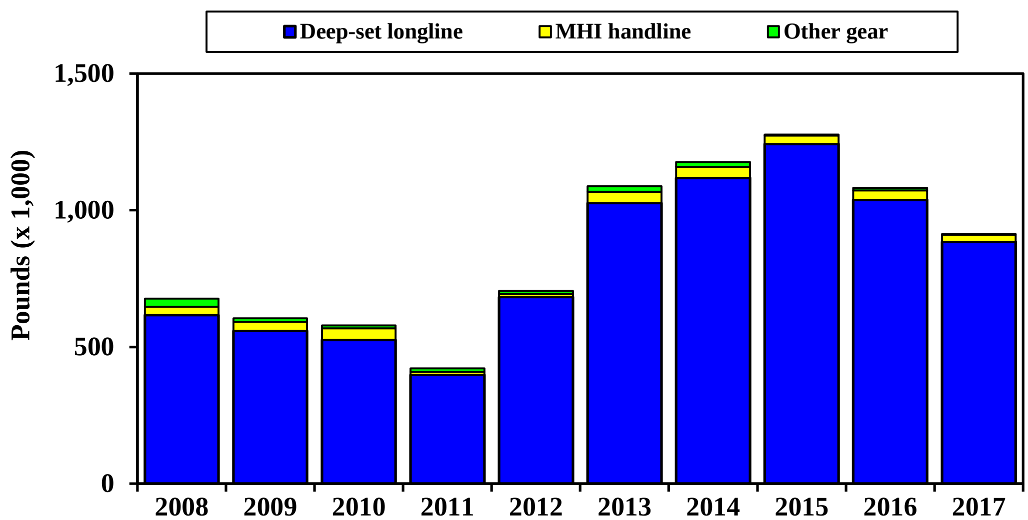
Supporting data shown in Table A-85.

Figure 85. Hawai`i ono (wahoo) catch by gear type from 2008-2017.



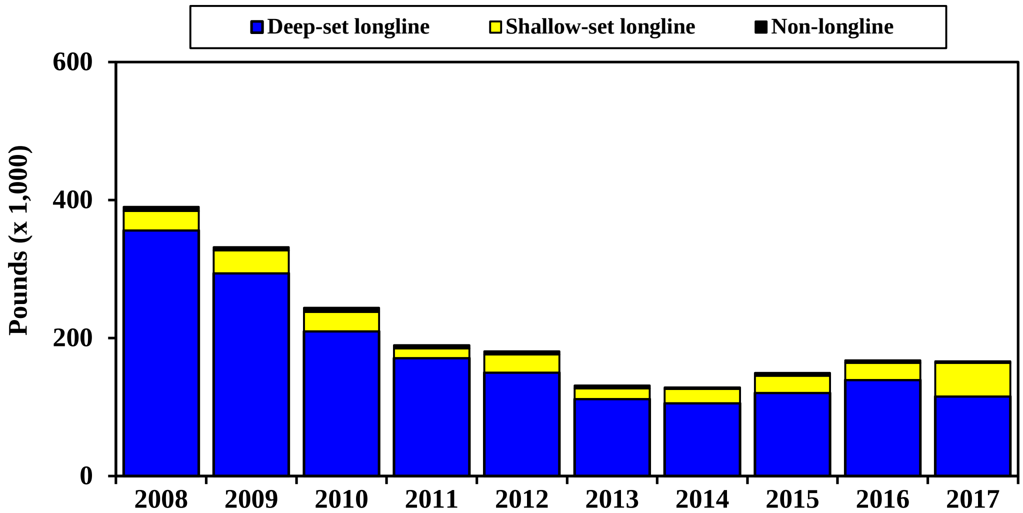
Supporting data shown in Table A-86.

Figure 86. Hawai`i pomfret (monchong) catch by gear type from 2008-2017.



Supporting data shown in Table A-87.

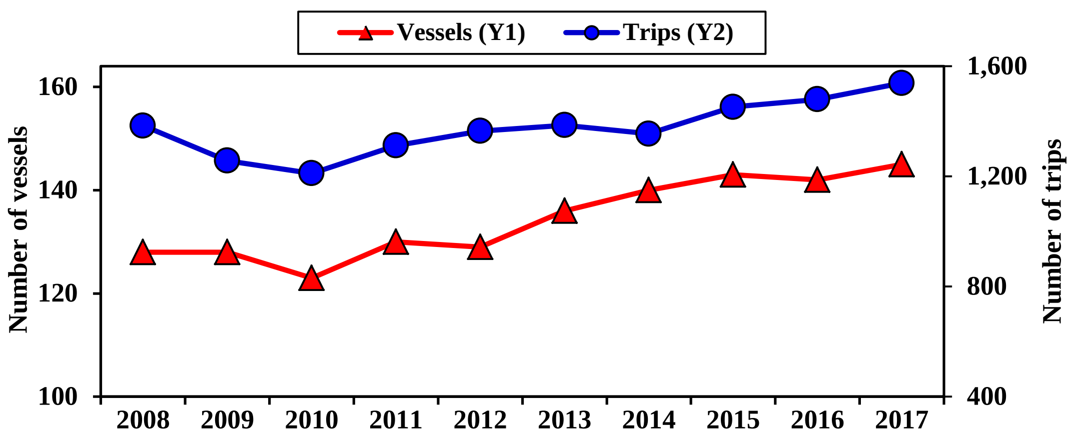
Figure 87. Hawai`i PMUS shark catch by gear type from 2008-2017.



Supporting data shown in Table A-88.

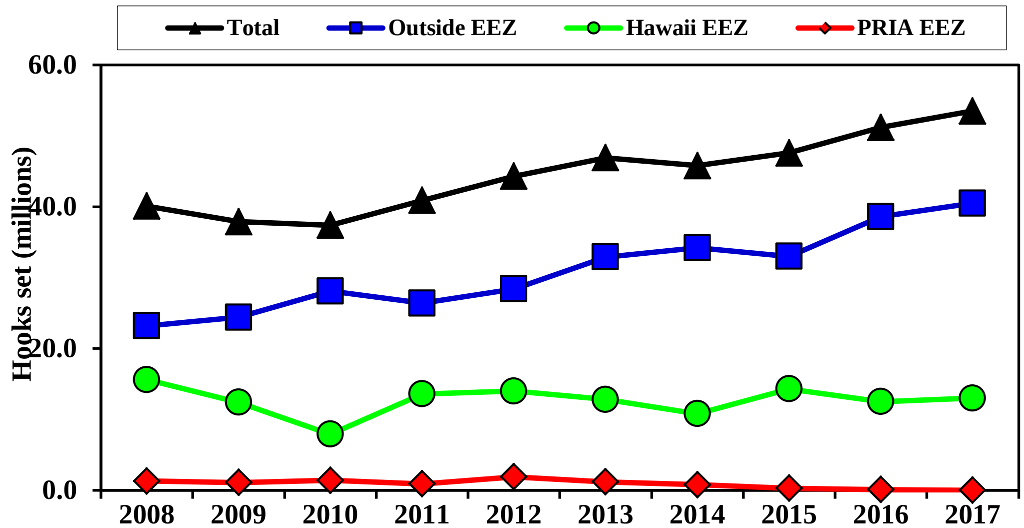
2.4.6 HAWAI`I DEEP-SET LONGLINE FISHERY EFFORT, LANDINGS. REVENUE, AND CPUE

Figure 88. Number of Hawai`i-permitted deep-set longline vessels trips/sets from 2008-2017.



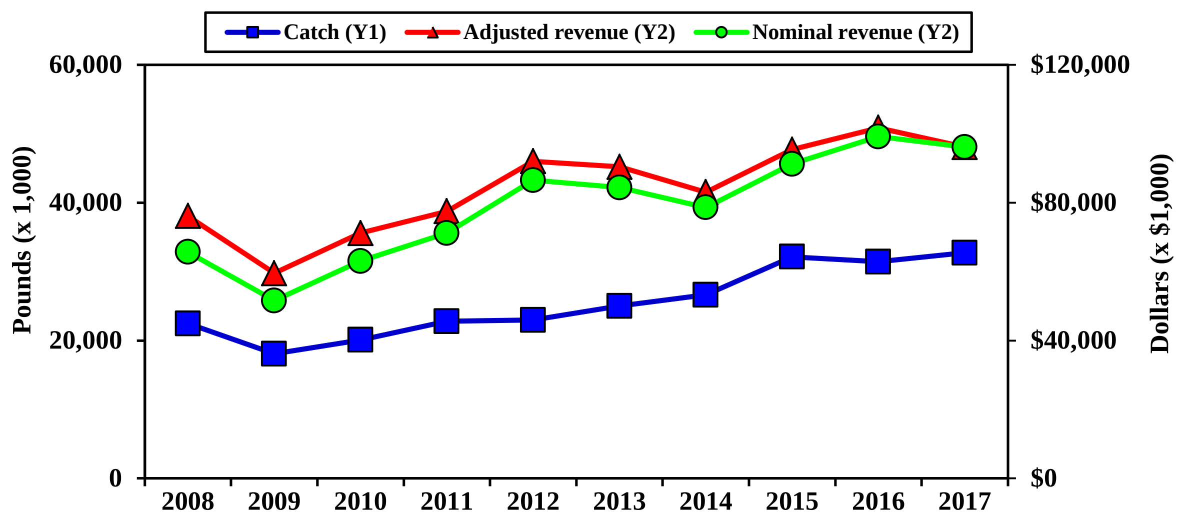
Supporting data shown in Table A-89.

Figure 89. Number of hooks set by Hawai`i-permitted deep-set longline fishery from 2008-2017.



Supporting data shown in Table A-90.

Figure 90. Catch and revenue for Hawai`i-permitted deep-set longline fishery from 2008-2017.



Supporting data shown in Table A-91.

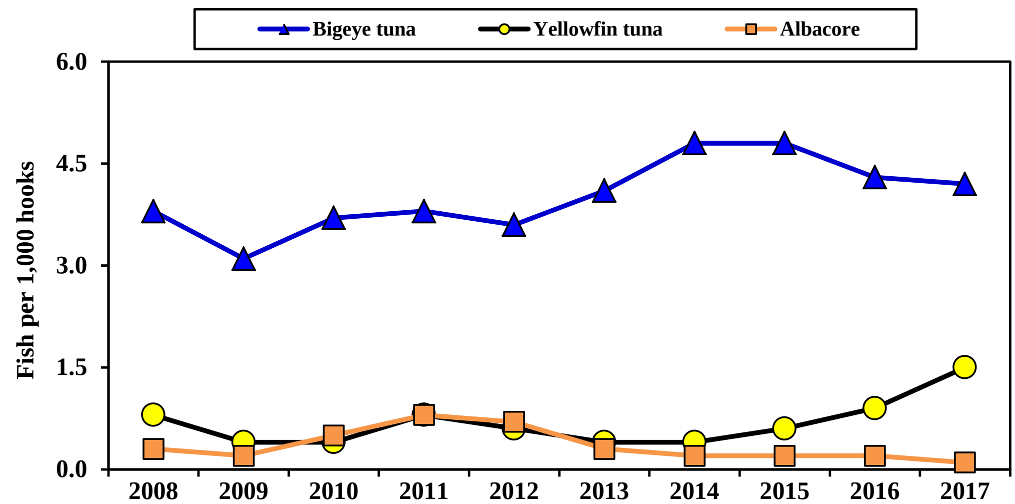
Table 21. Hawai`i-permitted deep-set longline catch (number of fish) by area from 2008-2017.

Year	Tunas			Billfish				Other PMUS				PMUS sharks
	Bigeye tuna	Yellowfin tuna	Albacore	Swordfish	Blue marlin	Striped marlin	Spearfish	Mahimahi	Ono (Wahoo)	Moonfish	Pomfrets	
Hawai EEZ												
2008	52,870	20,898	2,555	945	1,660	6,800	7,243	20,473	4,110	3,829	13,632	21,349
2009	35,147	4,340	2,274	843	761	2,943	2,453	10,886	1,725	3,494	8,221	15,825
2010	22,868	4,383	3,835	643	548	1,032	1,749	7,162	1,429	2,412	4,988	11,595
2011	44,194	12,884	11,101	873	1,452	7,225	5,885	21,995	2,022	3,133	10,721	22,849
2012	48,995	10,616	6,524	945	768	4,055	3,624	16,298	2,192	3,077	12,128	21,053
2013	49,124	7,700	3,461	922	1,177	5,642	5,434	16,711	2,912	2,963	11,047	20,766
2014	43,433	5,199	1,764	866	1,036	5,020	4,248	8,898	4,090	2,172	10,920	20,527
2015	60,987	11,842	3,089	1,324	2,561	5,945	7,087	15,360	6,388	2,754	21,960	25,395
2016	44,674	13,428	1,656	1,233	1,772	3,880	7,176	9,088	5,718	2,319	15,728	23,506
2017	52,261	24,316	276	822	2,296	4,311	5,506	8,843	5,126	1,794	12,699	27,661
Pacific Remote Islands Area EEZ												
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
2017												

Year	Tunas			Billfish				Other PMUS				PMUS sharks
	Bigeye tuna	Yellowfin tuna	Albacore	Swordfish	Blue marlin	Striped marlin	Spearfish	Mahimahi	Ono (Wahoo)	Moonfish	Pomfrets	
Outside EEZ												
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	20,315	2,434	2,296	4,759	7,068	59,776	8,096	14,247	37,030	33,054
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	175,897	32,830	8,197	3,870	4,445	7,701	16,841	39,401	24,444	22,033	65,882	65,391
2017	172,053	55,300	3,832	4,751	5,720	8,705	15,162	37,297	20,279	22,999	55,005	71,287

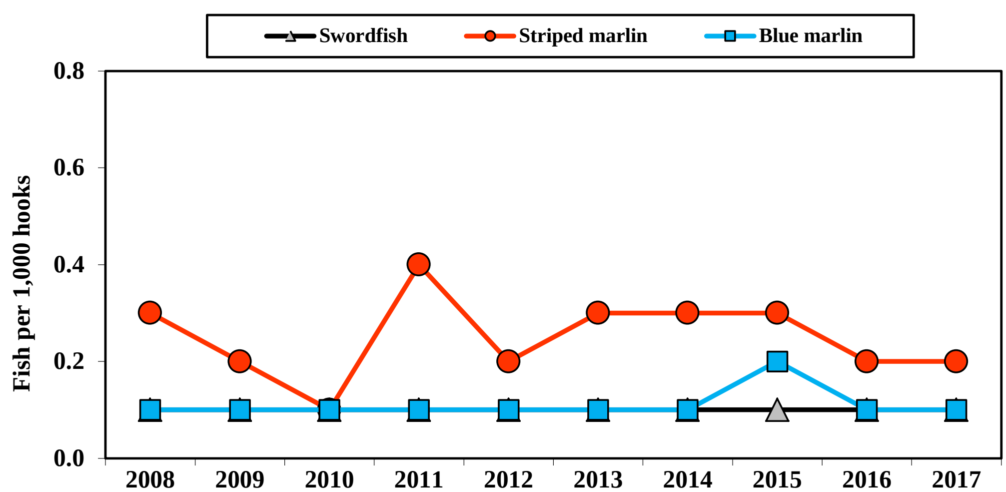
Year	Tunas			Billfish				Other PMUS				PMUS sharks
	Bigeye tuna	Yellowfin tuna	Albacore	Swordfish	Blue marlin	Striped marlin	Spearfish	Mahimahi	Ono (Wahoo)	Moonfish	Pomfrets	
All areas												
2008	152,036	34,121	13,850	3,660	3,874	13,478	15,302	62,867	14,118	15,233	42,996	48,402
2009	118,688	14,542	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	29,914	3,570	3,296	9,097	11,296	78,039	11,464	17,546	51,919	57,161
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	221,149	46,470	9,853	5,118	6,261	11,588	24,027	48,494	30,217	24,352	81,690	89,091
2017	224,314	79,616	4,108	5,573	8,016	13,016	20,668	46,140	25,405	24,793	67,704	98,948

Figure 91. Tuna CPUE for the Hawai`i-permitted deep-set longline fishery from 2008-2017.



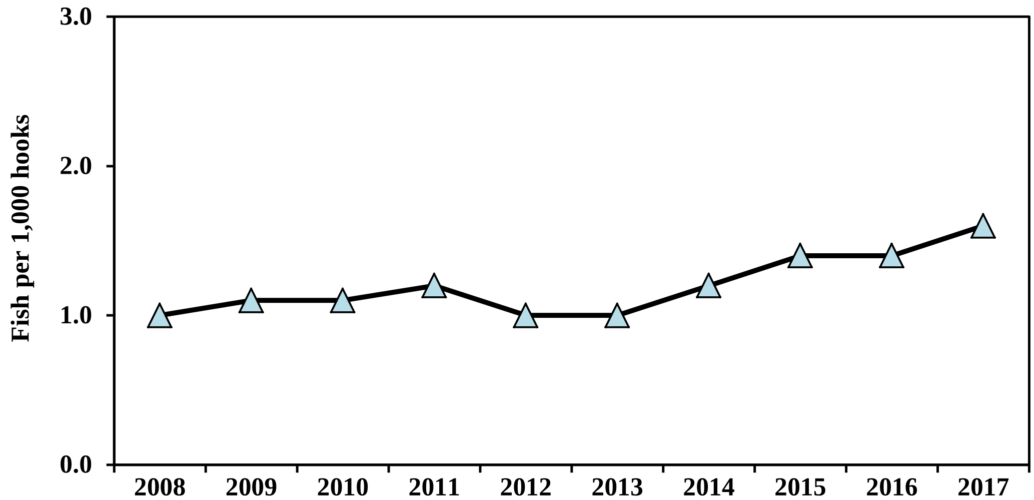
Supporting data shown in Table A-92.

Figure 92. Billfish CPUE for the Hawai`i-permitted deep-set longline fishery from 2008-2017.



Supporting data shown in Table A-93.

Figure 93. Blue shark CPUE for the Hawai`i-permitted deep-set longline fishery from 2008-2017.



Supporting data shown in Table A-94.

Table 22. Released catch, retained catch, and total catch for the Hawai`i-permitted deep-set longline fishery, 2017.

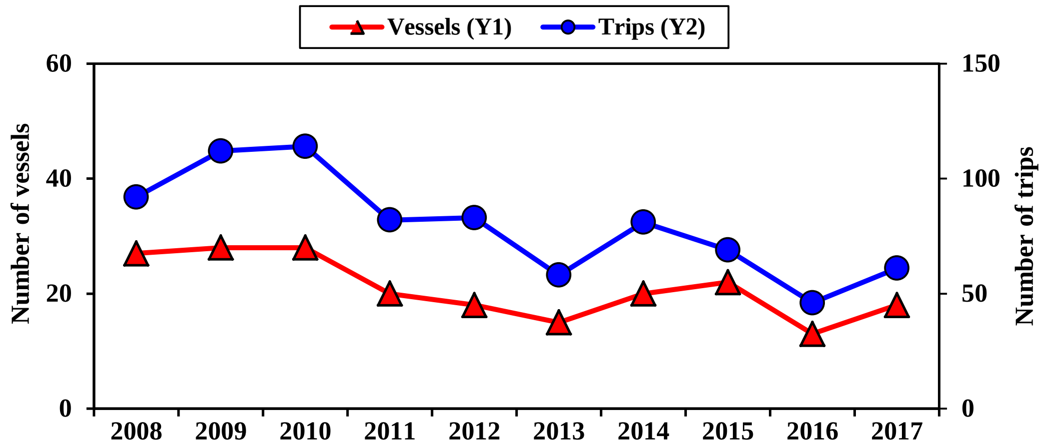
	Deep-set longline fishery			
	Released catch	**Percent released**	**Retained catch**	**Total Catch**
Tuna				
Albacore	21	0.5	4,087	4,108
Bigeye tuna	4,016	1.8	220,375	224,391
Bluefin tuna	2	15.4	11	13
Skipjack tuna	595	2.2	25,990	26,585
Yellowfin tuna	1,613	2.0	78,007	79,620
Other tuna	0	0.0	0	0
Total tunas	**6,247**	**1.9**	**328,470**	**334,717**
Billfish				
Swordfish	315	5.6	5,261	5,576
Blue marlin	32	0.4	7,986	8,018
Striped marlin	134	1.0	12,885	13,019
Spearfish	162	0.8	20,506	20,668
Other marlin	4	0.7	544	548
Total billfish	**647**	**1.4**	**47,182**	**47,829**
Other PMUS				
Mahimahi	344	0.7	45,802	46,146
Wahoo	128	0.5	25,298	25,426
Moonfish	121	0.5	24,673	24,794
Oilfish	2,099	11.5	16,153	18,252
Pomfret	346	0.5	67,390	67,736
Total other PMUS	**3,038**	**1.7**	**179,316**	**182,354**
Non-PMUS fish	3,634	89.2	442	4,076
Total non-shark	**13,566**	**2.4**	**555,410**	**568,976**
PMUS Sharks				
Blue shark	86,650	100.0	0	86,650
Mako shark	3,829	86.5	596	4,425
Thresher shark	7,092	99.5	39	7,131
Oceanic Whitetip shark	537	100.0	0	537
Silky shark	242	99.6	1	243
Total PMUS sharks	**98,350**	**99.4**	**636**	**98,986**
Non-PMUS sharks	721	99.7	2	723
Grand Total	**112,637**	**16.8**	**556,048**	**668,685**

Table 23. Average weight (lbs.) of the catch by the Hawai`i-permitted deep-set longline fishery from 2008-2017.

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
2008	87	58	53	18	200	211	65	196	33	59	252	12	32	89	14	15	183	205
2009	87	80	48	18	200	181	72	189	28	45	190	12	34	90	15	16	190	205
2010	88	90	46	19	200	171	93	202	31	55	190	10	32	91	14	16	203	182
2011	81	67	47	20	200	173	47	188	33	58	190	12	34	91	12	16	187	172
2012	82	71	48	16	253	172	66	200	31	57	187	12	32	92	13	16	198	193
2013	75	84	47	16	200	184	68	225	32	62	190	11	33	89	13	17	198	173
2014	73	84	50	17	---	158	62	205	30	58	258	12	30	89	14	17	201	214
2015	85	74	52	18	200	165	81	185	33	59	219	12	31	91	13	18	195	219
2016	83	72	55	17	224	165	73	193	31	51	242	13	31	88	13	19	179	183
2017	79	71	49	19	217	192	68	187	32	63	287	12	31	91	13	20	180	200
Average	**82.0**	**75.1**	**49.5**	**17.8**	**210.4**	**177.2**	**69.5**	**197.0**	**31.4**	**56.7**	**220.5**	**11.8**	**32.0**	**90.1**	**13.4**	**17.0**	**191.4**	**194.6**
SD	**5.1**	**9.5**	**3.0**	**1.3**	**18.3**	**15.5**	**12.0**	**12.0**	**1.6**	**5.3**	**36.7**	**0.8**	**1.3**	**1.3**	**0.8**	**1.6**	**8.8**	**16.6**

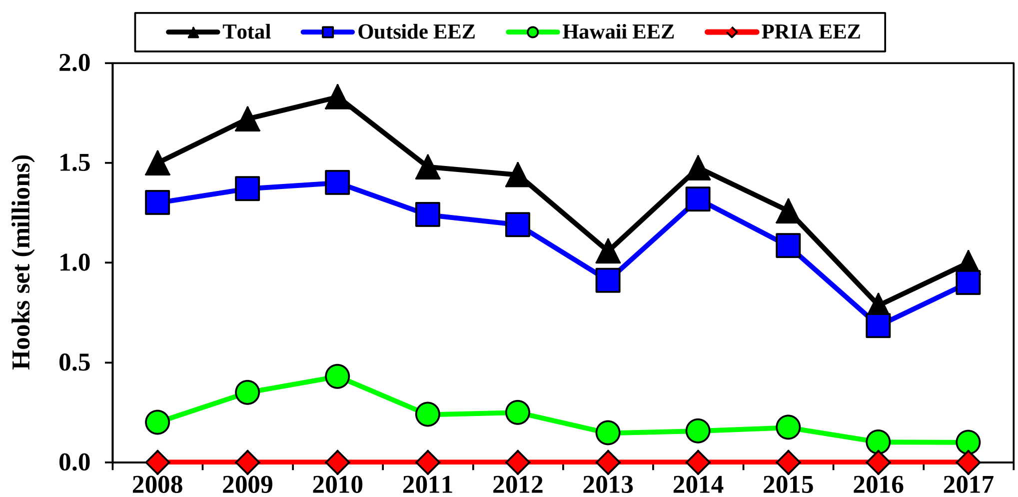
2.4.7 HAWAI`I SHALLOW-SET LONGLINE FISHERY EFFORT, LANDINGS. REVENUE AND CPUE

Figure 94. Number of Hawai`i-permitted shallow-set longline vessels, trips and sets from 2008-2017.



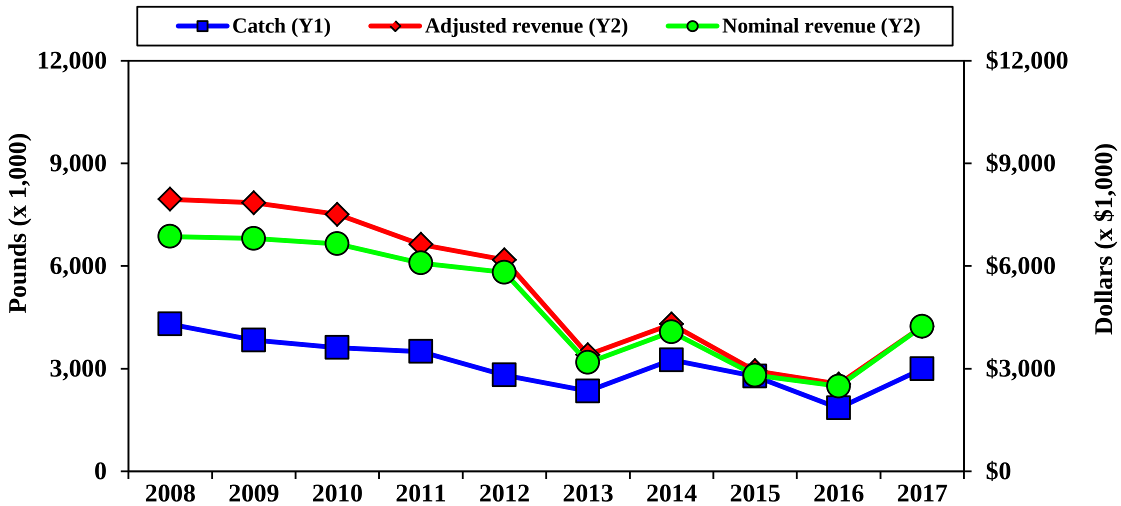
Supporting data shown in Table A-95.

Figure 95. Number of hooks set by the Hawai`i-permitted shallow-set longline fishery from 2008-2017.



Supporting data shown in Table A-96.

Figure 96. Catch and revenue for the Hawai`i-permitted shallow-set longline fishery from 2008-2017.

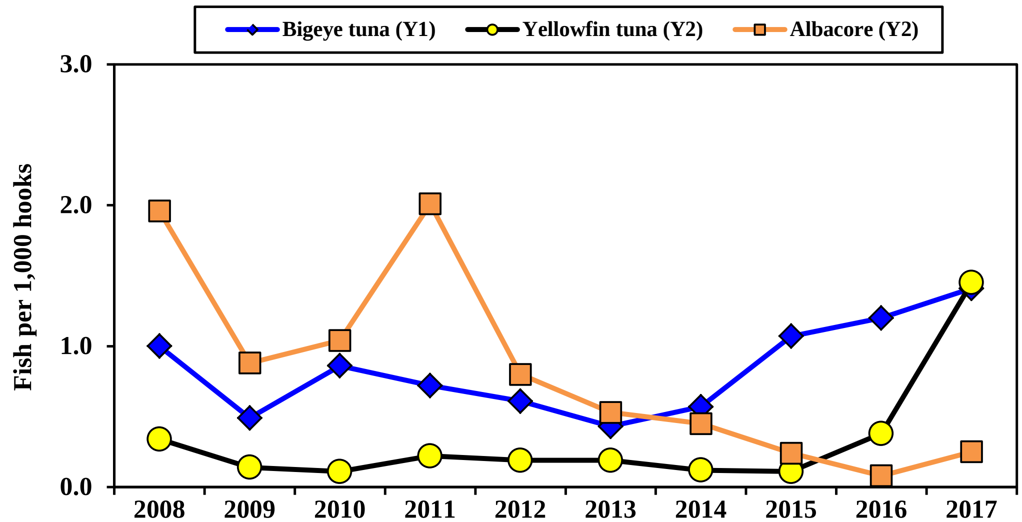


Supporting data shown in Table A-97.

Table 24. Hawai`i-permitted shallow-set longline catch (number of fish) by area, 2008-2017.

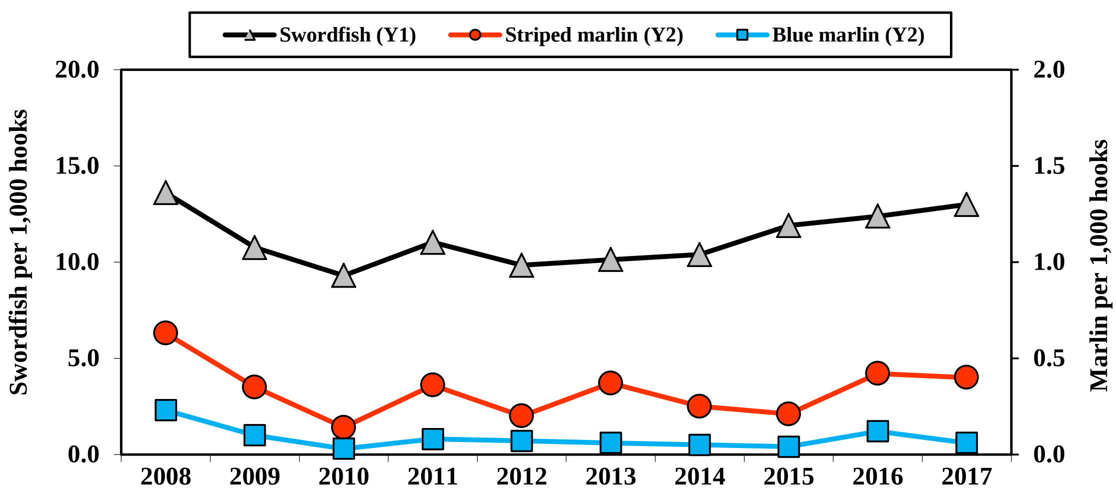
	Tunas			Billfish				Other PMUS				
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Pomfrets**	**PMUS sharks**
Hawaii EEZ												
2008	368	265	9	2,941	235	543	79	1,407	52	9	2	840
2009	86	55	2	3,876	103	278	37	401	17	25	14	1,115
2010	218	102	18	3,491	42	133	32	783	57	4	20	2,157
2011	209	91	18	2,097	85	267	77	1,506	10	4	4	1,131
2012	66	55	12	2,230	61	163	41	836	23	1	1	914
2013	93	76	5	1,507	43	298	32	1,679	8	0	3	819
2014	27	57	1	1,689	54	137	37	968	19	0	4	1,280
2015	40	36	1	2,001	23	111	40	804	5	0	3	1,537
2016	20	47	5	1,157	68	104	45	69	19	0	2	1,142
2017	12	31	1	787	32	88	38	38	10	0	2	584
Pacific Remote Islands Area EEZ												
No shallow-set longline fishing has occurred in the PRIA EEZ during this time period.												
	Tunas			**Billfish**				**Other PMUS**				
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Pomfrets**	**PMUS sharks**
Outside EEZ												
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
2017	1,439	1,456	256	12,553	26	321	120	1,255	64	412	25	9,837
All areas												
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
2017	1,451	1,487	257	13,340	58	409	158	1,293	74	412	27	10,421

Figure 97. Tuna CPUE for the Hawai`i-permitted shallow-set longline fishery from 2008-2017.



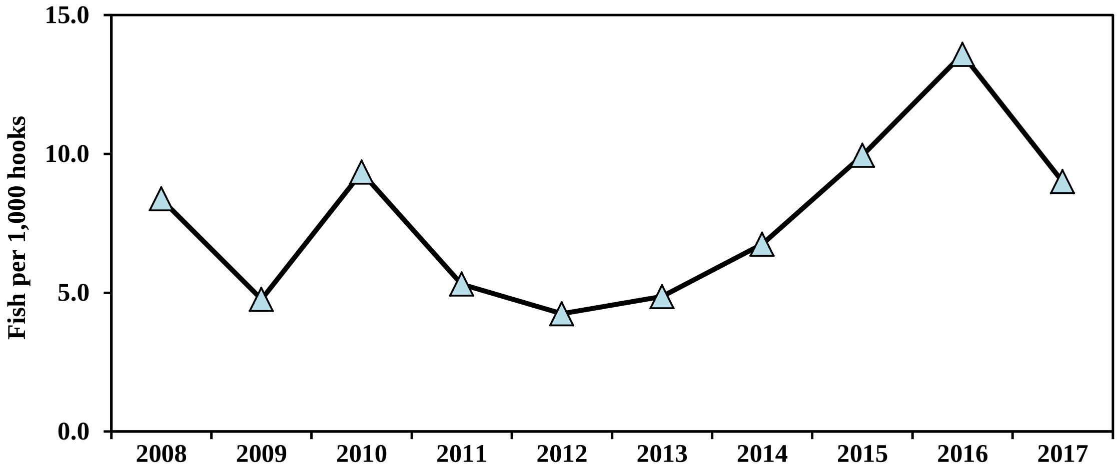
Supporting data shown in Table A-98.

Figure 98. Billfish CPUE for the Hawai`i-permitted shallow-set longline fishery from 2008-2017.



Supporting data shown in Table A-99.

Figure 99. Blue shark CPUE for the Hawai`i-permitted shallow-set longline fishery from 2008-2017.



Supporting data shown in Table A-100.

Table 25. Released catch, retained catch, and total catch for the Hawai`i-permitted shallow-set longline fishery, 2017.

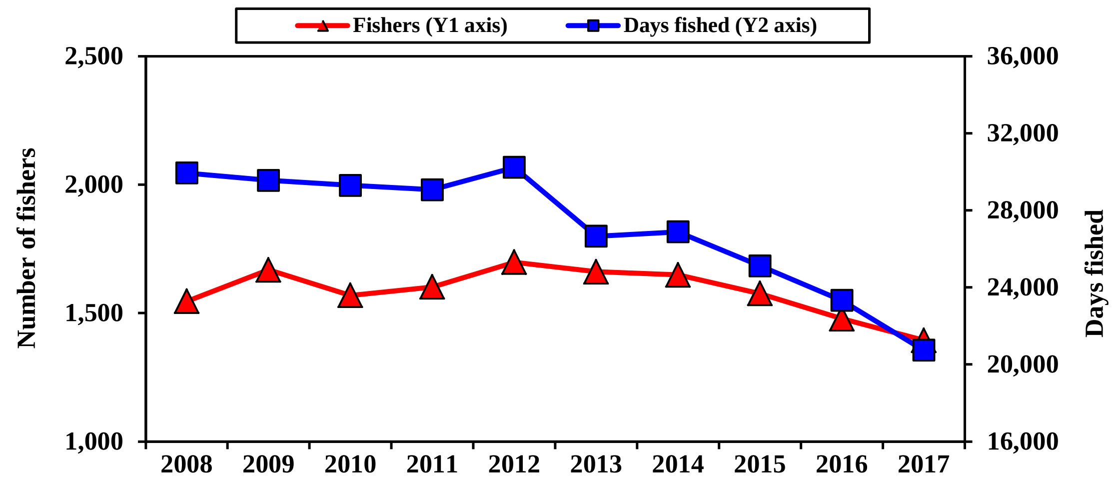
	Shallow-set longline fishery			
	Released catch	**Percent released**	**Retained catch**	**Total Catch**
Tuna				
Albacore	32	11.1	255	287
Bigeye tuna	215	14.1	1,315	1,530
Bluefin tuna	0	0.0	1	1
Skipjack tuna	0	0.0	79	79
Yellowfin tuna	98	6.3	1,455	1,553
Other tuna	0	0.0	0	0
Total tunas	**345**	**10.0**	**3,105**	**3,450**
Billfish				
Swordfish	1,109	8.0	12,819	13,928
Blue marlin	4	6.9	54	58
Striped marlin	73	17.8	338	411
Spearfish	11	6.9	149	160
Other marlin	2	10.5	17	19
Total billfish	**1,199**	**8.2**	**13,377**	**14,576**
Other PMUS				
Mahimahi	41	3.2	1,260	1,301
Wahoo	0	0.0	74	74
Moonfish	47	10.9	384	431
Oilfish	344	45.1	418	762
Pomfret	9	23.1	30	39
Total other PMUS	**441**	**16.9**	**2,166**	**2,607**
Non-PMUS fish	**7**	**46.7**	**8**	**15**
Total non-shark	**1,992**	**9.6**	**18,656**	**20,648**
PMUS Sharks				
Blue shark	9,638	100.0	0	9,638
Mako shark	843	75.8	269	1,112
Thresher shark	71	97.3	2	73
Oceanic Whitetip shark	22	100.0	0	22
Silky shark	7	100.0	0	7
Total PMUS sharks	**10,581**	**97.5**	**271**	**10,852**
Non-PMUS sharks	**5**	**100.0**	**0**	**5**
Grand Total	**12,578**	**39.9**	**18,927**	**31,505**

Table 26. Average weight (lbs.) of the catch by the Hawai`i-permitted shallow-set longline fisheries from 2008-2017.

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
2008	119	117	28	17	171	199	87	196	35	52	189	14	37	80	18	18	208	309
2009	121	111	29	15	171	204	92	274	35	44	---	13	44	79	19	16	180	417
2010	95	115	27	15	171	199	111	282	37	54	---	13	49	73	17	18	154	321
2011	110	121	28	18	---	212	91	246	37	52	---	11	38	56	18	17	187	200
2012	97	109	27	16	171	193	98	259	34	---	---	12	36	81	14	16	185	277
2013	106	111	27	17	171	217	92	281	34	---	---	12	42	82	15	23	177	---
2014	87	132	24	14	268	212	90	280	36	52	---	12	42	71	16	24	202	244
2015	78	120	22	16	---	184	97	292	37	52	---	12	39	76	13	22	150	244
2016	86	103	34	16	---	179	97	304	39	52	---	14	33	83	13	21	215	244
2017	98	94	35	18	171	199	102	259	39	52	---	12	36	83	14	20	179	244
Average	**99.7**	**113.3**	**28.1**	**16.2**	**184.9**	**199.8**	**95.7**	**267.3**	**36.3**	**51.3**	**189.0**	**12.5**	**39.6**	**76.4**	**15.7**	**19.5**	**183.7**	**277.8**
SD	**14.2**	**10.4**	**4.0**	**1.3**	**36.7**	**12.2**	**7.0**	**30.3**	**1.8**	**3.0**	---	**1.0**	**4.7**	**8.3**	**2.2**	**2.9**	**21.1**	**64.1**

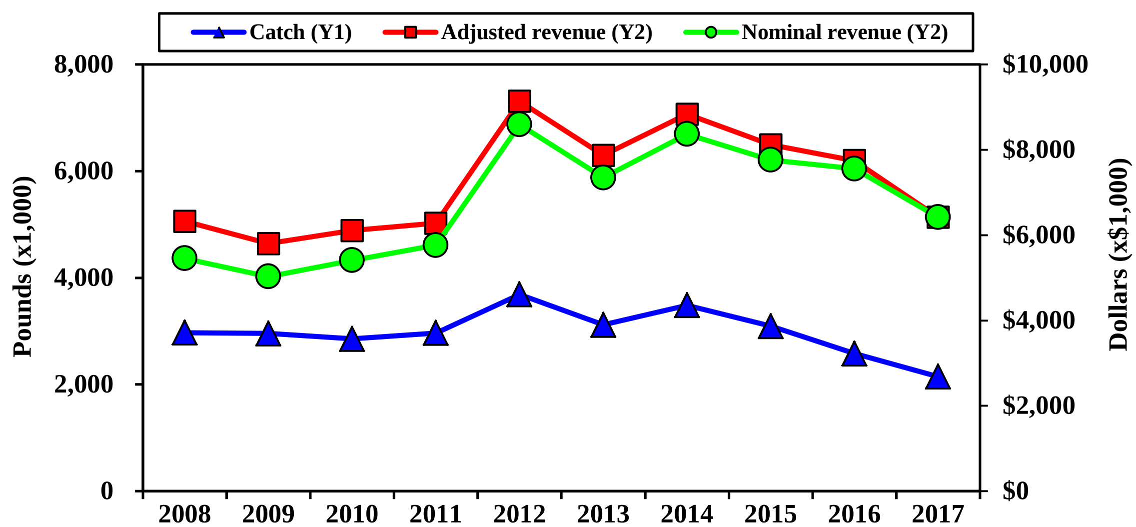
2.4.8 MHI TROLL FISHERY EFFORT, LANDINGS, REVENUE AND CPUE

Figure 100. Number of MHI troll fishers and days fished from 2008-2017.



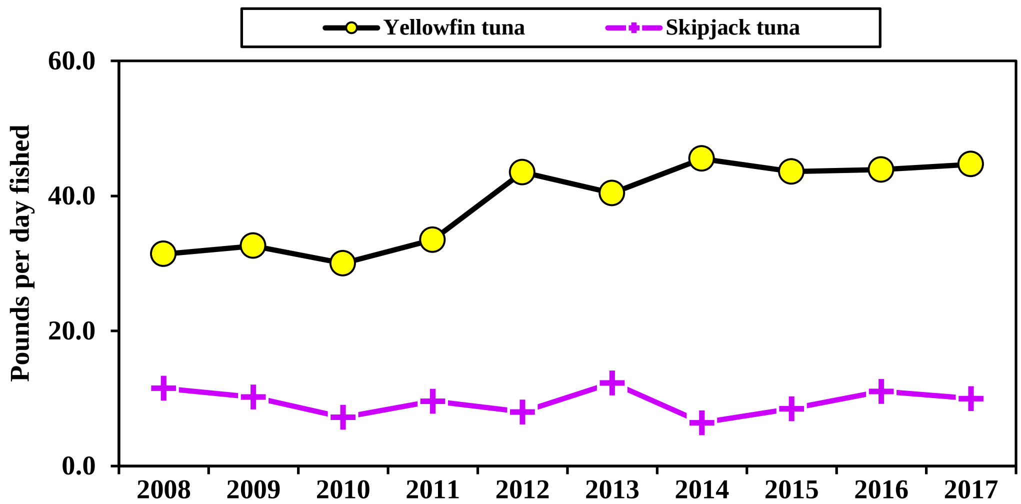
Supporting data shown in Table A-101.

Figure 101. Catch and revenue for the MHI troll fishery from 2008-2017.



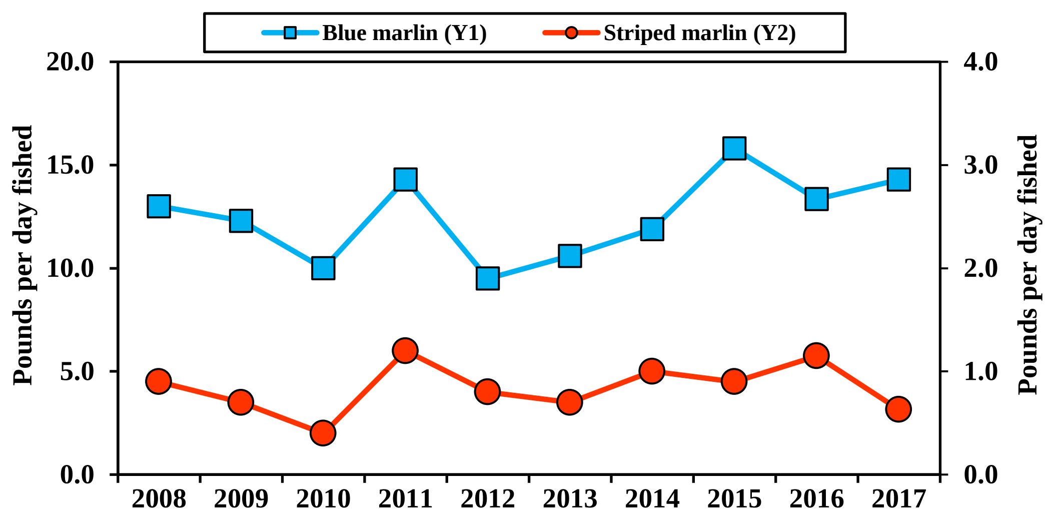
Supporting data shown in Table A-102.

Figure 102. Tuna CPUE for the MHI troll fishery from 2008-2017.



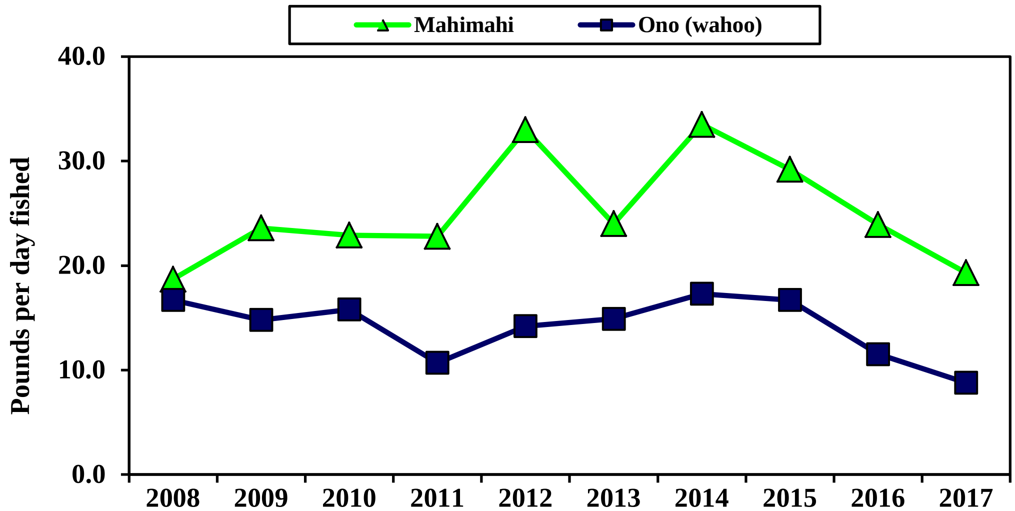
Supporting data shown in Table A-103.

Figure 103. Marlin CPUE for the MHI troll fishery from 2008-2017.



Supporting data shown in Table A-104.

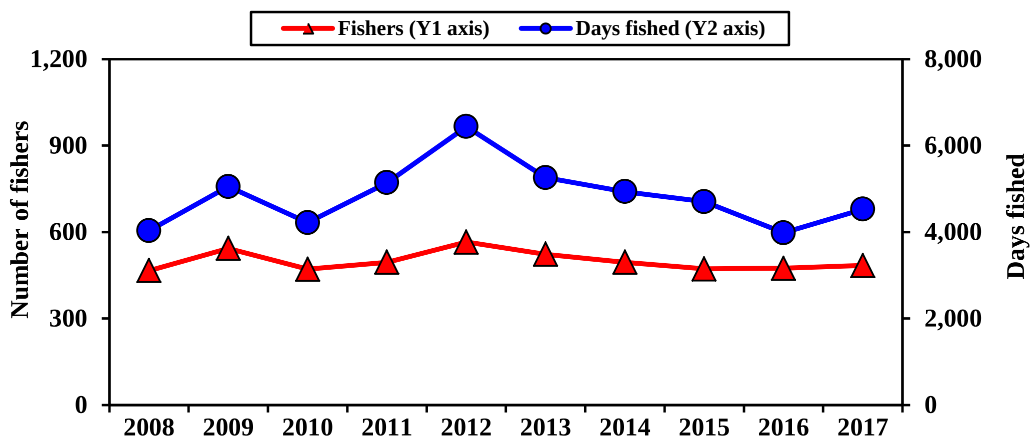
Figure 104. Mahimahi and Ono CPUE for the MHI troll fishery from 2008-2017.



Supporting data shown in Table A-105.

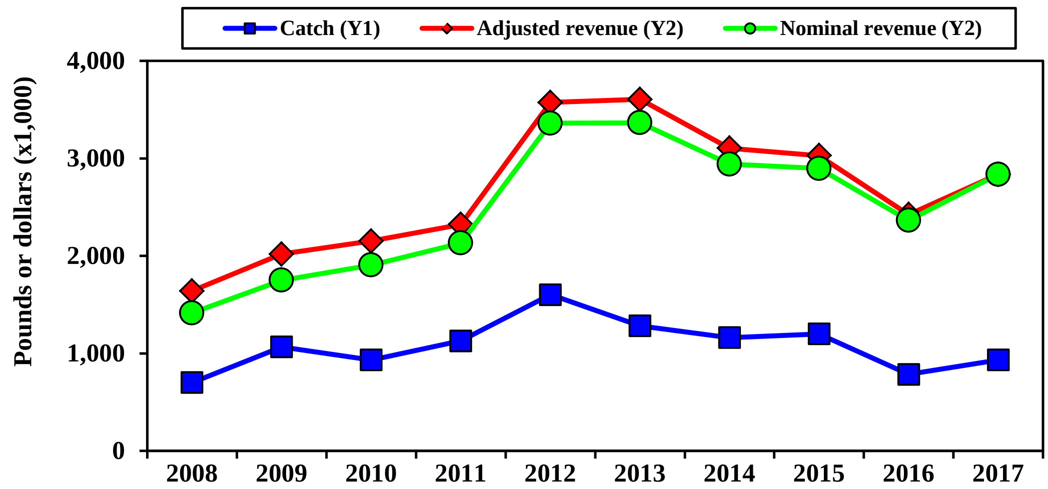
2.4.9 MHI HANDLINE FISHERY EFFORT, LANDINGS, REVENUE AND CPUE

Figure 105. Number of MHI handline fishers and days fished from 2008-2017.



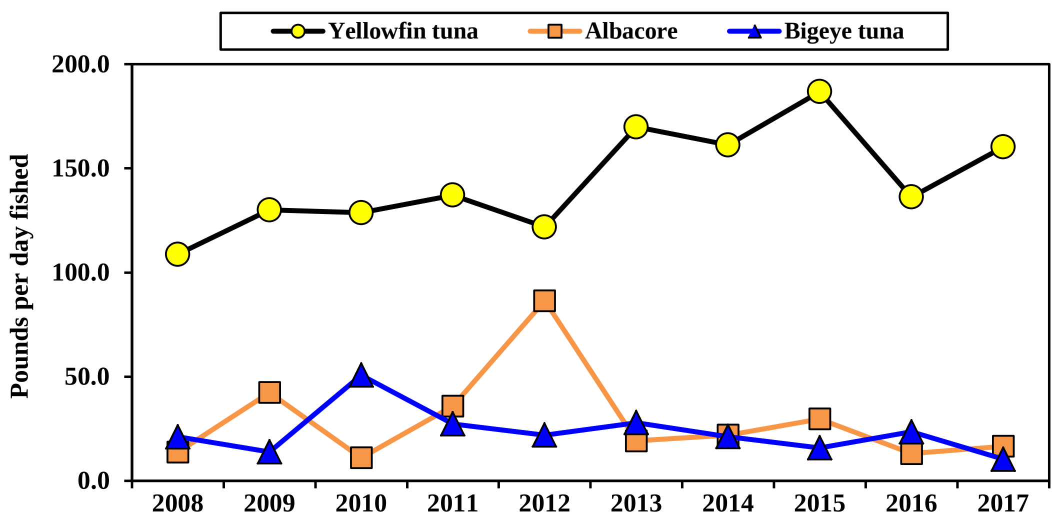
Supporting data shown in Table A-106.

Figure 106. Catch and revenue for the MHI handline fishery from 2008-2017.



Supporting data shown in Table A-107.

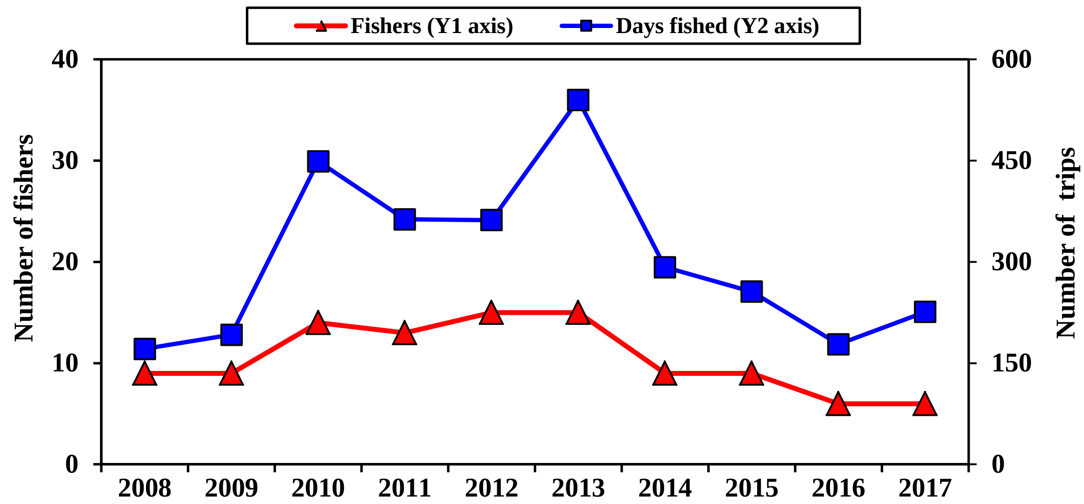
Figure 107. Tuna CPUE for the MHI handline fishery from 2008-2017.



Supporting data shown in Table A-108. .

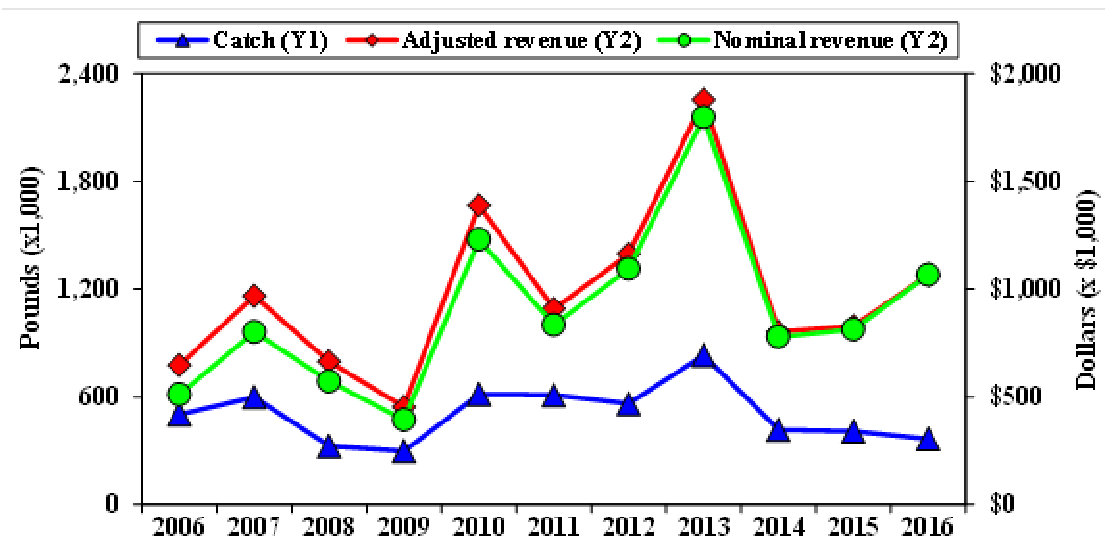
2.4.10 OFFSHORE HANDLINE FISHERY EFFORT, LANDINGS, REVENUE AND CPUE

Figure 108. Number of offshore handline fishers and days fished from 2008-2017.



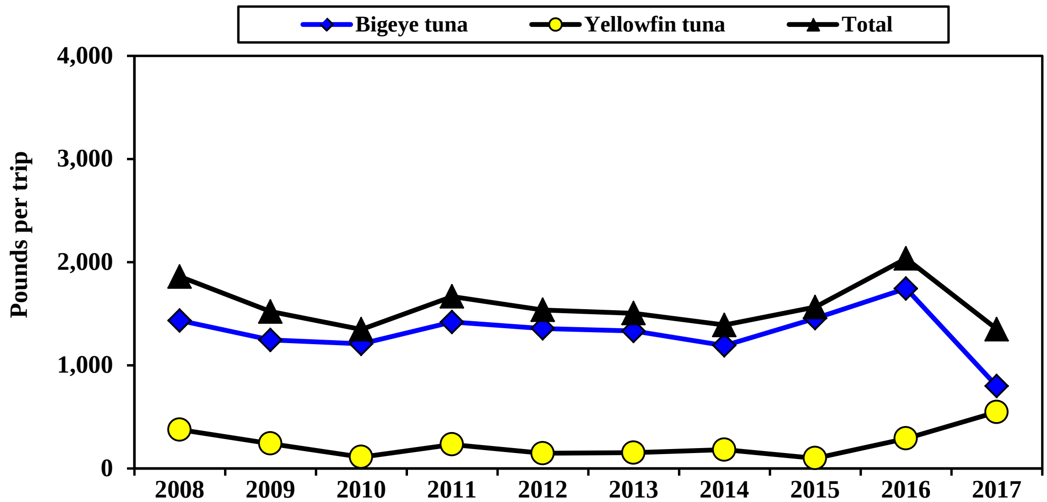
Supporting data shown in Table A-109.

Figure 109. Catch and revenue for the offshore tuna handline fishery from 2008-2017.



Supporting data shown in Table A-110.

Figure 110. Tuna CPUE for the offshore tuna handline fishery from 2008-2017.



Supporting data shown in Table A-111.

Table 27. Average weight (lbs.) of the catch by the Hawai`i troll and handline fisheries from 2008-2017.

	Tunas				Billfish			Other PMUS	
Year	**Albacore**	**Bigeye tuna**	**Skipjack tuna**	**Yellowfin tuna**	**Blue marlin**	**Striped marlin**	**Swordfish**	**Mahimahi**	**Ono (wahoo)**
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	44	22	8	34	171	73	96	13	22
2016	48	21	8	34	145	63	118	12	23
2017	53	24	10	43	175	74	124	11	19
Average	**47.5**	**26.2**	**7.2**	**33.3**	**219.3**	**68.9**	**134.0**	**12.9**	**23.7**
SD	**2.9**	**4.7**	**1.6**	**4.6**	**44.0**	**17.0**	**25.3**	**1.1**	**2.3**

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/year (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 U.S. 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 111). 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.

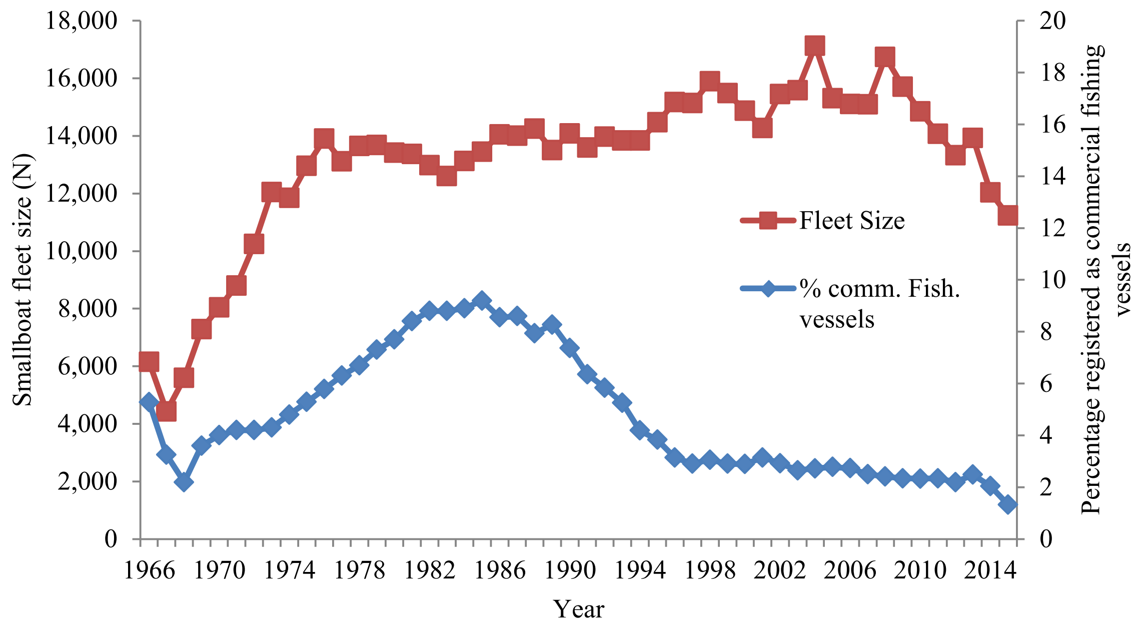


Figure 111. Annual number of small vessel fleet registrations in Hawai`i, 1966-2015[4]. Source: Hawai`i Division of Boating and Ocean Resources.

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 includes several fishing 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.

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

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

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.

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

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

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. sport fishing 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, wahoo, 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 28. 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 28. 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 [a]	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 29 through Table 33 present summaries of the charter vessel sports fishing 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 30). 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 commercial 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 29. 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 30), 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 31).

Table 30. Comparison of species composition of landings made by Hawai`i pelagic charter vessels versus commercial troll vessels, 2016.

Species	Charter troll		Commercial troll	
	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%
Others	98	0.02%	5,967	0.32%
Total	409,769	100.00%	1,883,344	100.00%

Table 31. 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	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 32), 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 32. 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 33). 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 33. 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 34 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 34. 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 112 through Figure 115 summarize aspects of the boat-based recreational fishery landings for six major pelagic fish species in Hawai`i (blue marlin, striped marlin, mahimahi, skipjack, yellowfin and wahoo) between 2011 and 2015. Figure 116 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 112) followed by yellowfin tuna, mahimahi and wahoo. In terms of weight, however, yellowfin tuna dominates recreational pelagic fish catches (Figure 113).

Although blue marlin numbers in the catch are small compared to other species, the much greater average weight (Figure 114) 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 115, 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.

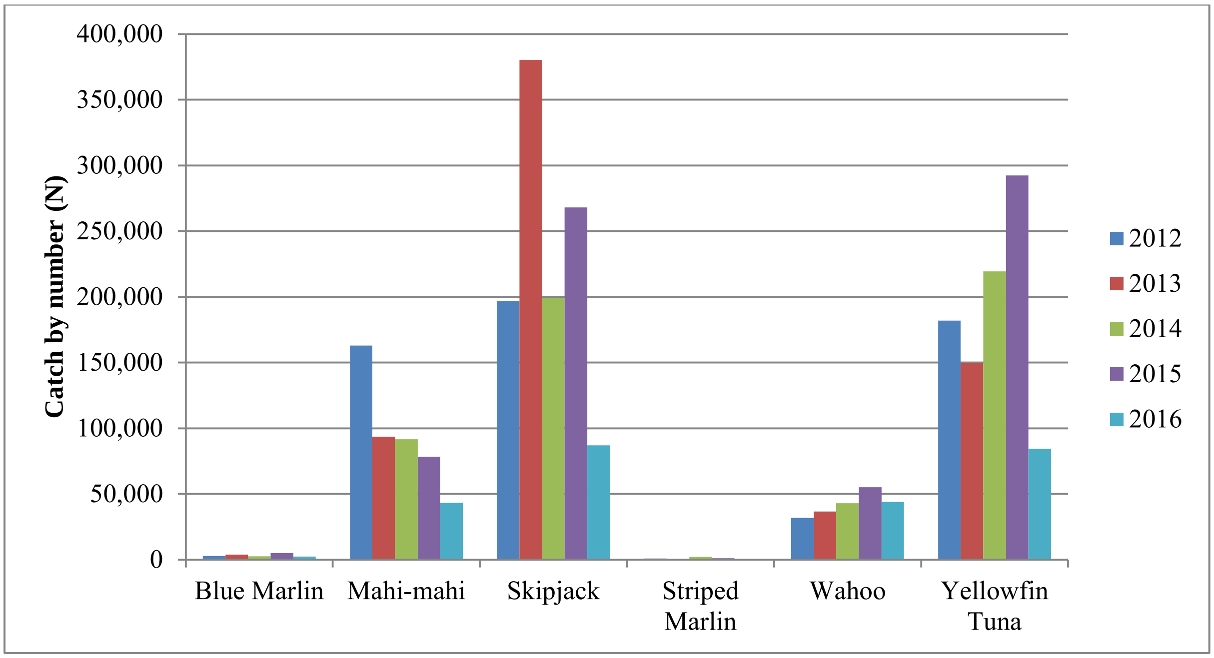


Figure 112. Annual recreational fishery landings by number for six major pelagic species between 2012 and 2016.

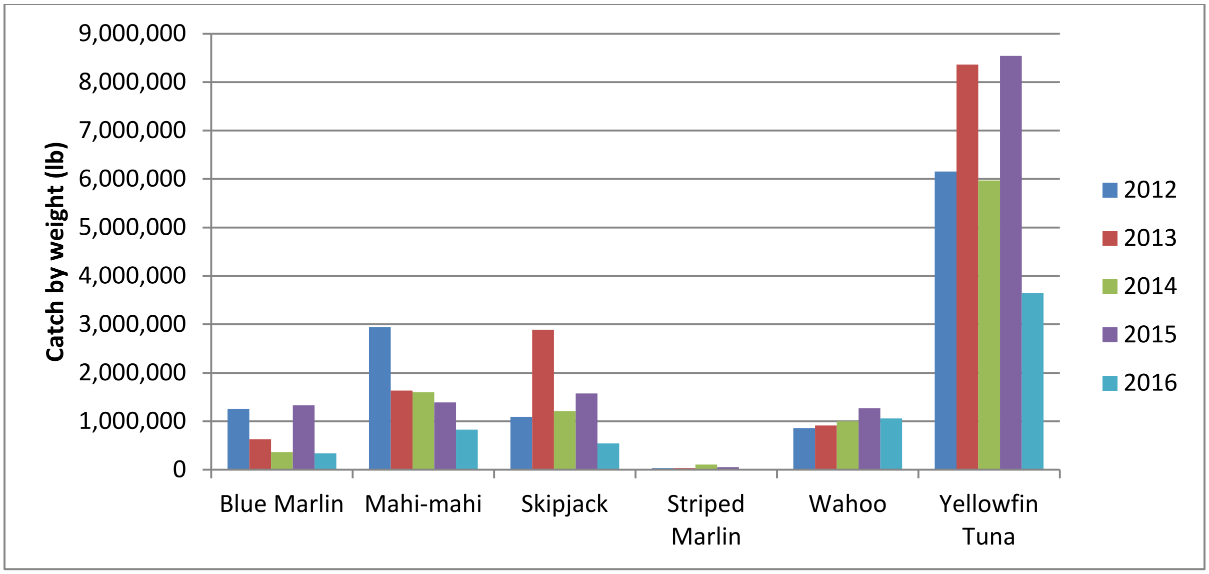


Figure 113. Annual recreational fishery landings by weight of six major pelagic fish species in Hawai`i between 2012 and 2016.

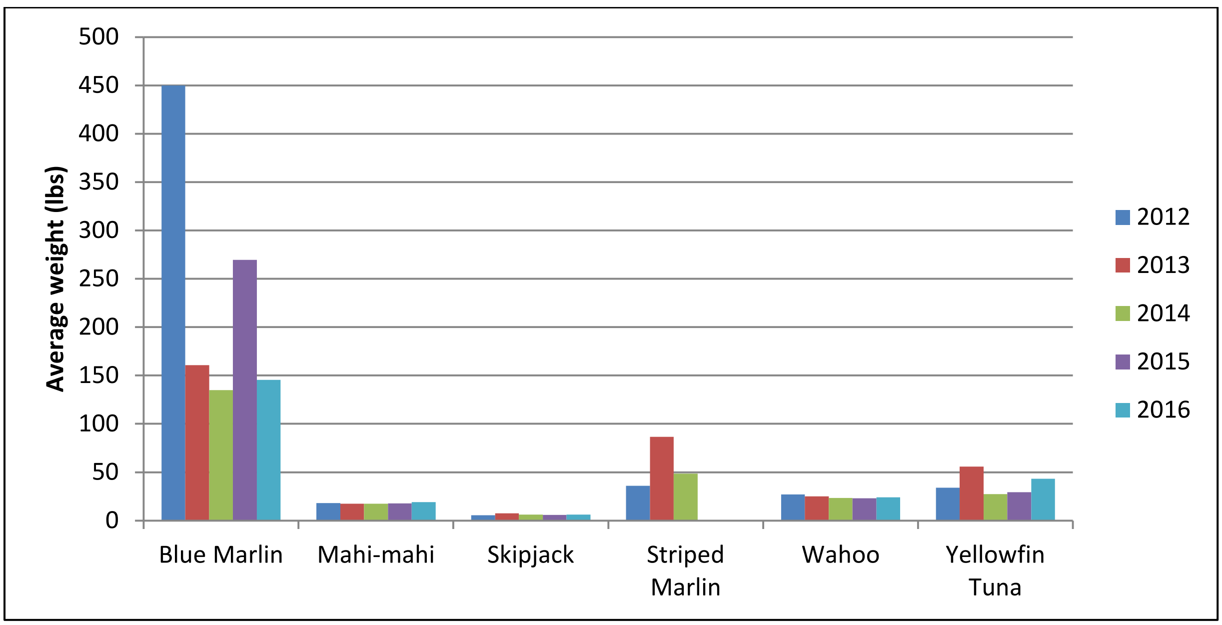


Figure 114. Average weight of six major pelagic fish species caught by recreational fishing in Hawai`i between 2012 and 2016.

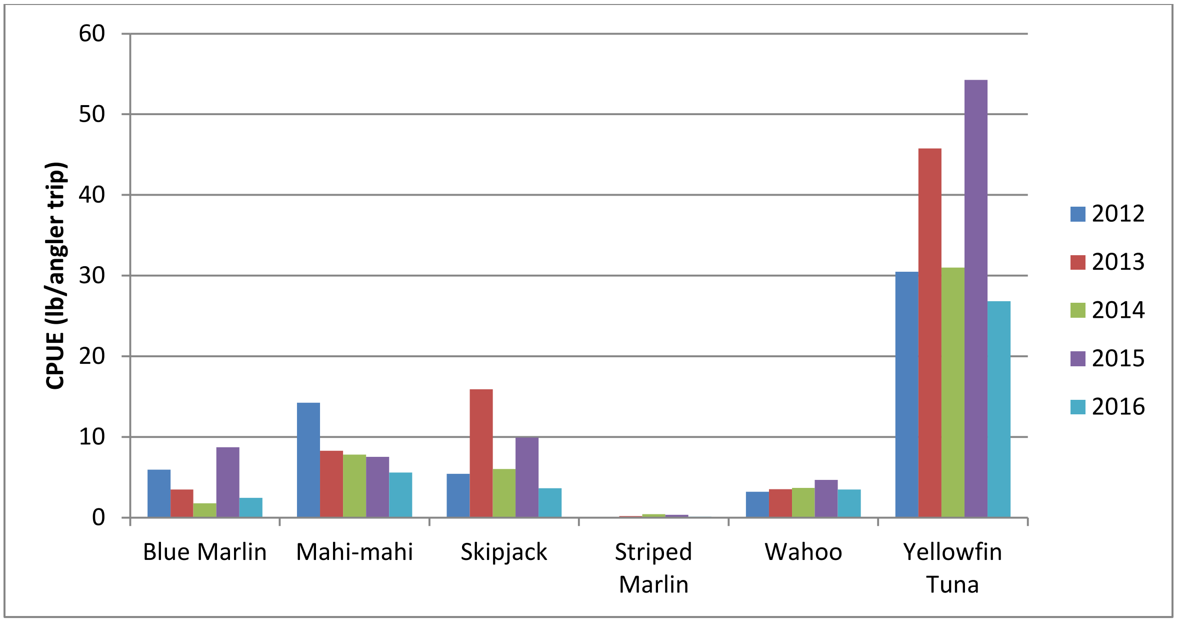


Figure 115. Annual recreational catch per unit effort (lbs. per trip) for six major pelagic species in Hawai`i between 2012 and 2016.

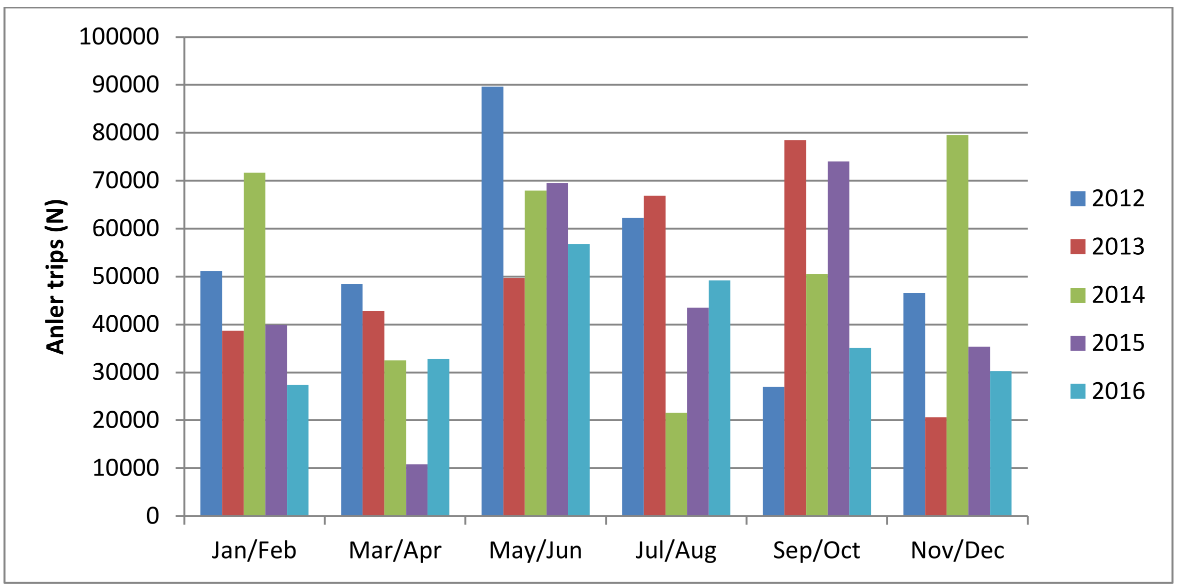


Figure 116. Boat fishing trip estimates (number of angler trips), 2012-2016.

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 their 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 as well as information essential for a SAFE report including the most recent assessment information relative to status determination criteria. Fishery trends in the entire Pacific Ocean are illustrated for the purse seine, longline and pole-and-line fisheries. Tables 41 through 43 provide the U.S. longline landings as submitted to the Western and Central Pacific Fisheries Commission (WCPFC) and Inter-American Tropical Tuna Commission (IATTC).

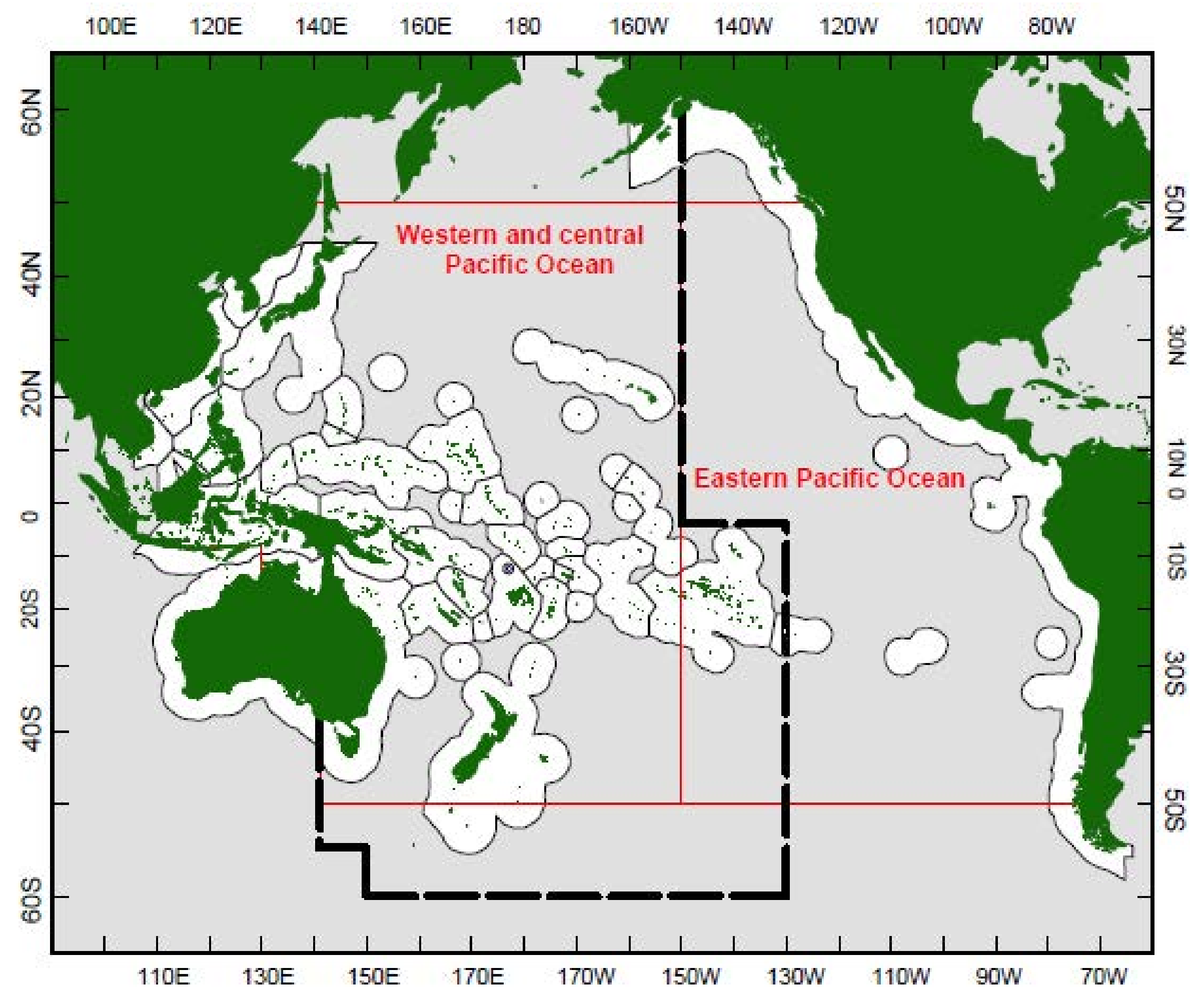


Figure 117. The WCPO, EPO, and WCPFC Convention Areas (WCP–CA; dashed line).

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 U.S. data submissions to the WCPFC and IATTC documented in this module

2.6.3 PLAN TEAM RECOMMENDATIONS

There were no International module recommendations by the Pelagics Plan Team in 2017 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 35 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 35. Estimated annual catch (mt) of tuna species in the Pacific Ocean.

Year	Albacore	Bigeye	Skipjack	Yellowfin	Total
2007	153,235	231,998	1,857,504	692,398	2,935,135
2008	130,995	250,251	1,917,652	801,831	3,100,729
2009	167,015	255,763	2,016,260	787,614	3,226,652
2010	155,865	227,201	1,839,503	820,034	3,042,603
2011	146,020	243,940	1,813,057	736,713	2,939,730
2012	179,911	259,894	2,022,031	819,875	3,281,711
2013	171,172	234,457	2,102,491	787,326	3,295,446
2014	162,760	248,203	2,262,922	842,991	3,516,876
2015	153,928	241,434	1,824,192	833,874	3,053,428
2016	126,653	238,907	2,122,992	893,025	3,381,577
Average	154,755	243,205	1,977,860	801,568	3,177,389
STD deviation	16,838	10,495	152,501	56,097	194,013

Source: SPC 2017.

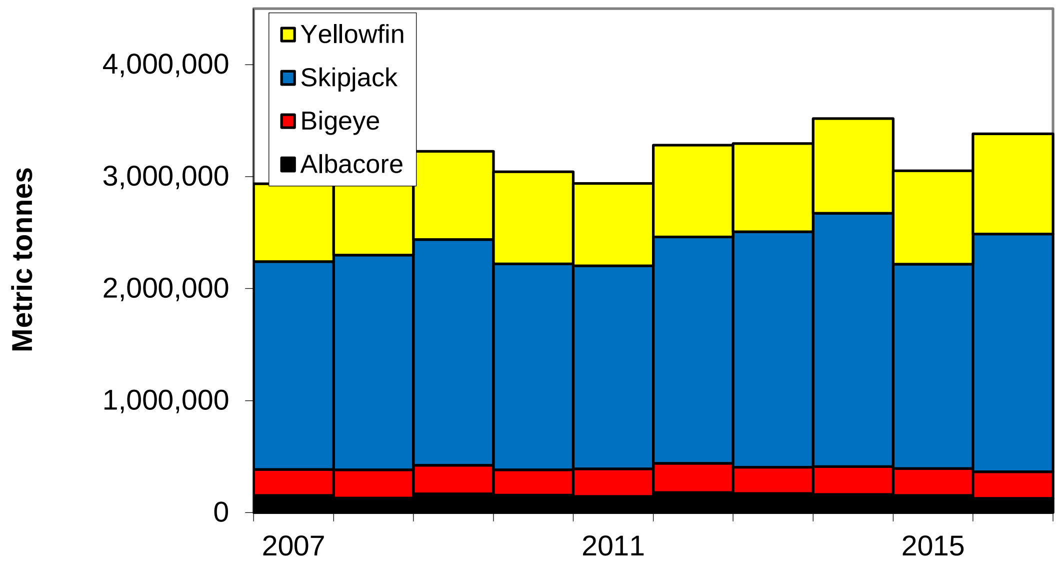


Figure 118. Estimated total annual catch of tuna species in the Pacific Ocean.
Source: SPC 2017.

2.6.4.1 PURSE SEINE FISHERY IN THE WCPFC

Source: WCPFC-SC13-2017 GN-WP-01

Vessels: The majority of the historic WCP–CA purse seine catch has come from the four main Distant Water Fishing Nation (DWFN) fleets – Japan, Korea, Chinese- Taipei and USA, which combined numbered 163 vessels in 1992, but declined to a low of 111 vessels in 2006 (due to reductions in the U.S. fleet), before some rebound in recent years (133 vessels in 2016). The Pacific Islands fleets have gradually increased in numbers over the past two decades to a level of 116 vessels in 2016. The remainder of the purse seine fishery includes several fleets which entered the WCPFC tropical fishery during the 2000s (e.g. China, Ecuador, El Salvador, New Zealand and Spain). The total number of purse seine vessels was relatively stable over the period 1990-2006 (in the range of around 180–220 vessels), but thence until 2014, the number of vessels gradually increased, attaining a record level of 307 vessels in 2014, before declining over the past two years (291 vessels in 2016).

Catch: The provisional 2016 purse-seine catch of 1,858,198 mt was the third highest catch on record, higher than in 2015, but more than 160,000 mt lower than the record in 2014 (2,028,630 mt); the main reasons for the increase in catch compared to 2015 is related to increased effort and improved conditions (catch rates) in the fishery. The 2016 purse-seine skipjack catch (1,408,110 mt; 75% of total catch) was about 200,000 mt lower than the record in 2014, but almost identical to the 2015 catch level. The 2016 purse-seine catch estimate for yellowfin tuna (394,756 mt; 21%) was the second highest on record (423,788 mt in 2008) coming after a poor catch year in 2015 and appears to be due to increased catches of large yellowfin from unassociated-school set types. The provisional catch estimate for bigeye tuna for 2016 (63,304 mt) was an increase from the relatively low catch level in 2015.

Fleet distribution: Despite the FAD closure for certain periods in each year since 2010, drifting FAD sets remain an important fishing strategy, particularly to the east of 160°E where most of the purse seine effort was directed during 2016. The relatively high proportion of unassociated sets in the eastern areas (e.g. Gilbert Islands) was a feature of the fishery in 2014–2015 and into the first half of 2016 (i.e. corresponding to El Niño conditions). The FAD closure periods (since 2010) have clearly contributed to an increase in unassociated sets, although in some years (e.g. 2016, this set type appears to have dominated in the non-FAD closure months as well, due to prevailing environmental conditions which were conducive to sets on free-swimming schools.

The El Niño -like conditions of 2015 meant that effort by most fleets remained in the eastern areas including Nauru, Gilbert/Phoenix groups of Kiribati and Tuvalu waters. The transition from El Niño to neutral ENSO conditions in the middle of 2016 resulted in a clear move westwards for some fleets (e.g. Korea). The U.S. fleet typically fishes in the more eastern areas and this was again the case during 2015/2016, with effort extended into the Phoenix Islands, the Cook Islands, Tokelau and the adjacent eastern high seas areas with hardly any effort west of 160°E. The difference in areas fished by the Asian fleets (Japan, Korean and Chinese Taipei fleets) in 2015/2016 is related to the areas they have access to and perhaps also related to fishing strategy (e.g. use of traditional fishing grounds, e.g. FSM, PNG and the Solomon Islands by the Japan fleet). During 2016, effort by the combined Pacific Islands fleet extended from west (the domestic PNG fishery) through to the eastern extent of the tropical WCPO (Line Group), albeit more reduced in this eastern area than in 2015.

Table 36. Total reported purse seine catch (mt) of tuna species in the Pacific Ocean.

Year	Skipjack	Yellowfin	Bigeye	Total
2007	1,495,465	503,957	113,575	2,112,997
2008	1,543,394	615,838	133,442	2,292,674
2009	1,671,832	559,963	135,343	2,367,138
2010	1,478,630	599,373	114,902	2,192,905
2011	1,475,385	513,938	130,563	2,119,886
2012	1,685,924	584,467	132,201	2,402,592
2013	1,770,387	573,480	125,847	2,469,714
2014	1,936,344	603,509	123,115	2,662,968
2015	1,466,277	555,102	113,928	2,135,307
2016	1,740,018	642,215	118,188	2,500,421
Average	1,626,366	575,184	124,110	2,325,660
STD Deviation	159,732	43,566	8,556	187,149

Source: SPC 2017.

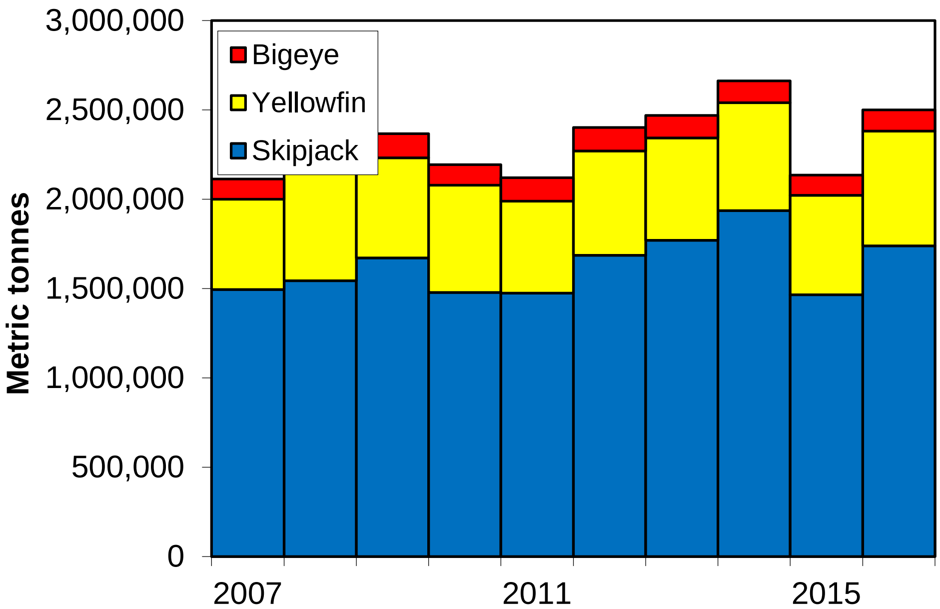


Figure 119. Total purse seine catch of tuna species in the Pacific Ocean.
Source: SPC 2017.

2.6.4.2 LONGLINE FISHERIES IN THE WCPFC

Source: WCPFC-SC13-2017 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 in recent years, total vessel numbers are just above 3,000 vessels.

The fishery involves two main types of operations:

- 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, PNG, Samoa, Solomon Islands, Tonga, Tuvalu 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.

The 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.

The 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 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 tuna 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 Hawaii. For example, the Hawaiian 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 and Portugal (one vessel started fishing in 2011).
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 (231,860 mt) for 2016 was lower than the average for the past five years. The WCP–CA albacore longline catch (71,571 mt – 31%) for 2016 was the lowest since 2000, 30,000 mt lower that the record of 101,816 mt attained in 2010. The provisional bigeye catch (64,131 mt – 28%) for 2016 was the lowest since 1996, mainly due to continued reduction in effort in the main bigeye tuna fishery (refer to Pilling *et al.*, 2017 for more detail). The yellowfin catch for 2016 (90,539 mt – 39%) was around the average for the past five 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 5,746 mt in 2016) and vessel numbers (366 in 2004 to 97 in 2016). The Chinese-Taipei distant-water longline fleet bigeye catch declined from 16,888 mt in 2004 to 4,751 mt in 2016, mainly related to a substantial drop in vessel numbers (137 vessels in 2004 reduced to 79 vessels in 2016). The Korean distant-water longline fleet also experienced a decline in bigeye and yellowfin catches since the period of highest catches 15–20 years ago in line with a reduction in vessel numbers – from 184 vessels active in 2002 reduced to 96 vessels in 2016.

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, mainly in international 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 targeting albacore tuna 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 37. Total reported longline catch (mt) of PMUS in the Pacific Ocean.

Year	Albacore	Yellowfin	Bigeye	Striped Marlin	Black Marlin	Blue Marlin	Swordfish	Total
2007	93,613	89,749	112,228	5,763	2,507	20,784	32,580	357,224
2008	88,271	87,373	106,508	5,062	1,820	17,428	34,474	340,936
2009	87,435	91,028	103,287	4,930	1,871	16,716	34,771	340,038
2010	109,440	105,368	107,389	4,160	2,066	17,018	35,298	380,739
2011	113,324	102,943	99,362	4,983	2,253	18,734	35,740	377,339
2012	97,892	103,670	102,450	6,328	1,926	16,938	38,407	367,611
2013	120,865	97,914	111,316	6,461	2,007	18,262	43,138	399,963
2014	113,147	86,403	91,778	5,881	1,820	20,037	41,110	360,176
2015	108,965	104,047	105,551	5,615	2,200	20,822	38,602	385,802
2016	111,371	110,633	107,215	5,044	2,504	20,063	41,758	398,588
Average	104,432	97,913	104,708	5,423	2,097	18,680	37,588	370,842
STD deviation	11,684	8,635	5,968	712	261	1,639	3,554	21,434

Source: SPC 2017 and IATTC 2017.

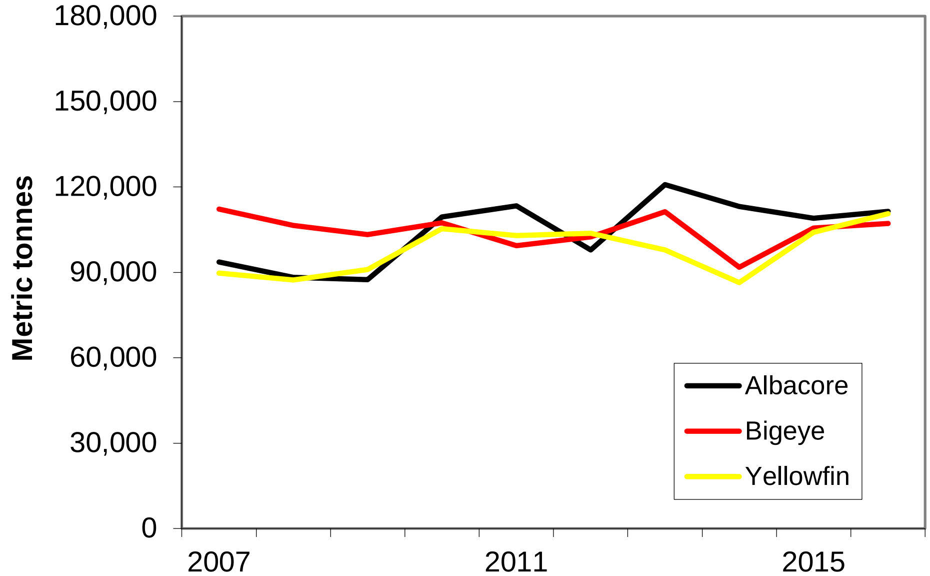


Figure 120. Reported longline tuna catches in the Pacific Ocean.
Source: SPC 2017 and IATTC 2017.

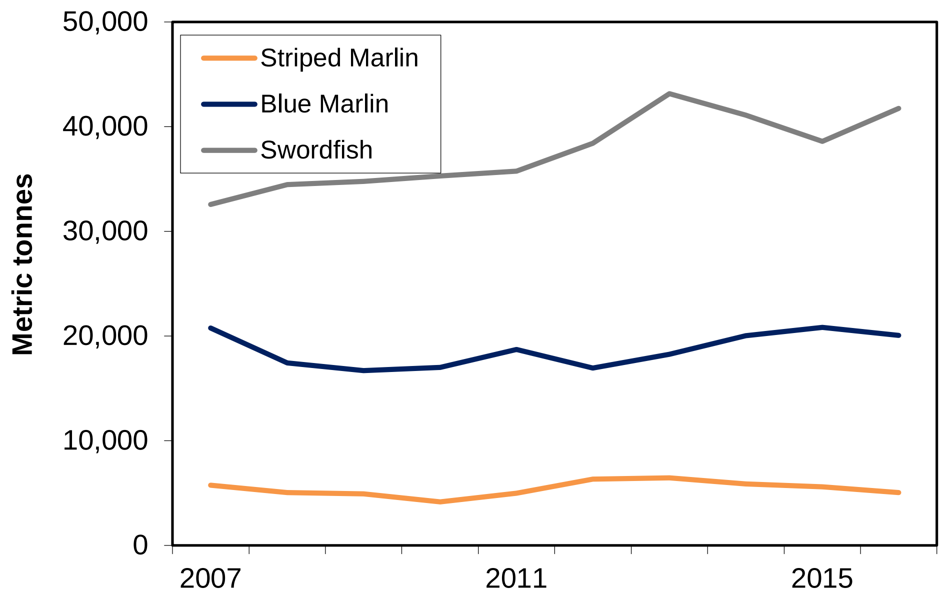


Figure 121. Reported longline billfish catches in the Pacific Ocean.
Source: SPC 2017 and IATTC 2017.

1.1.1.3 POLE-AND-LINE FISHERY IN THE WCPFC

Source: WCPFC-SC13-2017 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 2016 pole-and-line catch (199,457 mt) was the lowest annual catch since the late-1960s, although estimates are typically revised upwards by the start of WCPFC Scientific Committee meetings each year. 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 (90,343 mt in 2016), and the Indonesian fleets (108,327 mt in 2016), account for nearly all of the WCP–CA pole-and-line catch (99% in 2016). 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 2016 reduced to only 66 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 (420 mt in 2016 from 2 vessels).

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

- 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;
- Seasonal albacore/skipjack fishery east of Japan (largely an extension of the Japan home-water fishery).

Table 38. Total reported pole-and-line catch (mt) of skipjack in the Pacific Ocean.

Year	Catch
2007	212,996
2008	218,571
2009	200,843
2010	222,995
2011	206,566
2012	170,537
2013	169,023
2014	148,619
2015	151,349
2016	156,377
Average	185,788
STD deviation	29,447

Source: SPC 2017.

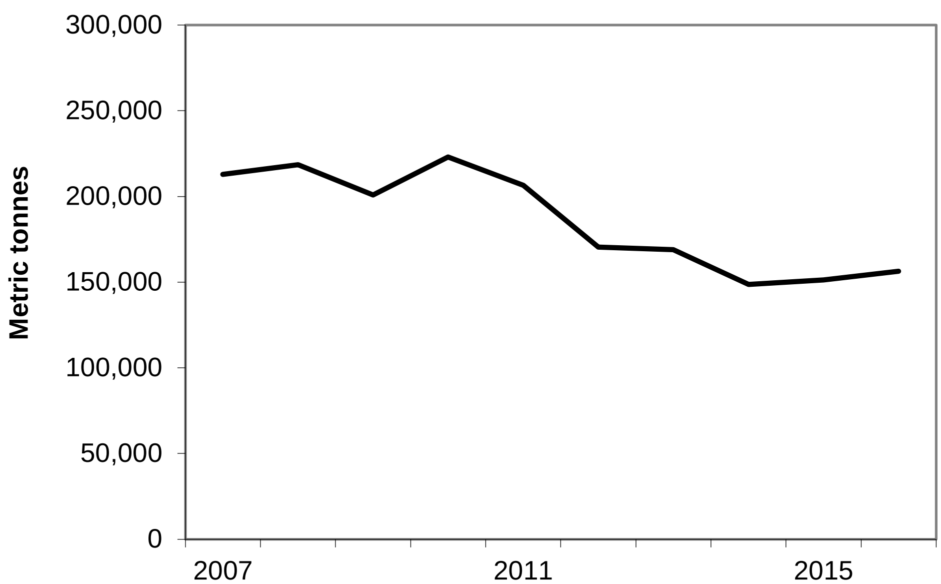


Figure 122. Reported pole-and-line catch (mt) in the Pacific Ocean.
Source: SPC 2017.

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 123. 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.

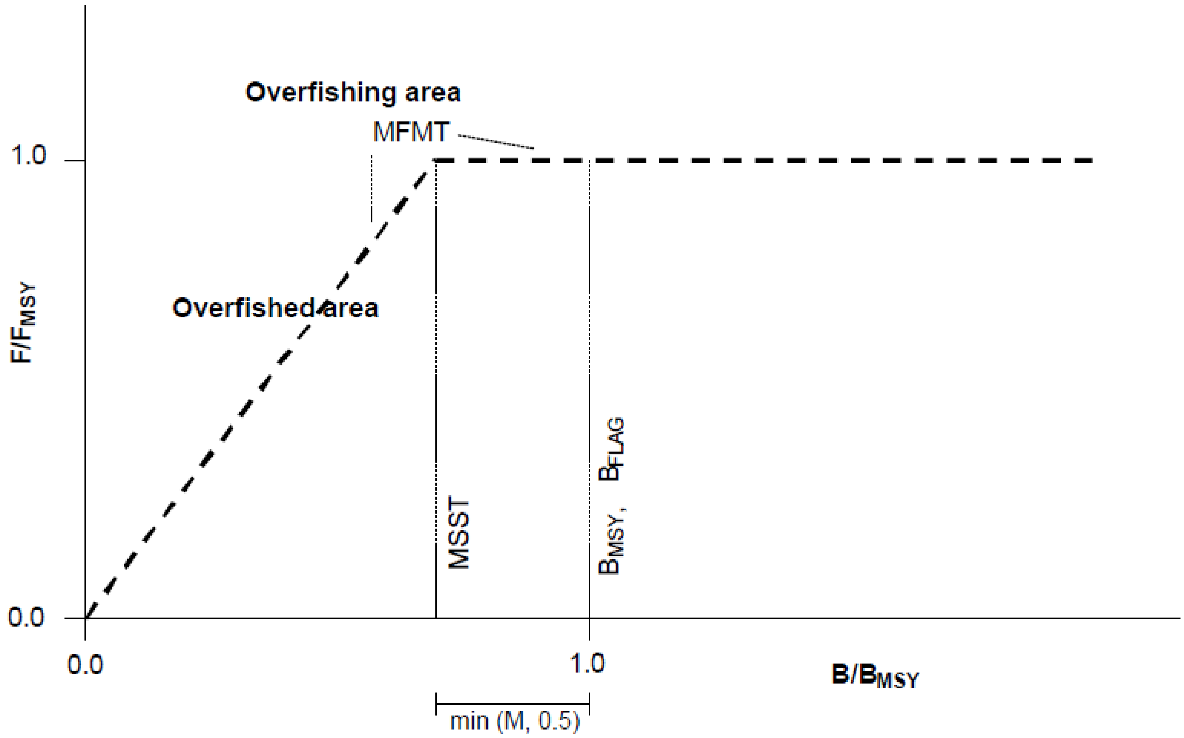


Figure 123. MSY control rule and reference points for pelagic MUS.

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 39 summarizes the stock assessments for pelagic MUS completed between 2012 and 2017.

Table 39. 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)	2017		Wahoo	
Other tuna relatives (*Auxis* sp.)			Yellowfin Tuna (WCPO)	2017
(*allothunnus* sp., *Scomber* sp.)			Kawakawa	
Bigeye Tuna (WCPO)	2017		Bluefin Tuna (Pacific)	2016
Black Marlin			Common Thresher Shark	
Blue Marlin	2016		Pelagic Thresher Shark	
Mahimahi			Bigeye Thresher Shark	2017 – risk assessment
Oilfishes			Shortfin Mako Shark	
Opah			Longfin Mako Shark	
Pomfrets			Blue Shark (N. Pacific)	2017
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 2017 based on the WCPFC SC13 Summary Report. For more information on stock assessments and assessment results completed prior to 2017, please see the past Annual Pelagic SAFE Reports.

2.6.7.1 WESTERN AND CENTRAL PACIFIC OCEAN BIGEYE TUNA

Stock assessment: McKechnie et al. 2017

SC13 endorsed the 2017 WCPO bigeye tuna stock assessment as the most advanced and comprehensive assessment yet conducted for this species.

SC13 also endorsed the use of the assessment model uncertainty grid to characterize stock status and management advice and implications but noted the large variance in the assessment results, mainly due to the inclusion of the old and new regional structures and growth curves, for which some CCMs considered further investigation is necessary.

SC13 reached consensus on the weighting of assessment models in the uncertainty grid for bigeye tuna. The consensus weighting considered all options within the four axes of uncertainty for steepness, tagging dispersion, size frequency and regional structure to be equally likely. For the growth axis of uncertainty, the new growth curve models (n=36 models, weight=3, 108 model weight units) were weighted three times more than the old growth curve models (n=36 models, weight=1, 36 model weight units). In total there were 144 model weight units. The resulting uncertainty grid was used to characterize stock status, to summarize reference points as provided in the assessment document SC13-SA-WP-05, and to calculate the probability of breaching the adopted spawning biomass limit reference point ($0.2*SB_{F=0}$) and the probability of F_{recent} being greater than F_{MSY}. It should be noted that the results would vary depending on the choice and/or weighting of grids, in particular the growth curve model, thus those characterizations of central tendency of stock status need to be interpreted with caution.

Stock status and trends

The median values of relative recent (2012-2015) spawning biomass ($SB_{recent}/ SB_{F=0}$) and relative recent fishing mortality (F_{recent}/F_{MSY}) over the uncertainty grid were used to measure the central tendency of stock status. The values of the upper 90th and lower 10th percentiles of the empirical distributions of relative spawning biomass and relative fishing mortality from the uncertainty grid were used to characterize the probable range of stock status.

A description of the updated structural sensitivity grid used to characterize uncertainty in the assessment was set out in Table BET-1. Time series of total annual catch by fishing gear for the diagnostic case model over the full assessment period is shown in Figure BET-1. Estimated annual average recruitment, spawning potential, juvenile and adult fishing mortality and fishing depletion for the diagnostic case model are shown in Figures BET-2 – BET-5. Figures BET-6 and BET-7 display Majuro plots summarising the results for each of the models in the structural uncertainty grid. Figures BET-8 and BET-9 show Kobe plots summarising the results for each of the models in the structural uncertainty grid. Figure

BET-10 provides estimated time-series (or “dynamic”) Majuro and Kobe plots from the bigeye ‘diagnostic case’ model run. Figure BET-11 provides estimates of reduction in spawning potential due to fishing by region, and over all regions attributed to various fishery groups (gear-types) for the diagnostic case model. Table BET-2 provides a summary of reference points over the 72 models in the structural uncertainty grid.

Table BET-1. Description of the updated structural sensitivity grid used to characterize uncertainty in the assessment.

Axis	Levels	Option
Steepness	3	0.65, 0.80, 0.95
Growth	2	‘Old growth’, ‘New growth’
Tagging over-dispersion	2	Default level (1), fixed (moderate) level
Size frequency weighting	3	Sample sizes divided by 10, 20, 50
Regional structure	2	2017 regions, 2014 regions

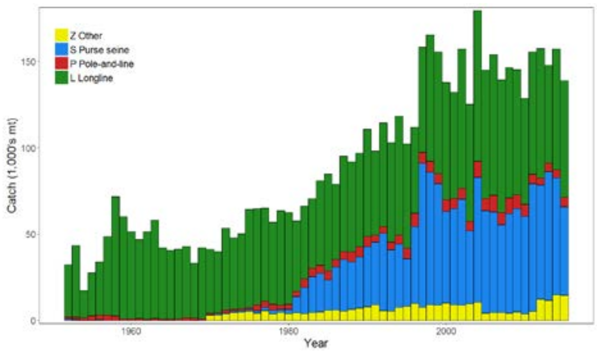


Figure BET-1. Time series of total annual catch (1000's mt) by fishing gear for the diagnostic case model over the full assessment period.

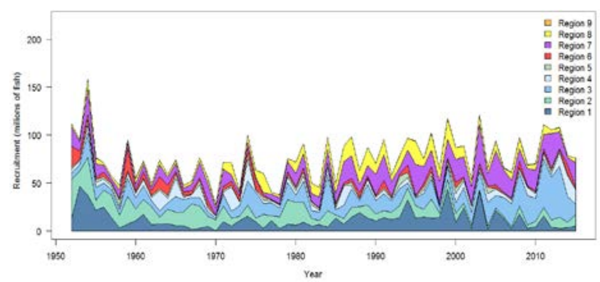


Figure BET-2. Estimated annual average recruitment by model region for the diagnostic case model, showing the relative sizes among regions.

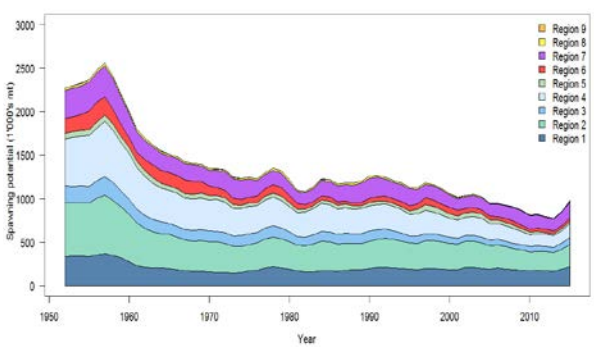


Figure BET-3. Estimated annual average spawning potential by model region for diagnostic case model, showing the relative sizes among regions

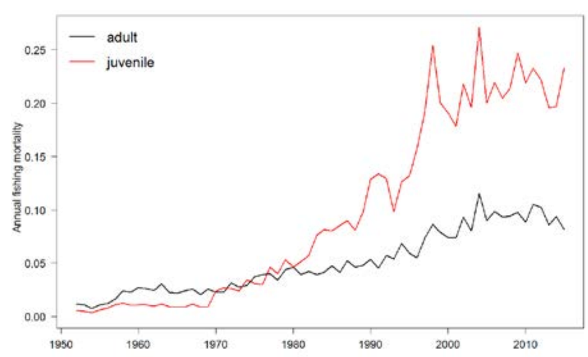


Figure BET-4. Estimated annual average juvenile and adult fishing mortality for the diagnostic case model.

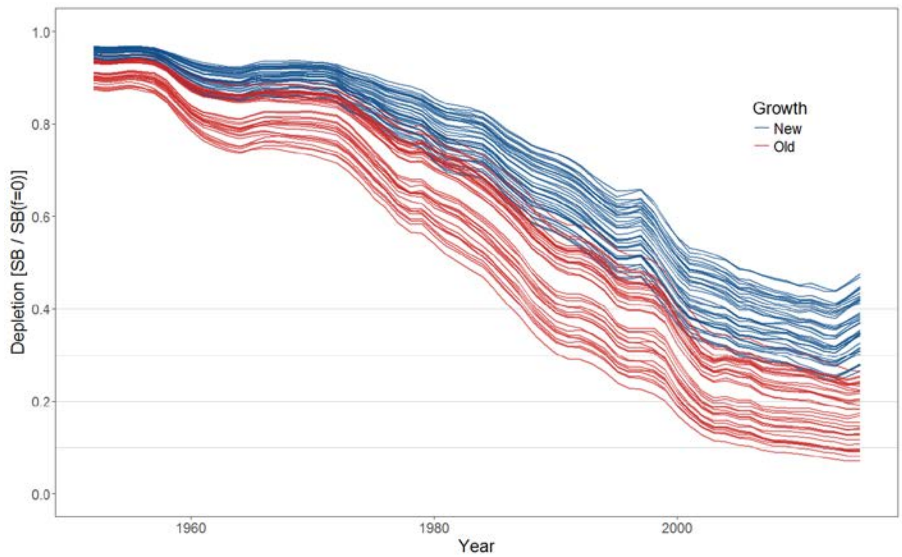
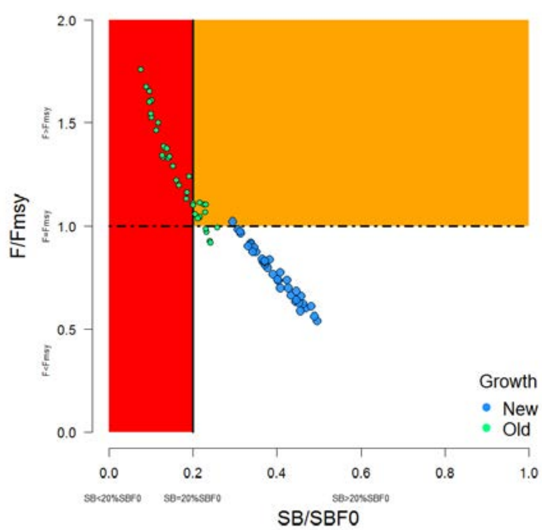


Figure BET-5. Plot showing the trajectories of fishing depletion (of spawning potential) for the 72 model runs included in the structural uncertainty grid. The colours depict the models in the grid with the new and old growth functions.



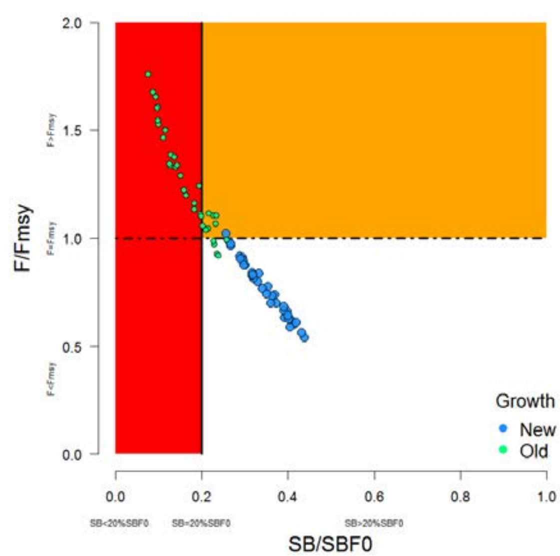


Figure BET-6. Majuro plot summarising the results for each of the models in the structural uncertainty grid. The plots represent estimates of stock status in terms of spawning potential depletion and fishing mortality. The red zone represents spawning potential levels lower than the agreed limit

Figure BET-7. Majuro plot summarizing the results for each of the models in the structural uncertainty grid. The plots represent estimates of stock status in terms of spawning potential depletion and fishing mortality. The red zone represents spawning potential levels lower than the agreed limit reference point which is marked with the solid black line. The orange region is for fishing mortality greater than F_{MSY} (F_{MSY} is marked with the black dashed line). The points represent $SB_{latest}/SB_{F=0}$ (labelled as $SB/SB_{F=0}$ above), and the colours depict the models in the grid with the new and old growth functions with the size of the points representing the decision of the SC to weight the new growth models three times higher than the old growth models.

reference point which is marked with the solid black line. The orange region is for fishing mortality greater than F_{MSY} (F_{MSY} is marked with the black dashed line). The points represent $SB_{recent}/SB_{F=0}$ (labelled as $SB/SB_{F=0}$ above), where SB_{recent} is the mean *SB* over 2012-2015 instead of 2011-2014 (used in the stock assessment report), at the request of the Scientific Committee. The colours depict the models in the grid with the new and old growth functions with the size of the points representing the decision of the SC to weight the new growth models three times higher than the old growth models.

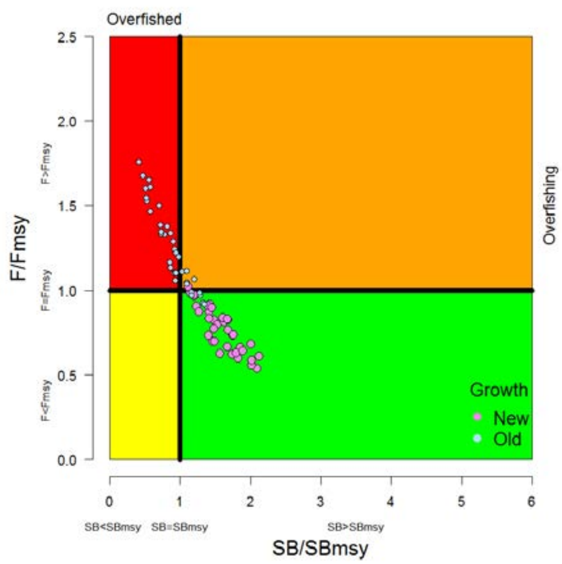


Figure BET-8. Kobe plot summarizing the results for each of the models in the structural uncertainty grid. The points represent SB_{latest}/SB_{MSY}, with the colours depicting the models in the grid with the new and old growth functions, and the size of the points representing the decision of the SC to weight the new growth models three times higher than the old growth models.

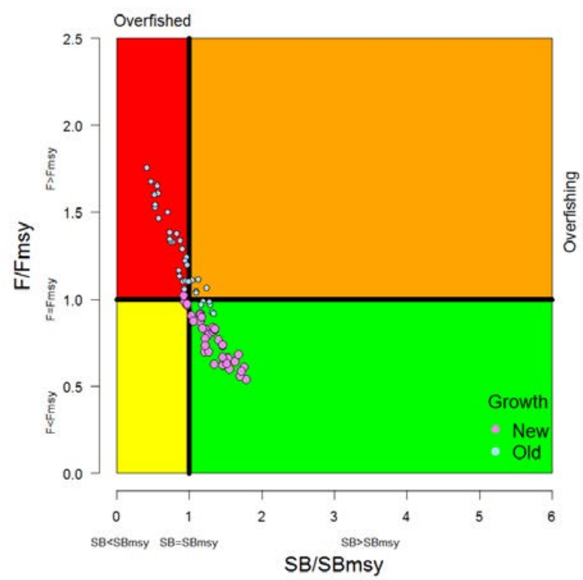


Figure BET-9. Kobe plot summarizing the results for each of the models in the structural uncertainty grid. The points represent SB_{recent}/SB_{MSY}, with the colours depicting the models in the grid with the new and old growth functions, and the size of the points representing the decision of the SC to weight the new growth models three times higher than the old growth models.

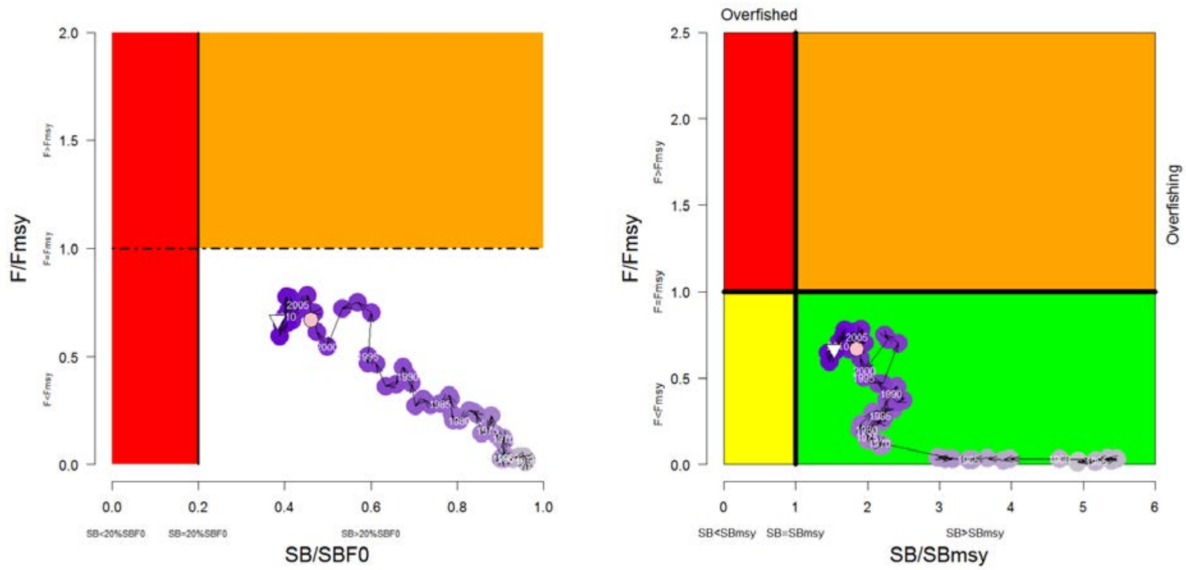


Figure BET-10. Estimated time-series (or "dynamic") Majuro and Kobe plots from the bigeye 'diagnostic case' model run.

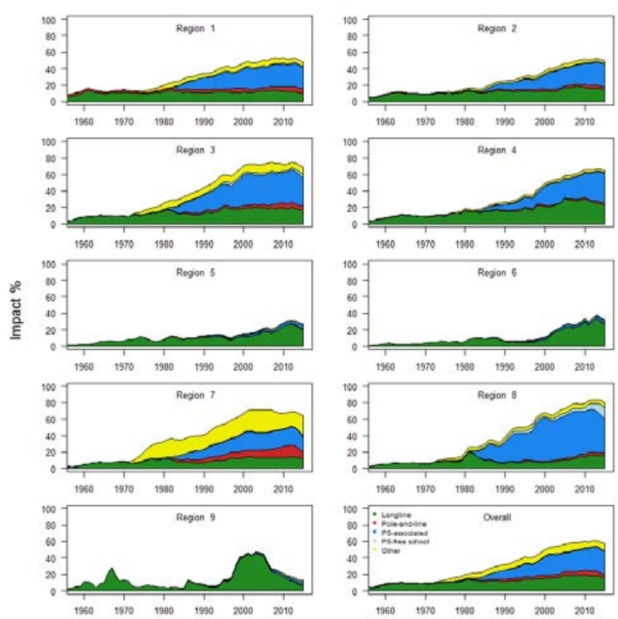


Figure BET-11. Estimates of reduction in spawning potential due to fishing by region, and over all regions (lower right panel), attributed to various fishery groups (gear-types) for the diagnostic case model.

Table BET-2. Summary of reference points over the 72 models in the structural uncertainty grid where the models using the new growth function are given three times the weighting of the models using the old growth function. Note that $SB_{recent}/SB_{F=0}$ is calculated where SB_{recent} is the mean *SB* over 2012-2015 instead of 2011-2014 (used in the stock assessment report), at the request of the Scientific Committee.

	Mean	Median	Min	10%	90%	Max
C_{latest}	149,178	153,137	130,903	131,597	156,113	157,725
MSY	156,765	158,040	124,120	137,644	180,656	204,040
$Y_{Frecent}$	150,382	148,920	118,000	133,400	168,656	187,240
F_{mult}	1.21	1.20	0.57	0.76	1.63	1.85
F_{MSY}	0.05	0.05	0.04	0.04	0.05	0.06
$F_{recent}/F_{\mathrm{MSY}}$	0.89	0.83	0.54	0.61	1.32	1.76
SB_{MSY}	457,162	454,100	219,500	285,530	598,210	710,000
SB_0	1,730,410	1,763,000	1,009,000	1,279,300	2,148,200	2,509,000
SB_{MSY}/SB_0	0.26	0.26	0.22	0.24	0.29	0.29
$SB_{\mathrm{F=0}}$	1,915,184	1,953,841	1,317,336	1,584,593	2,170,899	2,460,411
$SB_{\mathrm{MSY}}/SB_{F=0}$	0.24	0.24	0.17	0.18	0.27	0.29
SB_{latest}/SB_0	0.37	0.40	0.11	0.19	0.49	0.53
$SB_{latest}/SB_{F=0}$	0.34	0.37	0.08	0.15	0.46	0.49
$SB_{latest}/SB_{\mathrm{MSY}}$	1.42	1.45	0.42	0.86	1.97	2.12
$SB_{recent}/SB_{F=0}$	0.30	0.32	0.08	0.15	0.41	0.44
$SB_{recent}/SB_{\mathrm{MSY}}$	1.21	1.23	0.32	0.63	1.66	1.86

SC13 noted that the central tendency of relative recent spawning biomass under the selected new and old growth curve model weightings was median ($SB_{recent}/SB_{F=0}$) = 0.32 with a probable range of 0.15 to 0.41 (80% probability interval). This suggested that there was likely a buffer between recent spawning biomass and the LRP but that there was also some probability that recent spawning biomass was below the LRP.

SC13 also noted that there was a roughly 16% probability (23 out of 144 model weight units) that the recent spawning biomass had breached the adopted LRP with Prob(($SB_{recent}/SB_{F=0}$) < 0.2) = 0.16. This suggested that there was a high probability (roughly 5 out of 6) that recent bigeye tuna spawning biomass had not breached the adopted spawning biomass limit reference point of $0.2*SB_{F=0}$.

SC13 noted that the central tendency of relative recent fishing mortality under the selected new and old growth curve model weightings was median(F_{recent}/F_{MSY}) = 0.83 with an 80% probability interval of 0.61 to 1.31. While this suggested that there was likely a buffer between recent fishing mortality and F_{MSY}, it also showed that there was some probability that recent fishing mortality was above F_{MSY}.

SC13 also noted that there was a roughly 23% probability (33 out of 144 model weight units as described in para. 6) that the recent fishing mortality was above F_{MSY} with Prob((F_{recent}/F_{MSY}) > 1) = 0.23. While this suggested that recent fishing mortality was likely

below F_{MSY}, there was also a moderate probability (~ 1 out of 4) that recent fishing mortality has exceeded F_{MSY}.
SC13 noted that the best available information on the stock status of WCPO bigeye tuna has changed in two ways from the previous assessment under the selected weighting of the 2017 assessment uncertainty grid. First, the stock status condition is more positive with a higher central tendency for $SB_{recent}/SB_{F=0}$ in the 2017 assessment (median($SB_{recent}/SB_{F=0}$) = 0.32) in comparison to the 2014 assessment (($SB_{current}/SB_{F=0}$) = 0.20) and a lower ratio of relative recent F in the 2017 assessment (median(F_{recent}/F_{MSY}) = 0.83) in comparison to the 2014 assessment ($F_{current}/F_{MSY}$ = 1.57). Second, there is much greater uncertainty in the stock status of bigeye tuna in 2017 due to the fuller technical treatment of structural uncertainty through the use of the model uncertainty grid.

SC13 noted that the positive changes for bigeye tuna stock status in the 2017 assessment are primarily due to three factors: the inclusion of the new growth curve information, the inclusion of the new regional assessment structure, and the estimated increases in recruitment in recent years. In terms of the cause of the recent increases in recruitment, SC13 commented that it was unclear whether the recent improvement was due to positive oceanographic conditions, effective management measures to conserve spawning biomass, some combination of both, or other factors. SC13 also noted the recent recruitment improvements for yellowfin and skipjack tunas. SC13 also noted recent recruitment improvements for bigeye tuna in the Eastern Pacific Ocean.

SC13 also noted that, regardless of the choice of uncertainty grid, the assessment results show that the stock has been continuously declining for about 60 years since the late 1950's, except for the recent small increase suggested in the new growth curve model grid.
SC13 also noted the continued higher levels of depletion in the equatorial and western Pacific (specifically Regions 3, 4, 7 and 8 of the stock assessment) and the associated higher levels of impact, especially on juvenile bigeye tuna, in these regions due to the associated purse-seine fisheries and the 'other' fisheries within the western Pacific (as shown in Figures 35 and 46 of SC13-SA-WP-05).

SC13 noted that there has been a long-term increase in fishing mortality for both juvenile and adult bigeye tuna, consistent with previous assessments.

SC13 noted that there has been a long-term decrease in spawning biomass from the 1950s to the present for bigeye tuna and that this is consistent with previous assessments.

Management advice and implications

Based on the uncertainty grid adopted by SC13, the WCPO bigeye tuna spawning biomass is likely above the biomass LRP and recent F is likely below F_{MSY}, and therefore noting the level of uncertainties in the current assessment it appears that the stock is not experiencing overfishing (77% probability) and it appears that the stock is not in an overfished condition (84% probability).

Although SC13 considers that the new assessment is a significant improvement in relation to the previous one, SC13 advises that the amount of uncertainty in the stock status results for the 2017 assessment is higher than for the previous assessment due to the inclusion of new information on bigeye tuna growth and regional structures.
SC13 also noted that levels of fishing mortality and depletion differ between regions, and that fishery impact was higher in the tropical region (Regions 3, 4, 7 and 8 in the stock assessment model), with particularly high fishing mortality on juvenile bigeye tuna in these regions. SC13 therefore recommends that WCPFC14 could continue to consider measures to reduce fishing mortality from fisheries that take juveniles, with the goal to increase bigeye fishery yields and reduce any further impacts on the spawning potential for this stock in the tropical regions.

Based on those results, SC13 recommends as a precautionary approach that the fishing mortality on bigeye tuna stock should not be increased from current level to maintain current or increased spawning biomass until the Commission can agree on an appropriate target reference point (TRP).

Research Recommendations

SC13 recognized that future work is required to improve the assessment and to reduce uncertainty. Future research should concentrate on the two axes (e.g. growth, regional structure) of uncertainty which are the most influential. The growth analysis should continue with the emphasis on providing length at age estimates for larger fish between 130 and 180 cm FL. Additional research is also required for the regional structure uncertainty to consider options in addition to the structures used in the 2014 and 2017 assessments, for example, by using statistical approaches (e.g. tree models).
In addition, SC13 considers that the model ensemble or weighting will be increasingly important as SC moves to uncertainty grid approaches in stock assessments and requests the Scientific Services Provider to study those methods further.

SC13 requested that SPC undertake projections of potential changes in spawning biomass in the future under current levels of fishing mortality. This would be similar to the projections delivered in SC13-SA-IP-22, but would be based on the weighted uncertainty grid as described above.

2.6.7.2 WESTERN AND CENTRAL PACIFIC OCEAN YELLOWFIN TUNA

Stock assessment: Tremblay-Boyer et al. 2017

SC13 endorsed the 2017 WCPO yellowfin tuna stock assessment as the most advanced and comprehensive assessment yet conducted for this species.

SC13 also endorsed the use of the assessment model uncertainty grid to characterize stock status and management advice and implications.

SC13 reached consensus on the weighting of assessment models in the uncertainty grid for yellowfin tuna. The consensus weighting considered all options within five axes of uncertainty for steepness, tagging dispersion, tag mixing, size frequency (with two levels), and regional structure to be equally likely. The resulting uncertainty grid was used to characterize stock status, to summarize reference points as provided in the assessment document SC13-SA-WP-06, and to calculate the probability of breaching the adopted spawning biomass limit reference point ($0.2*SB_{F=0}$) and the probability of F_{recent} being greater than F_{MSY}.

Stock status and trends

The median values of relative recent spawning biomass (2012-2015) ($SB_{recent}/SB_{F=0}$) and relative recent fishing mortality (F_{recent}/F_{MSY}) over the uncertainty grid were used to measure the central tendency of stock status. The values of the upper 90th and lower 10th percentiles of the empirical distributions of relative spawning biomass and relative fishing mortality from the uncertainty grid were used to characterize the probable range of stock status.

Descriptions of the updated structural sensitivity grid used to characterize uncertainty in the assessment are provided in Table YFT-1. Catch trend data is presented in Figure YFT-1. Estimated annual average recruitment, biomass, fishing mortality and depletion are shown in Figures YFT-2 – YFT-5. Majuro plots summarizing the results for each of the models in the structural uncertainty grid retained for management advice are represented in Figures YFT-6 and YFT-7. Figure YFT-8 and YFT-9 present Kobe plots summarizing the results for each of the models in the structural uncertainty grid. Figure YFT-10 provides estimated time-series (or “dynamic”) Majuro and Kobe plots from the yellowfin ‘diagnostic case’ model run. Figure YFT-11 shows estimates of reduction in spawning potential due to fishing by region, and over all regions attributed to various fishery groups (gear-types) for the diagnostic case model. Table YFT-2 provides a summary of reference points over the 48 models in the structural uncertainty grid (based on the SC decision to include size frequency weighting levels 20 and 50 only).

Table YFT-1. Description of the updated structural sensitivity grid used to characterize uncertainty in the assessment.

Axis	Levels	Option
Steepness	3	0.65, 0.80, 0.95
Tagging over-dispersion	2	Default level (1), fixed (moderate) level
Tag mixing	2	1 or 2 quarters
Size frequency weighting	3	Sample sizes divided by 10, 20, 50
Regional structure	2	2017 regions, 2014 regions

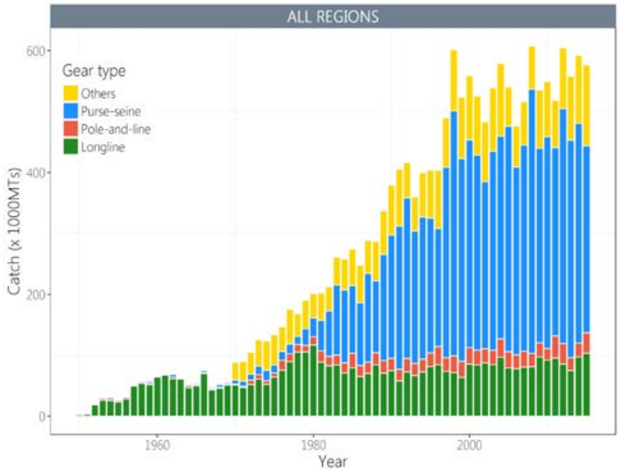


Figure YFT-1. Time series of total annual catch (1000's mt) by fishing gear for the diagnostic case model over the full assessment period.

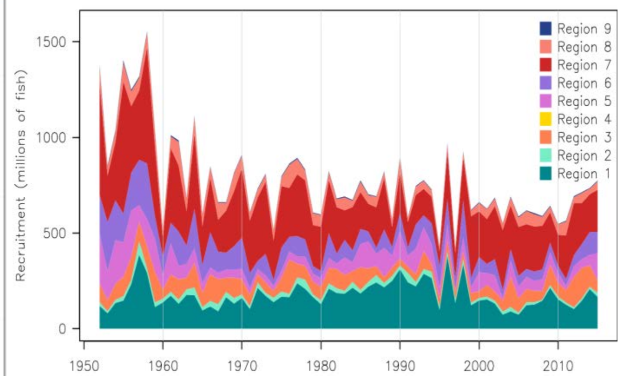


Figure YFT-2. Estimated annual average recruitment by model region for the diagnostic case model, showing the relative sizes among regions.

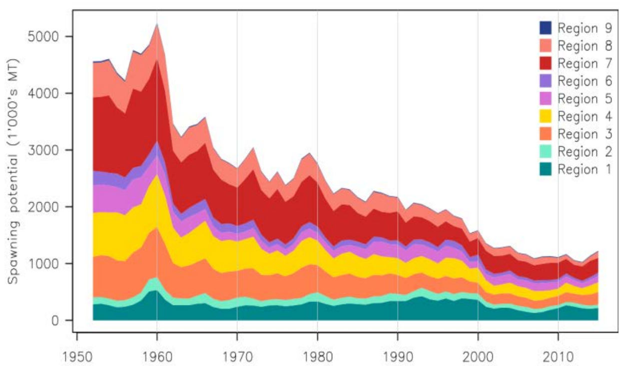


Figure YFT-3. Estimated annual average spawning potential by model region for the diagnostic case model, showing the relative sizes among regions.

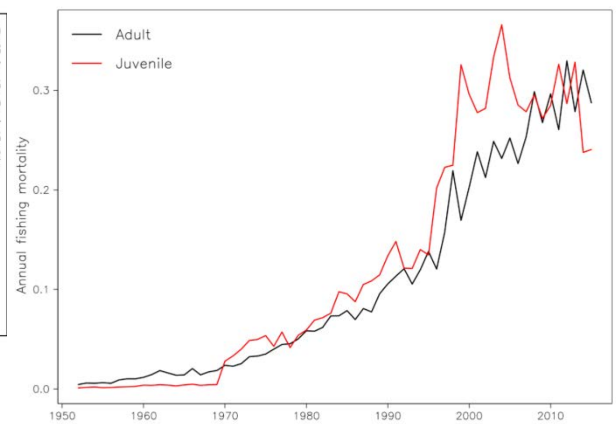


Figure YFT-4. Estimated annual average juvenile and adult fishing mortality for the diagnostic case model.

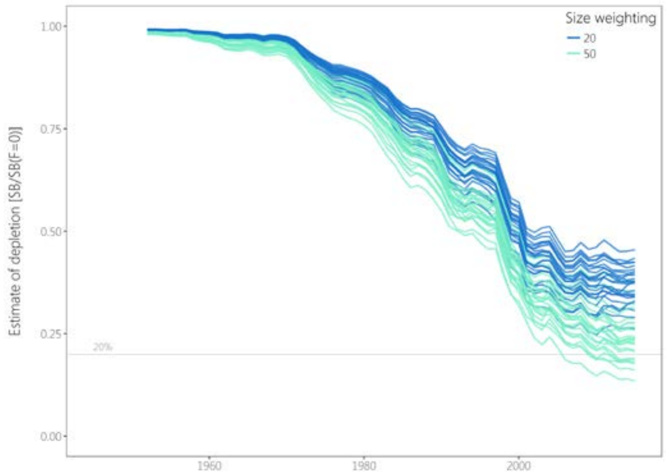


Figure YFT-5: Plot showing the trajectories of fishing depletion (of spawning potential) for the 48 model runs retained for the structural uncertainty grid used for management advice. The colours depict the models in the grid with the size composition weighting using divisors of 20 and 50.

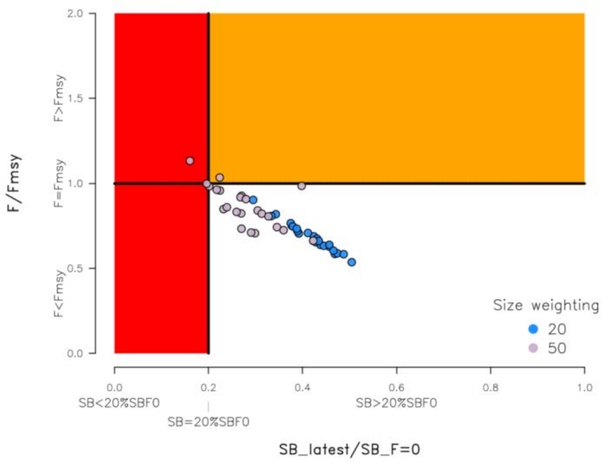


Figure YFT-6. Majuro plot summarizing the results for each of the models in the structural uncertainty grid retained for management advice. The plots represent estimates of stock status in terms of spawning potential depletion and fishing mortality. The red zone represents spawning potential levels lower than the agreed limit reference point which is marked with the solid black line. The orange region is for fishing mortality greater than F_{MSY} (F_{MSY} is marked with the black horizontal line). The points represent $SB_{latest}/SB_{F=0}$, and the colours depict the models in the grid with the size composition weighting using divisors of 20 and 50.

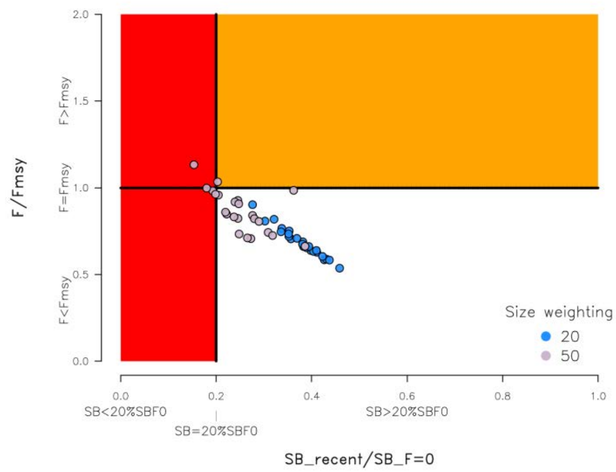


Figure YFT-7: Majuro plot summarizing the results for each of the models in the structural uncertainty grid retained for management advice. The plots represent estimates of stock status in terms of spawning potential depletion and fishing mortality. The red zone represents spawning potential levels lower than the agreed limit reference point which is marked with the solid black line. The orange region is for fishing mortality greater than F_{MSY} (F_{MSY} is marked with the black horizontal line). The points represent $SB_{recent}/SB_{F=0}$, and the colours depict the models in the grid with the size composition weighting using divisors of 20 and 50.

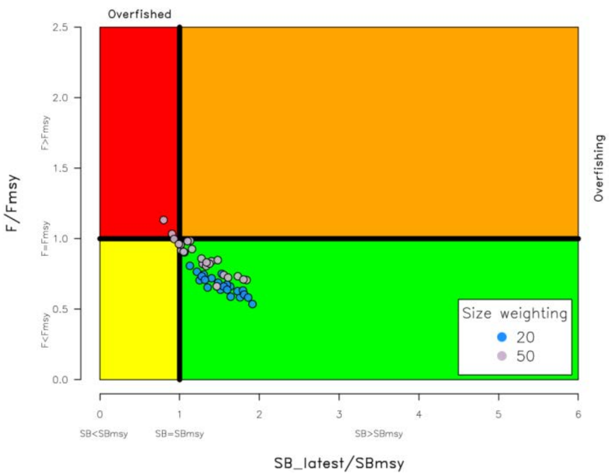


Figure YFT-8. Kobe plot summarizing the results for each of the models in the structural uncertainty grid. The points represent SB_{latest}/SB_{MSY}, the colours depict the models in the grid with the size composition weighting using divisors of 20 and 50.

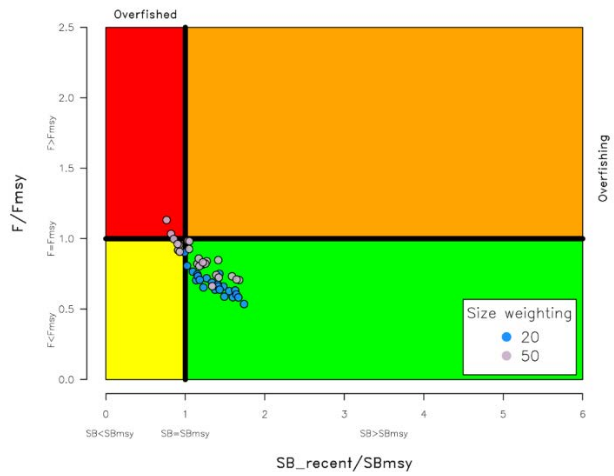


Figure YFT-9. Kobe plot summarizing the results for each of the models in the structural uncertainty grid. The points represent SB_{recent}/SB_{MSY}, the colours depict the models in the grid with the size composition weighting using divisors of 20 and 50.

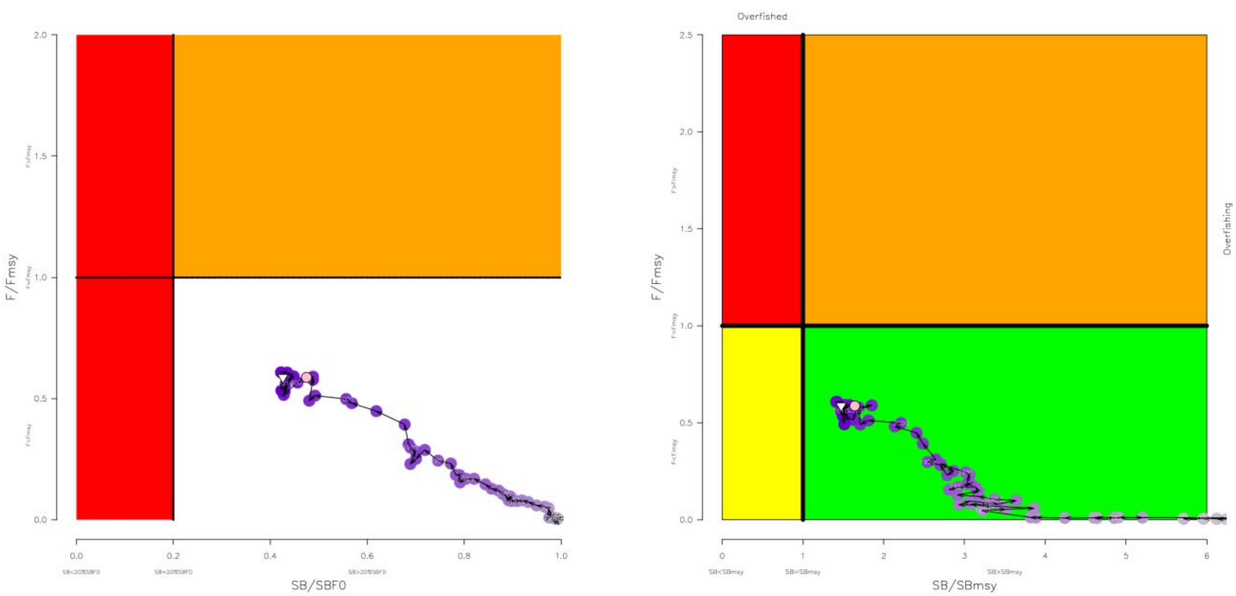


Figure YFT-10. Estimated time-series (or "dynamic") Majuro and Kobe plots from the yellowfin 'diagnostic case' model run.

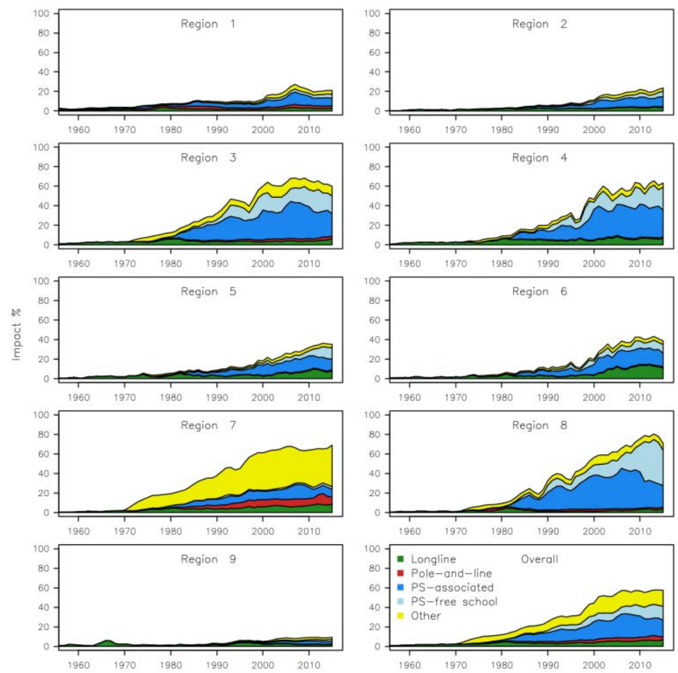


Figure YFT-11. Estimates of reduction in spawning potential due to fishing by region, and over all regions (lower right panel), attributed to various fishery groups (gear-types) for the diagnostic case model.

Table YFT-2. Summary of reference points over the 48 models in the structural uncertainty grid retained for management advice using divisors of 20 and 50 for the weighting on the size composition data. Note that $SB_{recent}/SB_{F=0}$ is calculated where SB_{recent} is the mean SB over 2012-2015 instead of 2011-2014 (used in the stock assessment report), at the request of the Scientific Committee.

	Mean	**Median**	**Min**	**10%**	**90%**	**Max**
C_{latest}	611,982	612,592	606,762	607,517	614,237	614,801
MSY	670,658	670,800	539,200	601,480	735,280	795,200
$Y_{Frecent}$	646,075	643,400	534,400	586,120	717,880	739,600
F_{mult}	1.34	1.36	0.88	1.03	1.61	1.86
F_{MSY}	0.12	0.12	0.07	0.10	0.14	0.16
$F_{recent}/F_{\mathrm{MSY}}$	0.77	0.74	0.54	0.62	0.97	1.13
SB_{MSY}	544,762	581,400	186,800	253,320	786,260	946,800
SB_0	2,199,750	2,290,000	1,197,000	1,366,600	2,784,500	3,256,000
SB_{MSY}/SB_0	0.24	0.24	0.15	0.18	0.28	0.34
$SB_{F=0}$	2,083,477	2,178,220	1,193,336	1,351,946	2,643,390	2,845,244
$SB_{\mathrm{MSY}}/SB_{F=0}$	0.25	0.26	0.16	0.19	0.30	0.35
SB_{latest}/SB_0	0.33	0.34	0.18	0.23	0.42	0.45
$SB_{latest}/SB_{F=0}$	0.35	0.37	0.16	0.22	0.46	0.50
$SB_{latest}/SB_{\mathrm{MSY}}$	1.40	1.39	0.80	1.02	1.80	1.91
$SB_{recent}/SB_{F=0}$	0.32	0.33	0.15	0.20	0.41	0.46
$SB_{recent}/SB_{\mathrm{MSY}}$	1.40	1.41	0.81	1.05	1.71	1.93

SC13 noted that the central tendency of relative recent spawning biomass was median ($SB_{recent}/SB_{F=0}$) = 0.33 with a probable range of 0.20 to 0.41 (80% probable range), and there was a roughly 8% probability (4 out of 48 models) that the recent spawning biomass had breached the adopted LRP with Prob(($SB_{recent}/SB_{F=0}$)<0.2) = 0.08. The median estimate (0.33) is below that estimated from the 2014 assessment grid (($SB_{current}/SB_{F=0}$) = 0.41, see SC10-SA-WP-04), noting the differences in grid uncertainty axes used in that assessment.

SC13 noted that the central tendency of relative recent fishing mortality was median (F_{recent}/F_{MSY}) = 0.74 with an 80% probability interval of 0.62 to 0.97, and there was a roughly 4% probability (2 out of 48 models) that the recent fishing mortality was above F_{MSY} with Prob((F_{recent}/F_{MSY})>1) = 0.04. The median estimate (0.74) is also comparable to that estimated from the 2014 assessment grid ($F_{current}/F_{MSY}$ = 0.76, see SC10-SA-WP-04).

SC13 noted that the assessment results show that the stock has been continuously declining for about 50 years since the late 1960's.

SC13 also noted that levels of fishing mortality and depletion differ between regions, and that fishery impact was highest in the tropical region (Regions 3, 4, 7 and 8 in the stock assessment model), mainly due to the purse seine fisheries in the equatorial Pacific and the "other" fisheries within the Western Pacific (as shown in Figure 44 of SC13-SA-WP-06).

Management advice and implications

Based on the uncertainty grid adopted by SC13 the spawning biomass is highly likely above the biomass LRP and recent F is highly likely below F_{MSY}, and therefore noting the level of uncertainties in the current assessment it appears that the stock is not experiencing overfishing 96% probability) and it appears that the stock is not in an overfished condition (92% probability).

Based on the diagnostic case, both juvenile and adult fishing mortality show a steady increase since the 1970s. Adult fishing mortality has increased continuously over most of the time series, while juvenile fishing mortality has stabilized since the late 1990s at a level similar to that now estimated for adult yellowfin.

SC13 reiterates its previous advice from SC10 that WCPFC could consider measures to reduce fishing mortality from fisheries that take juveniles, with the goal to increase to maximum fishery yields and reduce any further impacts on the spawning potential for this stock in the tropical regions.

SC13 also reiterates its previous advice from SC10 that measures should be implemented to maintain current spawning biomass levels until the Commission can agree on an appropriate target reference point (TRP).

Research Recommendations

SC13 recognized that reviewing yellowfin growth through a study of yellowfin otoliths collected from the WCPO and incorporating this into future assessments should be encouraged.

2.6.7.3 NORTH PACIFIC ALBACORE TUNA

Stock assessment: ISC Albacore Working Group 2017

Stock status and trends

SC13 noted that the ISC provided the following conclusions on the stock status of North Pacific albacore.

Stock status is depicted in relation to the limit reference point (LRP; 20%$SSB_{current, F=0}$) for the stock and the equivalent fishing intensity ($F_{20\%}$; calculated as 1-$SPR_{20\%}$) (Figure NPALB-1). Fishing intensity (F, calculated as 1-SPR) is a measure of fishing mortality expressed as the decline in the proportion of the spawning biomass produced by each recruit relative to the unfished state. For example, a fishing intensity of 0.8 will result in a SSB of approximately 20% of SSB_0 over the long run. Fishing intensity is considered a proxy of fishing mortality. 1

The Kobe plot shows that the estimated female SSB has never fallen below the LRP since 1993, albeit with large uncertainty in the terminal year (2015) estimates. Even when alternative hypotheses about key model uncertainties such as natural mortality and growth were evaluated, the point estimate of female SSB in 2015 (SSB_{2015}) did not fall below the LRP, although the risk increases with these more extreme assumptions (Figure NPALB-1). The SSB_{2015} was estimated to be 80,618 mt and was 2.47 times greater than the LRP threshold of 32,614 mt (Table NPALB-1). Current fishing intensity, $F_{2012-2014}$ (calculated as 1- $SPR_{2012-2014}$), was lower than potential F-based reference points identified for the north Pacific albacore stock, except $F_{50\%}$ (calculated as 1-$SPR_{50\%}$) (Table NPALB-1). Based on these findings, the following information on the status of the North Pacific albacore stock is provided:

- The stock is likely not overfished relative to the limit reference point adopted by the WCPFC (20%$SSB_{current, F=0}$); and
- No F-based reference points have been adopted to evaluate overfishing. Stock status was evaluated against seven potential reference points. Current fishing intensity ($F_{2012-2014}$) is below six of the seven reference points (see ratios in Table NPALB-1), except for $F_{50\%}$.

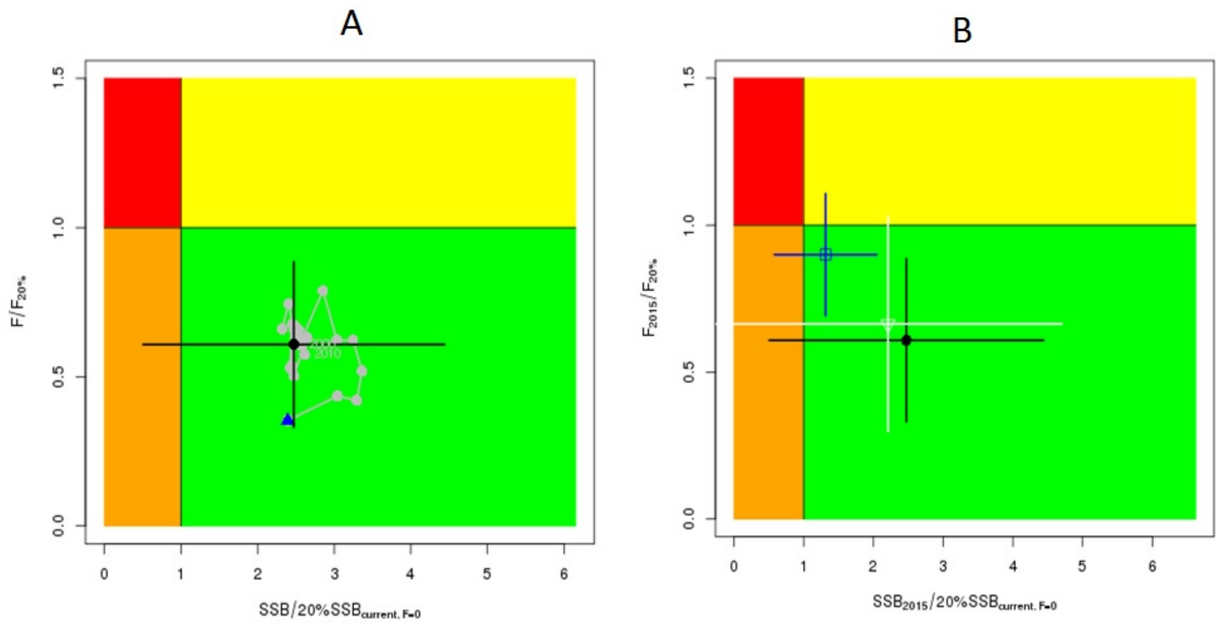


Figure NPALB-1. (A) Kobe plot showing the status of the north Pacific albacore (*Thunnus alalunga*) stock relative to the $20\%SSB_{current,\ F=0}$ biomass-based limit reference point, and equivalent fishing intensity ($F_{20\%}$; calculated as $1\text{-}SPR_{20\%}$) over the base case modelling period (1993-2015). Blue triangle indicates the start year (1993) and black circle with 95% confidence intervals indicates the terminal year (2015). (B) Kobe plot showing stock status and 95% confidence intervals in the terminal year (2015) of the base case model (black; closed circle) and important sensitivity runs with M = 0.3 y^{-1} for both sexes (blue; open square), and CV = 0.06 for L_{inf} in the growth model (white; open triangle). Fs in this figure are not based on instantaneous fishing mortality. Instead, the Fs are indicators of fishing intensity based on SPR and calculated as 1-SPR so that the Fs reflect changes in fishing mortality. SPR is the equilibrium SSB per recruit that would result from the current year's pattern and intensity of fishing mortality.

Table NPALB-1. Estimates of maximum sustainable yield (MSY), female spawning biomass (SSB) quantities, and fishing intensity (F) based reference point ratios for north Pacific albacore tuna for the base case assessment and important sensitivity analyses. SSB_0 and SSB_{MSY} are the unfished biomass of mature female fish and at MSY, respectively. The Fs in this table are not based on instantaneous fishing mortality. Instead, the Fs are indicators of fishing intensity based on SPR and calculated as 1-SPR so that the Fs reflect changes in fishing mortality. SPR is the equilibrium SSB per recruit that would result from the current year's pattern and intensity of fishing mortality. Current fishing intensity is based on the average fishing intensity during 2012-2014 ($F_{2012\text{-}2014}$).

Quantity	Base Case	M = 0.3 y^{-1}	Growth CV = 0.06 for L_{inf}
MSY (t) [A]	132,072	92,027	118,836
SSB_{MSY} (t) [B]	24,770	42,098	22,351

SSB_0 (t) [B]	171,869	270,879	156,336
SSB_{2015} (t) [B]	80,618	68,169	63,719
$SSB_{2015}/20\%SSB_{current,\ F=0}$ [B]	2.47	1.31	2.15
$F_{2012\text{-}2014}$	0.51	0.74	0.57
$F_{2012\text{-}2014}/F_{MSY}$	0.61	0.89	0.68
$F_{2012\text{-}2014}/F_{0.1}$	0.58	0.90	0.65
$F_{2012\text{-}2014}/F_{10\%}$	0.56	0.81	0.63
$F_{2012\text{-}2014}/F_{20\%}$	0.63	0.91	0.71
$F_{2012\text{-}2014}/F_{30\%}$	0.72	1.04	0.81
$F_{2012\text{-}2014}/F_{40\%}$	0.85	1.21	0.96
$F_{2012\text{-}2014}/F_{50\%}$	1.01	1.47	1.16

[A] – MSY includes male and female juvenile and adult fish

[B] – Spawning stock biomass (SSB) in this assessment refers to mature female biomass only.

Management advice and implications

SC13 noted the following conservation information from the ISC:

Two harvest scenarios were projected to evaluate impacts on future female SSB: F at the 2012-2014 rate over 10 years ($F_{2012\text{-}2014}$) and constant catch6 (average of 2010-2014 = 82,432 mt) over 10 years. Median female SSB is expected to decline to 63,483 mt (95% CI: 36,046 - 90,921 mt) by 2025, with a 0.2 and <0.01 % probability of being below the LRP by 2020 and 2025, respectively, if fishing intensity remains at the 2012-2014 level7 (Figure NPALB-2). In contrast, employing the constant catch harvest scenario is expected to reduce female SSB to 47,591 t (95% CI: 5,223 - 89,958 t) by 2025 and increases the probability that female SSB will be below the LRP to about 3.5 and 30 % in 2020 and 2025, respectively (Figure NPALB-3). In addition, as biomass declines during the projection period the fishing intensity approximately doubles by 2025. The probabilities of declining below the LRP in both harvest scenarios are likely higher in the future because projection results did not capture the full envelope of uncertainty. The ALBWG notes that the lack of sex-specific size data, uncertainty in growth and natural mortality, and the simplified treatment of the spatial structure of North Pacific albacore population dynamics are important sources of uncertainty in the assessment. Based on these findings, the following information is provided:

- If a constant fishing intensity ($F_{2012\text{-}2014}$) is applied to the stock, then median female spawning biomass is expected to undergo a moderate decline, with a < 0.01% probability of falling below the limit reference point established by the WCPFC by 2025. However, expected catches in this scenario will be below the recent average catch level for this stock.
- If a constant average catch ($C_{2010\text{-}2014}$ = 82,432 mt) is removed from the stock in the future, then the decline in median female spawning biomass will be greater than in the constant F intensity scenario and the probability that SSB falls below the LRP will

[6] It should be noted that the constant catch scenario is inconsistent with current management approaches for NPALB adopted by the IATTC and the WCPFC.

[7] Median future catch for the constant F scenario is expected to be below the average catch level for 2010-2014 (82,432 t – red line in Figure 7-6). This result is likely due to low estimated recruitment in 2011, which is expected to reduce female SSB beginning in 2015, the first year of the projection period.

be greater by 2025 (30%). Additionally, the estimated fishing intensity will double relative to the current level ($F_{2012\text{-}2014}$) by 2025 as spawning biomass declines.

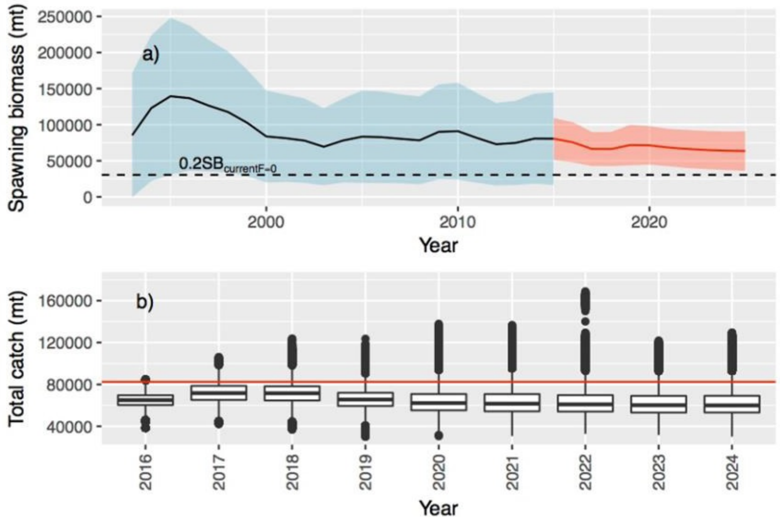


Figure NPALB-2. (A) Historical and future trajectory of North Pacific albacore (*Thunnus alalunga*) female spawning biomass (SSB) under a constant fishing intensity ($F_{2012\text{-}2014}$) harvest scenario. Future recruitment was based on the expected recruitment variability and autocorrelation. Black line and blue area indicates maximum likelihood estimates and 95% confidence intervals (CI), respectively, of historical female SSB, which includes parameter uncertainty. Red line and red area indicates mean value and 95% CI of projected female SSB, which only includes future recruitment variability and SSB uncertainty in the terminal year. (B) Expected annual catch under a constant fishing intensity ($F_{2012\text{-}2014}$) harvest scenario (2016-2025). The red line is the current average catch (2010-2014 = 82,432 mt).

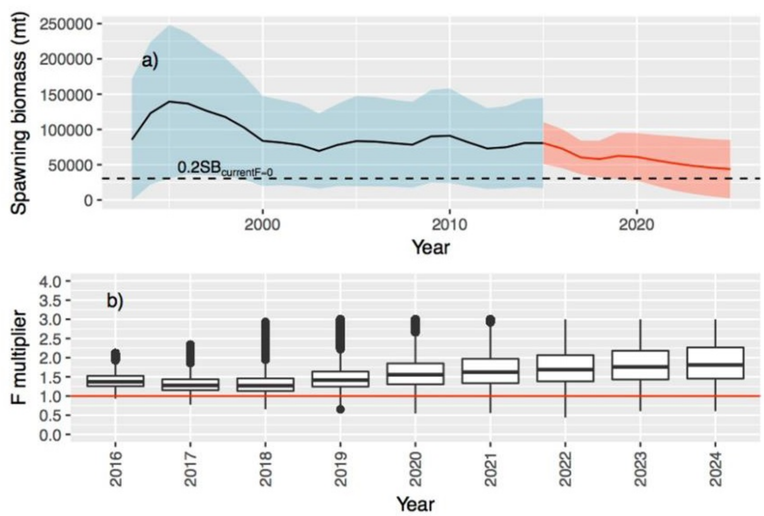


Figure NPALB-3. (A) Historical and future trajectory of North Pacific albacore (*Thunnus alalunga*) female spawning biomass (SSB) under a constant catch (average 2010-2014 = 82,432 mt) harvest scenario. Future recruitment was based on the expected recruitment variability and autocorrelation. Dashed line indicates the average limit reference point threshold for 2012-2014. Black line and blue area indicates maximum likelihood estimates and 95% confidence intervals (CI), respectively, of historical female SSB, which includes parameter uncertainty. Red line and red area indicates mean value and 95% CI of projected female SSB, which only includes future recruitment variability and SSB uncertainty in the terminal year. (B) Projected fishing intensity relative to the current fishing intensity (2012-2014) (red line) under a constant catch scenario (average 2010-2014).

2.6.7.4 NORTH PACIFIC BLUE SHARK

Stock assessment: ISC Shark Working Group, 2017.

Stock status and trends

SC13 noted that the ISC provided the following conclusions on the stock status of North Pacific blue shark.

The assessment uses a fully integrated approach in Stock Synthesis with model inputs that have been greatly improved since the previous assessment. The main differences between the present assessment and the 2014 assessment are: 1) use of SS with a thorough examination of the size composition data and the relative weighting of CPUE and composition data; 2) improved life history information, such as growth and reproductive biology, and their contribution to productivity assumptions; 3) an improved understanding and parametrization of the low fecundity stock recruit relationship (LFSR); 4) catch, CPUE and size time series updated through 2015; 5) a suite of model diagnostics including implementation of an Age Structured Production Model implemented in SS. There remain some uncertainties in the time series based on the quality (observer vs. logbook) and timespans of catch and relative abundance indices, limited size composition data for several fisheries, the potential for additional catch not accounted for in the assessment, and regarding life history parameters.

Extensive model explorations showed that the reference run had the best model performance and showed fits most consistent with the data. The CPUE indices used in the reference case were considered most representative of the North Pacific blue shark stock due to their broader spatial temporal coverage in the core distribution of the stock and the statistical soundness of the standardizations. Alternate CPUE series for the latter part of the time series produced different stock trajectories depending upon the index used, but in each case, median SSB during the last three years exceeded SSBMSY. Using alternate assumptions on stock productivity (i.e., form of the stock recruitment relationship) also resulted in variation in the stock trajectories; assuming stock productivity lower than supported by current biological studies, resulted in lowered spawning stock biomass relative to MSY.

Results of the reference case model showed that the spawning stock biomass was near a time-series high in the late 1970s, fell to its lowest level between 1990 to 1995, subsequently increased gradually to reach the time-series high again in 2005, and has since shown small fluctuations with no apparent trend (Figure NPBSH- 1B) close to the time-series high. Recruitment has fluctuated around 37,000,000 age-0 sharks annually with no apparent trend (Figure NPBSH-1A). Stock status is reported in relation to MSY based reference points.

Based on these findings, the following information on the status of the North Pacific blue shark stock is provided:

a) Female spawning biomass in 2015 (SSB_{2015}) was 69% higher than at MSY and estimated to be 295,774 mt (Table NPBSH-1; Figure NPBSH-1B).

b) The recent annual fishing mortality ($F_{2012\text{-}2014}$) was estimated to be well below F_{MSY} at approximately 38% of F_{MSY} (Table NPBSH-1; Figure NPBSH-1C).

c) The reference run produced terminal conditions that were predominately in the lower right quadrant of the Kobe plot (not overfished and overfishing not occurring) (Figure NPBSH-2).

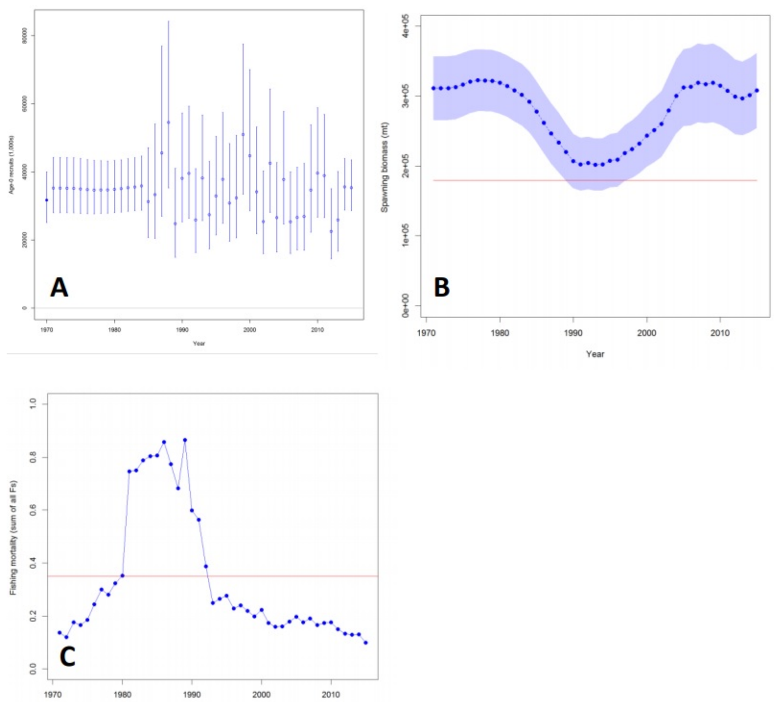


Figure NPBSH- 1. Results of the SS stock assessment reference case model: (A) estimated age-0 recruits (circles) and 95% confidence intervals (vertical bars); (B) estimated female spawning biomass and 95% confidence intervals (blue shaded area); (C) estimated fishing mortality (sum of F's across all fishing fleets). Red solid lines indicate the estimates of SB_{MSY} and F_{MSY} in (B) and (C), respectively.

Table NPBSH-1. Estimates of key management quantities for the North Pacific blue shark SS stock assessment reference case model and the range of values for 13 sensitivity runs.

Management Quantity	Reference Case Model	Range for Sensitivity Runs
SSB_{1971}	301,739 t	174,381 - 980,878 t
SSB_{2015}	295,774 t	140,742 - 1,082,300 t
SSB_{MSY}	175,401 t	100,984 - 482,638 t
F_{1971}	0.15	0.01 - 0.15
$F_{2012-2014}$	0.14	0.06 - 0.15
F_{MSY}	0.36	0.26 - 0.66
SSB_{2015}/SSB_{MSY}	1.69	1.39 - 2.59
$F_{2012-2014}/F_{MSY}$	0.38	0.15 - 0.50

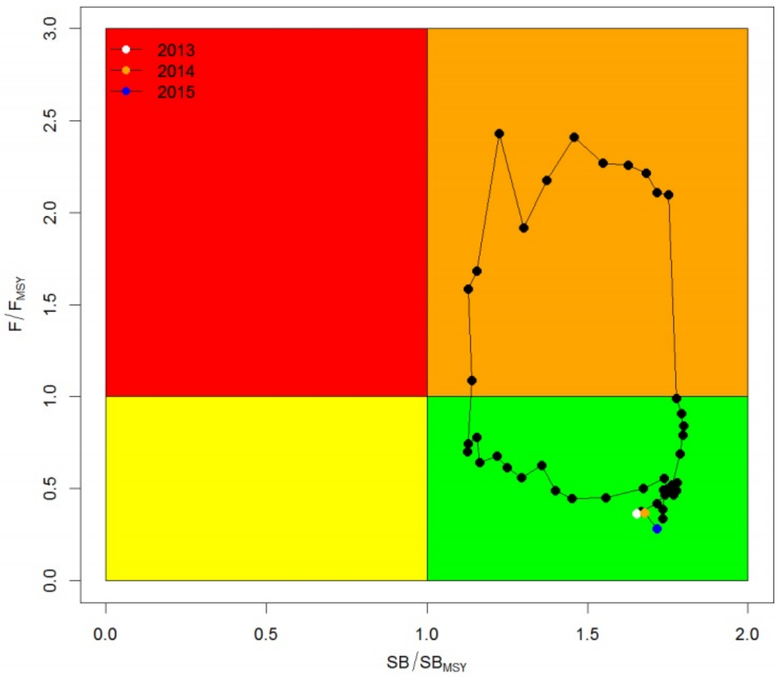


Figure NPBSH- 2. Kobe plot of the trends in estimates of relative fishing mortality and spawning biomass of North Pacific blue shark between 1971-2015 for the reference case of the SS stock assessment model.

Management advice and implications
SC13 noted the following conservation information from ISC.

Target and limit reference points have not yet been established for pelagic sharks by the WCPFC or the IATTC, the organizations responsible for management of pelagic sharks caught in international fisheries for tuna and tuna-like species in the Pacific Ocean.

The 2015 SSB exceeds SSB_{MSY} and $F_{2012-2014}$ is below F_{MSY}. Future projections under different fishing mortality (F) harvest policies (status quo, +20%, -20%, F_{MSY}) show that median BSH biomass in the North Pacific will likely remain above B_{MSY} in the foreseeable future (Table NPBSH-2; Figure NPBSH-3). Other potential reference points were not considered in these evaluations.

Table NPBSH-2. Projected trajectory of spawning biomass (in metric tons) for alternative harvest scenarios.

Year	Average F + 20%	F_{MSY}	Average F - 20%	Average F (2012-2014)
2015	308,286	308,286	308,286	308,286
2016	319,292	319,292	319,292	319,291
2017	328,679	324,591	330,693	329,683
2018	334,827	324,839	339,339	337,069
2019	337,305	323,009	344,621	340,929
2020	339,267	319,719	349,439	344,292
2021	340,833	316,419	353,720	347,185
2022	342,133	313,352	357,498	349,691
2023	343,229	310,601	360,796	351,859
2024	344,166	308,173	363,648	353,728

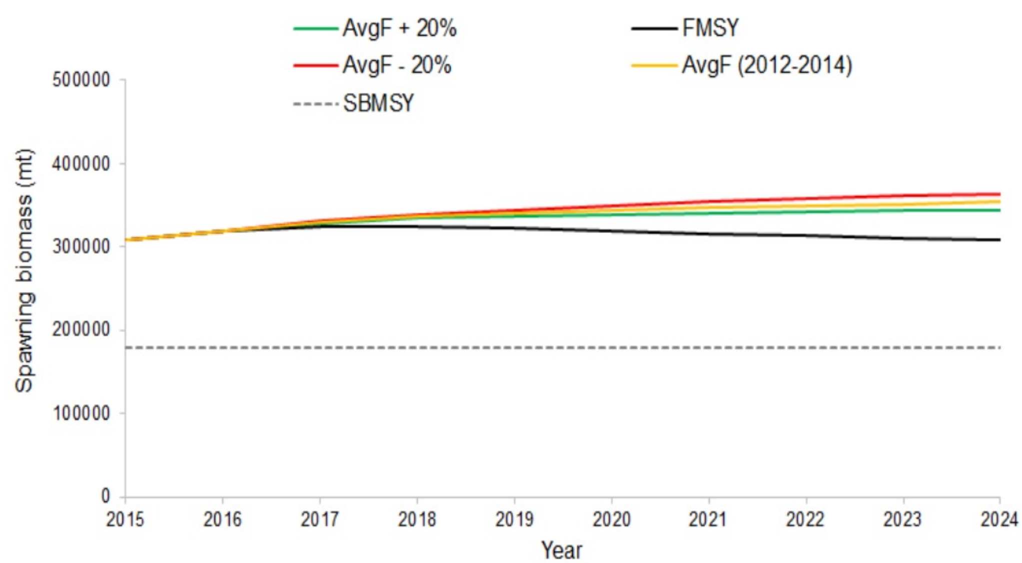


Figure NPBSH-3. Comparison of future projected blue shark spawning biomass under different F harvest policies (status quo, +20%, -20%, and F_{MSY}) using the SS reference case model. Status quo fishing mortality was based on the average from 2012-2014.

2.6.7.5 EASTERN PACIFIC OCEAN BIGEYE TUNA

Stock assessment: Xu et al. 2018

Stock status and trends

1. The assessment of bigeye tuna in the eastern Pacific Ocean (EPO) in 2017 uses the same model as the previous assessment, and includes new and updated data.

2. The results of this assessment indicate a recovering trend for bigeye in the EPO during 2005-2009, subsequent to IATTC tuna conservation resolutions initiated in 2004. However, although the resolutions have continued since 2009, the rebuilding trend was not sustained during 2010-2013, and the spawning biomass ratio (the ratio of the current spawning biomass to that of the unfished population; SBR) gradually declined to a historically low level of 0.15 at the start of 2013. This decline could be related to the below-average recruitments in 2007 and 2008, and coincides with a series of particularly strong La Niña events. Thereafter, the SBR is estimated to have increased markedly, from 0.15 in 2013 to 0.23 at the start of 2016, due mainly to the strong recruitment in 2012; in the model, the estimate is driven mainly by the recent increase in the catch per unit of effort (CPUE) of the longline fisheries that catch adult bigeye. It should be noted that after several years of recent increases, the SBR is estimated to have decreased to 0.21 at the start of 2017, due mainly to the decrease in the CPUE of the longline fisheries for bigeye from 2016 to 2017.

3. There is uncertainty about recent and future levels of recruitment and biomass. At current levels of fishing mortality, and if effort and catchability continue at recent levels and average recruitment persists, the spawning biomass is predicted to decrease towards a SBR of 0.17. This level of spawning biomass is below that corresponding to the maximum sustainable yield (MSY) (0.21).

4. According to the base case assessment, recent fishing mortality rates (*F*) are above the level corresponding to MSY (*F*MSY), whereas recent spawning biomasses (*S*) are slightly above that level. This is a substantial change from the previous assessment, which estimated recent fishing mortality rates below the level corresponding to MSY ($F < F$MSY). These interpretations are subject to uncertainty, but do not exceed the limit reference points; however, they are highly sensitive to the assumptions made about the steepness parameter (*h*) of the stock-recruitment relationship, the weighting assigned to the size-composition data (in particular to the longline size-composition data), the growth curve, and the assumed rates of natural mortality (*M*) for bigeye, as shown in previous assessments. An investigation of the reasons for the change in fishing mortality relative to *FMSY* is described in Document SAC-

5. The following topics should be a priority in future research into the bigeye stock assessment:

a. Investigation of the causes of model misspecification responsible for the two-regime recruitment pattern in the bigeye assessment.
b. Formulation of a growth curve that is more representative of the data.
c. Weighting of the different data sets.
d. Fishery definitions.
e. Stock structure. The IATTC staff will also conduct research aimed at improving the spatial structure in the current bigeye stock assessment model, as well as how best to incorporate the available tagging data. In addition, the staff will continue collaborating with the Secretariat of the Pacific Community (SPC) on a Pacific-wide assessment of bigeye. This will incorporate new tagging data in a spatially-structured population dynamics model, which will help to evaluate potential biases resulting from the current approach of conducting separate assessments for the EPO and the Western and Central Pacific Ocean.
f. Improving the estimates of natural mortality.
g. Improving the indices of relative abundance used in the assessment.
h. Modelling temporal variation in purse-seine selectivity.

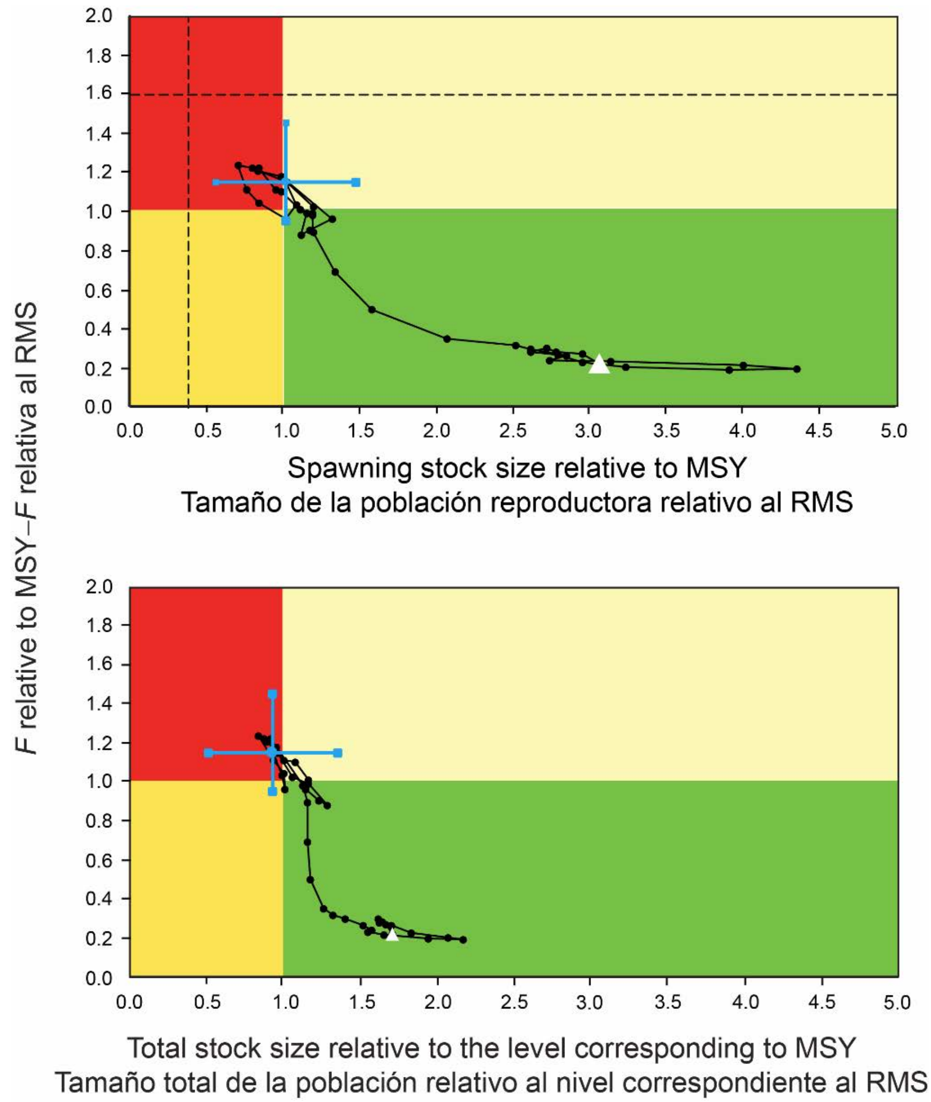


Figure 124. Kobe (phase) plot of the time series of estimates of spawning stock size

(Top panel: spawning biomass; bottom panel: total biomass aged 3+ quarters) and fishing mortality relative to their MSY reference points. The colored panels represent target reference points (SMSY and FMSY; solid lines) and limit reference points (dashed lines) of 0.38 SMSY and 1.6 FMSY, which correspond to a 50% reduction in recruitment from its average unexploited level based on a conservative steepness value (h = 0.75) for the Beverton-Holt stock-recruitment relationship. Each dot is based on the average fishing mortality rate over three years; the large dot indicates the most recent estimate. The squares around the most recent estimate represent its approximate 95% confidence interval. The triangle represents the first estimate (1975). From Xu et al., 2018.

2.6.7.6 EASTERN PACIFIC OCEAN YELLOWFIN TUNA

Stock assessment: Minte-Vera et al. 2018

Stock status and trends

1. The assessment of yellowfin tuna in the eastern Pacific Ocean in 2017 uses the same model as the previous assessment, and includes new and updated data.

2. There is uncertainty about recent and future levels of recruitment and biomass. There may have been three different recruitment productivity regimes since 1975, and the levels of maximum sustainable yield (MSY) and the biomasses corresponding to the MSY (*B*MSY, *S*MSY) may differ among the regimes. The recruitment was below average until 1982, mostly above average from 1983 to 2002, and then mostly below average until 2014. The annual recruitments for 2015 and 2016 were estimated to be at or above average, as is the annual recruitment for 2017. The spawning biomass ratio (SBR) was at or below the MSY level from 2005 through 2017, except during 2008-2010. However, at the start of 2018 it was above the MSY level, following the large recruitments of 2015 and 2016. Under the current (2015-2017 average) fishing mortality, the SBR is predicted to increase in the next two years, and level off at about the MSY level if recruitment is average.

3. The recent fishing mortality (*F*) is slightly above the MSY level (*F*MSY; *F* multiplier = 0.99). The current spawning biomass (*S*) is estimated to be above that level (*S*recent/*S*MSY = 1.08), as is the recent biomass of fish aged 3 quarters and older (*B*) (*B*recent/*B*MSY = 1.35). As noted in Document SAC-07-05b, these interpretations are uncertain, and highly sensitive to the assumptions made about the steepness parameter (*h*) of the stock-recruitment relationship, the average size of the oldest fish (*L*2), and the rate of natural mortality (*M*). The results are more pessimistic if a stock-recruitment relationship is assumed, if a higher value is assumed for *L*2, or if lower rates of *M* are assumed for adult yellowfin. Previous assessments reported that the data components diverge on their information about abundance levels: results are more pessimistic if the weighting assigned to length-frequency data is decreased, and more optimistic if the model is fitted more closely to the index of relative abundance based on the catch per unit of effort (CPUE) of the northern dolphin-associated purse-seine fishery rather than of the southern longline fishery.

4. The highest fishing mortality (*F*) has been on fish aged 11-20 quarters (2.75-5 years). The average annual *F* has been increasing for all age classes since 2009, but in 2017 it showed a slight decline for all age groups.

5. Increasing the average weight of the yellowfin caught could increase the MSY.

6. The following topics continue to be a priority for future research to improve the yellowfin stock assessment:

a. Analysis of changes in spatial distribution of effort for the southern longline fishery, and potential changes in targeting, whether they invalidate the use of the CPUE of this fishery as the main abundance index in the assessment model, and whether a time change in selectivity is needed.
b. Implementation of a large-scale tagging program to address hypotheses about stock structure and regional differences in life-history parameters and depletion.
c. Improved estimates of growth, particularly for older fish.

d. Weighting of the different data sets that are fitted in the assessment model.
e. Refinement of fisheries definitions within the assessment model.
f. Implementation of time-variant selectivity, mainly for the purse-seine fisheries on floating objects.
g. Exploration of alternative assumptions about stock structure within the assessment model.

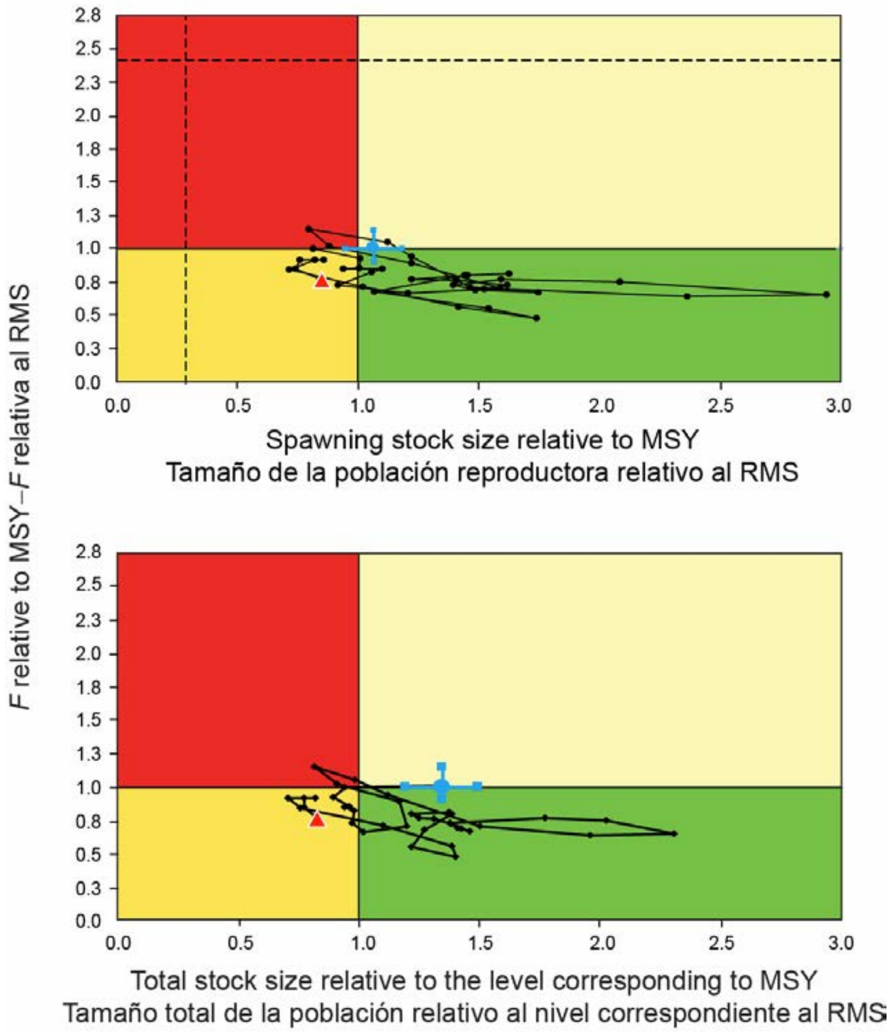


Figure 125. Kobe (phase) plot of the time series of estimates of stock size.

(Top: spawning biomass; bottom: total biomass of fish aged 3 quarters and older) and fishing mortality relative to their MSY reference points. The panels represent target reference points (SMSY and FMSY). The dashed lines represent the interim limit reference points of 0.28 *SMSY and 2.42*FMSY, which correspond to a 50% reduction in recruitment from its average unexploited level based on a conservative steepness value (h = 0.75) for the Beverton-Holt stock-recruitment relationship. Each dot is based on the average exploitation rate over three years; the large red dot indicates the most recent estimate. The squares around the most recent estimate represent its approximate 95% confidence interval. The triangle is the first 3-year period (1975-1977; Minte-Vera et al., 2018).

Table 40. 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}
Skipjack Tuna (EPO)	Unknown	No	Unknown	Unknown	No	Unknown	Maunder 2016	Unknown	Unknown
Yellowfin Tuna (WCPO)	F/F_{MSY}=0.74	No	No	$SB_{2012-2015}/SB_{MSY}$=1.41, $SB_{2012-2015}/SB_{F=0}$=0.33	No	No	Tremblay-Boyer *et al.* 2017	0.8-1.6 yr^{-1}	0.5 B_{MSY}
Yellowfin Tuna (EPO)	F/F_{MSY}=1.01	Yes, because F>MFMT	Not applicable	$SB_{2015-2017}/SB_{MSY}$=1.08, $B_{2012-2015}$/BMSY=1.35	No	No	Minte-Vera *et al*. 2018	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}=0.61	No	No	$SB_{2015}/SB_{F=0}$=0.40	No	No	ISC 2017	0.4 yr^{-1}	0.6 B_{MSY}
Bigeye Tuna (WCPO)	F/F_{MSY}=0.83	No	No	$SB_{2012-2015}/SB_{MSY}$=1.23, $SB_{2012-2015}/SB_{F=0}$=0.32	No, because SSB>MSST	No	McKechnie *et al*. 2017	0.4 yr^{-1}	0.6 B_{MSY}
Bigeye Tuna (EPO)	F/F_{MSY}=1.15	Yes, because F>MFMT	Not applicable	$SB_{2015-2017}/SB_{MSY}$=1.02, $B_{2012-2015}$/BMSY=0.91	No, because SSB>MSST	No	Aires-da_Silva *et al*. 2018	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<MSST	Not applicable	ISC 2016	0.25-1.6 yr^{-1}	~0.75 B_{MSY}
Blue Marlin (Pacific)	F/F_{MSY}=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 (WCNPO)	F_{2012}/F_{MSY}=0.58	No	Unknown	SB_{2012}/SB_{MSY}=1.20	No	Unknown	ISC 2014	0.3 yr^{-1}	0.7 B_{MSY}
Swordfish (EPO)	F_{2012}/F_{MSY} = 1.11	Yes, because F >	Not applicable	SB_{2012}/SB_{MSY} =1.87	No	Unknown	ISC 2014		

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
		MFMT							
Striped Marlin WC (N. Pacific)	F/F_{MSY}=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}
Striped Marlin (NEPO)	Not provided in assessment	No	No	$SB_{(2009)}/SB_{MSY}$=1.5	No	Unknown	Hinton and Maunder 2011	0.5 yr^{-1}	0.5 B_{MSY}
Blue Shark (N. Pacific)	F/F_{MSY}=0.38	No	Unknown	$SB_{2012-2014}/SB_{MSY}$=1.69	No	Unknown	ISC 2017	0.145-0.785 yr^{-1}	~0.8 B_{MSY}
Oceanic white-tip shark (WCPO)	F/F_{MSY}=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/F_{MSY}=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}
Silky Shark (EPO)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Longfin mako shark (N. Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Shortfin mako shark (N. Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Common thresher shark (N. Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bigeye thresher shark N. Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Pelagic thresher shark (N. Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Salmon shark (N. Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Mahimahi (Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

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
Wahoo (Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Opah (Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Pomfret (family Bramidae, W. Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Black marlin (Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Shortbill spearfish (Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Sailfish (Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Kawakawa (Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Oilfish (family Gempylidae, Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Other tuna relatives (*Auxis* spp., *Allothunnus* spp., and *Scomber* spp, Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Squids (Pacific)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

[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 2017.

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 2015-2017, as reported to the WCPFC (NMFS PIFSC, unpublished data).

Table 41. U.S. and Territorial longline catch (mt) by species in the WCPFC Statistical Area from 2015 to 2017.

	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		
	2017	**2016**	**2015**	**2017**	**2016**	**2015**	**2017**	**2016**	**2015**	**2017**	**2016**	**2015**	**2017**	**2016**	**2015**	**2017**	**2016**	**2015**
Vessels	**136**	**133**	**135**	**119**	**117**	**117**		**118**	**112**	**118**	**23**	**22**	**15**	**20**	**21**	**150**	**151**	**156**
Albacore, North Pacific	74	208	197							16	34	19				90	243	217
Albacore, South Pacific			0										1,381	1,517	1,855	1,381	1,517	1,855
Bigeye tuna	2,968	3,747	3,427	997	879	999		932	856	1,330	586	441	64	72	116	5,358	6,216	5,840
Pacific bluefin tuna	0	0	0							0			1	0	6	2	1	6
Skipjack tuna	157	186	176							35	26	11	63	94	67	254	306	254
Yellowfin tuna	1,761	1,093	681							293	175	105	533	386	255	2,587	1,654	1,041
Other tuna		0	0								0						0	0
TOTAL TUNA	**4,960**	**5,234**	**4,482**	**997**	**879**	**999**		**932**	**856**	**1,674**	**821**	**577**	**2,042**	**2,069**	**2,299**	**9,673**	**9,936**	**9,214**
Black marlin	0	1	0							0		0	0			1	1	0
Blue marlin	485	419	445							84	57	55	38	30	25	606	506	525
Sailfish	9	15	11							2	2	2	1	2	2	12	19	15
Spearfish	206	251	188							26	28	15	2	2	1	234	281	204
Striped marlin, North Pacific	286	280	378							48	48	36				334	327	414
Striped marlin, South Pacific			0										2	2	3	2	2	3
Other marlins	1	1	1							0		0				1	1	1
Swordfish, North Pacific	924	596	665							49	43	24				973	639	690
Swordfish, South Pacific			0										6	6	8	6	6	8
TOTAL BILLFISH	**1,910**	**1,562**	**1,688**							**209**	**179**	**133**	**48**	**41**	**40**	**2,168**	**1,782**	**1,861**
Blue shark											0			1	1		1	1
Mako shark	30	37	35							5	9	4	0	0		35	46	39
Thresher	2	3	5							0	0	1	1	0		3	4	6
Other sharks	0	0											0	0		0	0	
Oceanic whitetip shark														0				
Silky shark	0															0		
Hammerhead shark		0															0	
Tiger shark																		
Porbeagle																		
TOTAL SHARKS	**32**	**40**	**40**							**6**	**10**	**5**	**1**	**1**	**1**	**39**	**51**	**45**
Mahimahi	147	202	199							22	28	21	14	4	6	183	234	226
Moonfish	258	304	279							61	74	55	1	2	2	321	380	336
Oilfish	93	160	165							21	29	20	0	2	0	115	191	185
Pomfret	261	339	380							38	46	39	0	0	0	299	386	419
Wahoo	218	309	256							35	47	27	48	47	58	301	403	340
Other fish	2	7	7							0	1	1	0	1	1	3	9	9
TOTAL OTHER	**980**	**1,322**	**1,285**							**178**	**224**	**164**	**64**	**55**	**66**	**1,222**	**1,602**	**1,515**
GEAR TOTAL	**7,883**	**8,158**	**7,495**	**997**	**879**	**999**		**932**	**856**	**2,067**	**1,235**	**878**	**2,155**	**2,167**	**2,405**	**13,101**	**13,371**	**12,634**

Source: NMFS (2018).

Table 42. U.S. longline catch (mt) by species in the North Pacific Ocean from 2013 to 2017.

	U.S. (ISC)				
	2017	2016	2015	2014	2013
Vessels	145	141	143	141	136
Species					
Albacore, North Pacific	95	248	243	208	317
Albacore, South Pacific					
Bigeye tuna	7,984	8,229	8,774	7,131	6,493
Pacific bluefin tuna	1	0	0	0	1
Skipjack tuna	221	240	212	187	233
Yellowfin tuna	2,584	1,512	921	658	736
Other tuna		0	0		0
TOTAL TUNA	10,885	10,230	10,150	8,185	7,781
Black marlin	1	1	0	1	1
Blue marlin	684	554	631	535	406
Sailfish	15	19	15	19	12
Spearfish	303	340	263	218	213
Striped marlin, North Pacific	411	390	493	426	398
Striped marlin, South Pacific					
Other marlins	1	1	2		1
Swordfish, North Pacific	1,617	1,092	1,516	1,665	1,270
Swordfish, South Pacific					
TOTAL BILLFISH	3,032	2,397	2,919	2,864	2,300
Blue shark		0			1
Mako shark	71	70	59	53	52
Thresher	4	4	7	7	6
Other sharks	0	0			0
Oceanic whitetip shark					0
Silky shark	0				
Hammerhead shark		0			
Tiger shark					
Porbeagle					
TOTAL SHARKS	75	74	66	60	59
Mahimahi	259	296	328	389	403
Moonfish	1,038	982	1,207	1,043	952
Oilfish	151	218	239	235	262
Pomfret	402	471	564	509	466
Wahoo	356	418	354	313	213
Other fish	3	9	8	6	10
TOTAL OTHER	2,208	2,394	2,700	2,495	2,307
GEAR TOTAL	16,200	15,094	15,835	13,603	12,447

Table 43. U.S. longline catch (mt) by species in the Eastern Pacific Ocean from 2013 to 2017.

	All U.S. vessels					U.S. vessels ≥ 24 m					U.S. vessels ≤ 24 m				
	2017	2016	2015	2014	2013	2017	2016	2015	2014	2013	2017	2016	2015	2014	2013
Vessels	131	123	131	126	120	29	24	30	34	30	102	99	101	92	90
Species															
Albacore, North Pacific	5	6	26	23	19	2	2	19	17	6	3	4	7	6	13
Albacore, South Pacific			0												
Bigeye tuna	2,690	2,084	3,050	2,073	2,043	492	306	553	508	587	2,198	1,778	2,497	1,564	1,457
Pacific bluefin tuna	0		0	0	0	0			0	0			0		0
Skipjack tuna	29	29	25	11	11	4	5	5	2	3	25	23	20	9	8
Yellowfin tuna	530	244	134	61	43	86	33	38	18	23	444	211	96	43	20
Other tuna															
TOTAL TUNA	3,254	2,362	3,234	2,168	2,117	584	346	615	545	619	2,671	2,016	2,620	1,622	1,498
Black marlin	0	0			0						0	0			0
Blue marlin	115	78	131	76	59	15	7	9	17	14	100	70	123	59	45
Sailfish	4	2	2	4	1	0	0	0	1	0	4	2	2	2	1
Spearfish	71	60	59	44	38	10	7	6	9	9	61	53	53	35	29
Striped marlin, North Pacific	77	62	79	69	70	10	11	9	13	19	67	51	70	55	51
Striped marlin, South Pacific															
Other marlins	0	0	1			0		0		0		0	1		0
Swordfish, North Pacific	644	453	826	786	687	388	253	347	388	279	257	200	479	397	408
Swordfish, South Pacific															
TOTAL BILLFISH	912	656	1,099	978	854	423	279	371	429	321	489	377	728	549	534

	All U.S. vessels					U.S. vessels ≥ 24 m					U.S. vessels ≤ 24 m				
	2017	2016	2015	2014	2013	2017	2016	2015	2014	2013	2017	2016	2015	2014	2013
Blue shark		0										0			
Mako shark	35	24	20	16	14	21	10	9	10	7	14	14	10	6	6
Thresher	1	0	2	1	1	0	0	0		0	1	0	1	1	1
Other sharks		0										0			
Oceanic whitetip shark															
Silky shark															
Hammerhead shark															
Tiger shark															
Porbeagle															
TOTAL SHARKS	36	25	21	17	14	22	10	10	10	7	15	14	12	7	7
Mahimahi	90	65	108	138	129	9	10	9	35	35	80	56	98	103	94
Moonfish	718	604	872	637	504	163	99	156	165	145	555	506	717	472	359
Oilfish	37	29	54	53	47	7	6	11	16	14	30	23	44	37	33
Pomfret	103	86	145	117	108	24	10	22	30	30	79	76	123	87	78
Wahoo	103	62	72	51	27	17	12	14	12	8	85	50	58	39	18
Other fish	0	0	0	0	0	0		0	0	0	0	0	0	0	0
TOTAL OTHER	1,051	847	1,252	997	814	221	136	212	258	231	830	710	1,040	739	583
GEAR TOTAL	5,253	3,889	5,606	4,160	3,800	1,249	772	1,207	1,243	1,178	4,005	3,117	4,399	2,917	2,622

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3 FISHERY ECOSYSTEMS

3.1 SOCIOECONOMICS

The socioeconomics section outlines the pertinent economic, social, and community information available for assessing the performance of Fishery Ecosystem Plan management measures for the Pelagic Fisheries (WPRFMC 2016). This section meets the objective "Support Fishing Communities" adopted at the 165th Council meeting; specifically, it identifies the various social and economic groups and their interconnections within the region's fishing communities. The section begins with an overview of the socioeconomic context for the region, and then provides a summary of relevant general studies and data for each jurisdiction, followed by summaries of relevant studies and data for each specific 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. In doing so, the measures would ensure the community's sustained participation in fisheries and minimize associated adverse economic impacts provided that these considerations do not compromise local conservation. Unlike other regions of the United States, the settlement of the Western Pacific region was intimately tied to the sea (Figure 126), which is reflected in local culture, customs, and traditions.

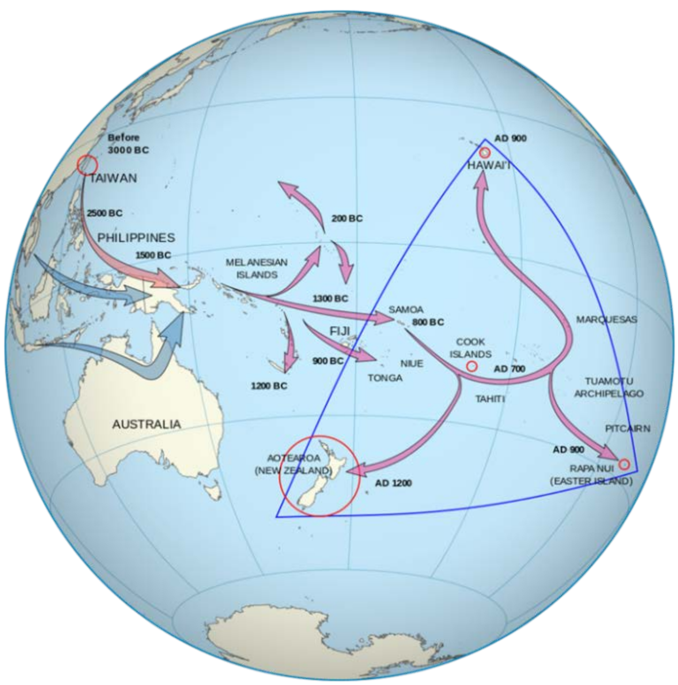

Figure 126. Settlement of the Pacific Islands[1].

[1] Source: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 hold similar significance for many marine resources. Thus, fishing and seafood are integral ways of life in the local community. This is reflected in the amount of seafood eaten in the region in comparison with the rest of the United States, as well as in the language, customs, ceremonies, and community events of the region(s). Because fishing is such an integral part of the culture, it is difficult to discern commercial from non-commercial fishing, with many trips involving multiple motivations and multiple uses of the catch landed. While economics are an important consideration, fishermen report other motivations (e.g. customary exchange) as being equally important, if not more so. Due to changing economies and westernization, recruitment of younger fishermen has become 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, Hawaii, the Council reiterated its recommendation that NMFS expedite economic analysis on the impact of U.S. purse seine effort limits in American Samoa. This analysis was completed and presented at the 168th Council meeting in Honolulu, Hawaii (WPRFMC 2016).

In addition, the Council approved modifications to the FEP objectives, one of which is to support fishing communities by identifying the various social and economic groups and their interconnection within the region's fishing communities. This section meets this objective.

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

In addition, the Council directed staff to develop a brief report identifying data sources, data quality, and data coverage for each required socioeconomic parameter in the 2017 Annual SAFE Reports as resources permit. This report should also identify the quality and coverage of this data in addition to any gaps. The data synthesis presented here was conducted and used to guide the development of the associated text for this section.

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 section is the first effort at including the importance of community and extended cultural and social values into these reports.

- To break out trip costs by island for the CNMI section, as trip costs vary by island. This section 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 Annual SAFE Report. The CNMI Department of Commerce Statistical Yearbook was reviewed in the development of this section. 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 an official profession. For these reasons, occupational information was not included in this section.
- To include enhanced information on social, economic, and cultural impacts of a changing climate associated with 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 that NMFS PIFSC 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 conducted over the course of 2017.

At its 168th meeting held in Honolulu, Hawaii, the Council requested that NMFS PIFSC provide information on catch and CPUE for trolling vessels and continue analysis of economics in the American Samoa longline fishery. The 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 as resources allow.

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. The Pacific Islands Regional Office (PIRO) is considering future work on this topic.

The Council also requested that the NMFS PIFSC socioeconomic program undertake the release of the “Community Snapshot Tool” once available to Council, PIRO, and other groups so that these groups know how to utilize the tool for policy analysis, etc. The tool began development in 2017 starting with Hawaii.

Finally, the Council requested that the PIFSC socioeconomic program complete the economic impact analysis of the NWHI 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 American Samoa FEP (WPRFMC 2016a). Over the past decade, a number of studies have synthesized more specifics about the role of fishing and marine resources in American Samoa, as well as information about the people who engage in the fisheries or use of fishery resources (Armstrong et al. 2011; Grace-McCaskey 2015; Levine and Allen 2009; Richmond and Levine 2012). These studies describe the importance of marine resources in cultural, economic, and subsistence aspects of Samoan village life. Fishing was held in high esteem in traditional Samoan culture, with proficiency in fishing bringing high social status; fishing activities were featured prominently in Samoan mythology as well. The basic units of Samoan social structure are the family and village, with the family as the central unit. The village leadership would decide, according to season, what sort of community fishing should take place. The tautai, or master fishermen of the village, were key decision makers who were awarded higher status than others when it came to matters of fishing (even those that might otherwise outrank him). 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 help 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 of the territory's people (93%). 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. Through this time, modern fishing gears and new technologies were 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 locals' 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 at least once a week. 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 surrounding EEZ, and certain special provisions of U.S. law that allowed the development of the 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 (ASG 2016), main imports include fish brought in for processing. Exports are primarily canned tuna and by-products, including fish meal and pet food. In 2016, domestic exports (including re-exports) from American Samoa amounted to $385,152,000, of which $371,214,000 (or 96%) was from canned tuna (American Samoa Government, 2016). 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 2016, the ASG employed 6,585 people (37% of total employment; American Samoa Government, 2016), and the private sector employed 8,502 people (Figure 127). Supporting data for Figure 127 are provided in Table A-112. The canneries employed 2,843 people, which is 16% of the total people employed in the territory. Ancillary businesses involved in re-provisioning the fishing fleet generate a significant number of jobs and income for local residents.

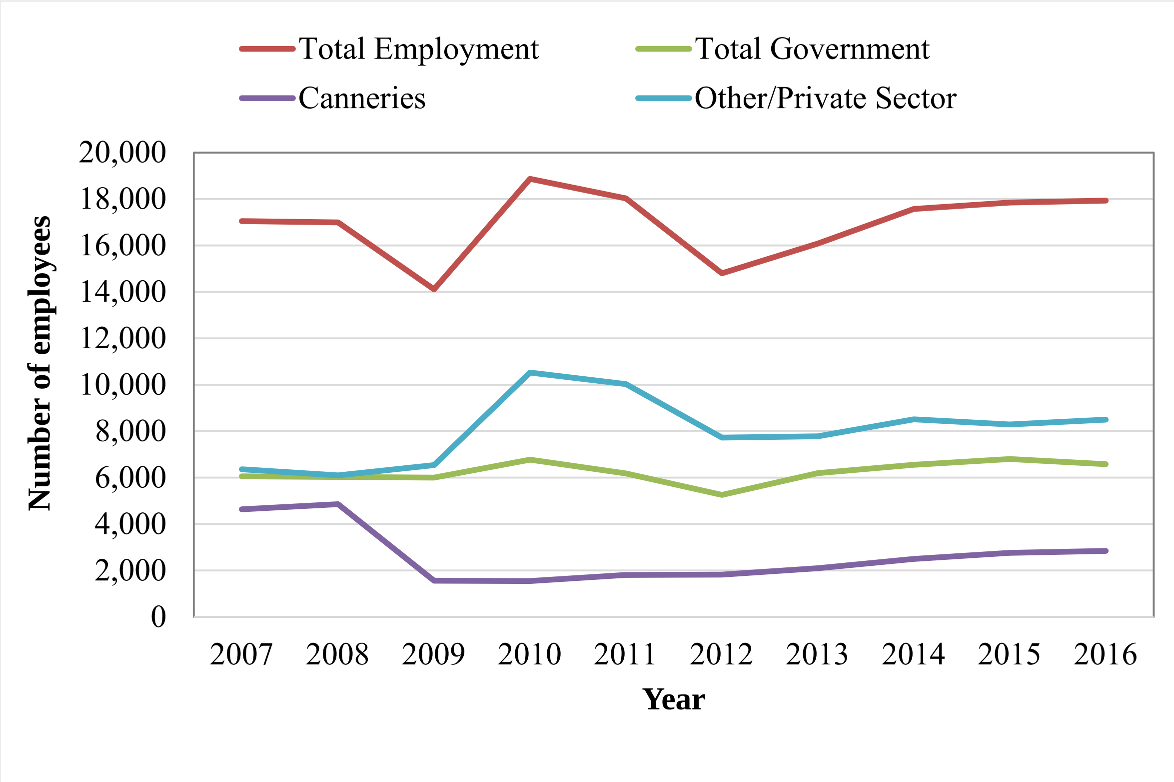

Figure 127. American Samoa Employment Estimates from 2007-2016[1].

[1] Source: American Samoa Statistical Yearbook 2016, American Samoa Government (2016).

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 uncertain for nearly 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 before reopening in 2015. In October 2016, SunKist Co. suspended operations due to lack of fish, partly because of the 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). 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 have yet to be detailed.

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. 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.

In 2017, understanding the relationship of pelagic fisheries with cultural fishing practices took on a greater focus. During the peak of longline landings in 2002, the National Marine Fisheries Service (NMFS) created a Large Vessel Prohibited Area (LVPA) to prevent gear conflicts and catch competition between large and small vessels, as well as to preserve opportunities for fishing by American Samoa's small boat ("alia") fleet (NOAA 2017). Since 2002, both large and small vessels have experienced declining catch rates, fish prices, and increasing fuel and operating costs. In 2016, NMFS published an exemption to the LVPA rule to allow large U.S. vessels holding a Federal American Samoa longline limited entry permit to fish in portions of the LVPA (NOAA 2016). NMFS and the Council were then sued by the American Samoa government, who claimed that the 1900 and 1904 Deeds of Cession were not considered in the rulemaking process. The U.S. District Court ruled in favor of American Samoa in March 2017, requiring NMFS to preserve American Samoan cultural fishing practices as part of their obligations to the Deeds of Cession. The discussion on defining cultural fishing is ongoing.

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, with only 3% of those who fish stated that they frequently did so to sell their catch and 62% never selling 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, limited income has made American Samoans less inclined to engage in strenuous fishing activities when food imports are relatively more 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 availability of low-cost fish for many residents and ensured that the livelihood of American Samoans are still tightly tied to fishing activities.

As described in the FEP, 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.

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

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, a preference to buy fish at the market rather than expend effort in fishing, and an increased availability of inexpensive imported reef fish from Western Samoa and Tonga are also likely contributing to decreasing rates of subsistence fishing in the region (Richmond and Levine 2012).

3.1.2.3 AMERICAN SAMOA LONGLINE

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 and land catch with longline gear in the EEZ around Guam, the CNMI, and the Pacific Remote Island Areas. It may not, however, be used to fish with longline gear in the Hawaii EEZ.

The American Samoa longline fishery faces many challenges in recent years. 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). Pan (2015) also 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. The small-scale alia fleet has been reduced to one vessel that still operates.

3.1.2.3.1 Commercial Participation, Landings, Revenue, and Prices

American Samoa longline includes large longline vessels (> 50ft.) and small longline vessels (alia boats). There were 14 large longline active vessels (> 50 ft.) and only one active small (alia) vessels in 2017. The total landings and revenue presented in the "longline fishery" in this report included the alia longline vessel. American Samoa longline mainly targets albacore, different from the Hawaii longline that targets bigeye tuna and swordfish. American Samoa longline, especially the large vessels, sold majority of their catches to the local canaries. In 2017, the total fleet revenue (estimated landed value) was $4.7 million, and albacore composed of over 71% of the total landed value. Other main species included yellowfin, bigeye, skipjack, and wahoo. The estimated value of the species landed were 23%, 2%, 2%, and 1.5%, respectively. All the five species are sold to the canneries in American Samoa and they composed of over 99% of the total revenue of the fleet. Figure 128 presents the trends of commercial landings and revenue from 2008-2017. Supporting data for Figure 128 are provided in Table A-113, and the table also shows the average fish price of total longline landings.

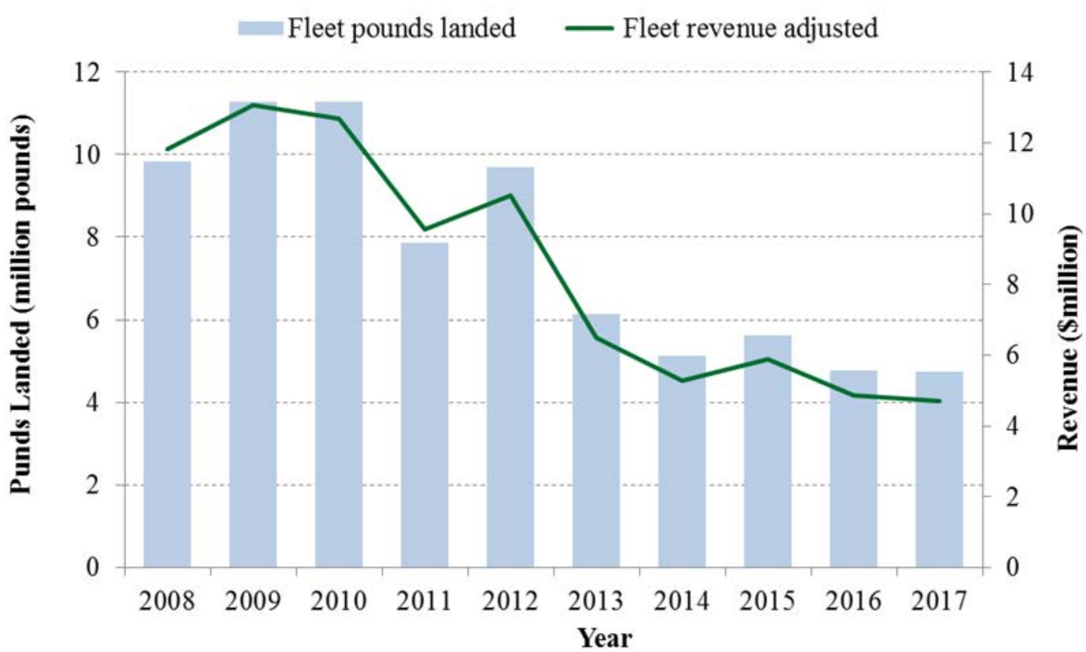

Figure 128. Commercial landings and revenues of the American Samoa longline fishery from 2008-2017 adjusted to 2017 dollars[1].

[1] Data source: Pacific Islands Fisheries Science Center: Fishery Economic Performance Measures (Tier 1 indicators). https://inport.nmfs.noaa.gov/inport/item/46097).

The price data for the five main species harvested by American Samoa longline were collected through in-person interview with fisheries since 2012. The trend of albacore price from 2012 to 2017 is presented in Figure 129. Supporting data for Figure 129 are presented in Table A-114. The albacore price was in the lowest in 2013, dropping from the peak at 2012. The albacore price went up in later years, but did not reach to its highest point. In 2017, the average albacore price was $1.16 per pound (whole weight), or $2559 per metric ton, $0.01 per pound higher than that in the previous year.

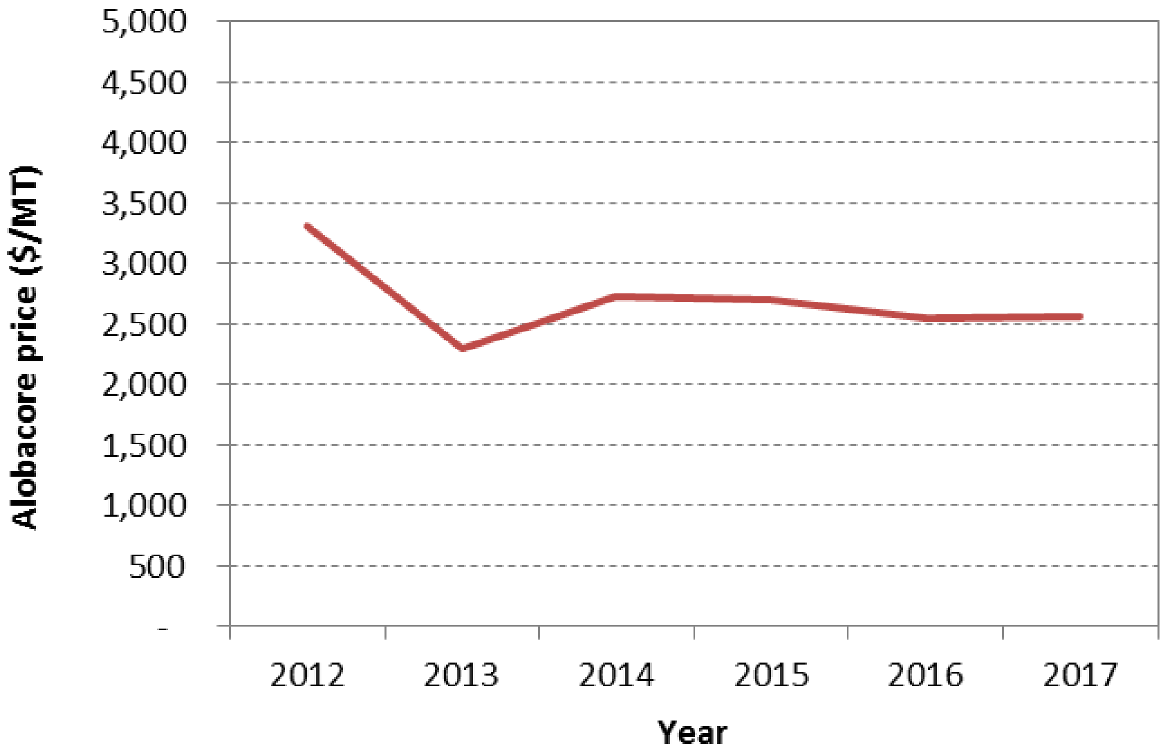

Figure 129. Albacore whole-weight price as reported by American Samoan fishers for 2012-2017 adjusted to 2017 dollars[1].

[1] Data source: Pacific Islands Fisheries Science Center, economic data collection program (Pan, 2018 in review).

3.1.2.4 COST OF FISHING FOR AMERICAN SAMOA LONGLINE

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. Fisher participation in the economic data collection program is voluntary. 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 the main cost items, including diesel fuel, engine oil, and bait, information is collected on unit price, quantity used, and total cost. For other items, such as gear, provisions, and communications, information is collected on total cost only. Often it was difficult for observers to collect trip cost data when vessels were operated by hired captains. In an effort to increase the number of observations for the economic data collection program, PIFSC economists began to supplement observer data by traveling to American Samoa to conduct in-person interviews of owners or agents starting in 2012. The details of the data collection program were descripted in the NOAA tech memo (Pan 2018, in review).

Figure 130 shows the cost structure for an average trip of American Samoa longline in 2017, while Figure 131 presents the trends of costs per set for the period of 2008-2017. The data supporting Figure 131 are presented in Table A-115. Using the average per set can be a better index to examine the cost trend across the years, because the average trip length (total trip days) for the American Samoa longline fleet varied substantially over the years. Fuel costs usually compose of about 50% of trip costs. The percentages of fuel costs to total trip costs were relatively lower in 2015-2017, compared to previous years, due to lower fuel price. The percentages of fuel costs among the total fishing costs (per set) were also relatedly lower in the recent three years. The fuel price in 2017 was slightly higher than that in 2016. It can be observed from Figure 131 that the fishing cost per set fluctuated across years.

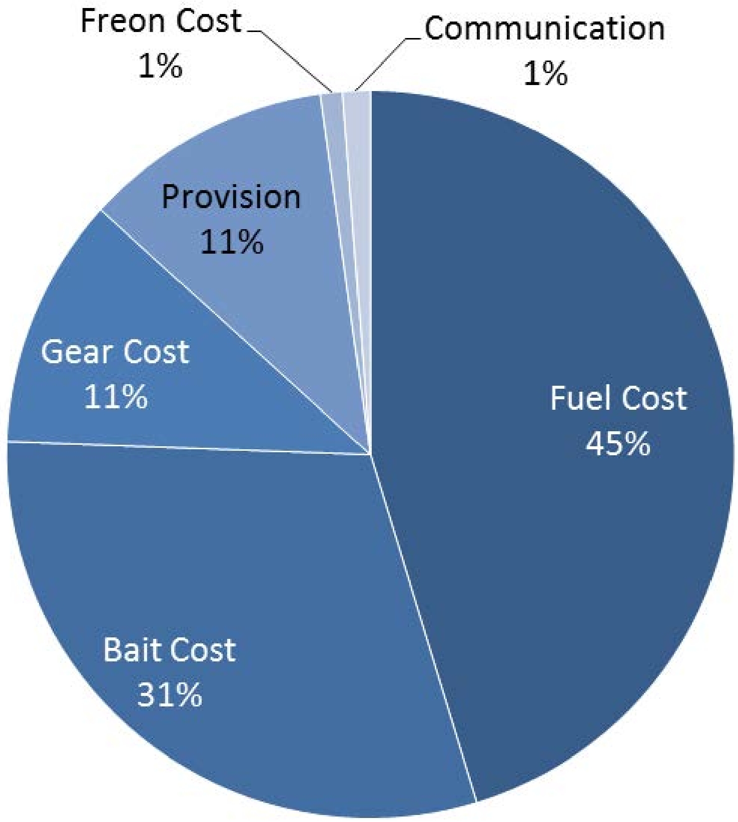

Figure 130. The cost structure for an average American Samoa longline trip in 2017[1].

[1] Data source: PIFSC economic data collection program (Pan 2018, in review).

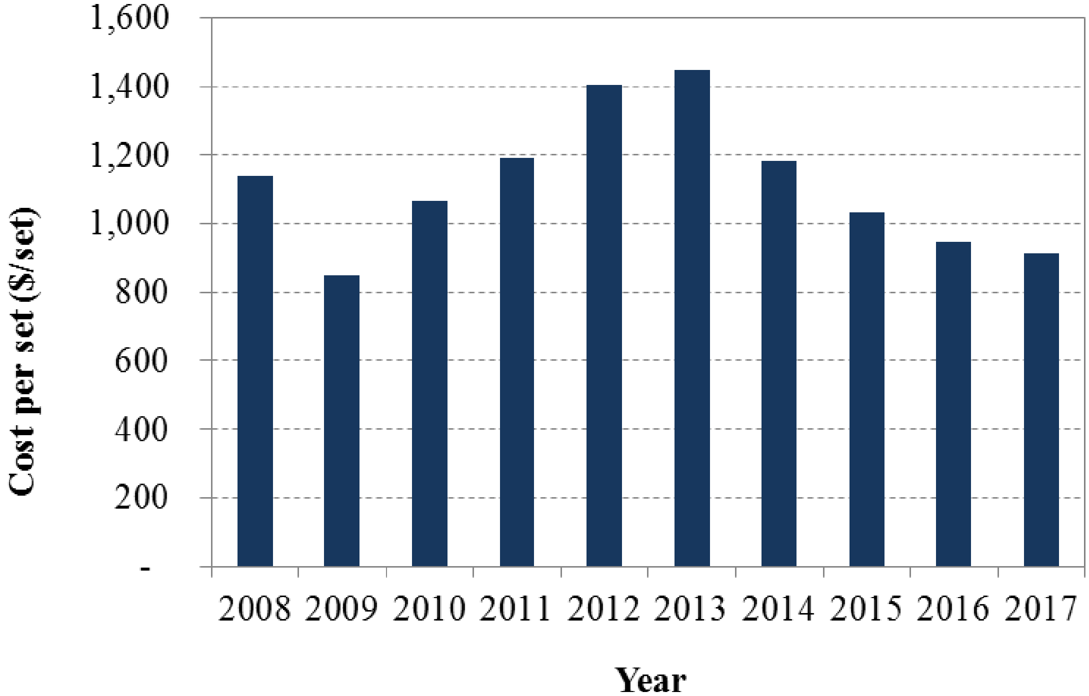

Figure 131. Costs per set[1] for the American Samoa Longline Fishery (not including labor cost and fixed costs)from 2008-2017 adjusted to 2017 dollars[2].

[1] Data source for the costs per set were generated by database built upon the cost data collected by the continuous economic data collection program and the fisheries data provided by the Pacific Islands Fisheries Science Center. The details of the data collection program and database development were described in the NOAA tech memo (Pan 2018, in review).
[2] Inflation-adjusted revenue (in 2017 dollars) uses the American Samoa Consumer Price Index (CPI) to convert nominal into real values for the American Samoa longline fishery. The American Samoa CPI is based on the Yearbook (http://doc.as.gov/research-and-statistics/statistical-yearbook/) for 2008-2017.

3.1.2.4.1 Economic Performance Measures

The continuous economic data collection program allows for the monitoring of variation in the fishing cost over time. Compiling the revenue data, it is possible to measure the economic performance in term of net revenue and monitor the changes. Figure 132 presents the trends of net revenue per set for the period of 2008 to 2017 . The data supporting Figure 132 are in Table A-115. Using the average per set can be a better index, compared to the average per trip, to present the revenue and cost trends for comparisons across the years, because the average trip length (total trip days) for the American Samoa longline fleet varied substantially over the years. Figure 132 shows a downward trend in the economic performance during 2008-2017. As fishing cost per set fluctuated across years, net revenue per set went down since revenue per set in a downward trend.

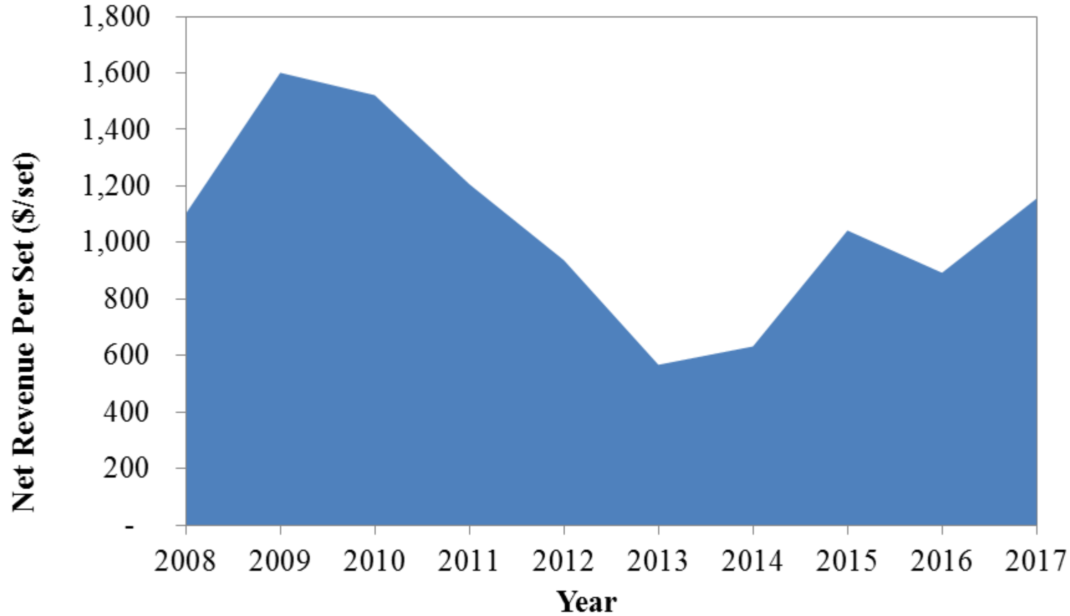

Figure 132. Revenue, net revenue, and net revenue per set for the American Samoa longline fishery from 2008-2017 (adjusted to 2017 dollars)[1].

[1] Data source: PIFSC economic data collection program (Pan, 2018 in review).

In addition to the measurement of the net revenue, 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. For American Samoa longline fishery, this section will present revenue performance metrics of (a) total revenue per day at sea, (b) revenue per vessel, and (c) Gini coefficient (while b and c are both shown in the same figure).

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. Data on aggregate revenue from species in fishery per-day-at-sea and revenue per vessel calculation (for Gini coefficient) are from Pacific Islands Fisheries Science Center, data run for the Fishery Economic Performance Measures (Tier 1 indicators). Trends in fishery revenue per day are shown Figure 132, while the trends in revenue distribution (Gini coefficient) are shown in Figure 133. Supporting data are provided in Table A-116 and Table A-117. The revenue per-day-at-sea was in a declining trend in American longline fishery during 2006 to 2016.

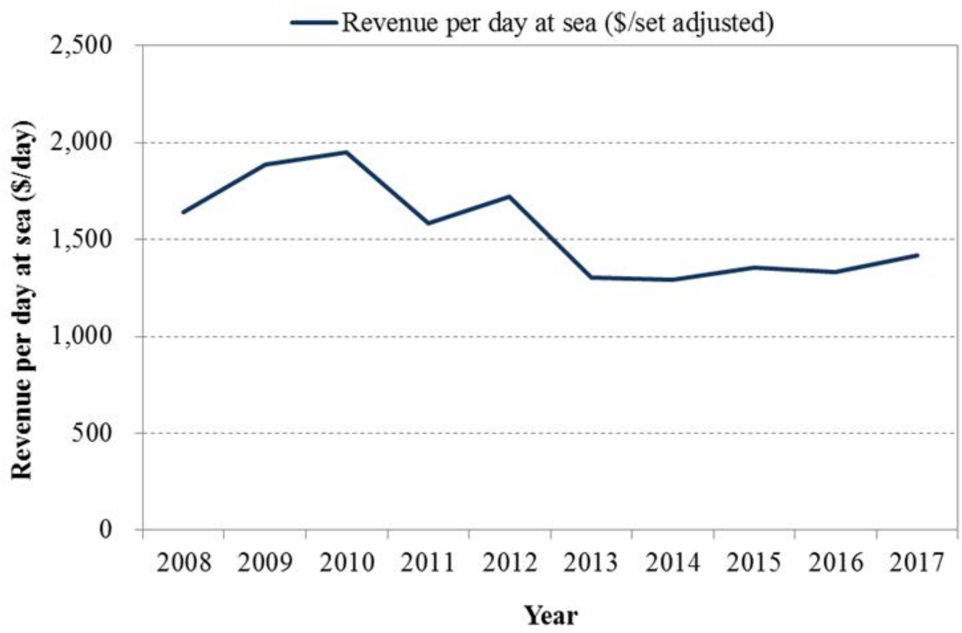

Figure 133. Revenue per-day-at-sea for the American Samoa longline fishery, 2008-2017[1].

[1] Data sourced from the Pacific Islands Fisheries Science Center: Fishery Economic Performance Measures (Tier 1 indicators). https://inport.nmfs.noaa.gov/inport/item/46097.

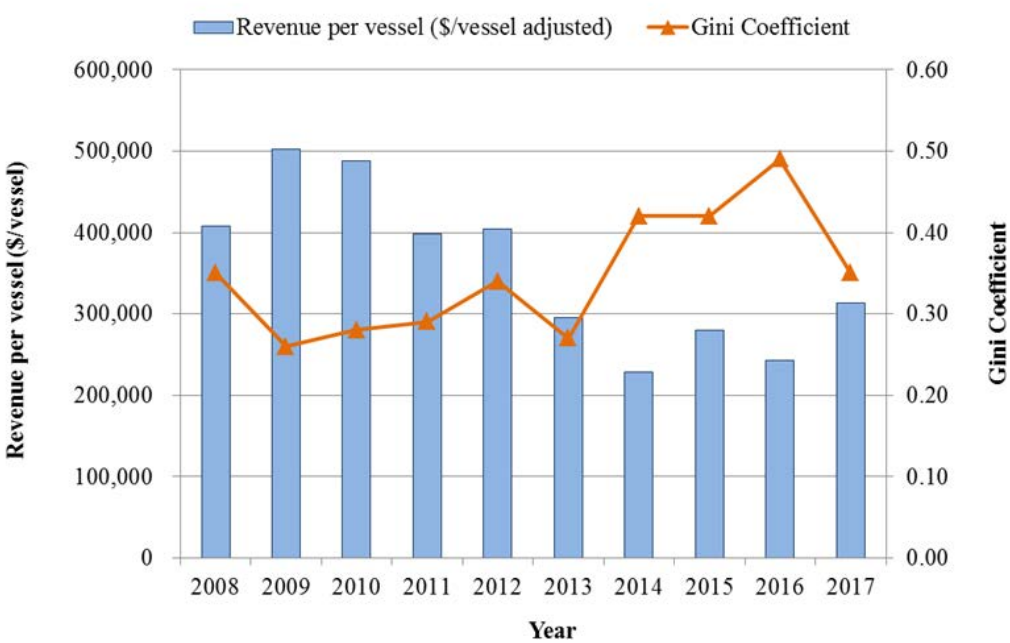

Figure 134. Revenue distribution (revenue per vessel and Gini coefficient) for the American Samoa longline fishery[1], 2008-2017[1].

[1] Data sourced from the Pacific Islands Fisheries Science Center: Fishery Economic Performance Measures (Tier 1 indicators). https://inport.nmfs.noaa.gov/inport/item/46097.

3.1.2.5 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 alia fishery has experienced a decline in its catch and effort. In 1996, seven 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. Nevertheless, the alia longlining dropped dramatically since then, and there was only one active alia longlining in 2017. The landings and revenue by Alia longling are not included in this section, but included in the American Samoa longline section.

3.1.2.5.1 Commercial Participation, Landings, Revenue, and Prices

This section will describe trends in commercial participation, landings, revenues and prices for the American Samoa troll fishery. The PMUS harvested by alia longliners has been included in the American Samoa longline section above. Thus, commercial landings and revenue are not included in this section. In addition, there were about 20% of the PMUS sold that were caught by neither longline fishery nor troll fishery.

Figure 135 presents the trends of revenue and pounds sold of the troll fishery for American Samoa for 2008-2017 and Figure 136 presents the price trend of the pelagic price for the PMUS sold by the trollers during 2008-2017. Supporting data for Figure 135 and Figure 136 are presented in Table A-117. In 2017, PMUS pounds sold by trolling were 8,974lbs and valued at $24,769. On average, the pounds sold recorded were 36% of the total landings during 2008-2017. The annual pounds sold in 2012 were much higher than previous years, and trend to be pretty stable since then. The revenue in 2017 was the highest during the period, mostly due to the fish price in 2017 was the highest.

Please notice that the data for pounds caught and pounds sold are collected by two different data collection methods. The data of pounds sold were collected through “Commercial Sales Receipt Books” Program (https://www.pifsc.noaa.gov/wpacfin/as/Pages/as_crform3.htm), while the data of pounds caught were collected through “Boat-based Creel Survey” and “Shore-based Creel Survey” (https://www.pifsc.noaa.gov/wpacfin/as/Pages/as_coll_5.php). Both data series are generated from an expansion algorithm built on a non-census data collection program respectively, and the survey coverage rates of two data collection methods may change independently in individual years. Therefore, the two time series may not move coherently to each other. For example, the low percentage of pounds sold compared to pounds caught could be due to the low coverage of dealer participations in the Commercial Receipt Books Program, or vice versa. In addition, the data summary for PMUS in socioeconomic module is based on the PMUS species defined in the Ecosystem Management Plan (http://www.fpir.noaa.gov/SFD/pdfs/feps/Pelagics_FEP.pdf) and the raw dataset frozen on March 15, 2018.

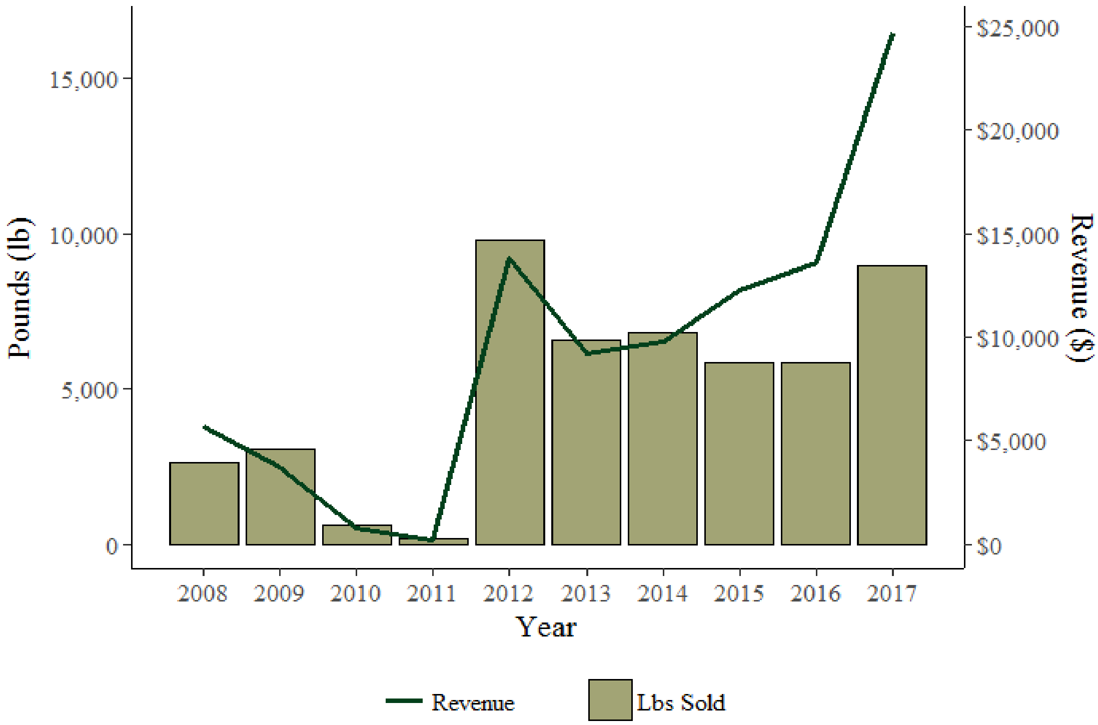

Figure 135. PMUS pounds sold and revenue trend by trolling gear from 2008-2017 adjusted to 2017 dollars[1].

[1] Data sourced from the Pacific Islands Fisheries Science Center WPacFIN.

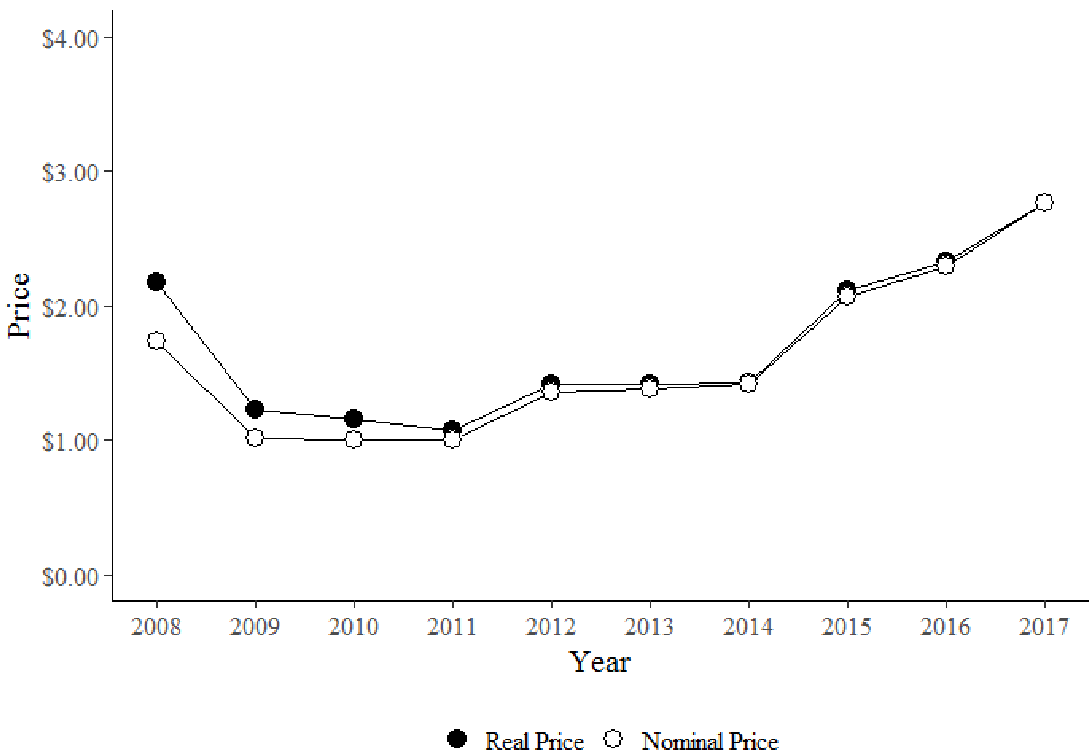

Figure 136. The real and nominal price of PMUS for fish sold by trolling gear from 2008-2017 adjusted to 2017 dollars[1].

[1] Data sourced from the Pacific Islands Fisheries Science Center WPacFIN.

3.1.2.5.2 Fishing Costs

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.

Figure 137 presents the average trip costs for American Samoa troll trips, 2011–2017 (adjusted to 2017 dollars). Supporting data for Figure 137 are presented in Table A-118. 2009 and 2010 data were not presented in the figure due to the number of respondents was fewer than three due to confidentiality concerns. In general, the fishing costs of an average troll trip slightly declined during the period of 2011-2016, mainly as a result of the decrease of fuel costs. In 2017, the average costs of a trolling trip went up and the trip costs of trolling were around $79.

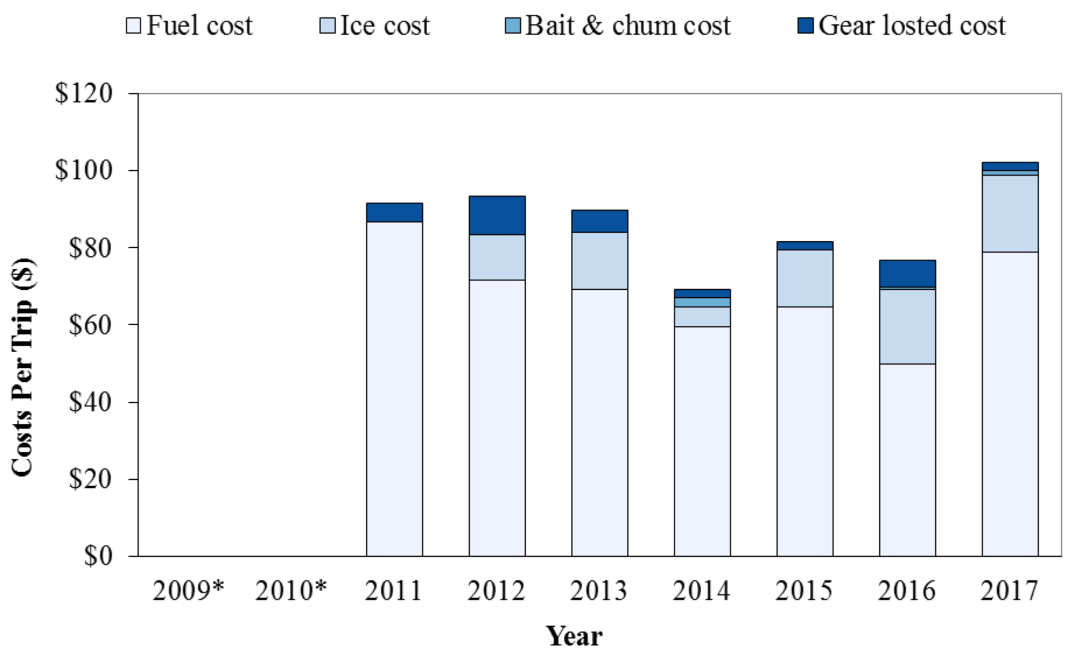

Figure 137. Average trip costs for American Samoa trolling trips from 2011–2017[1] adjusted to 2017 dollars[2].

[1] The number of boats (respondents) was fewer than 3; due to confidentiality concerns, responses are not presented.
[2] Data sourced from Chan and Pan (2018, in review).

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) is situated 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; 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 to 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 an average of just over $1,000 per month. Costs exceeded sales for almost every income category of fishermen, suggesting that for most fishing is not a profitable business and that they sell their catch 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 (Richmond and Kotowicz 2015, Kotowicz and Richmond 2013, Kotowicz and Allen 2015, and Kotowicz et al. 2017). 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. While CNMI residents generally supported designation of the monument, awareness was low (Kotowicz et al. 2017). In addition, fishing households showed higher awareness of the Monument but were less likely to strongly support it.

3.1.3.3 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 (Allen and Amesbury 2012). 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 and 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 "Pescadores", a term used to refer to fishermen who provide fish for important community and familial events. Pescadores customarily provide 100-200 lbs. of reef fish for cooked dishes and pelagic species for kelaguen (i.e., 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 and 2011. An estimated 1 to 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, and fish 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 three 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 (Hospital and Beavers 2014). 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.

3.1.3.3.1 Commercial Participation, Landings, Revenue, and Prices

This section presents the pounds sold, revenue, and price for all PMUS in CNMI by all gears. Unlike American Samoa, the data of pounds sold by gears are not available for CNMI. Figure 138 and Figure 139 present the trends of total pounds sold and revenue for all PMUS for CNMI during 2008-2017. Supporting data for these two figures are presented in Table A-119.

The pelagic fishing is an important commercial fishery in CNMI, and the average annual total pounds sold during the past ten years (2008-2017) were 180 thousand pounds, 46% of the total pounds caught. In 2017, total pounds sold dropped to 62 thousand pounds, while the total pounds caught were above the ten years average.

Please notice that the data for pounds caught and pounds sold are collected by two different data collection methods. The data of pounds sold were collected through "Commercial Sales Receipt Books" Program (https://www.pifsc.noaa.gov/wpacfin/cnmi/Pages/cnmi_cfrf.htm), while the data of pounds caught were collected through "Boat-based Creel Survey" and "Shore-based Creel Survey" (https://www.pifsc.noaa.gov/wpacfin/cnmi/Pages/cnmi_coll_3.php). Both data series are generated from an expansion algorithm built on a non-census data collection program respectively, and the survey coverage rates of two data collection methods may change independently in individual years. Therefore, the two time series may not move coherently to each other. For example, the low percentage of pounds sold compared to pounds caught could be due to the low coverage of dealer participations in the Commercial Receipt Books Program, or vice versa.

Figure 138. Total PMUS annual pounds sold and revenues in CNMI for all gears from 2008-2017 adjusted to 2017 dollars[1].

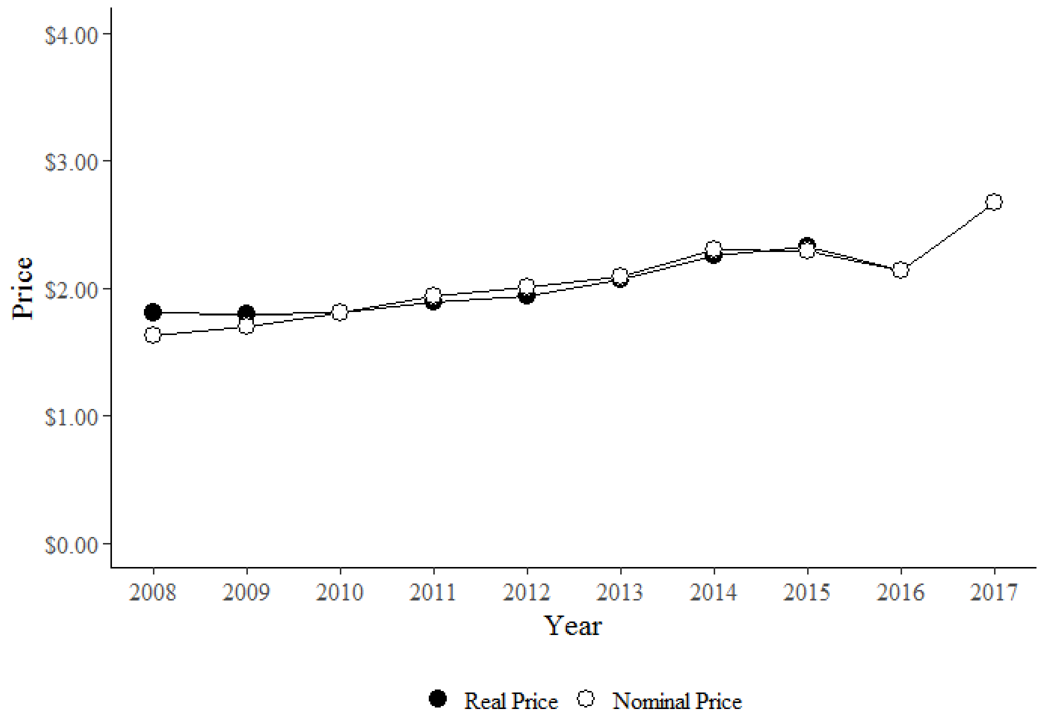

Figure 139. Real and nominal prices of PMUS for fish sold by all gears from 2008-2017[1].

[1] Data sourced from the Pacific Islands Fisheries Science Center WPacFIN.

3.1.3.3.2 Fishing Costs

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.

Figure 140 presents the average trip costs for CNMI troll trips from 2009 through 2017 (adjusted to 2017 dollars). In general, the fishing costs of trolling trips showed small changes across years. It moved up and down mainly with the changes of fuel costs. In 2017, the average trip costs of trolling trips were around $76. Supporting data for Figure 140 is presented in Table A-120.

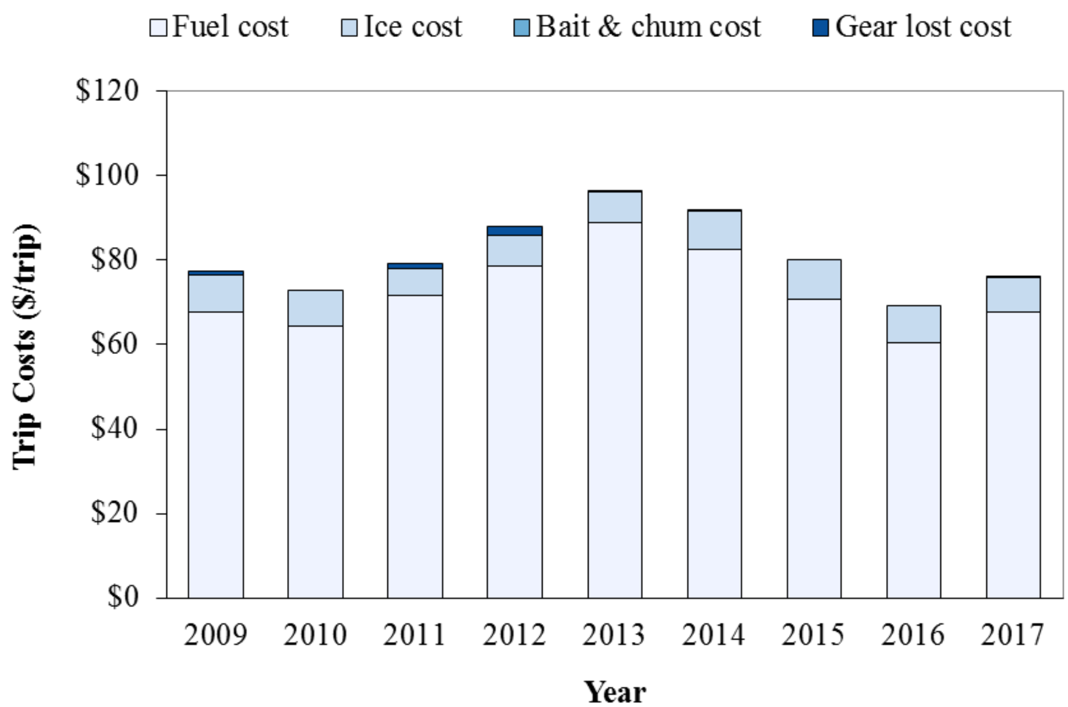

Figure 140. Average cost for CNMI trolling trips from 2009-2017 adjusted to 2017 dollars[1].

[1] Data sourced from Chan and Pan (2018, in review).

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 (WPRFMC 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 (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%) of the fish consumed was purchased at a store or restaurant and 9% 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 (NCRMP 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 GUAM TROLLING

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 was Filipino versus nearly 23% of the general population. Other Asian nationalities accounted for 3% of the pelagic fishing population versus 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 fishers also reported both 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.

3.1.4.3.1 Commercial Participation, Landings, Revenue, and Prices

This section will describe trends in commercial landings, revenues and prices of PMUS in Guam. Figure 141 presents the trends of pounds sold and revenue of PMUS in Guam fisheries and Figure 142 presents the trend of PMUS price during 2008 to 2017. Supporting data of Figure 141 and Figure 142 are shown in Table A-121. Figure 141 shows a slightly declining trend of PMUS pounds sold and revenue in Guam, but pounds sold and revenue in 2017 were slightly higher than the previous year (2016). The average of price of all PMUS was flat over the ten year period.

The pelagic fishing is an important commercial fishery in Guam, and the average annual total pounds sold during the past ten years (2008-2017) were 133.6 thousand pounds. The total pounds caught (based on WPacFIN estimation) were five times higher than pounds sold in the years during the past 10 years. Thus, the average pounds sold over pounds caught ratio was 20%. Please notice that the data for pounds caught and pounds sold are collected by two different data collection methods. The data of pounds sold were collected through “Commercial Sales Receipt Books” Program (https://www.pifsc.noaa.gov/wpacfin/guam/dawr/Pages/gdawr_cfrfc.htm), while the data of pounds caught were collected through “Boat-based Creel Survey” and “Shore-based Creel Survey” (https://www.pifsc.noaa.gov/wpacfin/guam/dawr/Pages/gdawr_coll_3.php). Both data series are generated from an expansion algorithm built on a non-census data collection program respectively, and the survey coverage rates of two data collection methods may change independently in individual years. Therefore, the two time series may not move coherently to each other. For example, the low percentage of pounds sold compared to pounds caught could be due to the low coverage of dealer participations in the Commercial Receipt Books Program, or vice versa.

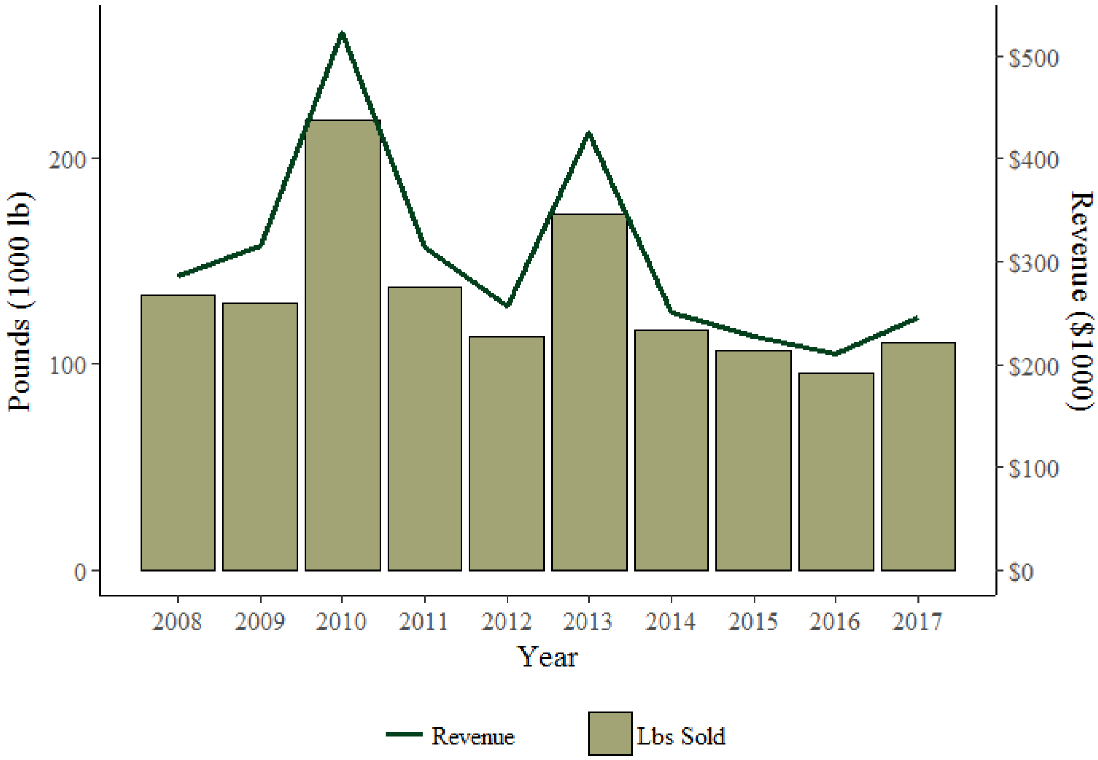

Figure 141. Total PMUS annual pounds sold and revenue in Guam from 2008-2017 adjusted to 2017 dollars[1].

[1] Data sourced from the Pacific Islands Fisheries Science Center WPacFIN.

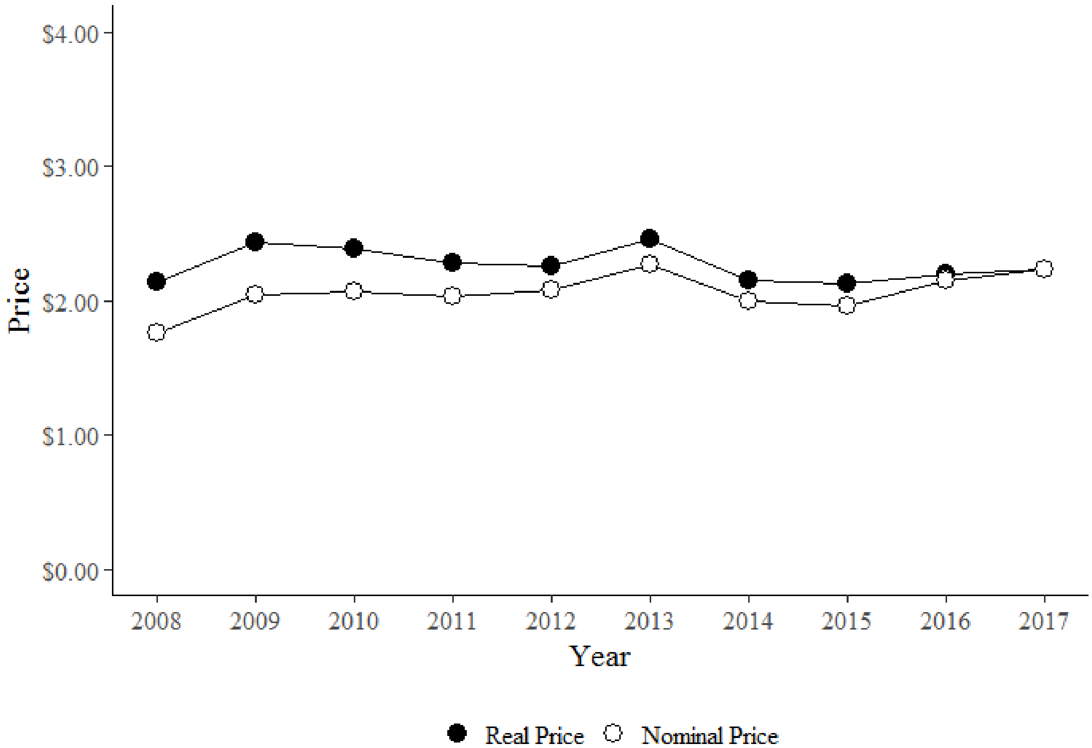

Figure 142. The real and nominal prices of PMUS sold by all gears in Guam from 2008-2017[1].

[1]Data sourced from the Pacific Islands Fisheries Science Center WPacFIN.

3.1.4.3.2 Fishing Costs

Since 2011, 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 (Chan and Pan, in review). Metadata for these data are available online (PIFSC 2016b). Figure 143 shows the trend of trip costs of trolling trips in Guam. It seems that fishing costs moves up and down across years mainly due to the fuel cost changes. The average costs of trolling trips in 2017 were $99 in Guam, which was higher than that in the previous year. Supporting data for Figure 143 are presented in Table A-122.

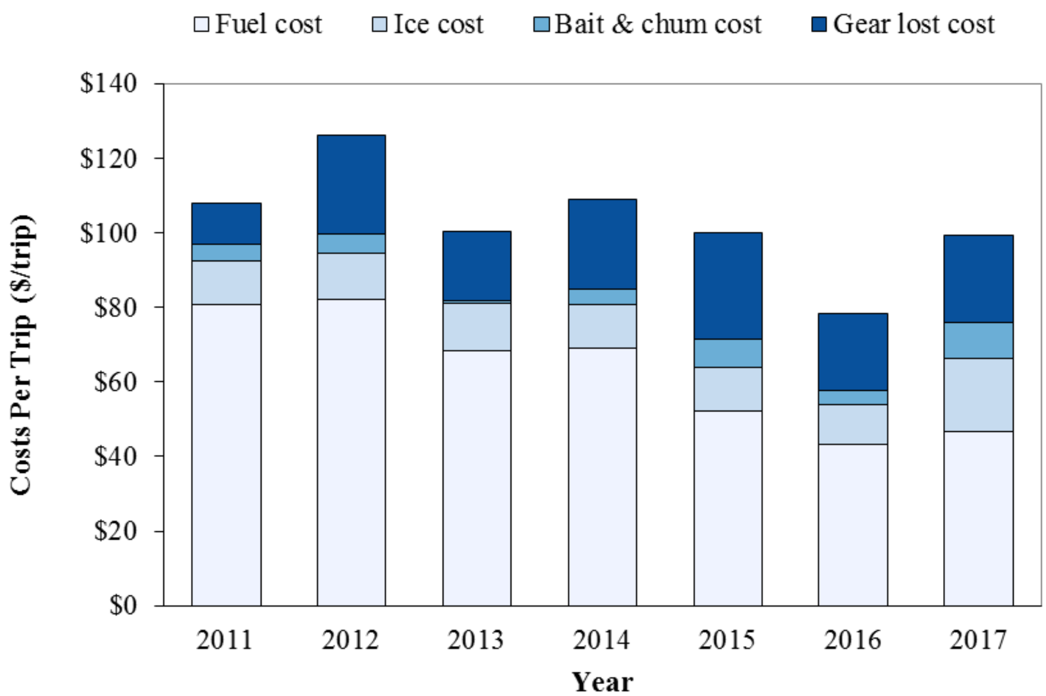

Figure 143. Average cost for Guam troll trips from 2011–2017 adjusted to 2017 dollars[1].

[1] Data sourced from (Chan and Pan 2018, in review).

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. Geslani et al., 2012; 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 Hawaiʻi, 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 the following section. 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 44.

Table 44. 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. 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 the disposition of Hawaii fishermen and public perception 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 Hawai‘i Division of Aquatic Resources (DAR) have been collecting information on recreational fishing in Hawai‘i, administered through the Hawai‘i 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 are regularly collected in the intercept surveys, but has not yet been compared to the composition of the general public. As observed in the other surveys, this program documented wide range of gears used to catch a variety of both pelagic and insular fish. 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 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 (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 while 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 U.S. 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, U.S. 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. U.S. legislation and federal rules that have prevented subsequent closures of the fishery have since been put in place.

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 members 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 were there records 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.

3.1.5.3.1 Commercial Participation, Landings, Revenue, and Prices of Hawaii Longline

The Hawaii permitted longline fishery conducts two types of fishing to target the pelagic species of bigeye tuna and swordfish by setting the fishing gear at different depths in the water column. Most of the vessels only target tuna while some vessels switch between these two types of fishing depending on the season. The majority of the catches by the Hawaii permitted longline vessels were landed and sold in the fish auction (United Fishing Agency) in Honolulu while some of catches were landed and sold in the West Coast. During the period of 2008-2017, the fish landed and sold in the West Coast increased gradually. However, the total revenue of the Hawaii longline presented in this report only included the fish landed and sold in Hawaii markets, due to the data quality concern on the commercial data of the West Coast landings.

The total revenue presented in Figure 144 included the revenue generated only from Hawaii markets. The data of fish landed and sold from West Coast are not presented in this year's report due to some data quality concerns. In general, the total revenue of the Hawaii permitted fleet shows an upward trend for the period of 2008-2017. Pounds sold in 2017 was higher than that in 2016, however, the revenue of 2017 was lower than 2016. Thus, only counting the fish sold in Hawaii markets, the revenue generated from Hawaii permitted longline was $100.4 million in 2017. Supporting data of Figure 144 are presented in Table A-123.

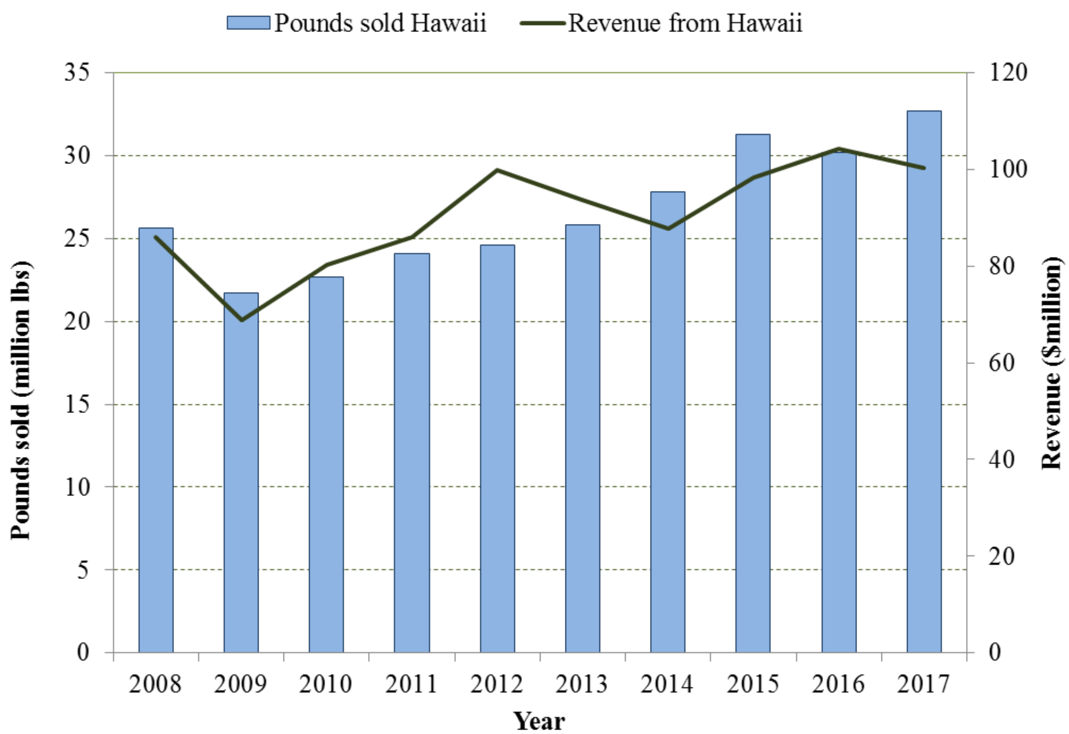

Figure 144. Commercial landings and revenue of Hawaii-permitted longline fleet from Hawaii 2008-2017 adjusted to 2017 dollars[1].

[1] Source: Pacific Islands Fisheries Science Center, Tier 1 indicators data request (https://inport.nmfs.noaa.gov/inport/item/46097).

Since there was no detailed market information on the fish landed and sold in West Coast, the price and revenue information of individual species of Hawaii permitted longline presented in the report only included the fish landed and sold in the Hawaii markets. Figure 145 shows the trends of the revenue composition from the main species (bigeye, swordfish, yellowfin, and all others) during 2008-2017, while Figure 146 shows the price trends for bigeye, swordfish, and yellowfin for the same period. Supporting data for Figure 145 and Figure 146 are presented in Table A-124 and Table A-125, respectively.

It can be observed that the bigeye composed of main portion of the revenue of the longline fleet and it increased substantially during the period of 2008-2017. Revenue from yellowfin and other species also shows slow increase in general, while the revenue from swordfish declined for the same period. In 2017, bigeye composed of 63% of the Hawaii permitted longline vessels landed in Hawaii, followed by yellowfin, 15%, and swordfish 6%. Fish price fluctuated in general. Bigeye and swordfish price peaked in 2012 before declining in recent years. The bigeye price and swordfish price picked up slightly in 2016, then decreased in 2017. Yellowfin price varied over time, and it peaked in 2013.

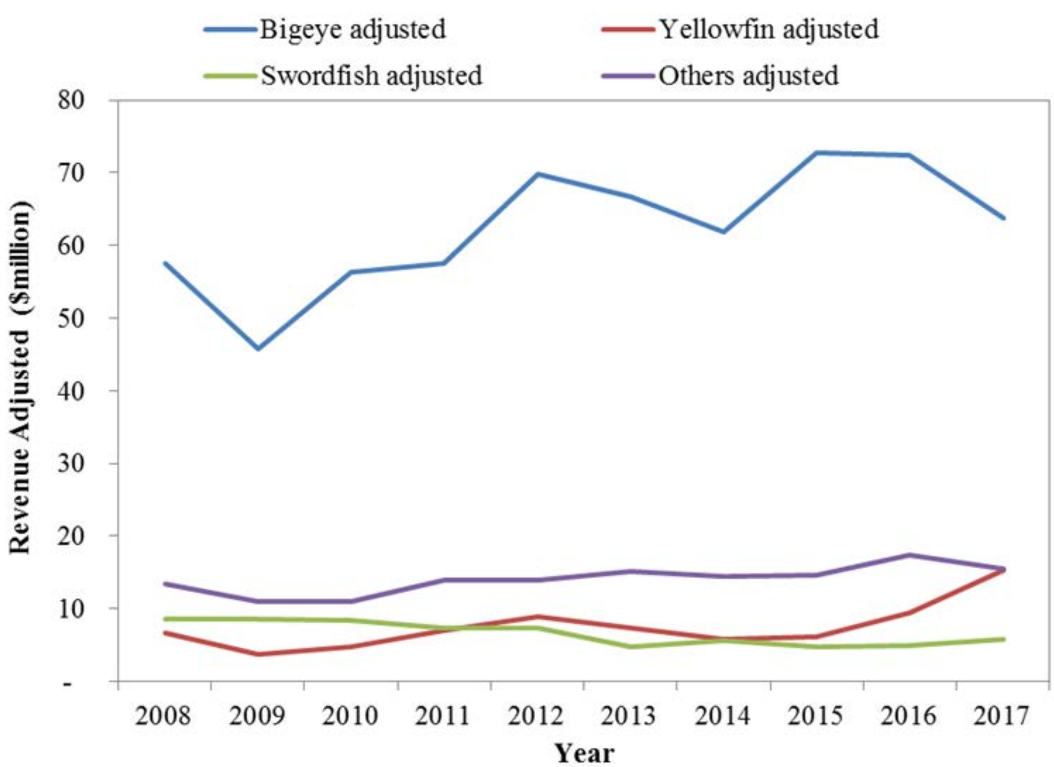

Figure 145. Trends in Hawaii longline revenue species composition from 2008-2017[1].

[1] Data Source: Pacific Islands Fisheries Science Center, pelagic data module data request.

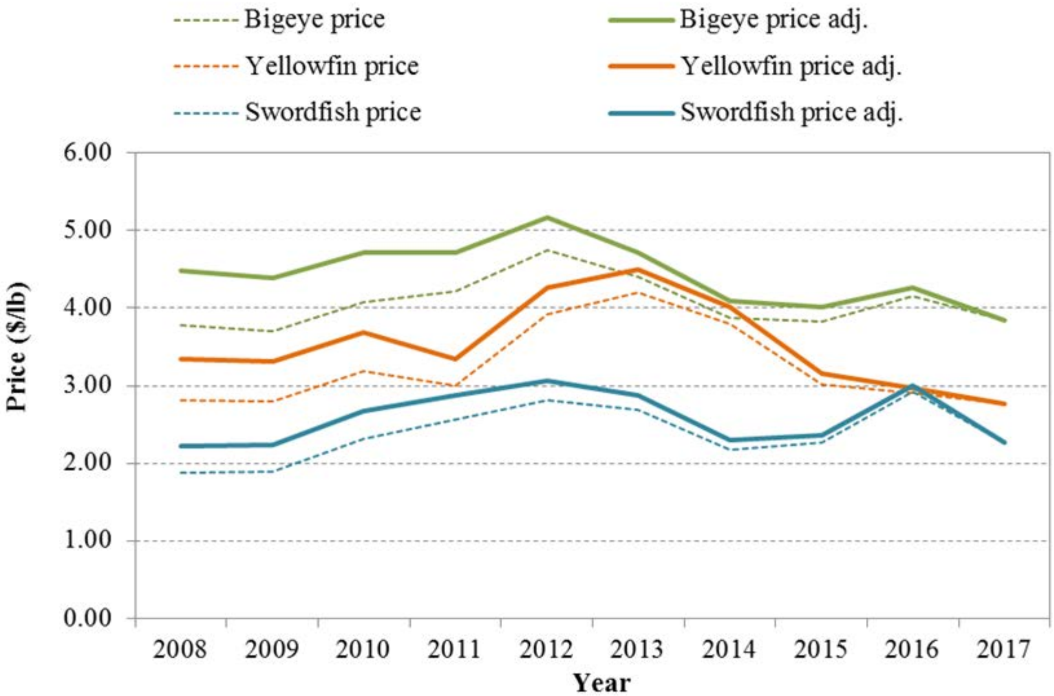

Figure 146. Price trends of nominal and adjusted of three main species (bigeye, yellowfin, and swordfish) from 2006-2016[1].

[1] Source: Pacific Islands Fisheries Science Center, pelagic data module data request.

3.1.5.3.2 Fishing Costs of Hawaii Longline

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 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, and Travis, 1996; O'Malley and Pooley, 2003; Kalberg and Pan, 2016). The continuous economic data collection program has provided important trend data to track the changes of economic performance of the Hawaii longline fisheries on a continuous basis.

The data form is comprised of eight cost items commonly arising in Hawaii 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, and Vietnamese) to ease survey burden.

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. The participation of fishermen in the economic data survey is voluntary. 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. The detailed description of the continuous data collection program can be found in a NOAA tech memo (Pan, under review).

This report assessed the trip-level fishing cost for the two types of fishing trips (shallow set components of the fisheries respectively, since a swordfish trip often has a longer trip length compared to the tuna trip. The average trip length for swordfish trips was 32 days per trip during the 2008 to 2017 period, while it was 23 days for tuna trips (based on the logbook information during the period).

In terms of cost structure, fuel accounts for the largest share of total fishing trip costs (non-labor items) for both tuna and swordfish trips. Figure 147 and Figure 148 show the cost structures of an average tuna trip and swordfish trip in 2017, respectively. In 2017, fuel cost was the leading item of trip costs, comprising 44% of trip costs for tuna trip costs. Bait was the second largest item making up 27% of tuna trip costs. Fuel and bait costs together made up over 71% of the trip costs for tuna fishing. For swordfish trip, the cost of fuel made up 43% of swordfish trip costs, while bait cost made up 20% of swordfish trip costs. The cost of the lightstick gear is unique to swordfish fishing, and it made of 15% of the total trip costs of swordfish trips.

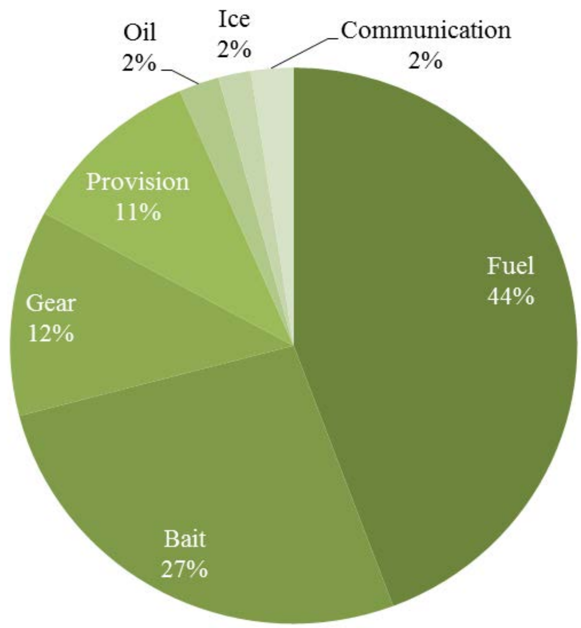

Figure 147. The cost structure of an average deep-set fishing trip in 2017[1].

[1] Data sourced from Pan (2018; in review).

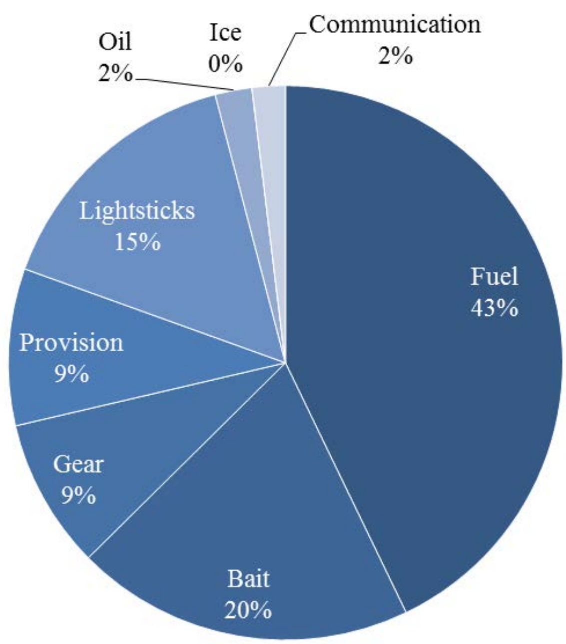

Figure 148. The cost structure of an average shallow-set fishing trip in 2017[2].

[2] Data sourced from Pan (2018; in review).

Figure 149 and Figure 150 show the trend of average trip costs and one standard deviation for the tuna and swordfish trips respectively of the Hawaii longline fishery for the 2008-2017 period. Supporting data for Figure 149 and Figure 150 are presented in Table A-126 and Table A-127. The average trip costs for both trip types are different, but they shared similar trend during the period of 2008 to 2017. Swordfish trip costs more than tuna trips. In 2017, the average trip costs for swordfish trips were $37,568 while it was $24,845 for tuna trips.

Trip costs in 2008 were relatively high, and it went down in 2009 but increased gradually in the following years. The trip costs of tuna trips peaked in 2012, while swordfish trips peaked in 2011. Since then, the fishing costs turned downward. The average trip costs in 2017 were lower than the previous year.

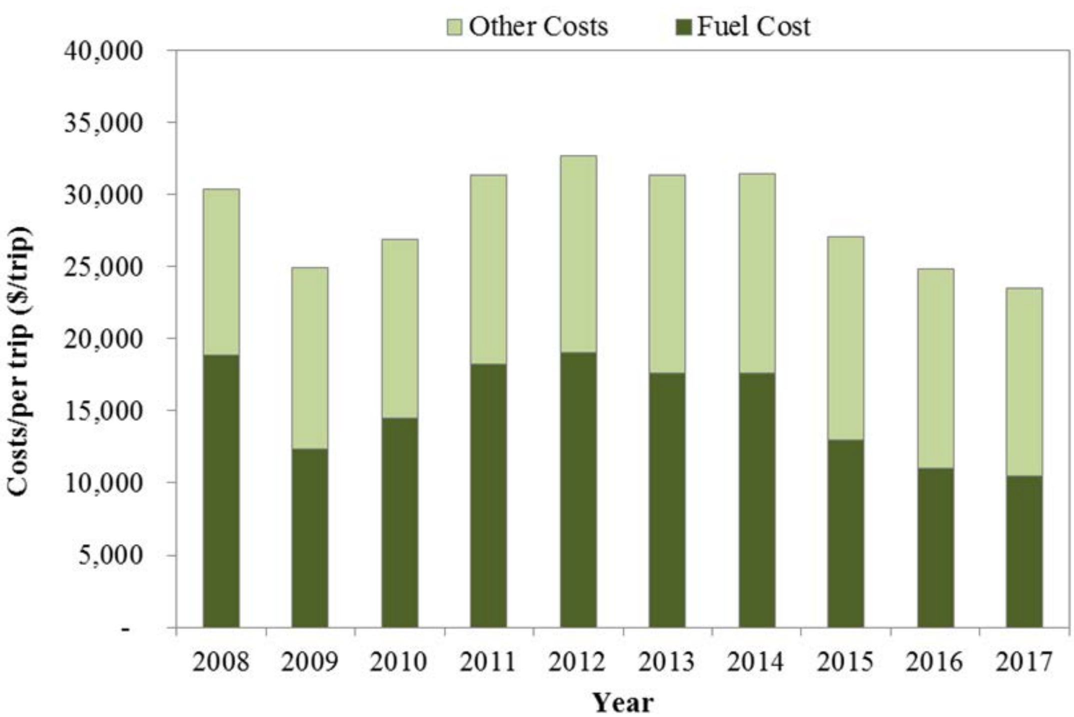

Figure 149. The trend of average trip costs with standard deviation for Hawaii longline deep-set fishing from 2008-2017 adjusted to 2017 dollars[1].

[1] Data sourced from Pan (2018; in review).

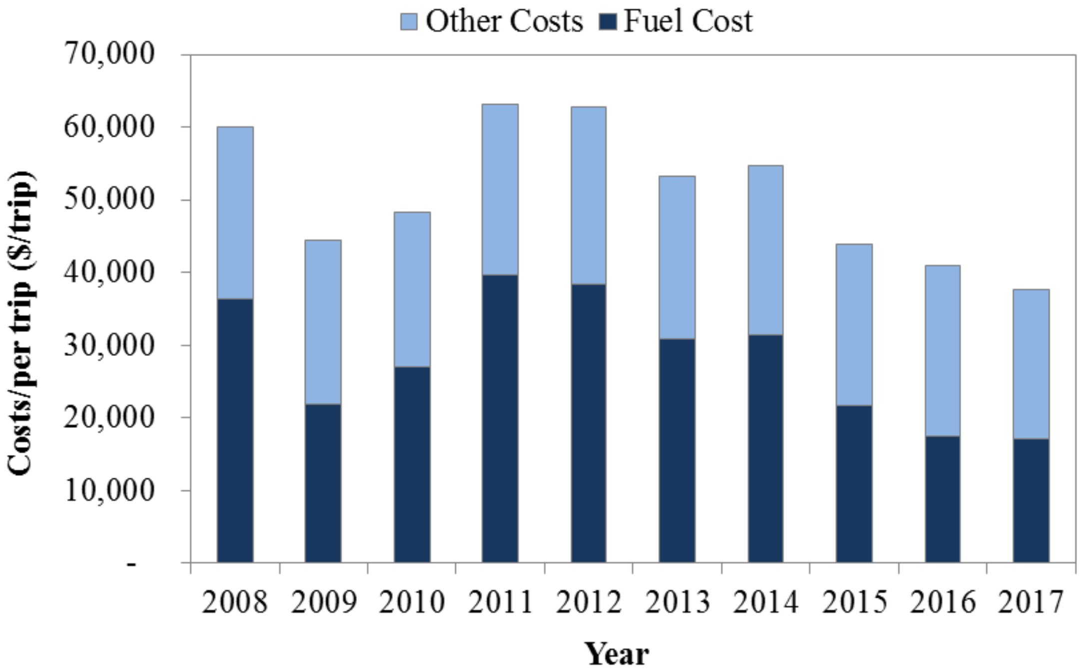

Figure 150. The trend of average trip costs with standard deviation for Hawaii longline shallow-set fishing from 2008-2017 adjusted to 2017 dollars[1].

[1] Data sourced from Pan (2018; in review).

3.1.5.3.3 Economic Performance Measures of Hawaii Longline

The continuous economic data collection program allows for the monitoring of movement in fishing cost over time. Compiling the revenue data allows for the measurement of the economic performance in term of net revenue and monitor the changes. Figure 151 and Figure 152 present the trends of trip level revenue, net revenues, and costs for the period of 2008 to 2017 for the two trip types respectively. Supporting data Figure 151 and Figure 152 are presented in Table A-128 and Table A-129. The net revenue of tuna (deep-set) fishing shows an upward trend during the period of 2008 to 2017 in general, while the net revenue of swordfish (deep-set) fishing shows fluctuations across years. The net trip revenue for both trip types peaked in 2016, and they were lower than previous years.

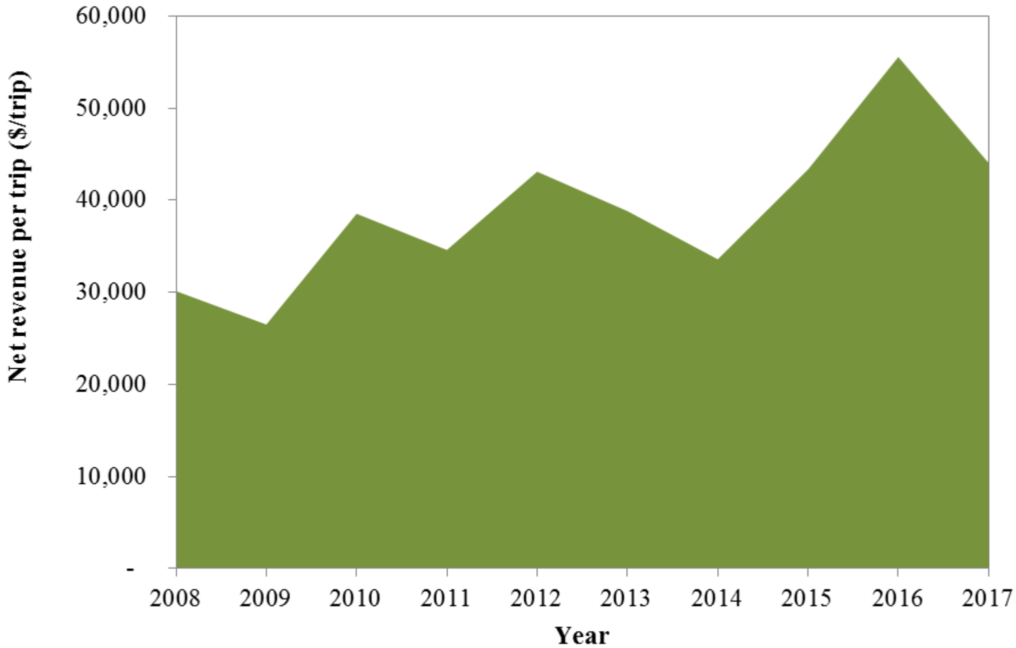

Figure 151. Average net revenue per trip for Hawaii longline deep-set trips from 2008-2017 adjusted to 2017 dollars[1].

[1] Data sourced from Pan (2018; in review).

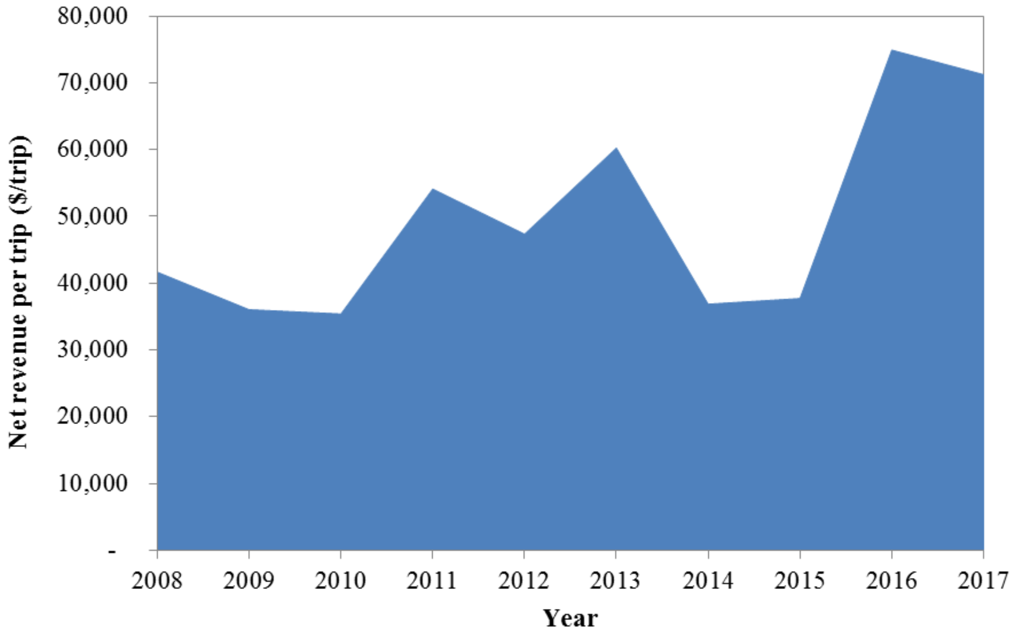

Figure 152. Average net revenue per trip for Hawaii longline shallow-set trips from 2008-2017 adjusted to 2017 dollars[2].

[2] Data sourced from Pan (2018; in review).

In addition to the measurement of the net revenue, 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. For American Samoa Longline fishery, this section will present revenue performance metrics of (a) the total revenue per day at sea, and (b) the Gini coefficient.

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. Data on Aggregate Revenue from Species in Fishery per-day-at-sea and revenue per vessel calculation (for Gini coefficient) are from Pacific Islands Fisheries Science Center, Fisheries Research and Monitoring Division. Figure 153 and Figure 154 presents the revenue per-day-at-sea and revenue per vessel and the Gini coefficient for the Hawaii longline fisheries during the period of 2008 to 2017. Supporting data for Figure 153 and Figure 154 are presented in Table A-130.

As an economic performance indicator, the revenue per-day-at-sea of the Hawaii longline fisheries presents an upward trend, which is different from the downward trend shown in the American Samoa longline fishery. Another economic performance indicator, the revenue per vessel also shows an upward trend for the Hawaii longline fisheries. The income distribution (Gini coefficient in term of revenue per vessel) among vessels is relatively stable in the period.

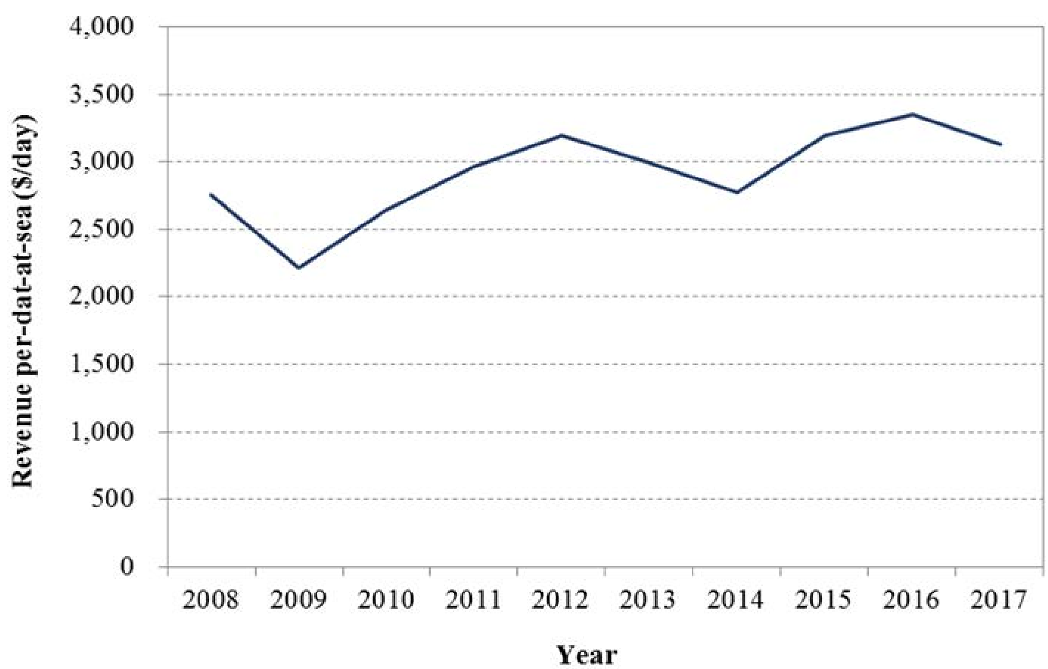

Figure 153. Revenue per-day-at-sea for Hawaii longline, 2008-2017, adjusted to 2017 dollars[1].

[1] Data Source: Pacific Islands Fisheries Science Center, Tier 1 indicators data request (https://inport.nmfs.noaa.gov/inport/item/46097).

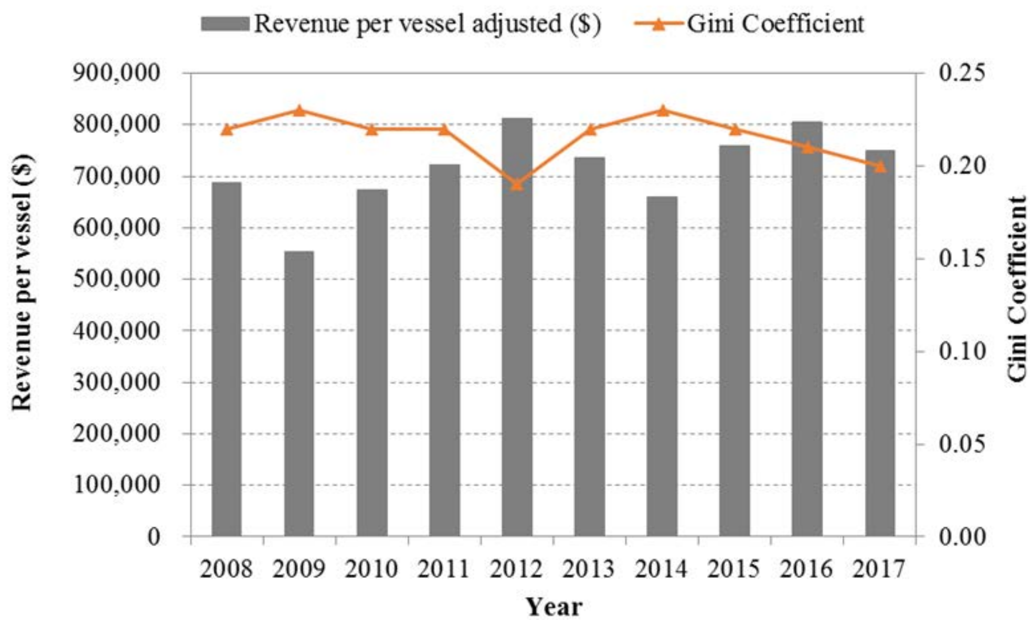

Figure 154. Revenue per vessel and Gini coefficient of the Hawaii longline fisheries[1] from 2008-2017 adjusted to 2017 dollars[2].

[1] Revenue per vessel includes the estimation of revenue landed in West Coast.

[2] Source: Pacific Islands Fisheries Science Center, Tier 1 indicators data request (https://inport.nmfs.noaa.gov/inport/item/46097).

3.1.5.4 OVERVIEW OF THE HAWAII NON-LONGLINE GEARS FOR PMUS

Beside that the Hawaii permitted longline vessels, there are the smaller scale fisheries, such as MHI troll, MHI handline, offshore handline, aku boats (pole and line), and some other gears, harvested PMUS and sold to the Hawaii markets. The following figures present an overview of these various gears in terms of pounds sold, revenue, price, and participants. Aku boat was grouped into the "other gears", because the fishery had been declining and the number of active vessels was less than 3 vessels since 2010.

If only counting the pelagic fish landed and sold in the Hawaii markets from all gear types, the total revenue generated from Hawaii's pelagic fisheries was $110.8 million in 2017. The Hawaii permitted longline fishery contributed 90% of the total revenue in 2017. Among the non-longline gears, troll is the leading fishing gear in terms of PMUS pounds sold and revenue, following by MHI handline gear. The MHI troll revenue was $6.4 million or 6% of the total in 2017 and was followed by the MHI handline fishery at $2.8 million (3%). The offshore handline fishery was worth $0.9 million in 2017. The sharp decline of the "other gears" reflected the decline of the aku boat fishing in the report period. Figure 155 presents the trend of commercial landings by different gears (not including longline), and Figure 156 presents the trend of commercial revenue by different gears (not including longline). Supporting data for the Figure 155 and Figure 156 are presented in Table A-133.

Figure 157 presents the price trends of PMUS harvested and sold by different gears, 2008-2017, (adjusted 2017 dollars). Supporting data for Figure 157 are presented in Table A-131. Figure 158 presents the fishing trip costs by the three main gears (small boats) for pelagic fishing. Supporting data are presented in Table A-132.

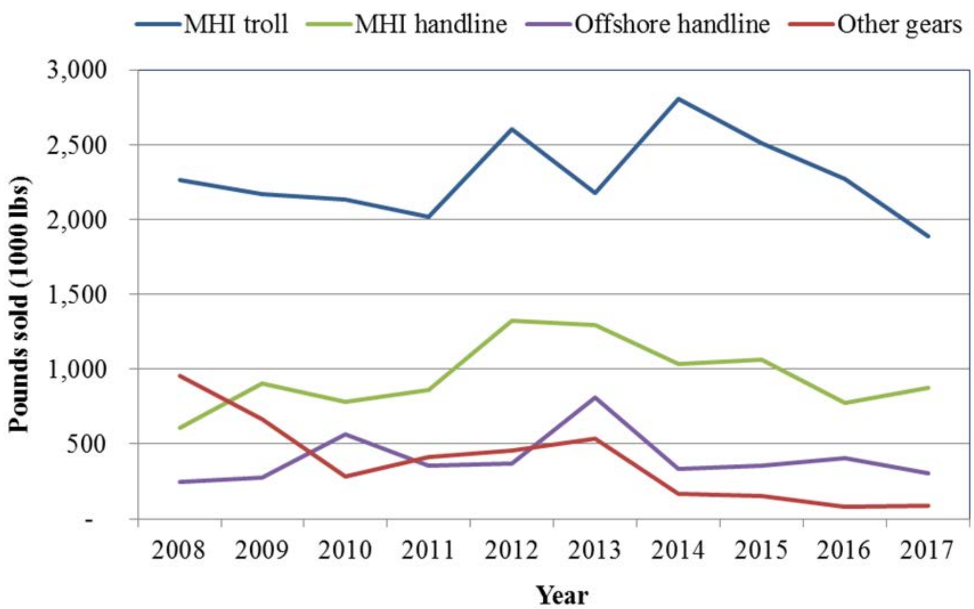

Figure 155. Pounds sold of various MHI commercial non-longline gears from 2008-2017[1].

[1] Data sourced from PIFSC Pelagic Module data request.

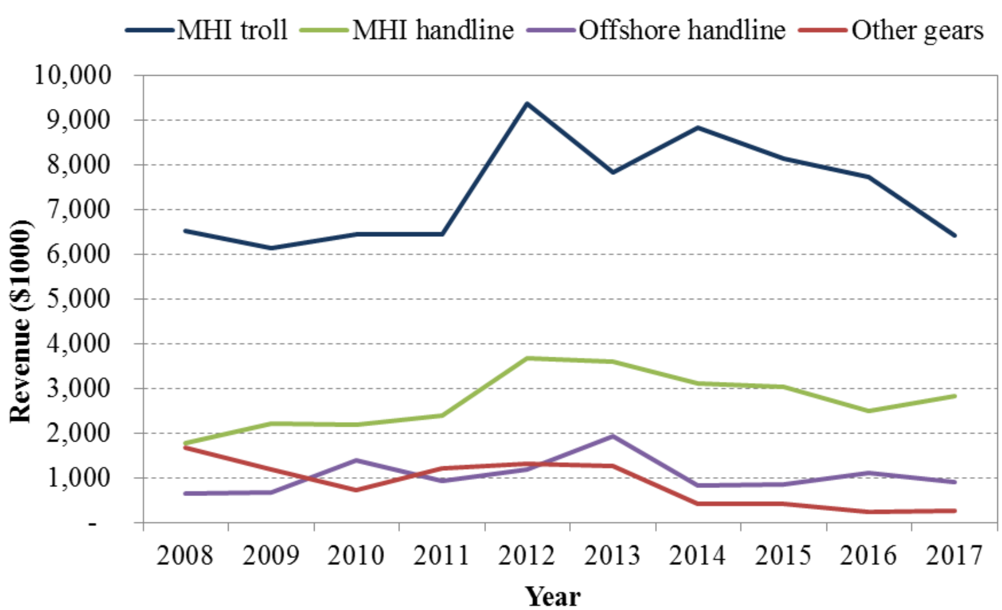

Figure 156. Revenue of non-longline gears from 2008-2017 adjusted to 2017 dollars[2].

[2] Data sourced from the PIFSC Pelagic Module data request.

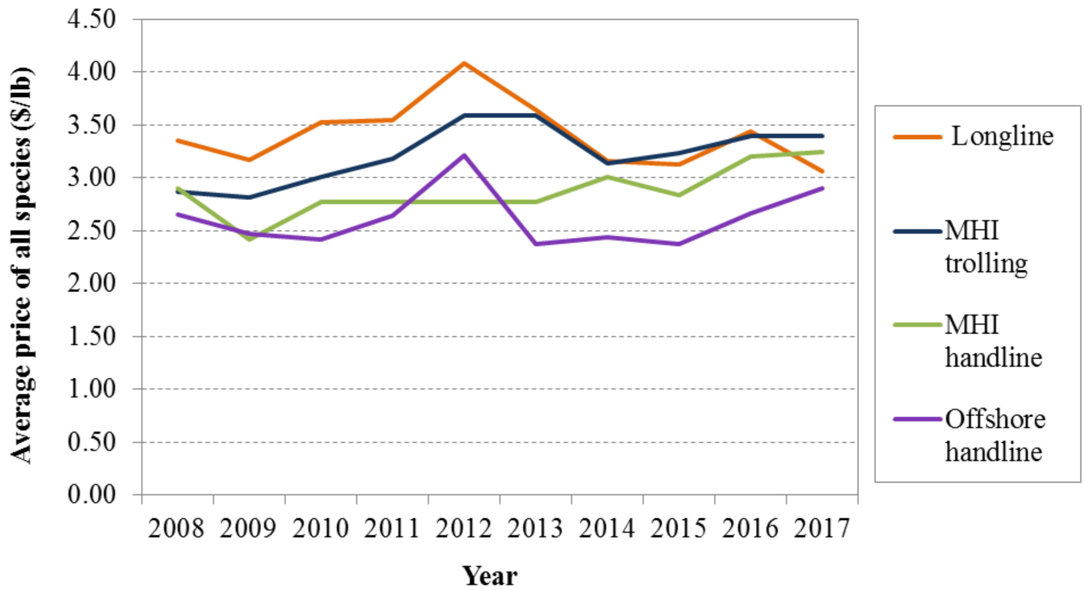

Figure 157. Price trends of PMUS by different gears, 2008-2017, adjusted to 2017 dollars[1].

[1] Data sourced from the PIFSCE Pelagic Module data request. Longline price included for reference.

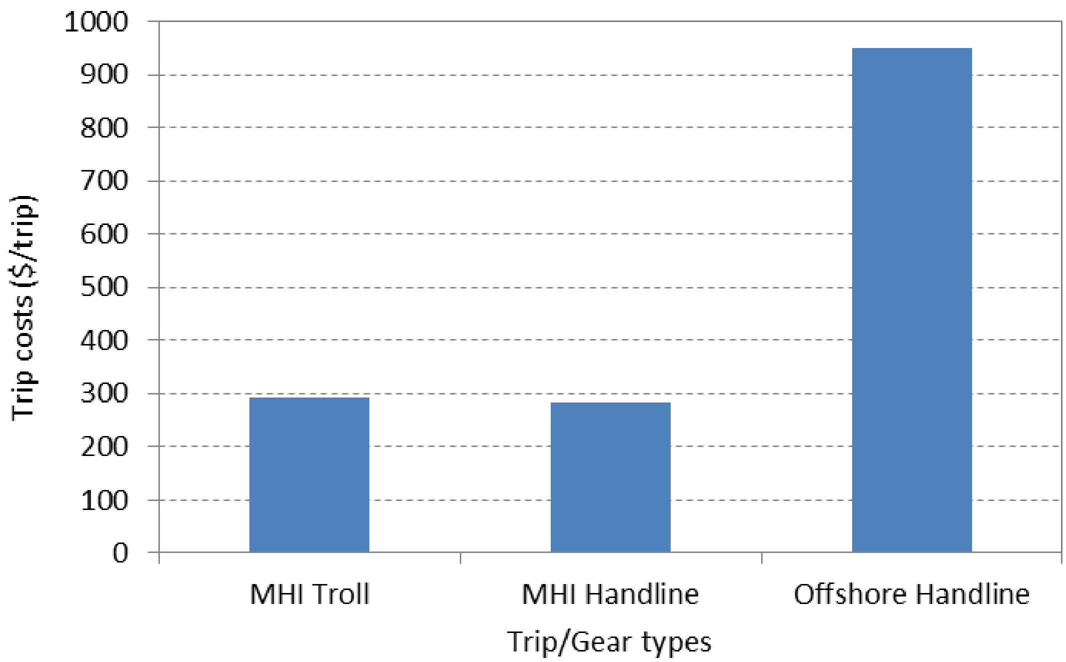

Figure 158. Fishing trip cost by gear type in 2014[2].

[2] Data sourced from a 2017 Hawaii small boat survey (Chan and Pan 2017).

3.1.5.5 HAWAII TROLLING

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 the Data Modules. 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, and Prices

This section will describe trends in commercial participation, landings, revenues and prices for the Hawaii troll fishery. Figure 159 presents the pounds sold and revenue (adjusted to 2017 dollars) of the MHI troll, 2008-2017. Supporting data of Figure 159 are presented in Table A-131 and Table A-132. The revenue from Hawaii troll fishery peaked at $9.4 million (in 2017 dollars) in 2014 then was in a declining trend from 2015-2017. Commercial landings from trolling peaked at 2.8 million pounds in 2014, also declining since then.

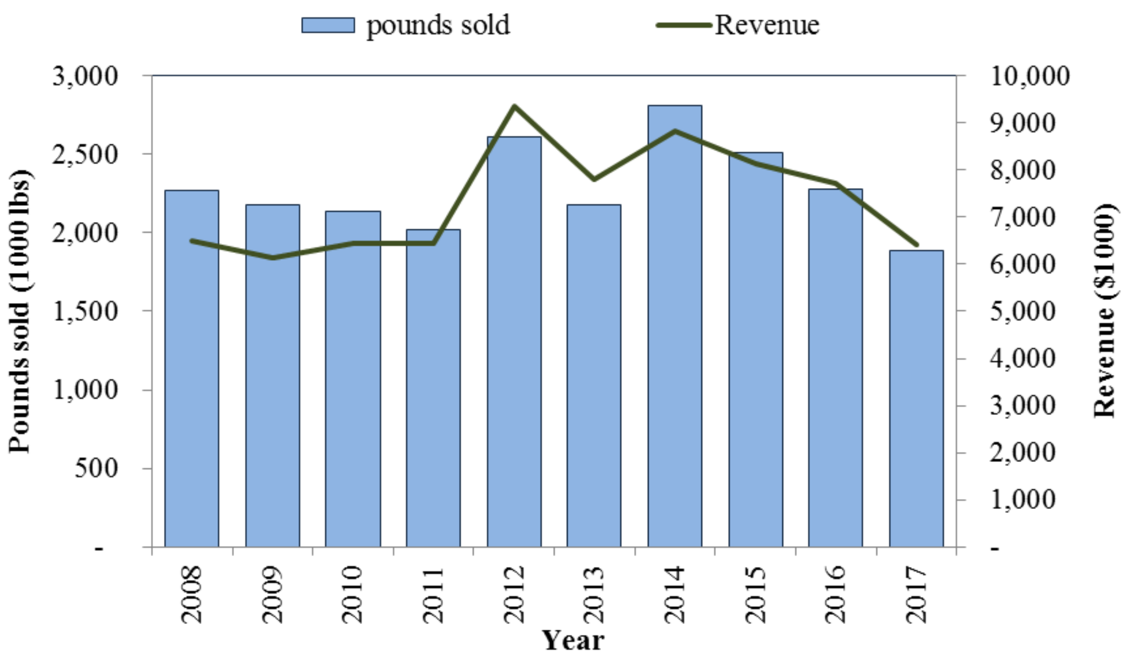

Figure 159. The pounds sold and revenue for the MHI troll from 2008-2017 adjusted to 2017 dollars [1].

[1] Data sourced from the PIFSC Pelagic Module data request.

3.1.5.6 FISHING COSTS

There are no continuous cost data collection program established for the non-longline PMUS fisheries in Hawaii. Past periodical research has documented the costs of pelagic small boat fishing in Hawaii; both trip expenditure and annual fishing expenditures (fixed costs) are provided in the literature (Hamilton and Huffman 1998; Hospital et al. 2011; Chan and Pan 2017). The most current data for a Hawaii trolling trip are presented in Figure 158.

3.1.5.7 HAWAII PELAGIC 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 Chapter 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).

3.1.5.7.1 Commercial Participation, Landings, Revenue, and Prices

This section describes trends in commercial participation, landings, revenues and prices for the Hawaii pelagic handline fishery. Figure 160 presents the pounds sold and revenue (adjusted to 2017 dollars) of the MHI troll, 2008-2017. Supporting data for Figure 160 can be found in Table A-131 and Table A-132. The landings and revenue from Hawaii handline fishery peaked in 2012, 1.3 million pounds pound sold valued at $3.7 million respectively, then was in a declining trend since 2013.

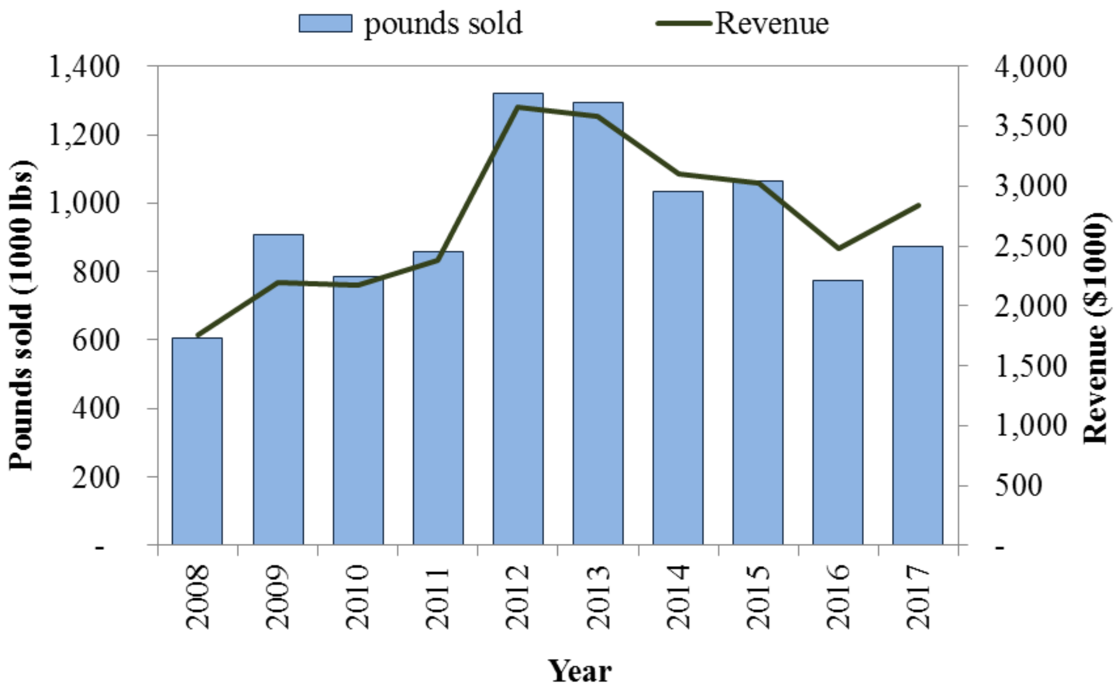

Figure 160. Pounds sold and revenue for MHI handline, 2008-2017, adjusted to 2017 dollars[1].

[1] Data sourced from the PIFSC Pelagic Module data request.

3.1.5.7.2 Fishing Costs

There are no continuous cost data collection program established for the non-longline PMUS fisheries in Hawaii. Past periodical research has documented the costs of pelagic small boat fishing in Hawaii; B\both trip expenditure and annual fishing expenditures (fixed costs) are provided in the literature (Hamilton and Huffman 1998; Hospital et al. 2011; Chan and Pan 2017). The most current data for a MHI handline trip are presented in Figure 158.

3.1.5.8 OFFSHORE HANDLINE

Pelagic offshore handline was one of the gear types included in the 2014 Small Boat Survey (Chan and Pan 2017) and fisher demographics and catch disposition on the offshore handline were available in Chan and Pan (2018, in review).

3.1.5.8.1 Commercial Participation, Landings, Revenue, and Prices

This section describes trends in pounds sold and revenues for the Hawaii offshore handline fishery. Figure 161 presents the pounds sold and revenue (adjusted to 2017 dollars) of the offshore handline, 2008-2017. Supporting data for Figure 161 can be found in Table A-131 and Table A-132. The offshore handline fishery seems stable in most of the years during the period of 2008-2017, except that the pounds sold and revenue jumped up considerably in 2010 and 2013, respectively.

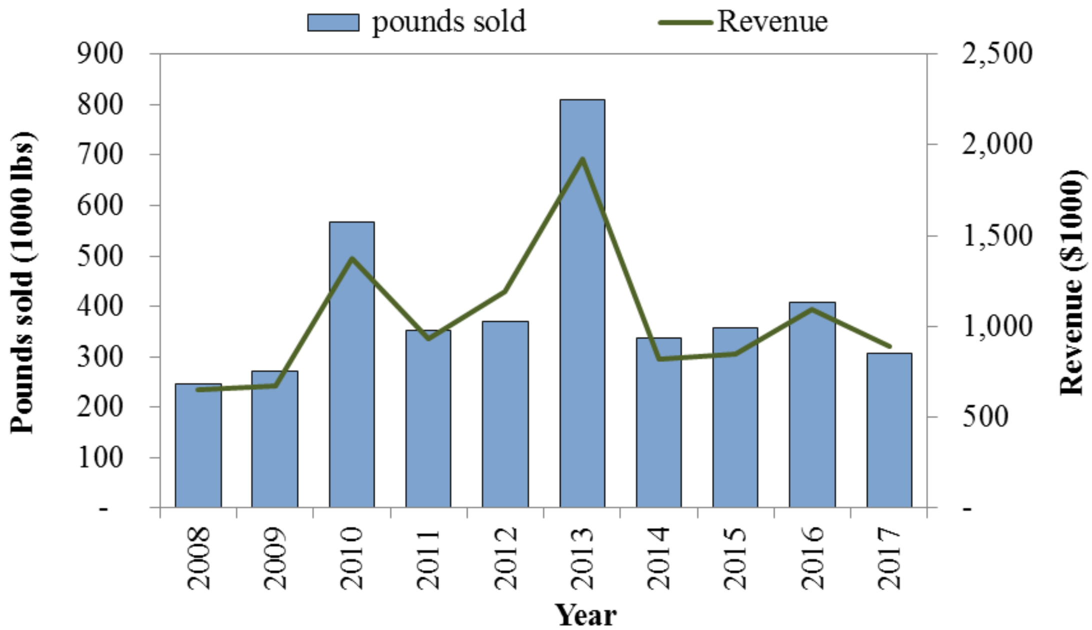

Figure 161. The pounds sold and revenue for the offshore handline from 2007-2017 adjusted to 2017 dollars[1].

[1] Data sourced from the PIFSC Pelagic Module data request.

3.1.5.8.2 Fishing Costs

Fishing costs for offshore handline were first studied in the 2014 Hawaii small boat survey (Chan and Pan 2018, in review). 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. The offshore handline trip are presented in Figure 158.

3.1.5.9 OTHER GEARS (INCLUDING AKU BOTA/POLE AND LINE)

This category represents pelagic species caught by methods or in areas other than those methods of longline, MHI troll and handline, and offshore handline. There is currently no socioeconomics information specific to this group of fisheries. Aku boat was included in the group. 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 are also included in this category.

3.1.5.9.1 Commercial Participation, Landings, Revenue, and Prices

This section will describe trends in commercial pounds sold and revenues for the "other gears". Figure 162 presents the pounds sold and revenue (adjusted to 2017 dollars) of the other gears (including aku boats), 2008-2017. Supporting data for Figure 162 can be found in Table A-131 and Table A-132. Pounds sold and revenue from this category is primarily composed of PMUS caught by the aku boat fishery. The sharp decline of pounds sold and revenue from this group reflected the decline of the aku boat fishing during the period 2008-2016. The revenue generated from the fisheries of "other gears" in 2017 composed less than 0.2% to the total revenue of pelagic sold by the Hawaii fisheries.

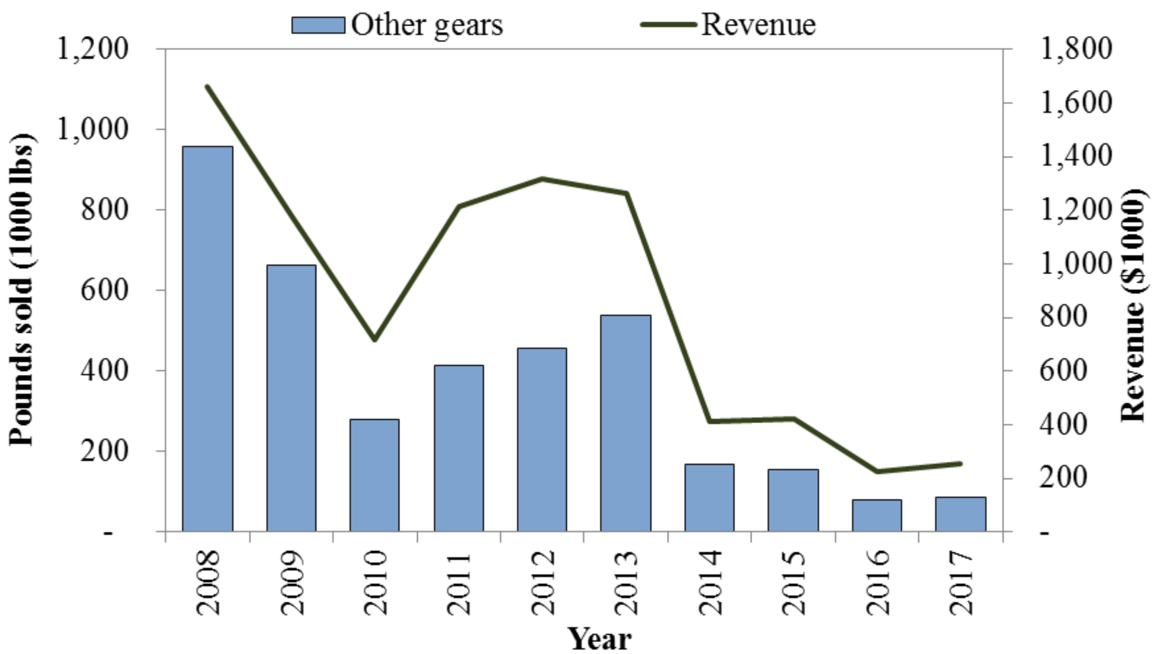

Figure 162. The pounds sold and revenue for all other gears from 2008-2017 adjusted to 2017 dollars[1].

[1] Data sourced from the PIFSC Pelagic Module data request.

3.1.5.9.2 Fishing Costs

Fishing cost data for the other presented gears were not available at the time of publication.

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 (WPRFMC 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 was developed to compile relevant socioeconomic data for Hawaii into a "Community Snapshot" by Census County Division or equivalent. Similar Community Snapshots are being developed for the other jurisdictions in the region. An update to the CNMI Community Profile is also in preparation. In addition, in 2017, an external review of the Economics and Human Dimensions Program was undertaken (PIFSC 2017). Recommendations will help focus and prioritize a strategic research agenda.

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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 the incidental take statement 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 (the Hawai`i DPS was delisted under the ESA in 2016), and not likely to adversely affect hawksbill turtles. NMFS also concluded that the fishery will not destroy or adversely modify the designated critical habitat for leatherback sea turtles. In a Biological Opinion dated January 6, 2012 (USFWS 2012a), USFWS 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 45). NMFS has determined that Pacific Island pelagic fisheries, including the shallow-set longline fishery, would have no effect on ESA-listed species of shallow reef-building corals because there is sufficient spatial separation between the listed reef corals and the activities of pelagic fishing vessels.

NMFS and USFWS have issued incidental take statements (ITS) for species included in the two 2012 Biological Opinions (Table 46). The 1-year ITSs for loggerhead and leatherback turtles are 34 and 26 (half of the 2-year ITS), respectively, are equivalent to the hard caps, and trigger closures for this fishery. Exceedance of the 2-year or 5-year ITSs requires reinitiation of consultation on the fishery under the ESA.

In 2016, NMFS documented the fishery’s first interaction with a Guadalupe fur seal (the interaction was observed in late 2015, but the vessel arrived in 2016). NMFS documented three additional interactions in 2017. On April 6, 2016, NMFS and USFWS issued a final rule to list 11 distinct population segments (DPS) of green sea turtle under the ESA (81 FR 20058). This final rule removed the previous range-wide listing and, in its place, listed eight DPSs as threatened and three as endangered. Additionally, in January 2018, oceanic whitetip sharks and giant manta rays were listed under the ESA (83 FR 4153 and 83 FR 2916, respectively). These recent developments trigger the requirement to re-initiate consultation for the fishery pursuant to Section 7 of the ESA, which NMFS is planning to do in 2018.

Table 45. 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
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 46. 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
Short-tailed albatross	5-year	1 injury or death		USFWS 2012a

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 2018 List of Fisheries (LOF; 83 FR 5349, February 7, 2018), meaning that this fishery has occasional incidental mortality and serious injuries of marine mammals. The 2018 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, and to allow for comparison with historical yearly interaction data (e.g., Table 47). Comparisons of annual incidental takes within a year to the ITSs are based on the interaction date rather than the vessel arrival date, consistent with the 2012 BiOp (e.g., Table 48).

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

Table 47 summarizes the incidental take data of sea turtles from 2004 to 2017 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 by PIFSC, and updated information necessary for any data analyses is available from PIFSC. The incidental take data for the fourth quarter of 2007 were combined with 2008 data due to vessel confidentiality rules.

Nearly all sea turtles observed in the Hawai`i shallow-set longline fishery from 2004 to 2017 were released alive. One loggerhead in 2013 was entangled in marine debris that became entangled with fishing gear and NMFS did not count this turtle towards the annual shallow-set interaction limit. One unidentified hard shell in 2013 was classified by NMFS as a loggerhead per protocol and was counted towards the annual shallow-set interaction limit for loggerheads. The highest interaction rates involved both leatherback and loggerhead turtles (average takes/1,000 hooks = 0.0061 and 0.0094, respectively), whereas interactions with greens, olive ridleys, and unidentified hard shell turtles were much less frequent (0.0005, 0.0005, 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 has been variable, ranging between 0-4 greens, 0-4 olive ridleys, 1-19 leatherbacks, 0-17 loggerheads, and 0-2 unidentified hard shell turtles.

At the end of 2017, relatively higher numbers of interactions with loggerheads were reported, with these higher numbers continuing into 2018. However, due to differences in counts of takes based on vessel arrival dates and interaction dates, the large numbers seen at the end of 2017 are not reflected in Table 47. Additional discussion on the higher loggerhead turtle interactions observed in late 2017 and early 2018 are included in Section 3.3.9 of this report.

Table 47. Observed takes and takes per fishing effort (1,000 hooks) for sea turtles in the Hawai`i shallow-set longline fishery, 2004-2017[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
2017	100	973	1,051,426	2	0.002	4	0.004	16	0.015	4	0.004	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: 2004-2017 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 the 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 any 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 ESA Section 7 consultation if fishery interactions reach these numbers in any given two-year time period.

NMFS began monitoring the ITSs 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 counts sea turtle interactions based on vessel arrival dates. 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 2017, the fishery has not exceeded the 2-year ITS for any of the species (Table 48).

Table 48. 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	2016-2017
Green turtle	6(2)	0	1(0.25)	1(0.25)	0	2(0.10)
Leatherback turtle	52(12)	18(3.05)	27(4.27)	21(4.07)	10(2.5)	9(2.35)
Loggerhead turtle	68(14)	12(0.95)	21(2.31)	28(2.95)	28(3)	36(5.85)
Olive ridley turtle	4(2)	0	1(0.05)	2(0.15)	1(0.1)	4(0.25)

[a] Takes are counted based on interaction date

3.2.1.3.2 Effectiveness of FEP Conservation Measures

As of the end of 2017, the fishery has not reached the current annual hard cap for either leatherback or loggerhead turtles (26 and 34, respectively) since those hard caps were revised based on the 2012 Biological Opinion ITSs. From 2004 to 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 through 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 49 through Table 53 summarize the incidental take data of marine mammals from 2004 to 2017 in the Hawai`i shallow-set longline fishery. Since there is full observer coverage for this fishery, all marine mammal interactions are 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 further examined by NMFS, and updated information necessary for any data analyses is available from 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 49). Of these species, Risso’s dolphins had the highest rate of interactions (average takes/1,000 hooks = 0.0022), followed by bottlenose dolphins (0.0010), striped dolphins (0.0004), common dolphins (0.0001), and rough-toothed dolphins with a single take. Marine mammals grouped as small whales (Table 50) and large whales (Table 51) 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 52.

Interactions with pinnipeds, including Northern elephant seals, Guadalupe fur seals, and unidentified pinnipeds and sea lions have been occasionally observed since 2013 (Table 53). 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 (the interaction actually occurred in 2015), and three were released injured in 2017.

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 49. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for dolphins in the Hawai`i shallow-set longline fishery, 2004-2017[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
2017	100	973	1,051,426	0	0.000	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.

Source: 2004-2017 PIRO Observer Program Annual and Quarterly Status Reports

Table 50. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for small whales in the Hawai`i shallow-set longline fishery, 2004-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Blainville's beaked whale		False killer whale		*Kogia* spp.		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	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	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	0	0.000
2007[b]	100	1,496	1,292,036	0	0.000	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	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	0	0.000
2010	100	1,879	1,828,529	0	0.000	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	0	0.000
2012	100	1,307	1,418,843	0	0.000	1	0.001	0	0.000	0	0.000	0	0.000
2013	100	912	1,000,084	0	0.000	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	0	0.000
2015	100	1,178	1,286,628	0	0.000	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	0	0.000
2017	100	973	1,051,426	0	0.000	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.

Source: 2004-2017 PIRO Observer Program Annual and Quarterly Status Reports

Table 51. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for large whales in the Hawai`i shallow-set longline fishery, 2004-2017 [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
2017	100	973	1,051,426	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: 2004-2017 PIRO Observer Program Annual and Quarterly Status Reports

Table 52. 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, 2004-2017[a].

Year	Obs. Cov. (%)	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
2017	100	973	1,051,426	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: 2004-2017 PIRO Observer Program Annual and Quarterly Status Reports

Table 53. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for pinnipeds in the Hawai`i shallow-set longline fishery, 2004-2017[a].

Year	Obs. Cov. (%)	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
2017	100	973	1,051,426	0	0.000	3[c]	0.003	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: 2004-2017 PIRO Observer Program Annual and Quarterly Status Reports

3.2.1.4.1 Comparison of Interactions with ITS

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, so interactions are no longer being monitored against the ITS. Humpback whale interactions in the shallow-set longline fishery will continue to be monitored against the PBR in this report.

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 54. 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 (Globicephalinae spp.) 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 54).

Table 54. 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 draft 2017 SARs	Outside EEZ[a]	Inside EEZ	
		Mean Annual M&SI	Mean Annual M&SI	PBR (Inside EEZ only)[c]
Bottlenose dolphin, HI Pelagic	2011-2015	2	0	140
Risso's dolphin, HI	2011-2015	3.2	0	82
Rough-toothed dolphin, HI	2011-2015	0	1	423
Striped dolphin, HI	2011-2015	0.6	0	449
Blainville's beaked whale, HI	2011-2015	0	0	10
False killer whale, HI Pelagic	2011-2015	0.1	0.1	9.3
Short-finned pilot whale, HI	2011-2015	0.1	0	106
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	2011-2015	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 seals taken in 2016 and 2017 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: Draft 2017 SARs.

3.2.1.5 SEABIRD INTERACTIONS IN THE HAWAI`I SHALLOW-SET LONGLINE FISHERY

Table 55 summarizes the incidental take data of seabirds from 2004 to 2017 in the Hawai`i shallow-set longline fishery. Since there is full observer coverage for this fishery, the interactions in Table 55 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 any 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 further examined by NMFS, and updated information necessary for any data analyses is available 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 majority of observed interactions and all mortalities during this time period involved Laysan albatrosses (average takes/1,000 hooks = 0.0291) and black-footed albatrosses (0.0193). There have also been four interactions with shearwaters (0.0002) and one with a northern fulmar, all of which were released injured, and one interaction with an unidentified gull that was released dead. NMFS identified the shearwaters as sooty shearwaters (NMFS 2016). There have been no observed takes of short-tailed albatrosses by this fishery. The table suggests an increase in takes of black-footed albatrosses after 2008, with a high of 51 takes (0.0485 takes/1,000 hooks) in 2017. However, no such trend is apparent for Laysan albatrosses.

Table 55. Observed takes, mortalities (M), and takes per fishing effort (1,000 hooks) for seabirds in the Hawai`i shallow-set longline fishery, 2004-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Laysan Albatross		Black-footed Albatross		Northern fulmar		Unidentified shearwater		Unidentified gull		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)	Takes/ 1,000 hooks	Takes (M)
2004	100	88	76,750	1	0.013	0	0.000	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	0.000	0
2006	100	939	745,125	8(3)	0.011	3(3)	0.004	0	0.000	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	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	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	0.000	0
2010	100	1,879	1,828,529	40(7)	0.022	39(11)	0.021	1	0.001	0	0.000	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	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	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	0.000	0
2014	100	1,349	1,509,727	36(2)	0.024	29(14)	0.019	0	0.000	1[c]	0.001	0	0.000	0
2015	100	1,178	1,286,628	45(6)	0.035	41(10)	0.032	0	0.000	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	0.000	0
2017	100	973	1,051,426	6(1)	0.007	51(20)	0.049	0	0.000	0	0.000	1	0.001	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 Report

Source: 2004-2017 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 albatrosses in the fishery, the ITS has not been exceeded as of the end of 2017.

3.2.1.6 ELASMOBRANCH 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, although other hammerheads have been taken in the 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. Giant manta rays were listed under the ESA on January 22, 2018 (83 FR 2916), and oceanic whitetip sharks were listed on January 30, 2018 (83 FR 4153). While these listings do not impact rays or whitetips that were taken in the fishery in 2017 or prior, interactions are included here (Table 56) for monitoring purposes going forward.

Table 56. Observed and estimated interactions with elasmobranchs in the Hawai`i shallow-set longline fishery, 2004-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Scalloped hammerhead shark		Oceanic whitetip shark		Giant manta ray	
				Takes (M[b])	Takes/ 1,000 hooks	Takes (M[b])	Takes/ 1,000 hooks	Takes (M)	Takes/ 1,000 hooks
2004	100	88	76,750	0	0.0000	3	0.0391	0	0.0000
2005	100	1,604	1,328,806	0	0.0000	348(32)	0.2619	0	0.0000
2006	100	939	745,125	0	0.0000	1	0.0013	0	0.0000
2007	100	1,496	1,292,036	0	0.0000	98(7)	0.0758	5(2)	0.0039
2008	100	1,487	1,350,127	0	0.0000	47(8)	0.0348	0	0.0000
2009	100	1,833	1,767,128	0	0.0000	54(14)	0.0306	0	0.0000
2010	100	1,879	1,828,529	0	0.0000	90(17)	0.0492	6	0.0027
2011	100	1,579	1,611,395	0	0.0000	78(9)	0.0484	3(2)	0.0031
2012	100	1,307	1,418,843	0	0.0000	24(2)	0.0169	0	0.0000
2013	100	912	1,000,084	0	0.0000	27(2)	0.0270	0	0.0000
2014	100	1,349	1,509,727	0	0.0000	21(3)	0.0139	1	0.0033
2015	100	1,178	1,286,628	0	0.0000	22(2)	0.0171	0	0.0000
2016	100	778	849,681	0	0.0000	32(3)	0.0377	0	0.0000
2017	100	973	1,051,426	0	0.0000	29(1)	0.0276	2	0.0048

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

[b] Mortality numbers include sharks that were released dead, finned, and kept.

Source: NMFS 2014 (2004-2013 data), NMFS unpublished (2014-2017 data)

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 the incidental take statement levels under ESA
- Take levels compared to marine mammal PBRs, where applicable

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 57). The humpback whale Hawai`i DPS was delisted under the ESA in 2016, so interactions are no longer monitored against the ITS. 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. In 2017, NMFS completed a

Supplement to the 2014 Biological Opinion for green, loggerhead, and olive ridley sea turtles due to exceedance of the ITS for these three species (NMFS 2017).

NMFS and USFWS have issued ITSs for species included in the Biological Opinions and determined not to jeopardize the species (Table 58). Exceedance of the 3-year or 5-year ITSs requires reinitiation of consultation on 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.

In January 2018, oceanic whitetip sharks and giant manta rays were listed under the ESA (83 FR 4153 and 83 FR 2916, respectively). NMFS will reinitiate consultation for these species.

Table 57. 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	BiOp[c]	LAA, non-jeopardy
Leatherback turtle	2014-09-19	BiOp	LAA, non-jeopardy
Olive ridley turtle, Endangered Mexico and threatened eastern Pacific populations	2017-03-24	BiOp[c]	LAA, non-jeopardy
Olive ridley turtle, Threatened western Pacific population	2017-03-24	BiOp[c]	LAA, non-jeopardy
Green turtle, East Pacific DPS	2017-03-24	BiOp[c]	LAA, non-jeopardy
Green turtle, Central North Pacific DPS	2017-03-24	BiOp[c]	LAA, non-jeopardy
Green turtle, East Indian-West Pacific DPS	2017-03-24	BiOp[c]	LAA, non-jeopardy
Green turtle, Southwest Pacific DPS	2017-03-24	BiOp[c]	LAA, non-jeopardy
Green turtle, Central West Pacific DPS	2017-03-24	BiOp[c]	LAA, non-jeopardy
Green turtle, Central South Pacific DPS	2017-03-24	BiOp[c]	LAA, non-jeopardy
Hawksbill turtle	2014-09-19	BiOp	NLAA
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.

[c] Supplement to the 2014 BiOp.

Table 58. 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	18	13	NMFS 2017
Leatherback turtle	3-year	72	27	NMFS 2014
Olive ridley turtle, Endangered Mexico and threatened eastern Pacific populations	3-year	144	134	NMFS 2017
Olive ridley turtle, Threatened western pacific population	3-year	42	40	NMFS 2017
Green turtle, East Pacific DPS	3-year	12	12	NMFS 2017
Green turtle, Central North Pacific DPS	3-year	6	6	NMFS 2017
Green turtle, East Indian-West Pacific DPS	3-year	6	6	NMFS 2017
Green turtle, Southwest Pacific DPS	3-year	6	6	NMFS 2017
Green turtle, Central West Pacific DPS	3-year	3	3	NMFS 2017
Green turtle, Central South Pacific DPS	3-year	3	3	NMFS 2017
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.

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 fishery under the MMPA 2018 List of Fisheries (LOF) (83 FR 5349, February 7, 2018), meaning that NMFS has determined that this fishery has frequent incidental mortality and serious injuries of marine mammals. The 2018 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
- Humpback whale, Central North Pacific stock
- *Kogia* spp. (Pygmy or dwarf sperm whale), HI 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, and to allow for comparison with historical yearly interaction data (e.g., Table 59). Comparison of annual incidental takes within a year to the ITSs are based on the interaction date rather than the vessel arrival date, consistent with the 2014 and 2017 BiOps (e.g., Table 60).

3.2.2.3 SEA TURTLE INTERACTIONS IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

Table 59 summarizes the incidental take data of sea turtles from 2002 to 2017 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 further examined by NMFS, and updated information necessary for any data analyses is available from 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 are not available, a standard expansion factor estimate is 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 observed interaction rates involved olive ridley sea turtles (2002-2017 average observed takes/1,000 hooks = 0.0010), whereas interactions with leatherbacks, greens, and loggerheads were much less frequent (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), 0-7 leatherbacks (0-38), 0-4 loggerheads (0-17), and 3-31 olive ridleys (10-162).

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 Supplement to the 2014 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 Supplement to the 2014 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. This recommendation will be implemented in 2018, with results expected to be available for the 2018 SAFE report update in calendar year 2019.

Table 59. 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, 2002-2017[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
2017	20.4	3,832	10,148,195	3(1)	0.0003	15	-	0	0.0000	0	-	3	0.0003	15	-	26(23)	0.0026	127	-	0	0.0000	-

[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.

Source: Take data—2002-2017 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 Supplement to the 2014 Biological Opinion for all other sea turtle species (Table 59; Table 60). NMFS began monitoring the 2014 Biological Opinion ITS in Quarter 3 of 2014 and the 2017 Supplement to the 2014 Biological Opinion ITS in Quarter 3 of 2016, and uses a rolling 3-year period to track incidental take. NMFS always uses the interaction date for tracking sea turtle interactions against the ITS, regardless of vessel arrival date. 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 arrival dates. 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 60. 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 compared to the 3-year ITS in the 2014 Biological Opinion and in the 2017 Supplement to the 2014 Biological Opinion[a].

2014 BiOp		
Species	3-year ITS Interactions (M)	Estimated Total Interactions and Mortalities Interactions (M) 2014- 2017
Leatherback turtle	72(27)	40 (16.7)
2017 Supp. BiOp		
Species	3-year ITS Interactions (M)	Estimated Total Interactions and Mortalities Interactions (M) Q3 2016-Q4 2017
Green turtle[b]	-	-
East Pacific DPS	12(12)	10.58(9.7)
Central North Pacific DPS	6(6)	1.81(1.7)
East Indian-west Pacific DPS	6(6)	1.21(1.1)
Southwest Pacific DPS	6(6)	1.06(.97)
Central West Pacific DPS	3(3)	0.159(14)
Central South Pacific DPS	3(3)	0.15(.14)
Loggerhead turtle[b]	18(13)	15(9.5)
Olive ridley turtle[b]	-	-
Endangered Mexico and threatened eastern Pacific populations	141(134)	120 (113.8)
Threatened western Pacific populations	42(40)	36(34.1)

[a] Takes are counted based on interaction date.

[b] These species exceeded their ITSs in 2016, and interactions beginning the third quarter of 2016 count against their new ITSs (NMFS 2017).

3.2.2.4 MARINE MAMMAL INTERACTIONS IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

Table 61 through Table 64 summarize the incidental take data of marine mammals from 2002 to 2017 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. 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 further examined, and updated information necessary for any data analyses is available from 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 are not available, a standard expansion factor estimate is 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. False killer whales had the highest interaction rate over the 2002-2017 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* spp. whales. Interactions with marine mammals grouped as large whales were also rare, with observed interactions recorded with humpback whales and one sperm whale (Table 63). Observed interactions with unidentified cetacean groups are shown in Table 64.

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 2002-2017 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 61. 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, 2002-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Bottlenose dolphin				Pantropical spotted dolphin				Rough-toothed dolphin				Risso's dolphin				Striped dolphin			
				Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME
				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		
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	-
2017	20.4	3,832	10,148,195	1	0.0001	5	-	0	0.000	0	-	0	0.0000	0	-	1	0.0001	5	-	0	0.0000	0	-

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

[b] One unidentified dolphin was later identified as a striped dolphin (), but is listed as an unidentified dolphin in the 2015 Annual Observer Report.

Source: Take data—2002-2017 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2005; McCracken, 2006; McCracken, 2011a; McCracken, 2016; McCracken, 2017b.

Table 62. 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, 2002-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Blainville's beaked whale				False killer whale				*Kogia* spp.				Pygmy killer whale				Short-finned pilot whale			
				Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME
				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		
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	0.0000	0	-	7	0.0007	35	-	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-
2017	20.4	3,832	10,148,195	0	0.0000	0	-	8(2)	0.0008	39	-	0	0.0000	0	-	0	0.0000	0	-	0	0.0000	0	-

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

Source: Take data—2002-2017 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2005; McCracken, 2006; McCracken, 2011a; McCracken, 2016; McCracken, 2017b.

Table 63. 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, 2002-2017[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	-
2017	20.4	3,832	10,148,195	0	0.0000	0	-	0	0.0000	0	-

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

Source: Take data—2002-2017 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2005; McCracken, 2006; McCracken, 2011a; McCracken, 2016; McCracken, 2017b.

Table 64. 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, 2002-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Unidentified cetacean[b]			Unidentified whale[b]			Unidentified dolphin[b]			Unidentified beaked whale[b]		
				Observed		EF Est.	Observed		EF Est.	Observed		EF Est.	Observed		EF Est.
				Takes	Takes/ 1,000 hooks		Takes	Takes/ 1,000 hooks		Takes	Takes/ 1,000 hooks		Takes	Takes/ 1,000 hooks	
2002	24.6	3,523	6,786,303	2	0.0003	8	0	0.0000	0	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	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
2005	26.1	4,602	9,360,671	1	0.0001	4	0	0.0000	0	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	0	0.0000	0
2007	20.1	3,506	7,620,083	1	0.0001	5	0	0.0000	0	1	0.0001	5	0	0.0000	0
2008	21.7	3,915	8,775,951	2	0.0002	9	2	0.0002	9	0	0.0000	0	0	0.0000	0
2009	20.6	3,520	7,877,861	0	0.0000	0	3	0.0004	15	0	0.0000	0	0	0.0000	0
2010	21.1	3,580	8,184,127	0	0.0000	0	3	0.0004	14	0	0.0000	0	0	0.0000	0
2011	20.3	3,540	8,260,092	2	0.0002	10	0	0.0000	0	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	0	0.0000	0
2013	20.4	3,830	9,278,133	2	0.0002	10	0	0.0000	0	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	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	0	0.0000	0
2016	20.1	3,880	9,872,439	2	0.0002	10	0	0.0000	0	0	0.0000	0	1	0.0001	5
2017	20.4	3,832	10,148,195	4	0.0004	20	0	0.0000	0	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; 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 Pacific Islands Fisheries Science Center.

[c] This dolphin was later identified as a striped dolphin (),

Source: Take data—2002-2017 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 65). 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 interaction date for tracking marine mammal interactions against the ITS, regardless of vessel arrival date. 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 arrival dates. 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 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, so interactions are no longer being monitored against the ITS. Humpback whale interactions will continue to be monitored against the PBR in this report.

Table 65. 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)	3-year Monitoring Period Interactions (M)
		2014-2017
Sperm whale	9(3)	0
MHI insular false killer whale	1(0.74)	0

[a] Takes are counted based on interaction date.

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 deep-set longline fishery is presented in Table 66 and Table 67. 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 66).

The M&SI interactions inside the Hawai`i EEZ for the HI Pelagic stock of false killer whales in 2009-2013 was 10.85, which exceeded the PBR of 9.3 for this stock. 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. The M&SI interactions inside the Hawai`i EEZ for the HI Pelagic stock for 2011 to 2015 was 7.5, which is below this stock's PBR (Table 67).

Table 66. 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 draft 2017 SAR	Outside EEZ[a]	Inside EEZ[b]	
		Mean Estimated Annual M&SI	Mean Estimated Annual M&SI	PBR (Inside EEZ only)
Bottlenose dolphin, HI Pelagic	2011-2015	2.2	0	140
Pantropical spotted dolphin, HI Pelagic	2011-2015	0[c]	0[c]	403
Rough-toothed dolphin, HI	2011-2015	0	0	46
Risso's dolphin, HI	2011-2015	0.9	0.6	42
Striped dolphin, HI	2011-2015	0.8	0	154
Blainville's beaked whale, HI	2011-2015	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	2011-2015	1.0	0.1	70
Humpback whale, Central North Pacific	2009-2013	0		83[d]
Sperm whale, HI	2011-2015	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 estimates are only available for portions of the stock within the U.S. EEZ around Hawai`i.

[c] M&SI estimates were not included in the draft 2017 SARs because there were no known takes in 2011-2015 by the deep-set or shallow-set Hawai`i longline fisheries.

[d] PBR for the Central North Pacific stock for humpback whales apply to the entire stock.

Source: Draft 2017 SARs

Table 67. 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 draft 2017 SAR	Outside EEZ[a]	Inside EEZ	
		Mean Estimated Annual M&SI	Mean Estimated Annual M&SI	PBR (Inside EEZ only)
MHI Insular	2011-2015	-	0.0	0.3
HI Pelagic	2011-2015	15.2	7.5	9.3
NWHI	2011-2015	-	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: Draft 2017 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 further examined by NMFS, and updated information necessary for any data analyses is available from NMFS. Observed take data are expanded to represent the estimated number of annual incidental takes for the entire fishery by PIFSC (hereafter "ME"). When ME are not available, a standard expansion factor estimate is 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 68 and Table 69 summarize the incidental take data of seabirds from 2002 to 2017 in the Hawai`i deep-set longline fishery. The large majority of observed interactions during this time period involved Laysan albatrosses (average observed takes/1,000 hooks = 0.0027) and black-footed albatrosses (0.0042). Additional takes of unidentified shearwaters (0.0003), sooty shearwaters (<0.0001), brown boobies (<0.0001), red-footed boobies (<0.0001), and unidentified gulls (<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 albatrosses, 16 and 541 for black-footed albatrosses, 0 and 12 for booby species, and 0 and 62 for shearwater species. Interactions with black-footed albatrosses since 2015 have been substantially higher compared to previous years. Interactions with sooty shearwaters and boobies are 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 in 2016. 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.

In response to the Council recommendation, a seabird workshop was convened in November 2017. The objectives of the workshop were to: 1) review recent increased albatross interactions in the Hawaii longline fishery; 2) explore possible factors responsible for this increase; 3) evaluate albatross population impacts; and 4) provide input for future data collection, analysis, and models. Information presented at the workshop strongly suggested that El Niño Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO) influence albatross distribution by affecting wind patterns and ocean productivity. In years of positive ENSO and PDO, albatross distributions and longline fishing effort overlap more closely, resulting in increased albatross interaction rates. The workshop also identified albatross population dynamics, mesoscale oceanographic processes, and increased albatross attraction to vessels as other factors that may influence interaction rates. A black-footed albatross population model indicated that the recent increase in albatross interactions is unlikely to significantly affect population growth as long as the increase is limited to the Hawaii longline fishery or is episodic. Next steps include filling a variety of data gaps in order to build an Integrated Population Model (IPM). The full workshop report will be published as a NOAA Technical Memorandum.

Additional discussion on the factors influencing seabird interaction trends is included in Section 4.1 of this report.

Table 68. Observed takes, mortalities (M), takes per fishing effort (sets and 1,000 hooks), and estimated annual takes using expansion factor estimates and ME for albatross species in the Hawai`i deep-set longline fishery, 2002-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Laysan albatross				Black-footed albatross				Unidentified albatross				Short-tailed albatross
				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)
2002	24.6	3,523	6,786,303	16(13)	0.002	65	-	18(17)	0.003	73	-	0	0.000	-	-	0
2003	22.2	3,204	6,442,221	44(44)	0.007	198	-	24(23)	0.004	108	-	0	0.000	-	-	0
2004	24.6	3,958	7,900,681	2(2)	0.000	-	10	4(4)	0.001	-	16	0	0.000	-	-	0
2005	26.1	4,602	9,360,671	6(6)	0.001	-	43	12(12)	0.001	-	82	0	0.000	-	-	0
2006	21.2	3,605	7,540,286	1(1)	0.000	-	7	17(17)	0.002	-	70	0	0.000	-	-	0
2007	20.1	3,506	7,620,083	7(7)	0.001	-	44	14(14)	0.002	-	77	0	0.000	-	-	0
2008[d]	21.7	3,915	8,775,951	14(13)	0.002	-	55	34(33)	0.004	-	118	0	0.000	-	-	0
2009	20.6	3,520	7,877,861	18(18)	0.002	-	60	23(23)	0.003	-	110	0	0.000	-	-	0
2010	21.1	3,580	8,184,127	39(38)	0.005	-	155	17(17)	0.002	-	65	0	0.000	-	-	0
2011	20.3	3,540	8,260,092	32(31)	0.004	-	187	13(12)	0.002	-	73	0	0.000	-	-	0
2012	20.4	3,659	8,768,728	30(25)	0.003	-	136	35(35)	0.004	-	167	0	0.000	-	-	0
2013	20.4	3,830	9,278,133	48(46)	0.005	-	236	50(47)	0.005	-	257	0	0.000	-	-	0
2014	20.8	3,831	9,608,244	13(10)	0.001	-	77	32(29)	0.003	-	175	0	0.000	-	-	0
2015	20.6	3,728	9,393,234	24(22)	0.003	-	119	107(92)	0.011	-	541	0	0.000	-	-	0
2016	20.1	3,880	9,872,439	34(32)	0.003	-	166	104(99)	0.011	-	485	1(1)	0.001	-	7	0
2017	20.4	3,832	10,148,195	38(38)	0.004	186	-	97(85)	0.010	475	-	0	0.000	0	-	0

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

Source: Take data—2002-2017 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.

Table 69. Observed takes, mortalities (M), takes per fishing effort (sets and 1,000 hooks), and estimated annual takes using expansion factor estimates and ME for other seabird species in the Hawai`i deep-set longline fishery, 2002-2017 [a].

Year	Obs. Cov. (%)	Sets	Hooks	Booby species				Sooty shearwater			Unidentified shearwater				Unidentified gull			
				Observed		EF Est.	ME	Observed		EF Est.	Observed		EF Est.	ME	Observed		EF Est.	ME
				Takes (M)	Takes/ 1,000 hooks			Takes (M)	Takes/ 1,000 hooks		Takes (M)	Takes/ 1,000 hooks			Takes (M)	Takes/ 1,000 hooks		
2002	24.6	3,523	6,786,303	0	0.000	0	-	0	0.000	0	0	0.000	0	-	0	0.000	-	-
2003	22.2	3,204	6,442,221	0	0.000	0	-	0	0.000	0	0	0.000	0	-	0	0.000	-	-
2004	24.6	3,958	7,900,681	0	0.000	0	-	0	0.000	0	2(2)	0.000	8	-	0	0.000	-	-
2005	26.1	4,602	9,360,671	1(1)[b]	0.000	4	-	0	0.000	0	0	0.000	0	-	0	0.000	-	-
2006	21.2	3,605	7,540,286	0	0.000	0	-	3(3)	0.000	14	2(2)[c]	0.000	9	-	0	0.000	-	-
2007	20.1	3,506	7,620,083	0	0.000	0	-	0	0.000	0	0	0.000	0	-	0	0.000	-	-
2008[d]	21.7	3,915	8,775,951	1[e]	0.000	-	4	0	0.000	0	14(14)[c]	0.002	-	62	0	0.000	-	-
2009	20.6	3,520	7,877,861	0	0.000	-	0	0	0.000	0	4(4)[c]	0.001	-	24	0	0.000	-	-
2010	21.1	3,580	8,184,127	0	0.000	-	0	0	0.000	0	1(1)[c]	0.000	-	0	0	0.000	-	-
2011	20.3	3,540	8,260,092	0	0.000	-	0	0	0.000	0	3(3)[c]	0.000	-	19	0	0.000	-	-
2012	20.4	3,659	8,768,728	0	0.000	-	0	1(1)	0.000	5	6(6)[c]	0.001	-	36	0	0.000	-	-
2013	20.4	3,830	9,278,133	0	0.000	-	0	0	0.000	0	8(8)[c]	0.001	-	43	0	0.000	-	-
2014	20.8	3,831	9,608,244	0	0.000	-	0	0	0.000	0	1(1)[c]	0.000	-	7	0	0.000	-	-
2015	20.6	3,728	9,393,234	1(1)[g]	0.000	-	6	5(4)	0.001	5	0	0.000	-	21[f]	0	0.000	-	-
2016	20.1	3,880	9,872,439	2(1)[g]	0.000	-	12	4(4)	0.000	20	0	0.000	0	-	0	0.000	-	-
2017	20.4	3,832	10,148,195	0	0.000	0	-	0	0.000	0	0	0.000	0	-	1	0.001	5	-

[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 were later identified as sooty shearwaters in 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 < 0.001, 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.

Source: Take data—2002-2017 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 2017.

3.2.2.6 ELASMOBRANCH INTERACTIONS IN THE HAWAI`I DEEP-SET LONGLINE FISHERY

Table 70 summarizes the incidental take data for the Indo-west Pacific DPS of scalloped hammerhead sharks, oceanic whitetip sharks, and giant manta rays in the Hawai`i deep-set longline fishery. The data only include interactions that occurred within the range of the Indo-west Pacific DPS of scalloped hammerhead sharks, and do not include interactions occurred within the range of the Central Pacific DPS, which is not listed under the ESA. Giant manta rays were listed under the ESA on January 22, 2018 (83 FR 2916), and oceanic whitetip sharks were listed on January 30, 2018 (83 FR 4153). While these listings do not impact rays or whitetips that were taken in the fishery in 2017 or prior, interactions are included here for monitoring purposes going forward.

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 (EF Est. = 100/% observer coverage * # takes).

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 2017.

Table 70. Observed and estimated interactions with elasmobranchs in the Hawai`i deep-set longline fishery, 2004-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Scalloped hammerhead shark			Oceanic whitetip shark			Giant manta ray		
				Observed			Observed			Observed		
				Takes (M[b])	Takes/ 1,000 hooks	EF Est.	Takes (M[b])	Takes/ 1,000 hooks	EF Est.	Takes (M[b])	Takes/ 1,000 hooks	EF Est.
2004	24.6	3,958	7,900,681	2	0.0003	9	434(101)	0.0549	1764	1	0.0001	4
2005	26.1	4,602	9,360,671	0	0.0000	0	341(80)	0.0364	1307	2	0.0002	8
2006	21.2	3,605	7,540,286	0	0.0000	0	331(78)	0.0439	1561	2(1)	0.0003	9
2007	20.1	3,506	7,620,083	1	0.0001	5	262(72)	0.0344	1303	2	0.0003	10
2008	21.7	3,915	8,775,951	0	0.0000	0	144(36)	0.0164	664	2	0.0002	9
2009	20.6	3,520	7,877,861	0	0.0000	0	244(55)	0.0310	1184	4	0.0005	19
2010	21.1	3,580	8,184,127	0	0.0000	0	253(44)	0.0309	1199	17(1)	0.0021	81
2011	20.3	3,540	8,260,092	0	0.0000	0	225(43)	0.0272	1108	1	0.0001	5
2012	20.4	3,659	8,768,728	0	0.0000	0	172(38)	0.0196	843	2	0.0002	10
2013	20.4	3,830	9,278,133	0	0.0000	0	196(36)	0.0211	961	1	0.0001	5
2014	20.8	3,831	9,608,244	0	0.0000	0	374(68)	0.0389	1798	3	0.0003	14
2015	20.6	3,728	9,393,234	0	0.0000	0	531(139)	0.0565	2578	2	0.0002	10
2016	20.1	3,880	9,872,439	0	0.0000	0	423(123)	0.0428	2104	4	0.0004	20
2017	20.4	3,832	10,148,195	0	0.0000	0	242(57)	0.0238	1186	0	0.0000	5

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

[b] Mortality numbers include animals that were released dead, finned (prior to passage of the Shark Conservation Act of 2010), and kept.

Source: NMFS 2014 (2004-2013 data), NMFS unpublished (2014-2017 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 American Samoa longline fishery using the following indicators:

- General interaction trends over time
- Effectiveness of FEP conservation measures
- Take levels compared to the incidental take statement 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 meet 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 complete 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 71). 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 USFWS 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 with a non-jeopardy determination in the Biological Opinions (Table 72). Exceeding the three-year ITSs requires reinitiation of consultation on the fishery under the ESA.

In January 2018, oceanic whitetip sharks and giant manta rays were listed under the ESA (83 FR 4153 and 83 FR 2916, respectively). NMFS will reinitiate consultation for these two species if there is likely an adverse effect by the American Samoa longline fishery.

Table 71. 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, Central South Pacific DPS	2015-10-30	BiOp	LAA, non-jeopardy
Green turtle, Southwest Pacific DPS	2015-10-30	BiOp	LAA, non-jeopardy
Green turtle, East Pacific DPS	2015-10-30	BiOp	LAA, non-jeopardy
Green turtle, Central West Pacific DPS	2015-10-30	BiOp	LAA, non-jeopardy
Green turtle, East Indian-West Pacific DPS	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 72. 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, Central South Pacific DPS[a]	3-year	30	27	NMFS 2015
Green turtle, Southwest Pacific DPS[a]	3-year	20	17.82	NMFS 2015
Green turtle, East Pacific DPS[a]	3-year	7	6.48	NMFS 2015
Green turtle, Central West Pacific DPS[a]	3-year	2	1.62	NMFS 2015
Green turtle, 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 2018 LOF (83 FR 5349, February 7, 2018), meaning that this fishery has occasional incidental mortality and serious injuries of marine mammals. The 2018 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 Samoa 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 about 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 purposes of this report for consistency with the Observer Program reports, and to allow comparison of historical yearly interactions data (e.g., Table 73). Comparison of annual incidental takes within a year to the ITSs are based on the interaction date rather than the vessel arrival date, consistent with the 2015 BiOp (e.g., Table 74).

3.2.3.3 SEA TURTLE INTERACTIONS IN THE AMERICAN SAMOA LONGLINE FISHERY

Table 73 summarizes the incidental take data of sea turtles from 2006 to 2017 in the American Samoa 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 further examined by NMFS, and updated information necessary for any data analyses is available from 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 are not available, a standard expansion factor estimate is used (EF Est. = 100/% observer coverage * # takes).

Between 2006 and 2017, 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 observed interaction rate involved green sea turtles (2006-2017 average takes/1,000 hooks = 0.0020), whereas interactions with leatherbacks, olive ridleys, and hawksbills were less frequent (0.0005, 0.0006, and <0.0001 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 2011-2017 when all interactions were observed (21.9%). Since leatherback, olive ridley, and hawksbill interactions with this fishery are relatively uncommon, it is possible the recent occurrence of interactions after 2010 is due to higher observer coverage as opposed to a real increase in interactions in the fishery.

Table 73. 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, 2006-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Green				Leatherback				Olive ridley				Hawksbill			
				Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME
				Takes (M)	Takes/ 1,000 hooks			Takes (M)	Takes/ 1,000 hooks			Takes (M)	Takes/ 1,000 hooks			Takes (M)	Takes/ 1,000 hooks		
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	-
2017	20.0	447	1,271,803	4(4)	0.003	20	-	1	0.001	5	-	2(2)	0.002	10	-	0	0.000	0	-

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

Source: Take data—2006-2017 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 74). 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 74. 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 2017 Interactions (M)
Green turtle [b]	60(54)	41.3(38)
Central South Pacific DPS[b]	30(27)	20.7(19.0)[c]
Southwest Pacific DPS[b]	20(17.82)	13.6(12.5)[c]
East Pacific DPS[b]	7(6.48)	5(4.6)[c]
Central West Pacific DPS[b]	2(1.62)	1.2(1.1)[c]
East Indian-West Pacific DPS[b]	1(1.08)	0.8(0.74)[c]
Leatherback turtle	69(49)	10.3(7)
Olive ridley turtle	33(10)	30.1(19.6)
Loggerhead turtle	6(3)	0
Hawksbill turtle	6(3)	5(3)

[a] Takes are counted based on interaction 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 75 summarizes the incidental take data of marine mammals from 2006 to 2017 in the American Samoa longline fishery. 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 further examined by NMFS, and updated information necessary for any data analyses is available from 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 2017 were relatively infrequent. False killer whales had the highest interaction rate over this period (average observed takes/1,000 hooks = 0.0006), followed by rough-toothed dolphins (0.0004), Cuvier's beaked whales (<0.0001), short-finned pilot whales (<0.0001), and 2 unidentified cetaceans (<0.0001). Between 2006 and 2017, there were 5 years of no observed marine mammal interactions with this fishery (2006, 2007, 2009, 2010, and 2012).

Table 75. 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, 2006-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Cuvier's beaked whale			False killer whale			Rough-toothed dolphin			Short-finned pilot whale			Unidentified cetacean		
				Observed		EF Est.	Observed		EF Est.	Observed		EF Est.	Observed		EF Est.	Observed		EF Est.
				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	
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
2017	20.0	447	1,271,803	0	0.000	0	1	0.001	5	1	0.001	5	0	0.000	0	0	0.000	0

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

Source: 2006-2017 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 76 summarizes the incidental take data of seabirds from 2006 to 2017 in the American Samoa 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 further examined by NMFS, and updated information necessary for any data analyses is available from 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 McCracken Estimates, or "ME"). When ME are not available, a standard expansion factor estimate is listed in the table (EF Est. = 100/% observer coverage * # takes).

Observed seabird interactions with the American Samoa longline fishery between 2006 and 2017 were uncommon, with a total of three observed unidentified shearwater and frigatebird interactions (all released dead). The observer program report for 2015 included 13 observed interactions with black-footed albatrosses that occurred in the North Pacific with vessels departing American Samoa and landing in California. There were no observed seabird interactions in 2016 or 2017.

Table 76. 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, 2006-2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Black-footed Albatross				Unidentified shearwater				Unidentified frigatebird			
				Observed		EF Est.	ME	Observed		EF Est.	ME	Observed		EF Est.	ME
				Takes (M)	Takes/ 1,000 hooks			Takes (M)	Takes/ 1,000 hooks			Takes (M)	Takes/ 1,000 hooks		
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	-
2017	20.0	447	1,271,803	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: 2006-2017 PIRO Observer Program Annual and Quarterly Status Reports

ME—McCracken, 2015a; McCracken, 2017a.

3.2.3.6 ELASMOBRANCH INTERACTIONS IN THE AMERICAN SAMOA LONGLINE FISHERY

Table 77 summarizes the incidental take data for the Indo-west Pacific DPS scalloped hammerhead sharks, oceanic whitetip sharks, and giant manta rays in the American Samoa longline fishery. Giant manta rays were listed under the ESA on January 22, 2018 (83 FR 2916), and oceanic whitetip sharks were listed on January 30, 2018 (83 FR 4153). While these listings do not impact rays or whitetips that were taken in the fishery in 2017 or prior, interactions are included here for monitoring purposes going forward.

Observed interactions with scalloped hammerheads range between 0-4 per year, with expanded total takes 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 one in 2017, and thus the ITS has not been exceeded.

Table 77. Observed and estimated total elasmobranch interactions with the American Samoa longline fishery for 2006–2017[a].

Year	Obs. Cov. (%)	Sets	Hooks	Scalloped hammerhead				Oceanic whitetip			Giant manta ray		
				Observed		EF Est.	ME	Observed		EF Est.	Observed		EF Est.
				Takes (M[b])	Takes/ 1,000 hooks			Takes (M[b])	Takes/ 1,000 hooks		Takes (M)	Takes/ 1,000 hooks	
2006	8.1	287	797,221	1(1)	0.0013	13	-	46(11)	0.0577	568	0	0.0000	0
2007	7.1	410	1,255,329	1	0.0008	15	-	62(18)	0.0494	873	0	0.0000	0
2008	6.4	379	1,194,096	0	0.0000	0	-	48(17)	0.0402	750	0	0.0000	0
2009	7.7	306	880,612	0	0.0000	0	-	45(13)	0.0511	584	1	0.0011	13
2010	25	798	2,301,396	4(1)	0.0017	-	17	130(37)	0.0565	520	3	0.0013	12
2011	33.3	1,257	3,605,897	2(1)	0.0006	-	7	116(44)	0.0322	348	3	0.0008	9
2012	19.8	662	1,880,525	0	0.0000	-	0	71(26)	0.0378	359	3	0.0016	15
2013	19.4	585	1,690,962	0	0.0000	-	0	88(15)	0.0520	454	2	0.0012	10
2014	19.4	565	1,490,416	1	0.0007	-	6	104(37)	0.0698	536	1	0.0007	5
2015	22.0	504	1,441,706	1(1)	0.0007	-	3	168(59)	0.1165	764	0	0.0000	0
2016	19.4	424	1,179,532	1	0.0008	5	-	197(70)	0.1670	1015	0	0.0000	0
2017	20.0	447	1,271,803	1	0.0008	5	-	63(22)	0.0495	315	0	0.0000	0

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

[b] Mortality numbers include sharks that were released dead, finned (prior to the passage of the Shark Conservation Act of 2010), and kept.

Source: NMFS American Samoa Longline Observer Program Annual Reports 2006–2011 (NMFS 2006b, 2007, 2008b, 2009, 2010b, 2011, 2012, 2013, 2014d) and unpublished data; 2010–2017, 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 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 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.

In January 2018, oceanic whitetip sharks and giant manta rays were listed under the ESA (83 FR 4153 and 83 FR 2916, respectively). NMFS will reinitiate consultation for those two species.

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 2018 LOF (83 FR 5349, February 7, 2018), 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 2018 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 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 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.

In January 2018, oceanic whitetip sharks and giant manta rays were listed under the ESA (83 FR 4153 and 83 FR 2916, respectively). NMFS will reinitiate consultation for those two species.

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 2018 LOF (83 FR 5349, February 7, 2018), 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 Chapter 2, 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 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 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.

In January 2018, oceanic whitetip sharks and giant manta rays were listed under the ESA (83 FR 4153 and 83 FR 2916, respectively). NMFS will reinitiate consultation for those two species.

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 2018 LOF (83 FR 5349, February 7, 2018), 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 Chapter 2, 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 IDENTIFICATION OF EMERGING ISSUES

Oceanic whitetip sharks were listed under the ESA in 2018. This species is incidentally captured in the Hawaii and American Samoa longline fisheries. Observed interaction data have been added to this report this year. RFMO conservation measures implemented in the U.S. domestic fisheries has required non-retention of oceanic whitetip sharks since 2011 in the IATTC area and 2015 in the WCPFC area. NMFS PIFSC is currently conducting a study to assess the post-release survivorship of sharks released alive in the Hawaii and American Samoa longline fishery.

Loggerhead turtle interactions in the Hawai`i shallow-set longline fishery since the start of the 2017-2018 fishing season (2017 fall through 2018 summer) were higher than levels observed since the fishery reopened in 2004 through 2016. The total number of loggerhead interactions (based on observed interaction date) for 2017 was 21, and 27 loggerhead interactions were observed in January 2018. While the factors influencing the recent spike in loggerhead turtle interactions are unclear at this time, available observer data indicate that sea turtle interactions can accumulate quickly in some years and have the potential to fluctuate substantially between years. The existing management measures for this fishery do not provide for early detection of and response to higher interaction rates, hotspots, or fluctuations that may indicate a potential for higher impacts to sea turtle populations or a fishery closure early in the calendar year. The Council at its 172nd Meeting in March 2018 initiated development of a management framework under the Pelagic FEP to effectively manage impacts to leatherback and loggerhead sea turtles. Additionally, PIFSC is undertaking analyses to characterize the recent loggerhead turtle interactions.

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.

One species that may interact with pelagic fisheries is currently a candidate for listing under the ESA, and several more ESA-listed species are being evaluated for critical habitat designation (Table 78). If this species is 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 78. 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)	Listed as threatened (83 FR 4153, 1/30/18)	Not determinable because of insufficient data (83 FR 4153, 1/30/18)	TBA
Pacific bluefin tuna	*Thunnus orientalis*	Positive (81 FR 70074, 10/11/2016)	Not warranted (82 FR 37060, 8/8/17)	N/A	N/A	N/A
Chambered nautilus	*Nautilus pompilius*	Positive (81 FR 58895, 8/26/2016)	Positive, threatened (82 FR 48948, 10/23/17)	Public comment period closed 12/22/17, final rule expected 10/2018	N/A	N/A
Giant manta ray	*Manta birostris*	Positive (81 FR 8874, 2/23/2016)	Positive, threatened (82 FR 3694, 1/12/2017)	Listed as Threatened (83 FR 2916, 1/22/18)	Not determinable because of insufficient data (83 FR 2916, 1/22/18)	TBA
Reef manta ray	*Manta alfredi*	Positive (81 FR 8874, 2/23/2016)	Not warranted (82 FR 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 TBA	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)	Critical habitat proposed (82 FR 51186, 11/3/17), comment period closed 1/2/18, final rule expected 7/1/18	In development, public comment expected 2018
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 TBA[a]	TBA

[a] NMFS and USFWS have been tasked with higher priorities regarding sea turtle listings under the ESA, and do not anticipate proposing green turtle critical habitat designations in the immediate future.

3.2.8 AMERICAN SAMOA, GUAM, AND CNMI TROLL FISHERY

3.2.8.1 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.

3.2.8.1.1 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 requires any vessel fishing under the FEP to comply with sea turtle handling and release regulations.

3.2.8.1.2 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.

In January 2018, oceanic whitetip sharks and giant manta rays were listed under the ESA (83 FR 4153 and 83 FR 2916, respectively). NMFS will reinitiate consultation for those two species.

3.2.8.1.3 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 2018 LOF (82 FR 5349, February 7, 2018), 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).

3.2.8.2 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 Chapter 2, no notable changes have been observed in the American Samoa, Guam, and CNMI troll fisheries. There is no other information to indicate that impacts to protected species from these fisheries have changed in recent years.

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 tunas, albatrosses, 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.
- Improve observer data collection for oceanic whitetip shark in longline fisheries to record release condition, handling, trailing gear, size and sex for every observed interaction; and
- Improve data collection for oceanic whitetip shark capture data in non-longline pelagic fisheries.

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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 the fisheries which it has jurisdiction. This 2017 Annual SAFE 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 the committee was renamed 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 as well as 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) To identify and prioritize research that examines the effects of climate change on Council-managed fisheries and fishing communities.
b) To ensure climate change considerations are incorporated into the analysis of management alternatives.
c) To monitor climate change related variables via the Council's Annual Reports.
d) To 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 focuses previous years' efforts by refining existing indicators and improving communication of their relevance and status. Future reports will include additional indicators as the information becomes available and their relevance to the development, evaluation, and revision of the FEPs 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 170th meeting from June 20th through the 22nd in 2017, the Council directed staff to develop and/or support the development of community training and outreach materials and activities on climate change. In addition, the Council directed staff, in preparation for community workshops on climate and fisheries, to coordinate a "train-the-trainers" workshop that includes NOAA scientists who presented at the 6th Marine Planning and Climate Change Committee (MPCCC) meeting and the MPCCC committee members. The Council and NOAA partnered to deliver the workshops in the fall of 2017 to the MPCCC members in Hawaii (with the Hawaii Regional Ecosystem Advisory Committee), as well as American Samoa, Guam, and the CNMI (with their respective Advisory Panel groups). Feedback from workshop participants has been incorporated into this year's climate and oceanic indicator section. To prepare for community outreach, Guam-based MPCCC members conducted a climate change survey and shared the results with the MPCCC at its 7th meeting on April 10th and 11th, 2018.

The Council also directed staff to explore funding avenues to support the development of additional oceanic and climate indicators, such as wind and extratropical storms. The Council previously engaged a contractor to evaluate environmental/ecological indicator data alongside available fishery performance statistics and identify potential fishery ecosystem relationships to inform the content of a new Data Integration chapter of the archipelagic versions of the Annual SAFE Report. A draft was presented to the MPCCC at its 7th meeting in April and will be included as Chapter 3 of the Archipelagic 2017 SAFE reports; changes are to be implemented for this section for the Pelagic report at the recommendation of the Council, SSC, and Plan Team members.

The Council also directed staff to include climate change in its Regional Ecosystem Advisory Committees' agendas as a fixed item, noting the importance of coordination among local and federal agencies on climate issues. It was recommended that a member of the Council's Social Science Planning committee (SSPC) be included as an ex-officio member, and staff were directed to write to the Pacific Community requesting how it is incorporating climate change information into tuna stock assessments.

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:

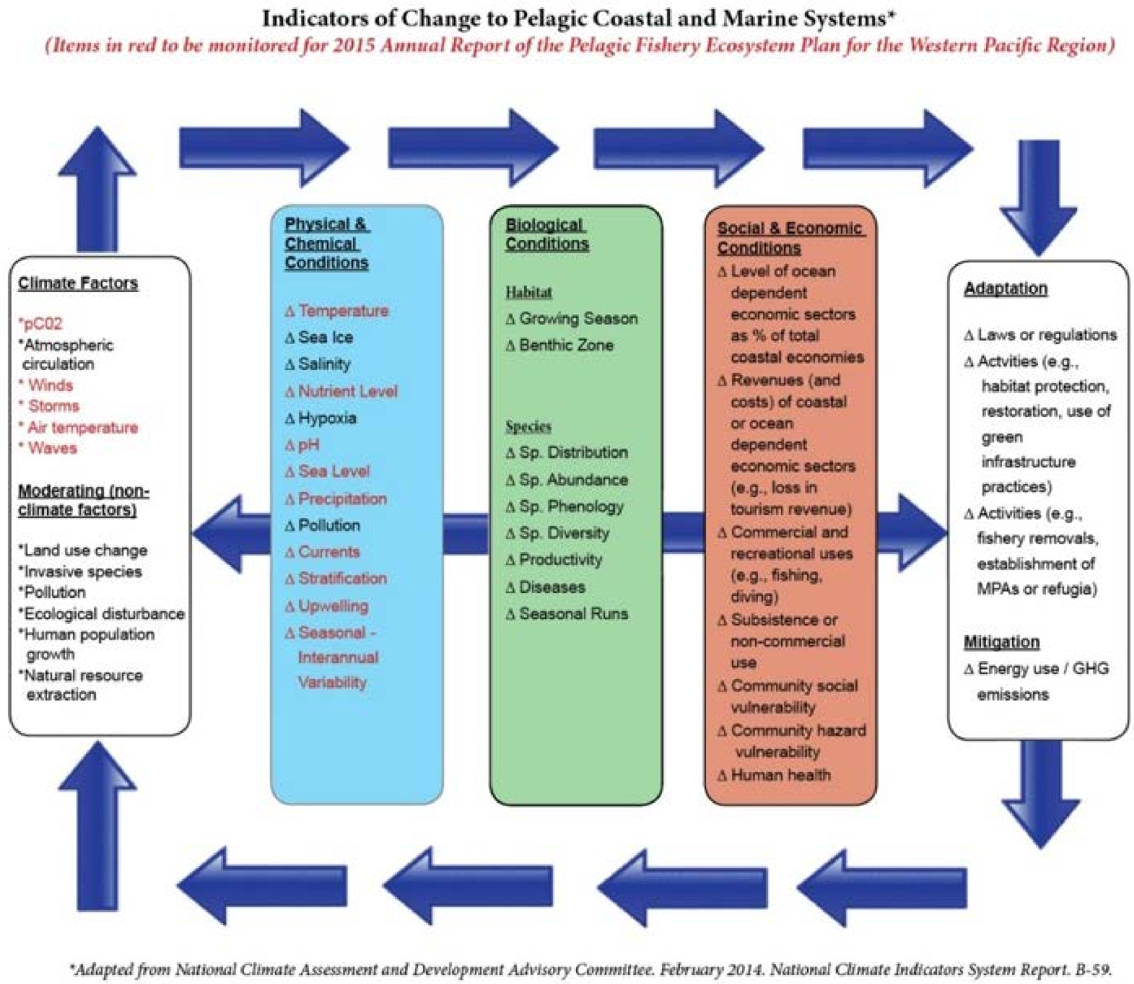

Figure 163. Indicators of change of pelagic coastal and marine systems; conceptual model.

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 Annual SAFE Reports, though the final list of indicators varied somewhat. Other indicators will be added over time as data become available and an understanding 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. This guide will ideally enable the Council and its partners to move forward from observations and correlations to understanding the specific nature of interactions, and to develop capabilities to predict future changes of importance in the developing, evaluating, and adapting of FEPs in the Western Pacific region.

3.3.3 SELECTED INDICATORS

The primary goal for selecting the indicators used in this report 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, this section includes 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 temperature at 300 m depth;
- Ocean color;
- North Pacific Subtropical Front (STF) and Transition Zone Chlorophyll Front (TZCF);
- Fish community size structure;
- Bigeye tuna weight-per-unit-effort; and
- Bigeye tuna recruitment index.

Table 79 provides a description of these indicators and a summary of the key findings detailed in the following sections of the report.

Table 79. Pelagic climate and oceanic indicator recent status summaries.

Indicator and Rationale	Indicator Status
Atmospheric Concentration of Carbon Dioxide (CO_2) at Mauna Loa Observatory. Increasing atmospheric CO_2 is a primary measure of anthropogenic climate change.	**Trend:** increasing exponentially **2017:** time series max 406.52 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 0.0369 pH units, an 8.9% increase in acidity **2016:** average pH = 8.08
Oceanic Niño Index (ONI) is used to determine the phase of El Niño – Southern Oscillation (ENSO), which has implications across the region and can affect the location, safety, and cost of commercial fishing.	**2017:** neutral through September, La Niña began in October
Pacific Decadal Oscillation (PDO) can be thought of as a long-lived, multi-decadal ENSO cycle that has well-documented fishery implications related to ocean temperature and productivity.	**2017:** positive (warm) from Jan – June, negative (cool) from Jul – Dec
Tropical Cyclones are measured by occurrence, strength, and energy and have the potential to significantly impact fishing operations.	**Eastern Pacific, 2017:** 18 named storms, 9 hurricanes, 4 major
	Central Pacific, 2017: 0 storms
	Western Pacific, 2017: 27 named storms, 10 typhoons, 4 major
	South Pacific, 2017: 8 named storms, 4 cyclones, 2 major
Sea Surface Temperature (SST) is projected to rise and impacts phenomena ranging from winds to fish distributions.	**Trend:** linear increase of 0.01 ºC per year **2017:** average = 22.2 ºC
Temperature at 300 m depth shows trends at the depth targeted by the deep-set bigeye tuna fishery. Bigeye tuna have specific water temperature preferences.	**2017:** average = 10.12 ºC
Ocean Color is a satellite remotely-sensed measure of ocean productivity.	**2017:** average = 0.13 mg chl m^{-3}
North Pacific Subtropical Frontal Zone (STF) & Transition Zone Chlorophyll Front (TZCF) are targeted by the swordfish fishery.	**STF, 2017:** north of average west of 160ºW, roughly average east of 160ºW **TZCF, 2017:** south of average between about 165º – 135ºW, north of average outside this region
Fish Community Size Structure is impacted by several factors, including climate.	**Full Fishery, 2017:** median weight = 20.9 kg
	Bigeye Tuna, 2017: median weight = 30.2 kg
	Swordfish, 2017: median weight = 77.6 kg
Bigeye Weight-per-Unit-Effort for the previous three years can provide indications of strong recruitment pulses, which may be tied to climate impacts.	**2017:** A weak recruitment pulse is evident in the second half of the year
Bigeye Recruitment Index based on the observation that catch rates of small bigeye ≤ 15 kg peak 1 year before CPUE peaks.	**2017:** small bigeye CPUE = 0.39

3.3.3.1 ATMOSPHERIC CONCENTRATION OF CARBON DIOXIDE (CO_2) AT MAUNA LOA

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: Atmospheric CO_2 is increasing exponentially. This means that atmospheric CO_2 is increasing at a faster rate each year. In 2017, the annual mean concentration of CO_2 was 406.53 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.

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 observed increase in monthly average carbon dioxide concentration is primarily due 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 approximately one year. The annual variations at Mauna Loa, Hawai`i are due to the seasonal imbalance between the photosynthesis and respiration of terrestrial plants. During the summer growing season, photosynthesis exceeds respiration, and CO_2 is removed from the atmosphere. In the winter (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 its larger land mass.

Timeframe: Annual, monthly.

Region/Location: Mauna Loa, Hawai`i, but representative of global atmospheric carbon dioxide concentration.

Measurement Platform: *In-situ* station.

Sourced from: Keeling et al. (1976), Thoning et al. (1989), and NOAA ESRL (2018a).

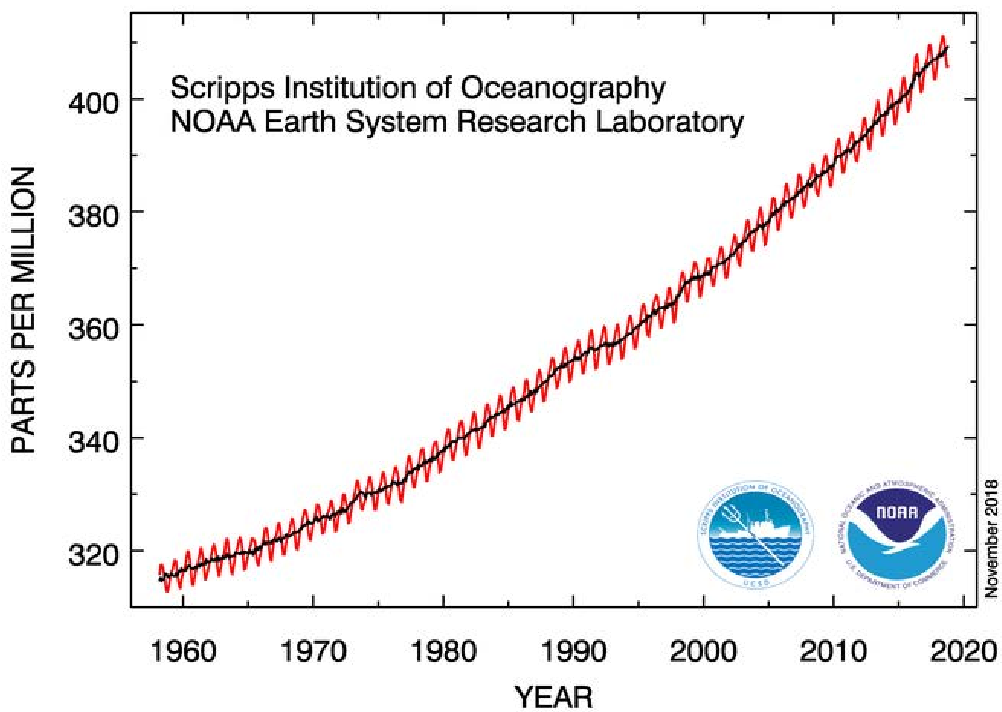

Figure 164. Monthly mean (red) and seasonally-corrected (black) atmospheric carbon dioxide (ppm) at Mauna Loa Observatory, Hawai`i.

3.3.3.2 OCEANIC PH

Rationale: Oceanic 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 limits the ability of marine organisms to build shells and other calcareous structures. Recent research has shown that pelagic organisms such as 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: The ocean is roughly 8.9% more acidic than it was nearly 30 years ago at the start of this time series. Over this time, pH has declined by 0.0369 pH at a constant rate. In 2016, the most recent year for which data are available, the average pH was 8.08. Additionally, small variations seen over the course of the year are now almost outside the range seen in the first year of the time series. The highest pH value reported for the most recent year (8.0846) is roughly equal to the lowest pH value reported in the first year of the time series (8.0845).

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 2016 (2017 data are not yet available). 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. Oceanic pH is calculated from total alkalinity (TA) and dissolved inorganic carbon (DIC). 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.

Measurement Platform: *In-situ* station.

Sourced from: Fabry et al. (2008), Feely et al. (2016), and the Hawaii Ocean Time Series as described in Karl et al. (1996) and on its website (HOT, 2018).

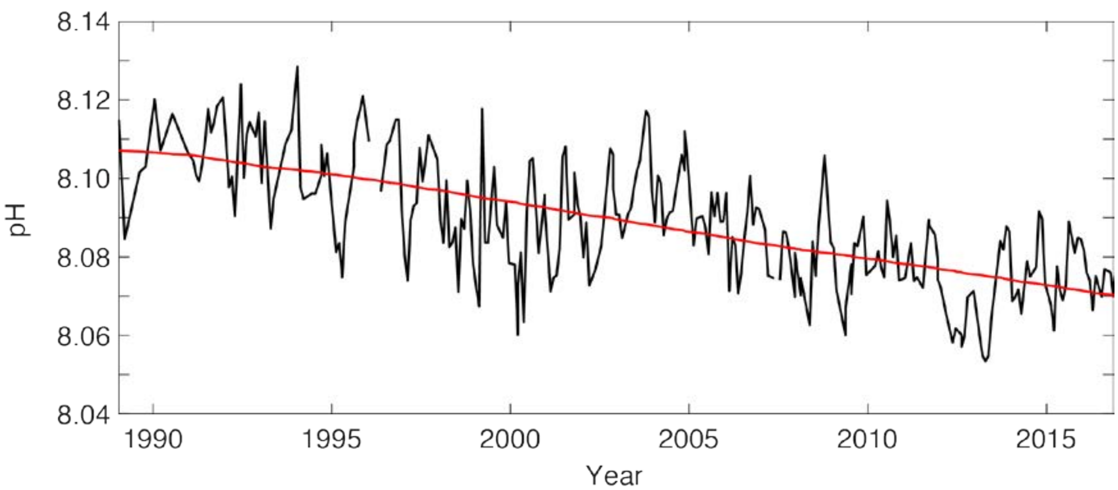

Figure 165. Trend in oceanic pH (black) at Station ALOHA from 1989-2016.

3.3.3.3 OCEANIC NIÑO INDEX (ONI)

Rationale: The El Niño – Southern Oscillation (ENSO) cycle is known to have impacts on Pacific fisheries including tuna fisheries. The ONI focuses on ocean temperature, which has the most direct effect on these fisheries.

Status: The ONI was neutral in 2017.

Description: The three-month running mean of satellite remotely-sensed 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 ENSO is measured using the Southern Oscillation Index.

Timeframe: Every three months.

Region/Location: Niño3.4 region: 5°S – 5°N, 120° – 170°W

Measurement Platform: *In-situ* station, satellite, model.

Sourced from: NOAA Climate.gov and NOAA NCEI NCDC.

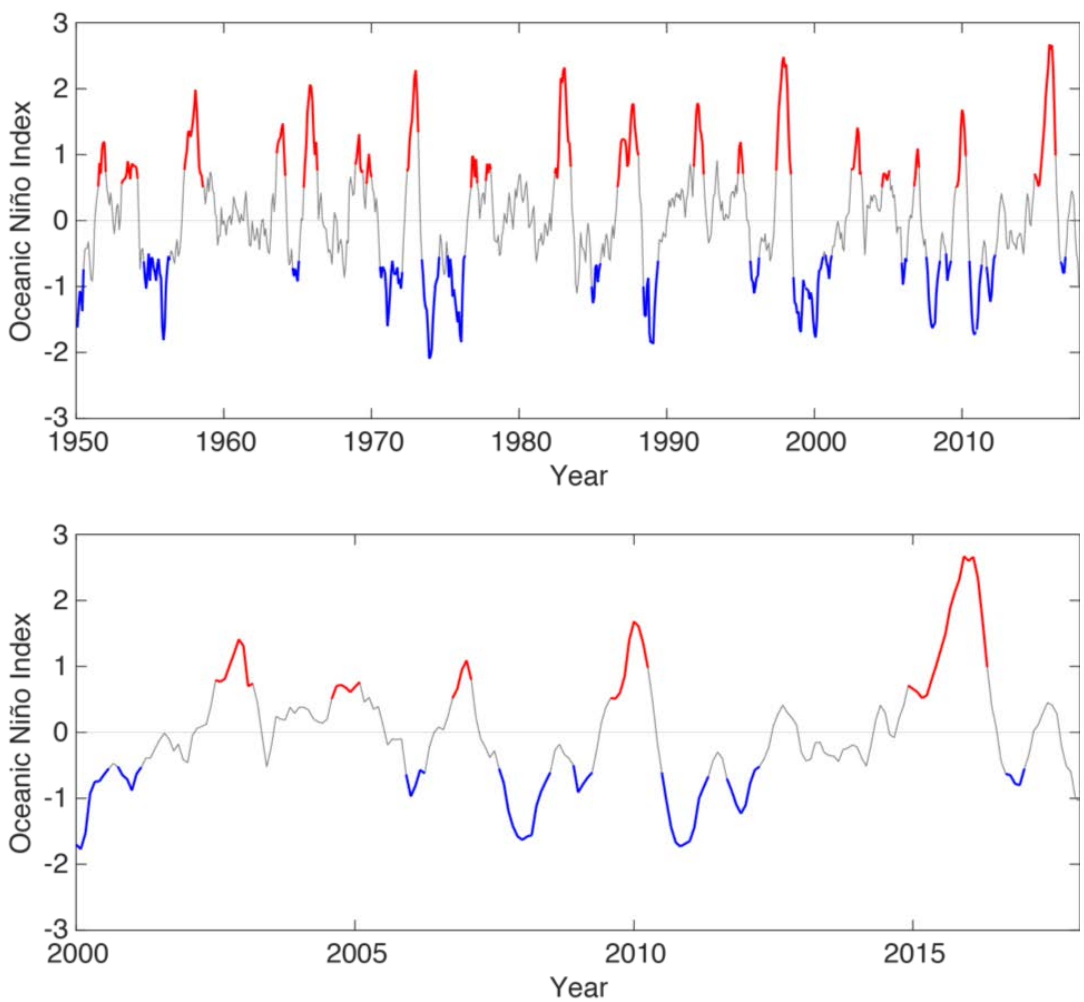

Figure 166. Oceanic Niño Index from 1950-2017 (top) and 2000-2017 (bottom).

Note that El Niño periods are highlighted in red, and La Niña periods are highlighted in blue.

3.3.3.4 PACIFIC DECADAL OSCILLATION (PDO)

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 ENSO, the PDO reflects changes between periods of persistently warm or persistently cool ocean temperatures, but over a period of 20 to 30 years (versus 6 to 18 months for ENSO events). The climatic finger prints of the PDO are most visible in the Northeastern Pacific, but secondary signatures exist in the tropics.

Status: The PDO was positive, or warm, from January through June of 2017. For the remainder of the year, the PDO was negative, or cool. It remains to be seen whether the negative conditions during the second half of the year represent a short-term fluctuation or a true phase change.

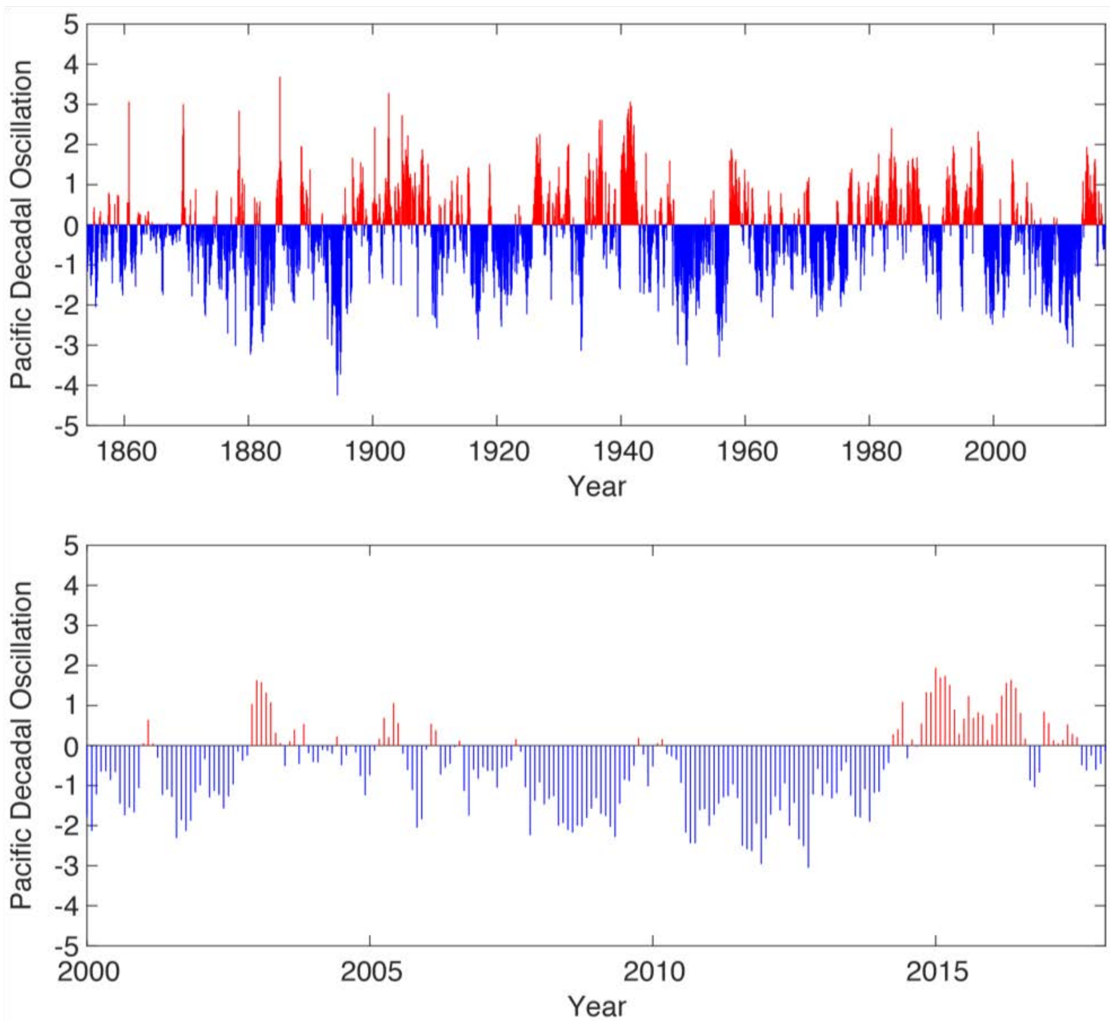

Figure 167. Pacific Decadal Oscillation from 1854-2017 (top) and 2000-2017 (bottom).

Note: Positive, or warm, phases are plotted in red, while negative, or cool, phases are plotted in blue.

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 below average 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 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.

Measurement Platform: *In-situ* station, satellite, model

Sourced from: NOAA NCEI (2018b) and Mantua (2017).

3.3.3.5 TROPICAL CYCLONES

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 2017 East Pacific hurricane season had 18 named storms, including nine hurricanes, four of which became major. The 1981-2010 average number of named storms in the East Pacific is 16.5, with 8.9 hurricanes, and 4.3 major hurricanes. The ACE index for the East Pacific basin during 2017 was 98 ($x10^4$ $knots^2$), which is below the 1981-2010 average of 132 ($x10^4$ $knots^2$) and the lowest since 2013.

Summary inserted from NOAA National Centers for Environmental Information, State of the Climate: Hurricanes and Tropical Storms for Annual 2017.

The timing of storms in 2017 followed a near climatological pattern with peak tropical cyclone activity in the summer (July – Sept.).

Central North Pacific. Tropical cyclone activity in 2017 was below average with no tropical cyclone activity. The last year in which no tropical cyclones passed near Hawaii was 2012.

Western North Pacific. There were 27 named storms in 2017. Ten of these storms were typhoons and two were super-typhoons. Tropical cyclone activity was generally below average, with the exception of July which saw an above-average number of storms and marked an usually early peak to the season. The ACE Index was also below average in the Western North Pacific.

South Pacific. The South Pacific saw eight named storms in 2017, four of which were categorized as cyclones. Of the cyclones that occurred, two were major. Overall, tropical cyclone activity was below average, with the exception of April and May. The ACE Index was below average in 2017.

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.

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 2017 are provided by 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.

South Pacific: south of the equator.

Measurement Platform: Satellite.

Sourced from: NOAA NCEI (2018c), and Unisys (2018).

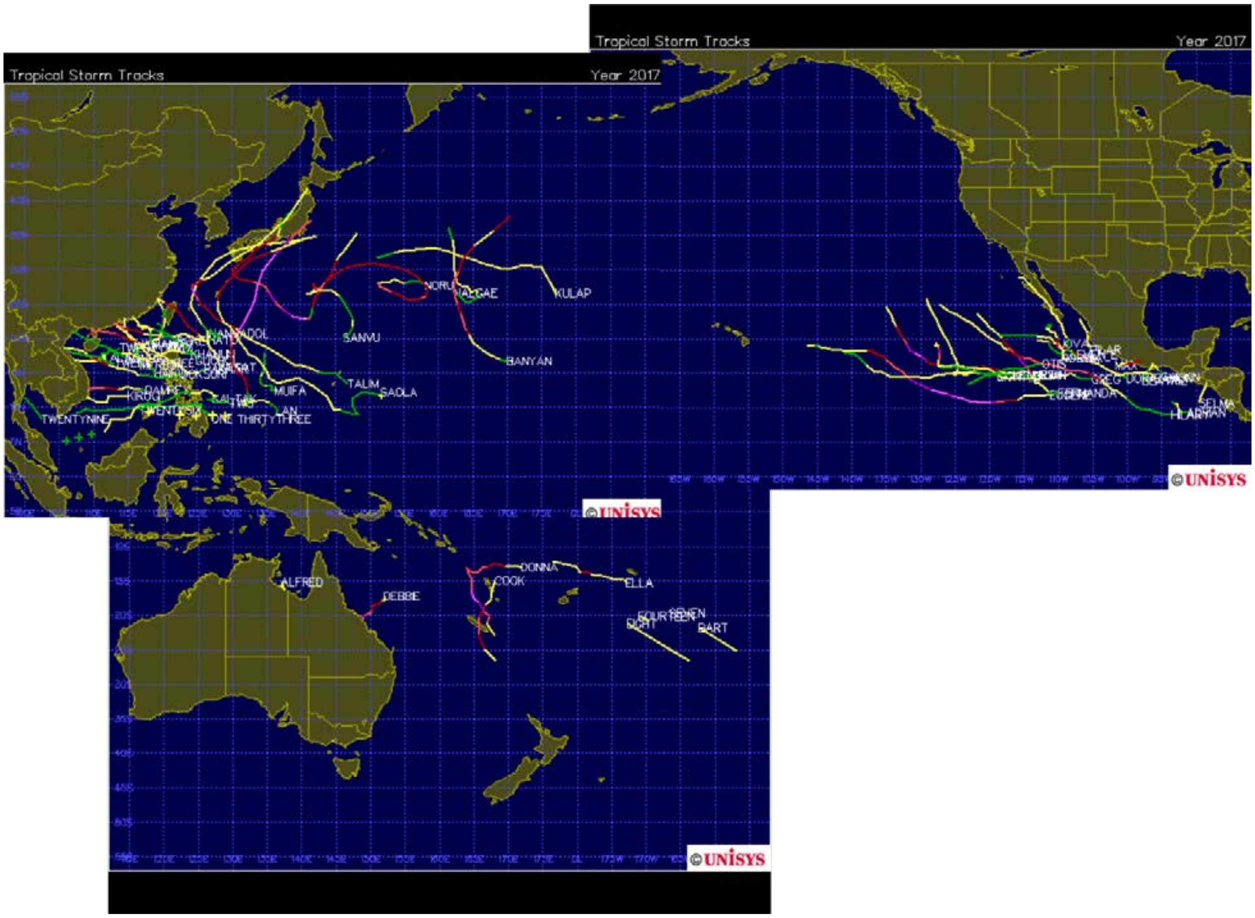

Figure 168. 2017 Pacific basin tropical cyclone tracks.

Note: Tropical depressions are shown in green, tropical storms in yellow, category 1 hurricanes/typhoons/cyclones in red, category 2 in light red, category 3 in magenta, category 4 in light magenta, and category 5 in white.

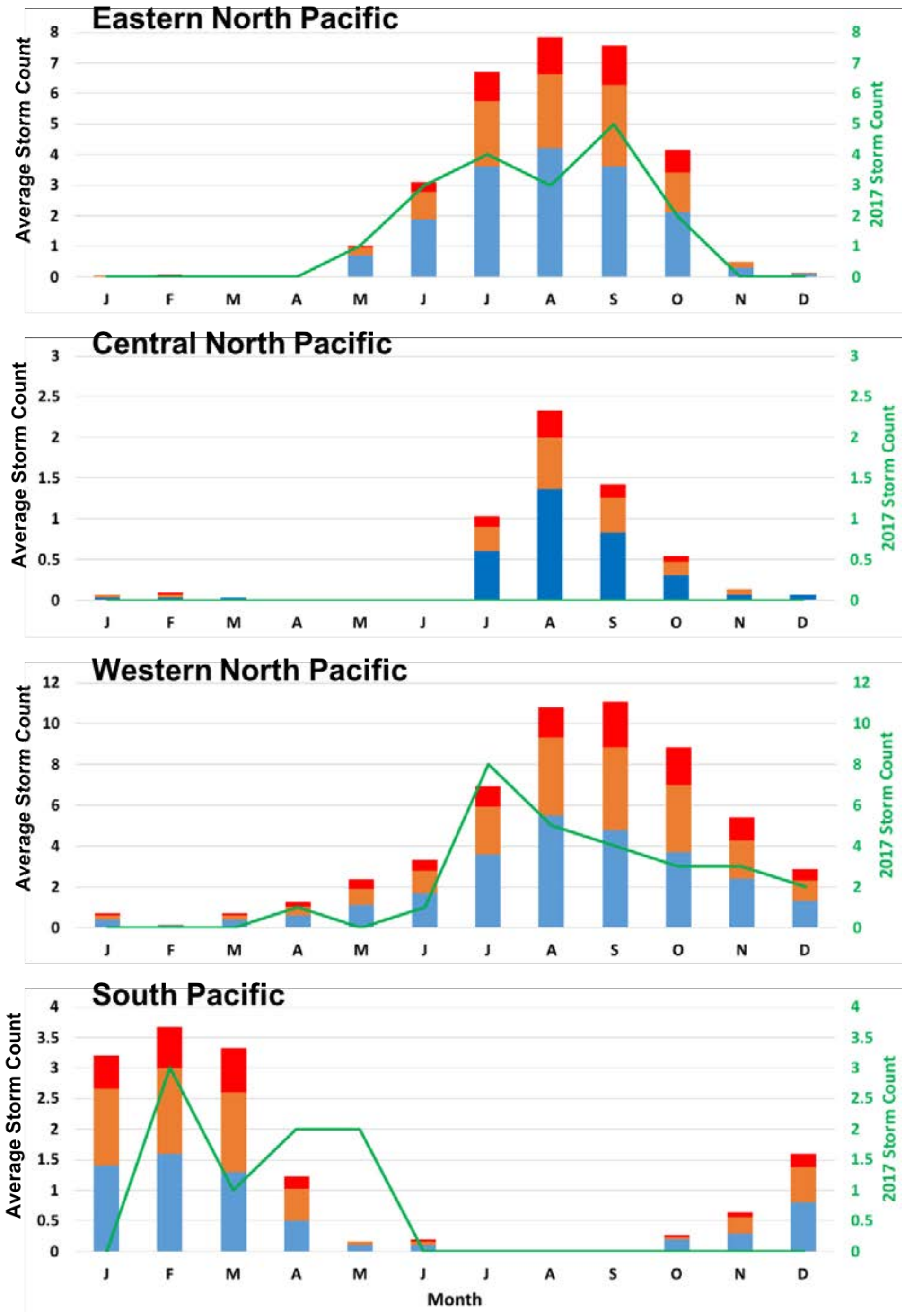

Figure 169. Tropical cyclone climatology.

Note that climatologies span the period from 1981-2010. Named storm totals are in blue, hurricanes/typhoons/cyclones in orange, and major storms (≥ category 3) in red. Monthly 2017 totals are plotted with a green line.

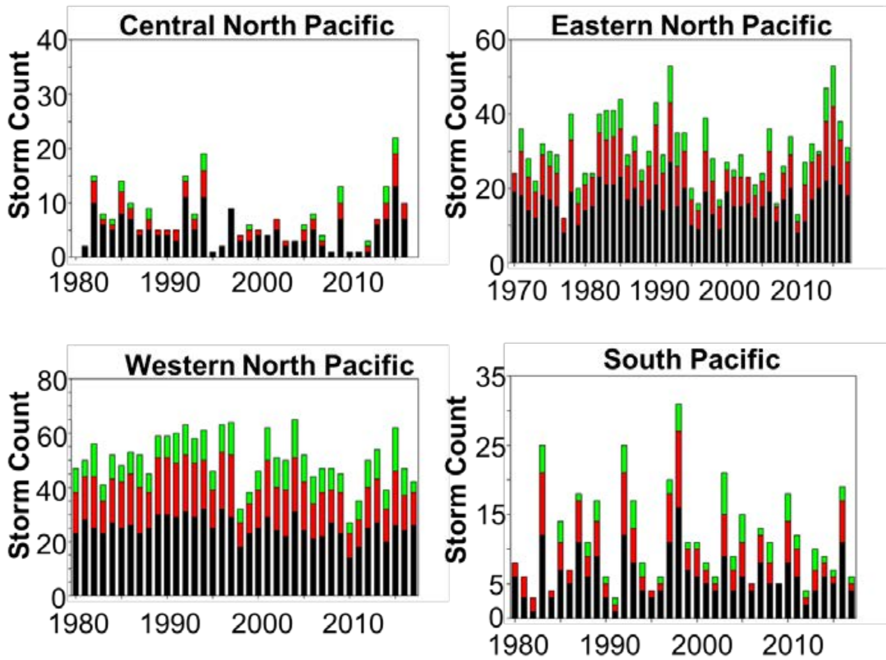

Figure 170. Tropical storm totals by region.

Note: Tropical cyclone counts are shaded in black, hurricanes/typhoons/cyclones in red, and major hurricanes/typhoons/cyclones in green.

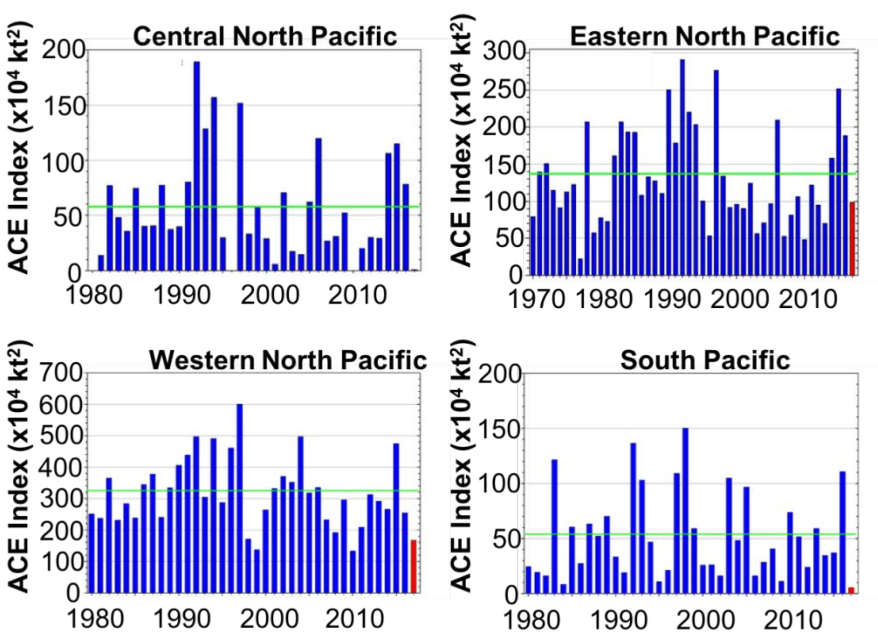

Figure 171. Accumulated Cyclone Energy (ACE) Index by region.

Note: The Annual ACE Index values are plotted in blue, with 2017 plotted in red, and the green line shows the 1981-2010 average ACE Index value for each region.

3.3.3.6 SEA SURFACE TEMPERATURE (SST)

Rationale: Sea surface temperature is one of the most directly observable existing measures 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 22.2 ºC in 2017. Over the period of record, annual SST has increased at a rate of 0.01 ºC yr^{-1}. Monthly SST values in 2017 ranged from 20.2 – 24.9 ºC, within the time series range of 19.3 – 25.7 ºC. In general, SSTs were above average across most of the longline fishing ground, with an area of below average SSTs extending from 30 – 45 ºN and 170 – 130 ºW.

Note that from the top to bottom in Figure 172, panels show climatological SST (1982-2016), 2017 SST anomaly, time series of monthly mean SST, and time series of monthly SST anomaly. The white box in the upper panels indicates the area over which SST is averaged for the time series plots.

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.

Region/Location: Hawai`i longline region: 5° – 45°N, 180° – 120°W.

Measurement Platform: Satellite.

Sourced from: NOAA OceanWatch (2018) and NOAA NCEI (2018a).

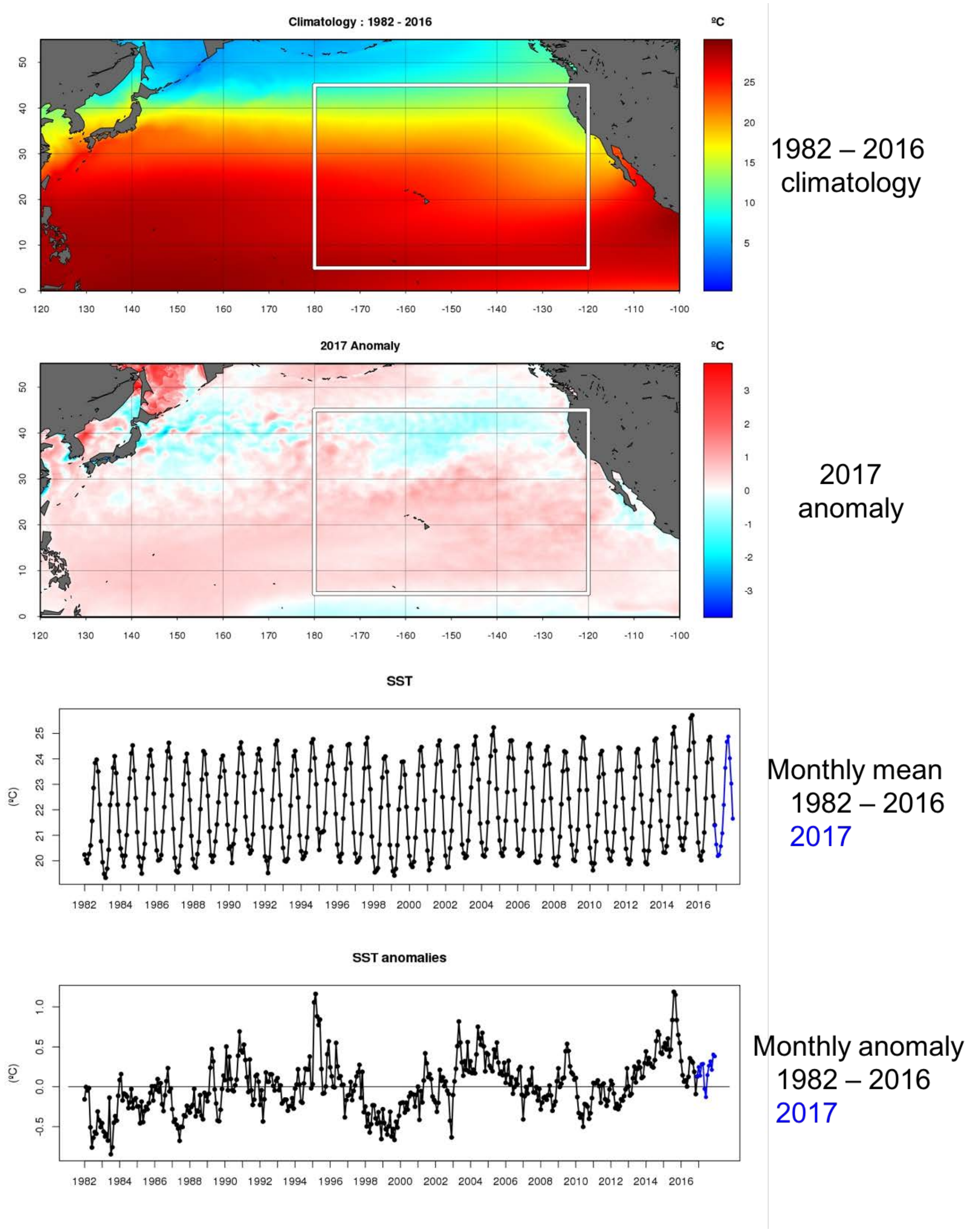

Figure 172. Sea surface temperature (SST).

3.3.3.7 TEMPERATURE AT 300 M DEPTH

Rationale: The temperature at 300 m 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.

Note that, from top to bottom in Figure 173, panels show climatological 300 m temperature (1980-2016), 2017 anomaly, time series of monthly mean 300 m temperature, and time series of monthly 300 m temperature anomaly. The white box in the upper panels indicates the area over which temperature is averaged for the time series plots.

Status: In 2017, 300 m temperatures ranged from 10.06 – 10.20 °C with an average value of 10.12 °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). The spatial pattern of temperature anomalies was mixed across the longline fishing grounds, though 300 m temperatures close to the main Hawaiian Islands were below average.

Description: Ocean temperature at 300 m 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.

Measurement Platform: *In-situ* sensors, model.

Sourced from: NOAA ESRL (2018b) and Knapp et al. (2010).

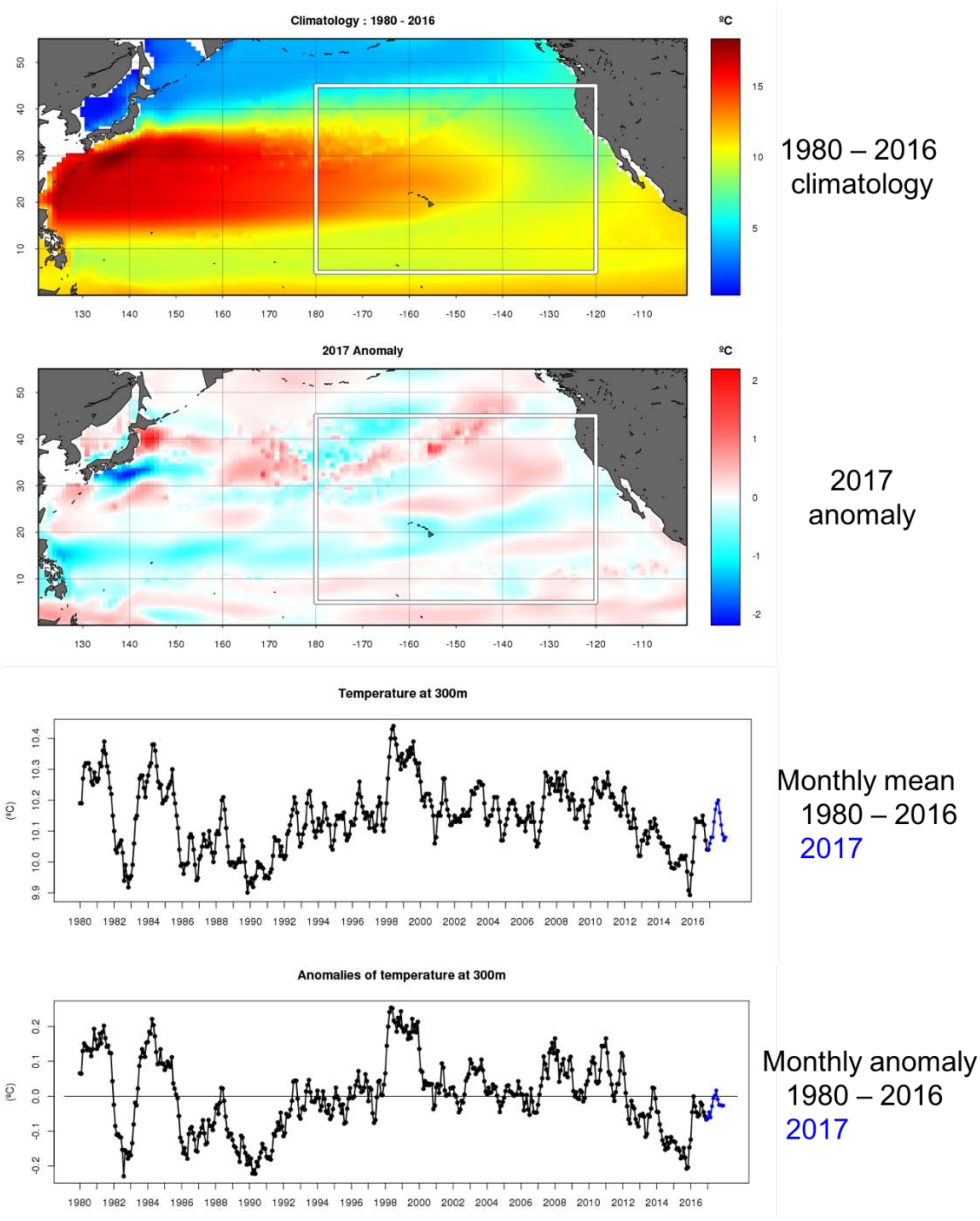

Figure 173. Ocean temperature at 300 m depth.

3.3.3.8 OCEAN COLOR

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: The mean monthly chlorophyll concentration was 0.13 mg chl m^{-3} in 2017. Monthly mean chlorophyll concentrations ranged from 0.09 – 0.15 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 2017, though some anomalies were observed at the far northern and southern boundaries of the longline fishing ground.

Note that, from top to bottom in Figure 174, panels show climatological chlorophyll concentration (2003-2016), 2017 anomaly, time series of monthly mean chlorophyll concentration, and time series of monthly chlorophyll anomaly. The white box in the upper panels indicates the area over which ocean color is averaged for the time series plots.

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

Region/Location: Hawai`i longline region: 5° – 45°N, 180° – 120°W

Measurement Platform: Satellite

Sourced from: NOAA OceanWatch (2018).

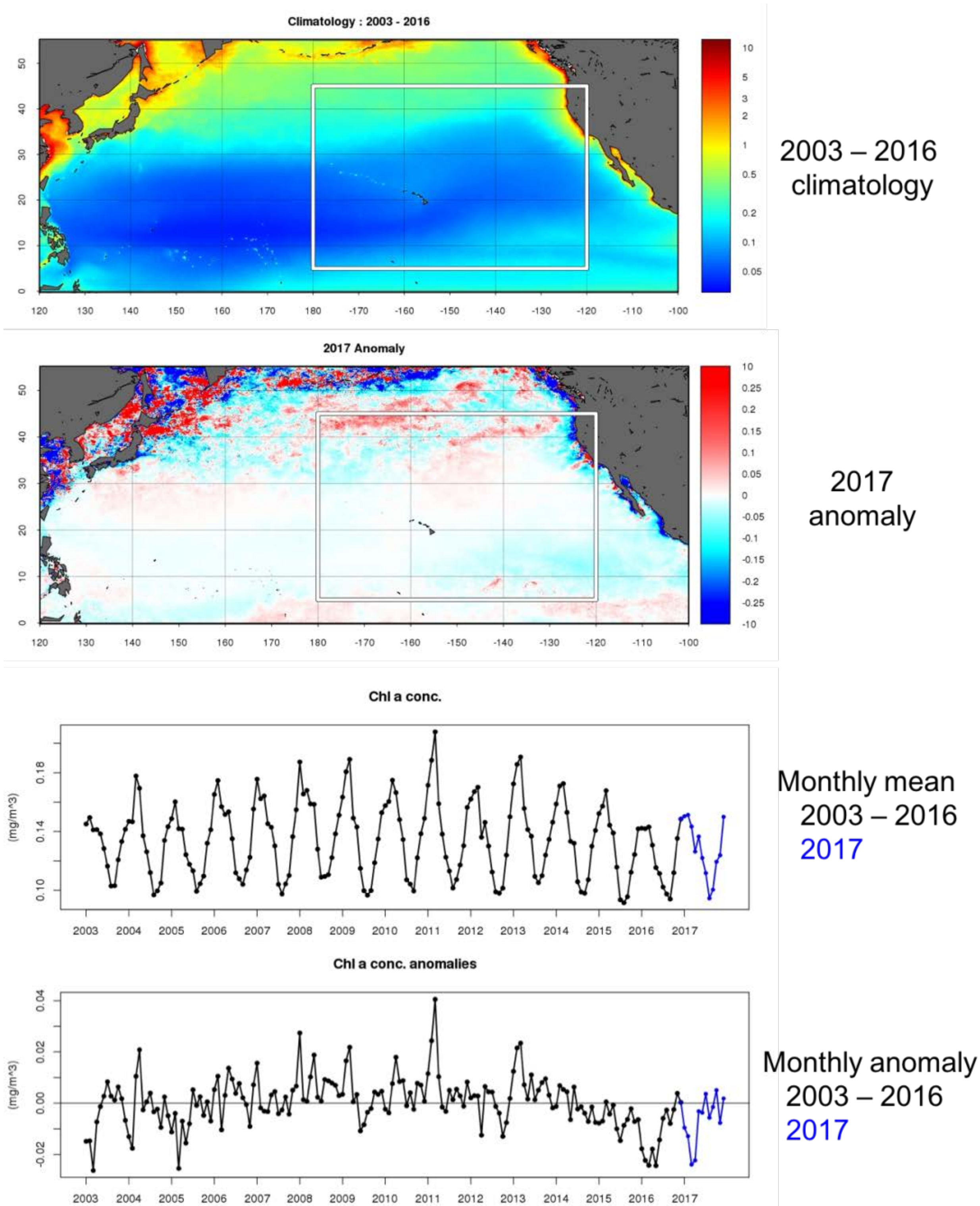

Figure 174. Ocean color.

3.3.3.9 NORTH PACIFIC SUBTROPICAL FRONT (STF) AND TRANSITION ZONE CHLOROPHYLL FRONT (TZCF)

Rationale: The STF is targeted by the swordfish fishery. Additionally, both the STF and TZCF are used as migration and foraging corridors by both commercially-valuable and protected species. 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 2017, the STF was north of its average latitude west of 160°W and was roughly average east of 160°W. The TZCF was farther south than average between about 165 – 135°W and north of average to the east and west of this region.

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. Both fronts migrate in a meridional direction on a seasonal basis and their positions are impacted by the phase of the El Niño – Southern Oscillation (ENSO). Due to significant seasonal variation, the climatology and anomaly (2017) 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

Measurement Platform: Satellite

Sourced from: Bograd et al. (2004), Polovina et al. (2001), and NOAA OceanWatch.

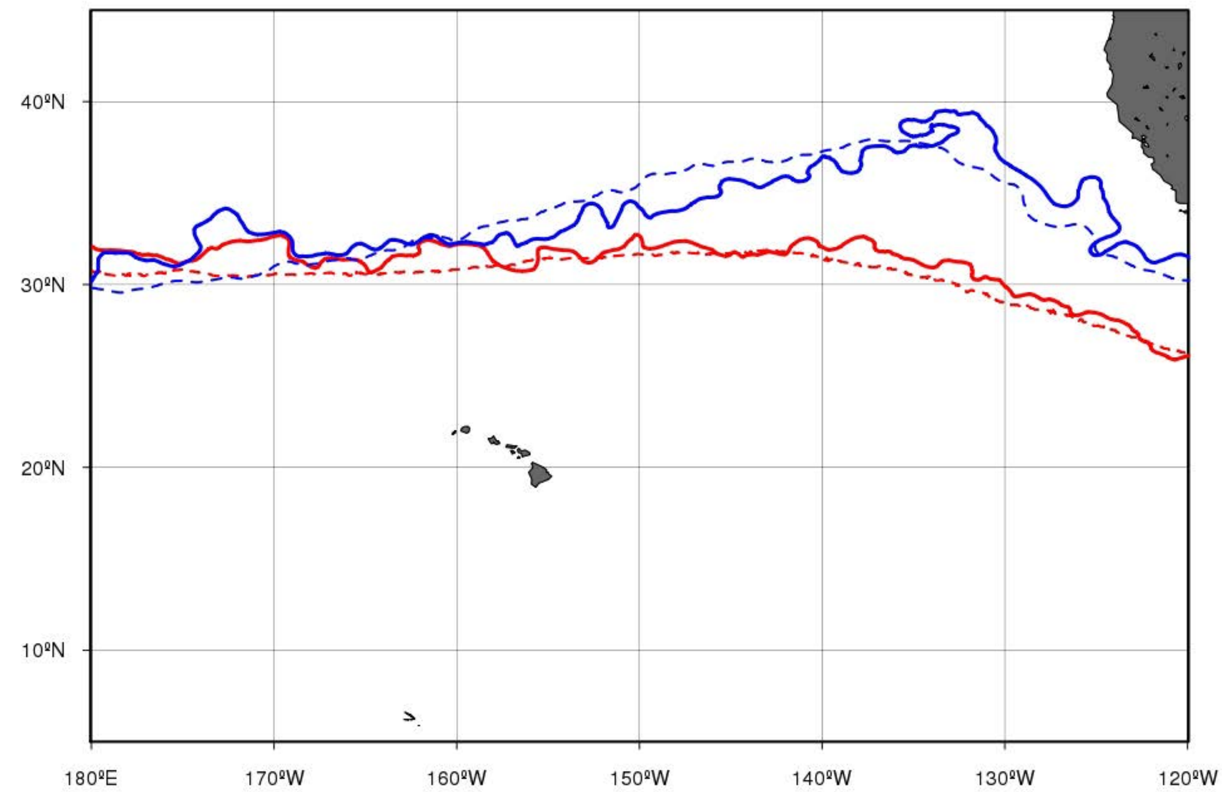

Figure 175. Subtropical Front and Transition Zone Chlorophyll Front.

Note that the climatological (dashed) and 2017 (solid) positions of the subtropical front (red) and the transition zone chlorophyll front (blue) in the first quarter of the year (Jan. - Mar.). The climatological period for the STF is 1982-2016. The climatological period for the TZCF is 2003-2016.

3.3.3.10 FISH COMMUNITY SIZE STRUCTURE

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 scale 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: For the longline fishery as a whole, fish were somewhat larger than usual in 2017 with a higher proportion of 20 – 25 kg fish. This peak may have been driven by an above average proportion of bigeye tuna in this size range. Swordfish also appeared larger than average in 2017, with the greatest proportion of fish being in the 60 – 70 kg range rather than the climatological average of 30 – 40 kg.

In 2017, the median bigeye weight was 30.2 kg, and the median swordfish weight was 77.6 kg. The median fish weight for all species caught was 20.9 kg. These weights were within the bounds observed over the time series from 2000 to 2017 (though the data for swordfish began in 2005). There was no significant trend in bigeye, swordfish, or all species' median weight.

Description: The weight of individual fish moving through the Honolulu auction is available from 2000 through the present. Using these weights, community size structure is presented. A standardized pooled climatological distribution is presented, as is the 2017 distribution. Similar distributions for target species (bigeye tuna and swordfish) are also presented. Annual time series of pooled target species weights are presented as violin plots. Bigeye weights are from deep sets (≥ 15 hooks per float) only. Swordfish weights 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.

Region: Hawai`i-based longline fishing grounds.

Measurement Platform: *In-situ* measurement.

Sourced from: Hawai`i Division of Aquatic Resources Measurement Platform and Langley et al. (2006).

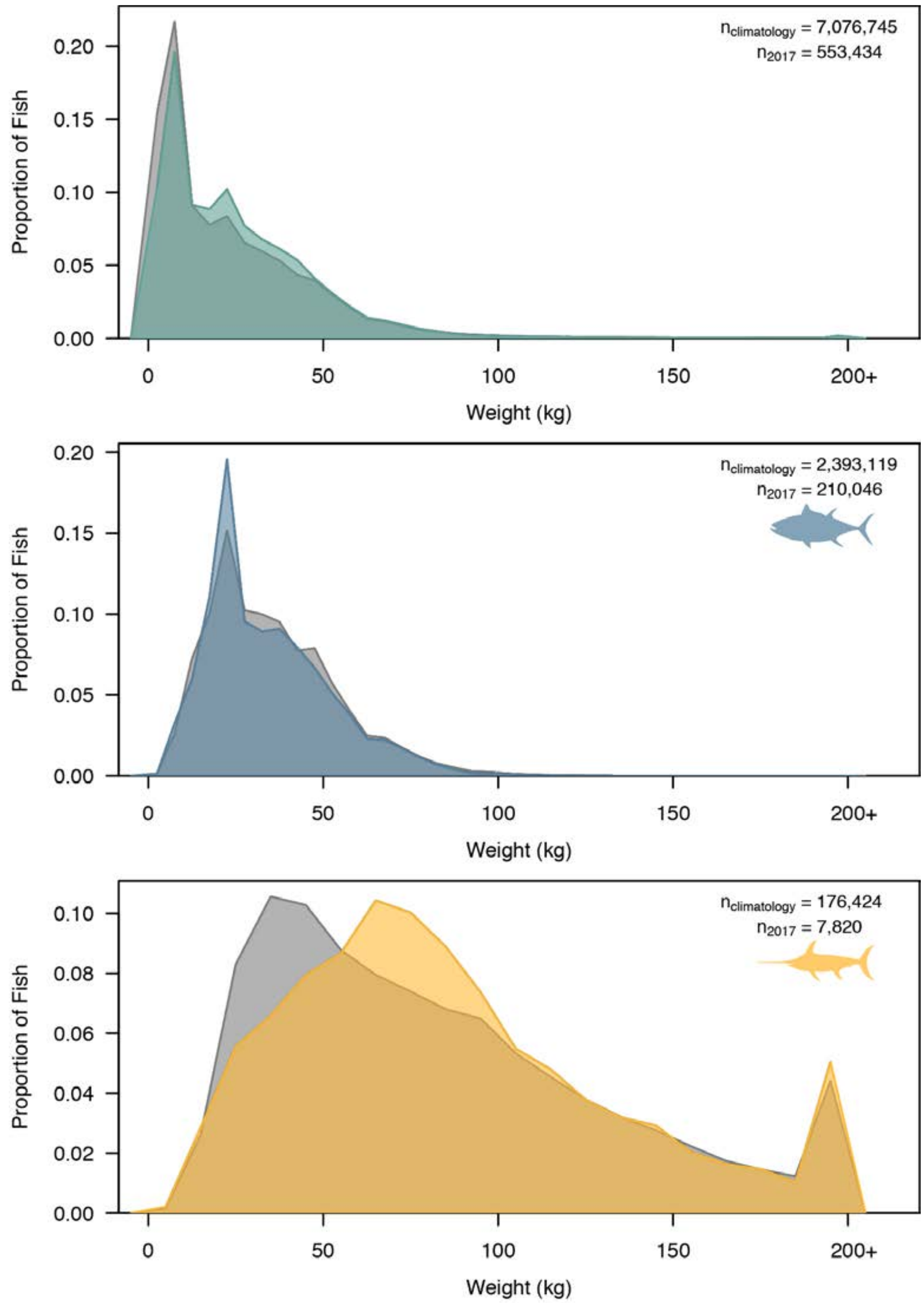

Figure 176. Longline fishery fish weights in Hawaii.

Note the climatological (2000-2016; grey) and 2017 (colored) distributions of all fish weights (top), bigeye tuna weights (middle), and swordfish weights (bottom). Bigeye weights are from sets using ≥ 15 hooks per float and swordfish weights are from sets using < 15 hooks per float.

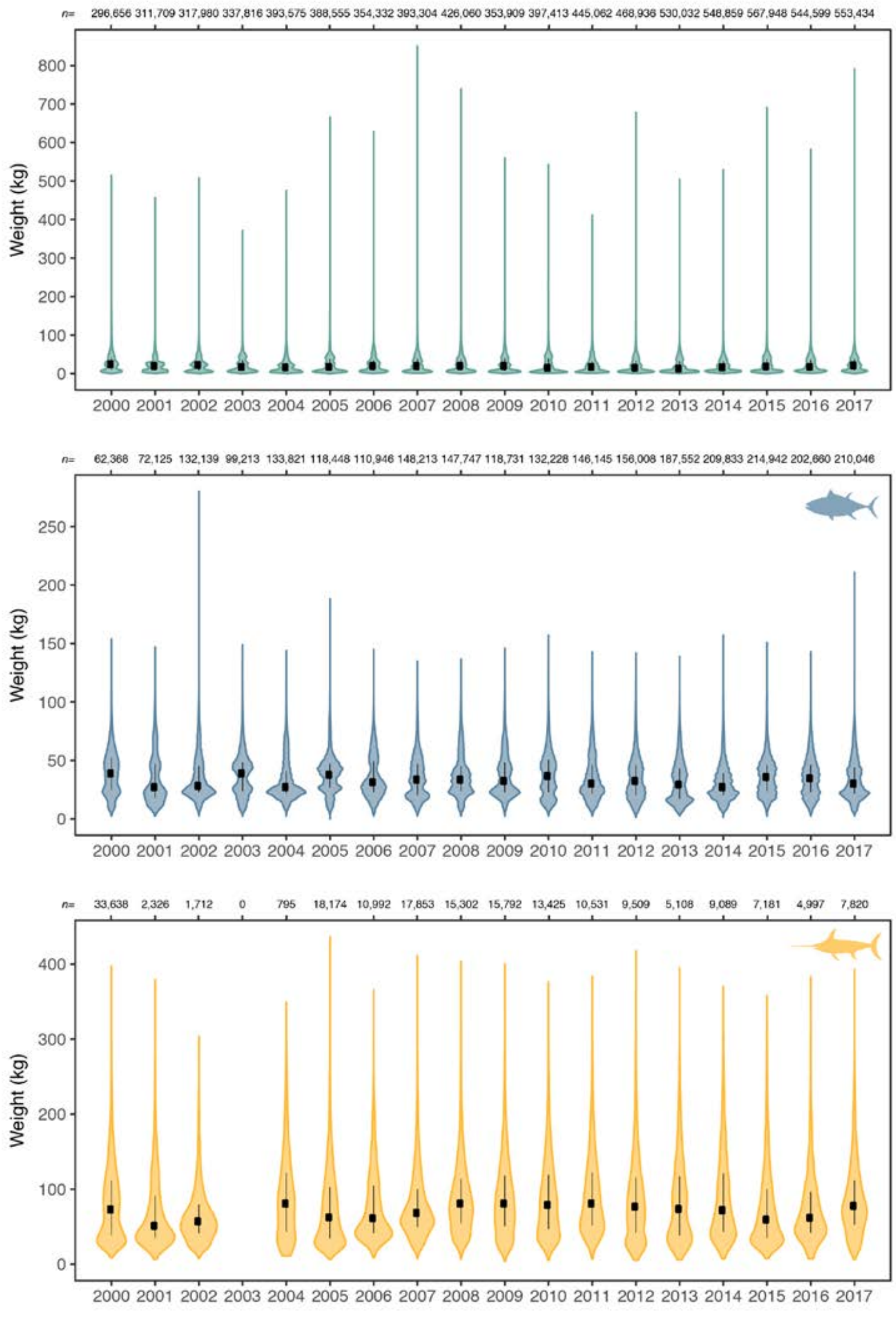

Figure 177. Distribution of annual longline fishery weights in Hawaii.

Note: Violin plots show the annual distribution of all fish weights (top), bigeye tuna weights (middle), and swordfish weights (bottom). Violin width is proportional to the number of fish of a given weight. The black lines note the range of the middle 50% of fish. The black squares note the median weight. Bigeye weights are from sets using ≥ 15 hooks per float. Swordfish weights are from sets using < 15 hooks per float.

3.3.3.11 BIGEYE WEIGHT-PER-UNIT-EFFORT

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 two-year-old bigeye was observed in the second half of 2017. Based on previous years, this indicates the potential for a peak in the CPUE of four- and five-year-old bigeye from 2019 to 2020.

Description: Quarterly time series of bigeye weight-per-unit-effort (hooks set) is presented for the previous three years. Fish weights are those of 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). Note the quarterly (colored) and climatological (grey) distributions of bigeye tuna weight-per-unit-effort in Figure 178. The vertical dashed line shows 15 kg. Bigeye weights are from sets using ≥ 15 hooks per float.

Timeframe: Quarterly.

Region: Hawai`i-based longline fishing grounds.

Measurement Platform: *In-situ* measurement.

Sourced from: Hawai`i Division of Aquatic Resources.

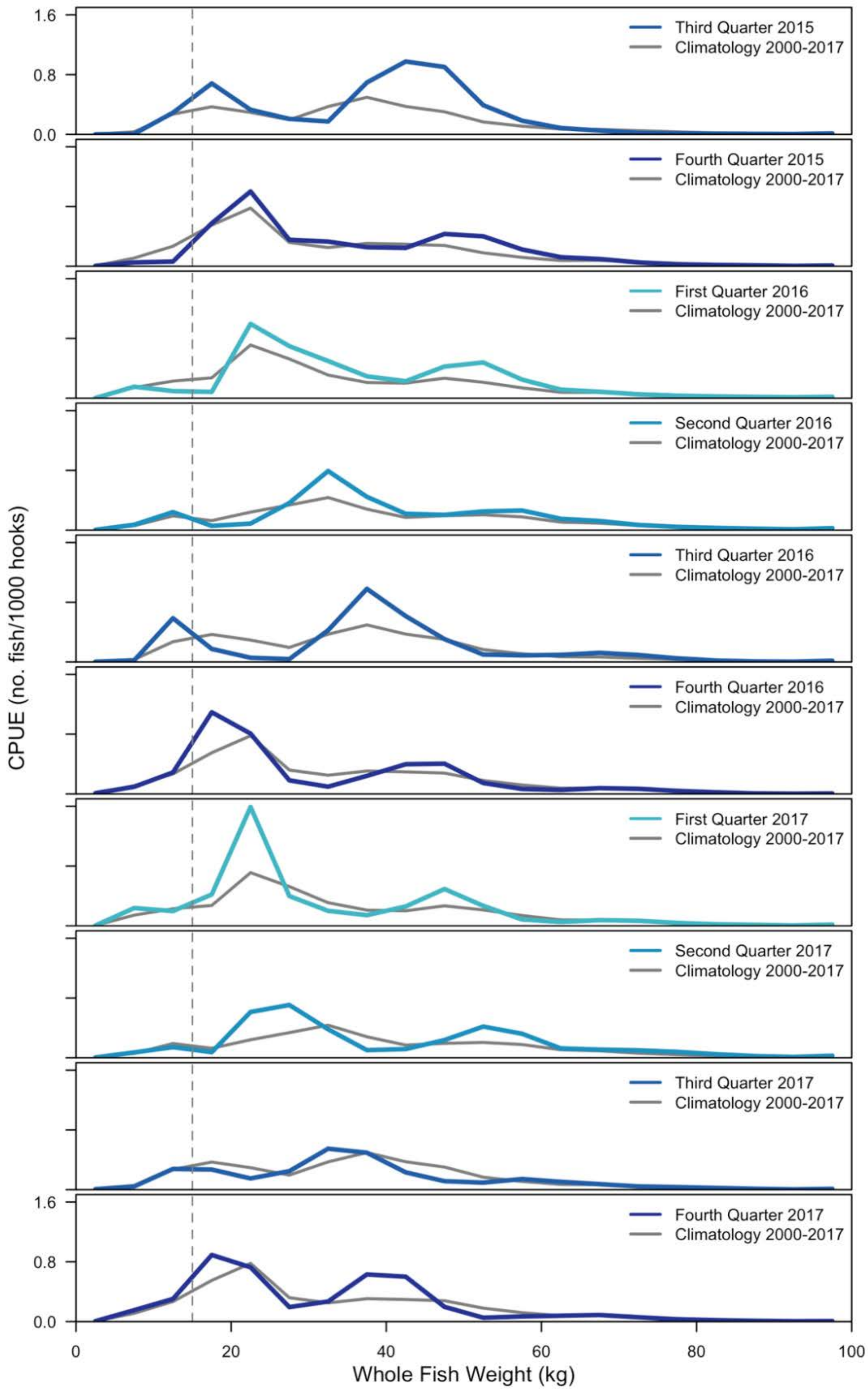

Figure 178. Bigeye weight-per-unit-effort.

3.3.3.12 BIGEYE RECRUITMENT INDEX

Rationale: Catch rates of small bigeye tuna (≤ 15 kg) peak one year prior to peaks in catch rates (CPUE) and biomass (weight-per-unit-effort), indicating a recruitment pulse and allowing for predictions regarding increases in total catch rates of the fishery. 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 2017, the CPUE of bigeye ≤ 15 kg was 0.39 fish per 1,000 hooks set. This is within the range observed over the previous 17 years (0.16 – 0.81 fish per 1,000 hooks set) and at this time does not appear indicative of a strong recruitment pulse such as was seen in 2001 or 2013.

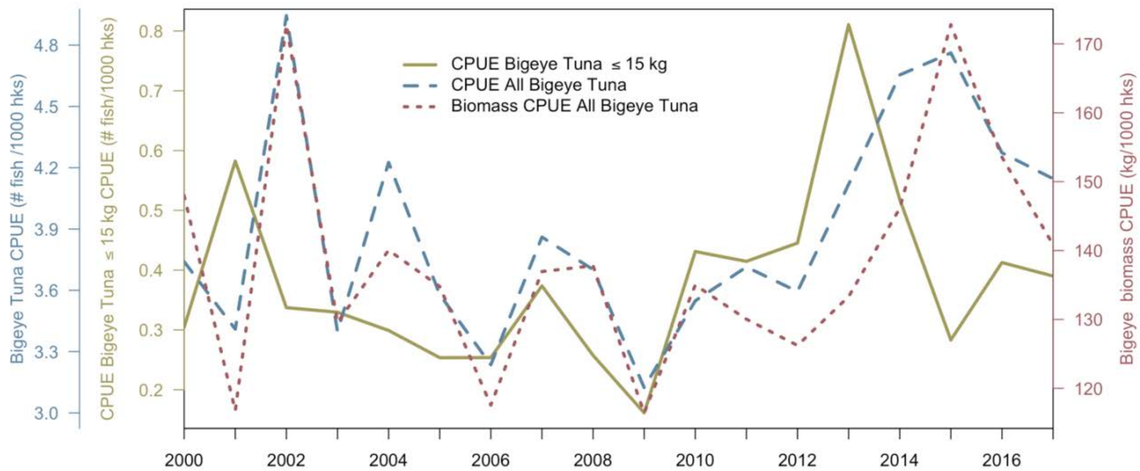

Figure 179. Bigeye tuna catch- and weight-per-unit-effort.

Note: Time series of CPUE of all bigeye tuna (blue, dashed), CPUE of bigeye tuna ≤ 15 kg (yellow, solid), and biomass CPUE, or weight-per-unit-effort, of all bigeye tuna (red, dotted). Y-axes follow this order, from left to right. Data are from sets with ≥ 15 hooks per float.

Description: 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. Fish weights are those of 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: Annual.

Region: Hawai`i-based longline fishing grounds.

Measurement Platform: Model-derived.

Sourced from: Hawai`i Division of Aquatic Resources and Langley et al. (2006).

3.3.4 OBSERVATIONAL AND RESEARCH NEEDS

Through preparation of this and previous Annual Pelagic Reports, the Council has identified a number of observational and research needs that, if addressed, would improve the information content of future Climate and Oceanic Indicators section. 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 to:

- 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 mahimahi 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;
    - 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.

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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 five 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 2017 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 170th meeting, the Council directed staff to scope the non-fishing impacts review, from the 2016 SAFE reports, through its advisory bodies. The Plan Team met January 26, 2018 and provided comments on the review.

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 3.3) 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 pelagic 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 recommended at its 2017 meeting 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

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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 165th 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 has been limiting fishing. Thus there is no interest to fish within the monument boundaries. The Pelagics Plan Team deferred decision on Rose Atoll in 2017 until after the Administration reviews to make 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 50 feet in length. The Council will review the LVPA exemption on an annual basis with regards to, but not limited to: catch rates of fishery participants; small vessel participation; and fisheries development initiatives. The LVPA regulations have been vacated through legal action and Council action following the court's ruling is ongoing.

3.5.3 MARINE MANAGED AREAS

Council-established MMAs are shown in Figure 180, and are compiled in Table 80.

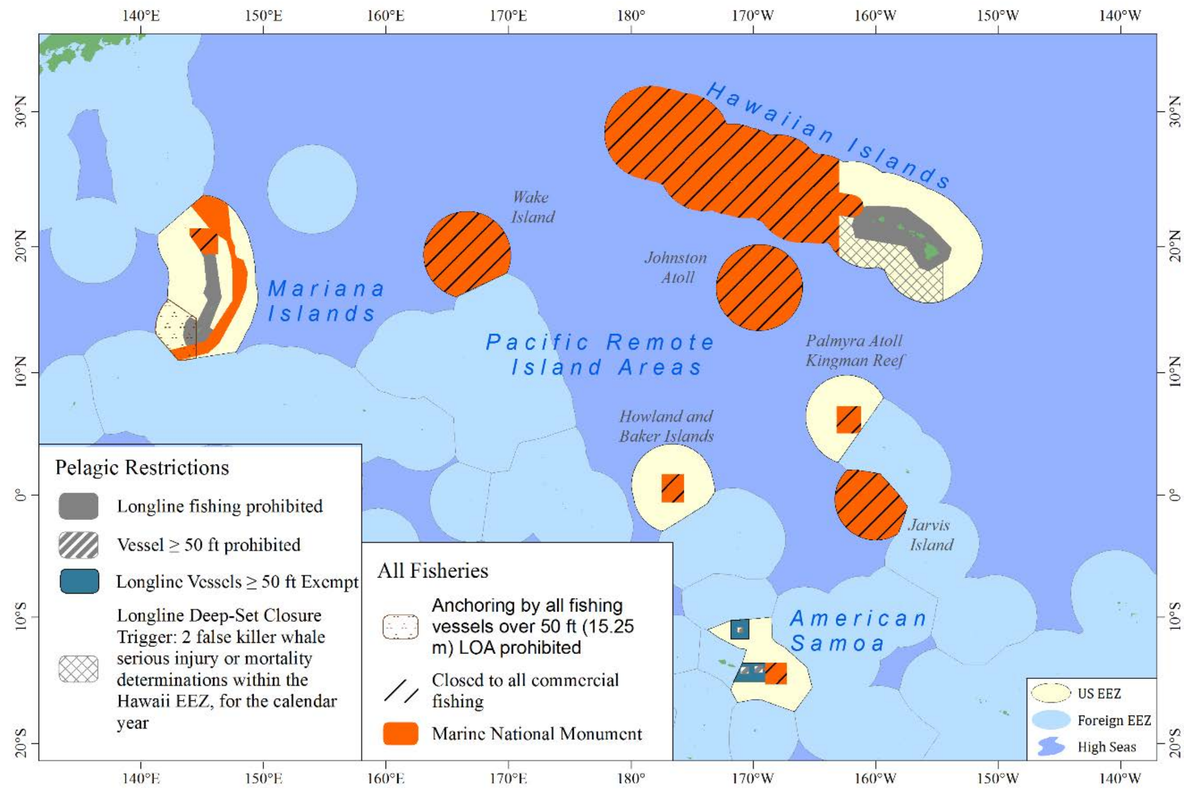

Figure 180. Regulated Fishing Areas (MMAs) of the Western Pacific Region.

Table 80. 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)
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	-

Name	FEP	Island	50 CFR /FR /Amendment Reference	Marine Area (km^2)	Fishing Restriction	Goals	Most Recent Evaluation	Review Deadline
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	-
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)

Name	FEP	Island	50 CFR /FR /Amendment Reference	Marine Area (km^2)	Fishing Restriction	Goals	Most Recent Evaluation	Review Deadline
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	-
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. Activities which are no longer reasonably foreseeable or have been replaced with another planning activity are removed from the report, though may occur in previous reports.

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 81 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; Van Fossen and Wunderlich 2015), unless otherwise noted.

Table 81. Aquaculture facilities in the Western Pacific region.

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 alongside several existing alternative energy facilities (Table 82).

Table 82. Alternative Energy Facilities and Development in the Western Pacific region.

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 U.S., 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 Corps Base Hawai`i Wave Energy Test Site	Shallow- and Deep-Water Wave Energy	1, 2 and 2.5 km N of Mokapu, O'ahu	Hazard to navigation	Shallow and Deep-water wave energy units are operational	Final Environmental Assessment, NAVFACPAC, January 2014. http://www.eenews.net/stories/1060046254

3.5.4.3 MILITARY TRAINING AND TESTING ACTIVITIES AND IMPACTS

The Department of Defense major activities in the region are summarized in Table 83.

Table 83. Department of Defense (DOD) major activities in the Western Pacific region.

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 U.S. 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 – Supplemental	The supplement to the 2015 Final EIS/OEIS is being prepared to support ongoing and future activities conducted at sea and on Farallon de Medinilla (FDM) beyond 2020. New information, including an updated acoustic effects model, updated marine mammal density data, and evolving and emergent best available science, will be used to update the MITT.	Scoping August 1, 2017 to September 15, 2017. DoD representatives met with the Guam and CNMI APs and the Council submitted a scoping comment.	Likely access and habitat impacts similar to previous analysis
Hawai`i-Southern California Training and Testing	Increase naval testing and training activities.	DEIS published October 13, 2017. Comment period closed Dec. 12, 2017. Staff attended a public hearing.	EFH consultation has not been initiated. Likely access and habitat impacts similar to previous analysis.
Long Range Strike Weapon Systems Evaluation Program (WSEP)	Conduct operational evaluations of Long Range Strike weapons and other munitions as part of Long Range Strike WSEP operations at the Pacific Missile Range Facility at Kauai, Hawaii.	Comment period closed Feb. 6, 2017 on NMFS authorization to take marine mammals incidental to conducting munitions testing for their Long Range Strike Weapons Systems Evaluation Program (LRS WSEP) over the course of five years, from September 1, 2017 through August 31, 2022 (82 FR 1702).	Access – closures during training
CNMI Joint Military Training	Establish unit and combined level training ranges on Tinian and Pagan.	Supplemental Draft EIS expected in late 2018 or early 2019. Suit filed for segmentation and range of reasonable alternatives under NEPA. DOJ asked U.S. District Court for the NMI to dismiss the plaintiff's complaint with prejudice to prevent refiling.	Significant access and habitat impacts
Garapan Anchorage	Military Pre-Positioned Ships anchor and transit.	Expired Memorandum of Understanding with the CNMI government. As of March 2018, MOU had not been signed.	Access, invasive species, unmitigated damage to reefs

Farallon de Medinilla	Restricted airspace covering the island to 12 nmi radius to conduct military training scenarios using air-to-ground ordnance delivery, naval gunfire, lasers, and special operations training.	Final rule published March 13, 2017, effective June 22, 2017, designating a new area, R-2701A, that surrounds existing R-2701, encompassing airspace between a 3 nmi radius and 12 nmi radius of FDM (82 FR 13389). Proposed surface danger zone to 12 nmi. Damage to submerged lands and fisheries to be included within consultation establishing continued U.S. interest in the island and compensation to the CNMI (Report to the President on 902 Consultations, 2017).	Access – to fishing grounds and transit to fishing grounds - and damage to submerged lands

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 14-15, 2018. The RPB's American Samoa Ocean Planning Team has completed its draft Regional Ocean Plan, on which the RPB provided comments and endorsement. CNMI and Guam Ocean Planning Teams have held their kick-off meetings. The RPB, by consensus, adopted the following goals for 2018: finalize the American Samoa Ocean Plan; continue planning in Guam and CNMI including conducting coastal and marine spatial planning training; transfer data portal prototype to permanent site and identify data gaps; and increase funding.

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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 two-day workshop on November 30th-December 1st, 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. Recent analysis conducted by Gilman et al. 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).

From 2015 to 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 and 2016 compared to previous years in both the deep-set and shallow-set longline fishery. The higher number of overall seabird interactions in 2015 and 2016 coincided with the strong El Niño (see Section 3.3.3) and the high MEI values, suggesting that the recent interaction trend is consistent with the findings of Gilman et al. 2016.

At its 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 continue undertaking efforts in 2018 to improve the understanding of the factors underlying the higher seabird interaction rates in 2015 through 2017 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.

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 to 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[8].

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 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 1,000 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 mt). However, in 2013, the CPUE for albacore fell to 11.9 fish per 1,000 hooks (versus 14.8 in 2009) and the fuel price increased to $3.20 per gallon (versus $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.

[8] http://www.samoanews.com/tri-marine-says-local-longline-fleet-vital-economy

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 to 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[9]. 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.

4.2.1.1 HAWAII LONGLINE: SHALLOW-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 unlike the relatively steady increase in tuna trip revenue over time (see Chapter 2). 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 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.

[9] http://www.spc.int/coastfish/publications/bulletins/419-spc-fisheries-newsletter-142.html

4.2.1.1.1 Weakened Swordfish Market

The weakened swordfish market has been a disincentive for Hawaii fishermen to re-engage in the swordfish fishery in recent years. Unlike bigeye tuna, which is mainly consumed in Hawaii's local market, the majority of the swordfish landed in Hawaii and used to be exported to the U.S. mainland where it competed with imports from other nations and the Atlantic. Concern over mercury contamination could have possibly contributed to decreased demand as well. In early 1990, bigeye and swordfish ex-vessel prices in the Hawaii market were similar at around $4.50 per pound. From 1994 to 2009, swordfish prices declined while bigeye prices have held relatively stable. In recent years, the price differential between these two species has increased. 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 per pound.

4.2.1.1.2 CPUE Declines for Swordfish Trips

Swordfish CPUE was high at the beginning of the time series, being above 15 fish per 1,000 hooks in the years of 2005, 2006, and 2007. It has decreased since 2007, dropping to its lowest in 2010 with only 10 fish per 1,000 hooks. The swordfish CPUE has slightly increased and then remained unchanged in recent years. Bigeye CPUE, on the other hand, shows a different trend; it was quite steady from 2005 to 2012, and has increased continuously in the last four years from 3.8 fish per 1,000 hooks in 2012 to approximately 4.5 fish per 1,000 hooks in 2015.

4.2.1.1.3 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 from 2005 to 2014, while the average net revenue for tuna trips has generally increased over the same period of time (Pan, 2016).

4.2.1.1.4 Sudden Closures During Fishing Season

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.

4.3 FACTORS AFFECTING CPUE OF TARGET SPECIES

The work of PIFSC researchers in spatial and temporal changes in Hawaiʻi 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 (SSC). Authors include Phoebe Woodworth-Jefcoats, Johanna Wren, Jeff Drazen and

Jeff Polovina[10]. 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.

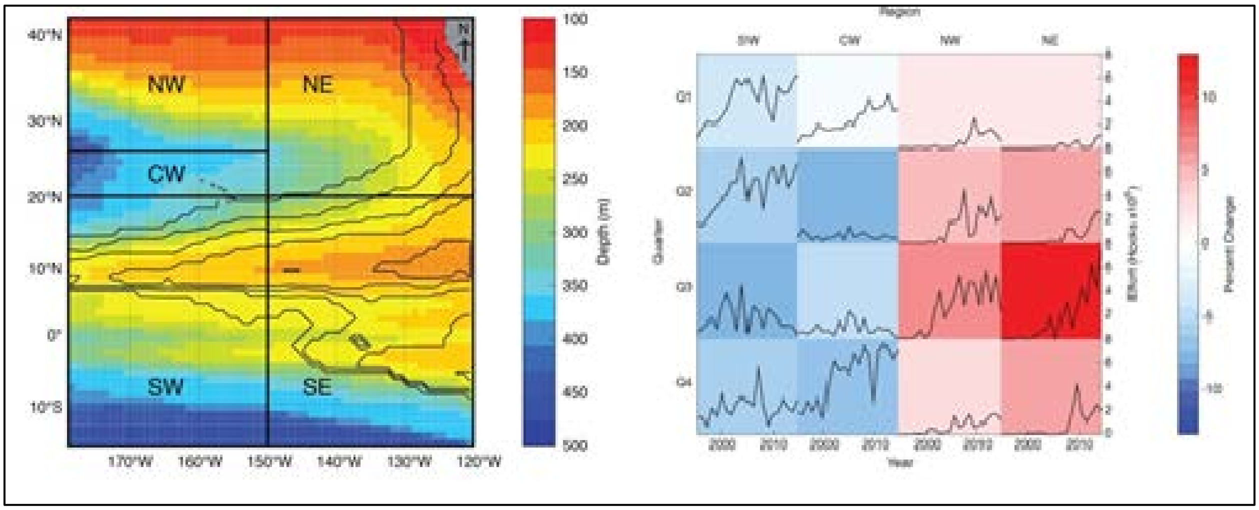

Figure 181. Left: Map depicting the five regions by which the fishery is examined overlaid on the climatological (1995-2015) median depth of preferred thermal habitat.

Note: (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 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

[10] 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 p.

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 181).

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 181). 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 182).

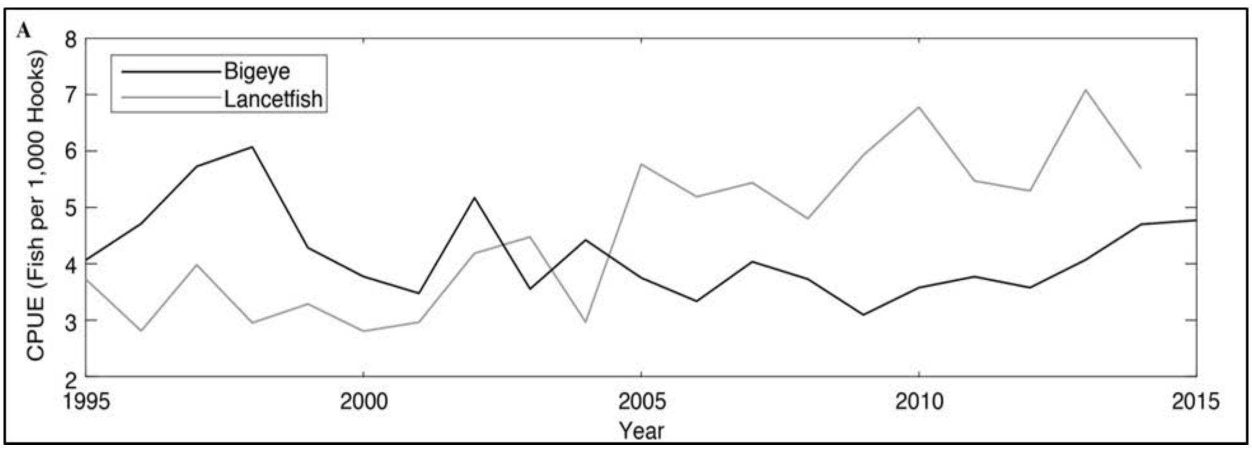

Figure 182. Annueal deep-set bigeye tuna (black) and lancetfish (gray) CPUE.

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 183A). 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 183C).

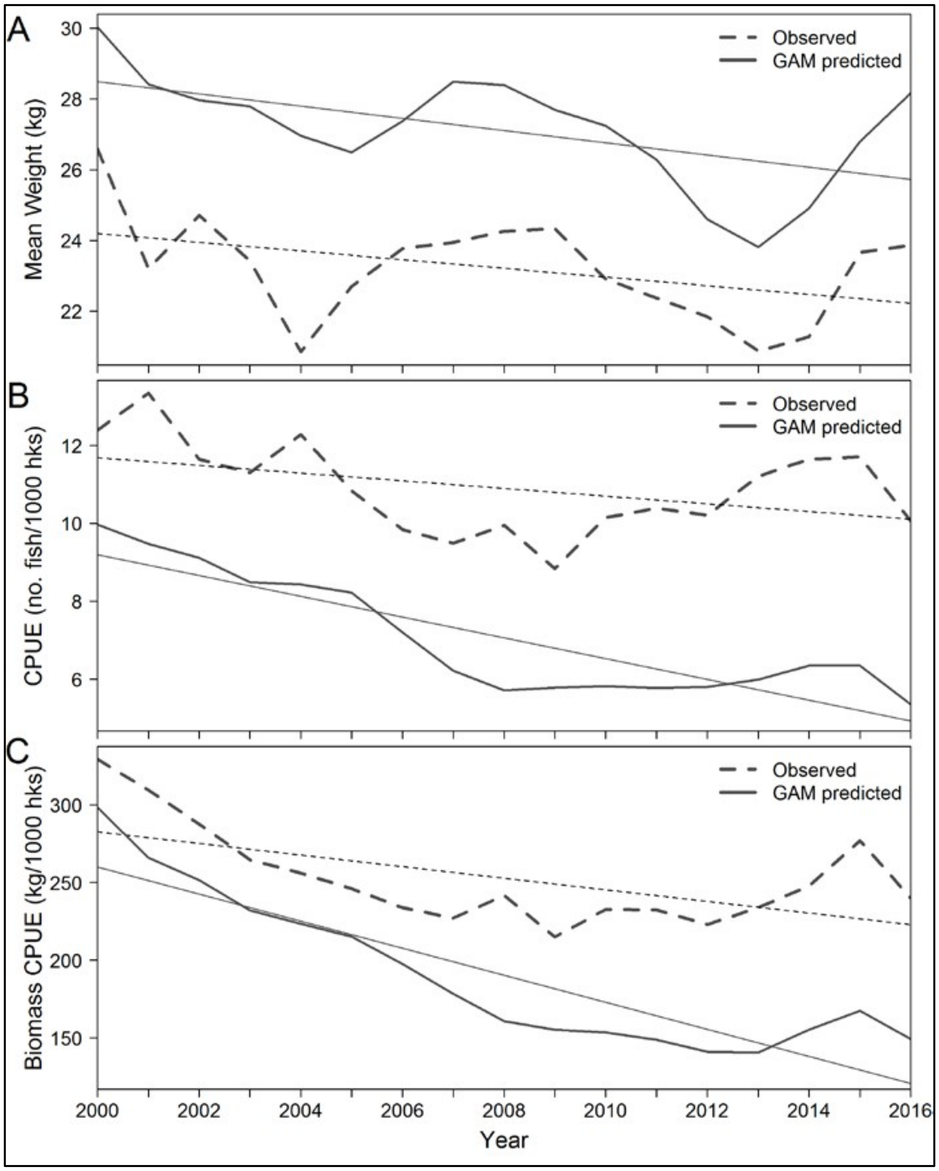

Figure 183. Mean weight (A), catch per unit effort (B), and weight per unit effort (WPUE) for all fish in the Hawai‘i-based longline fishery from dealer provided data.

Note: 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 184).

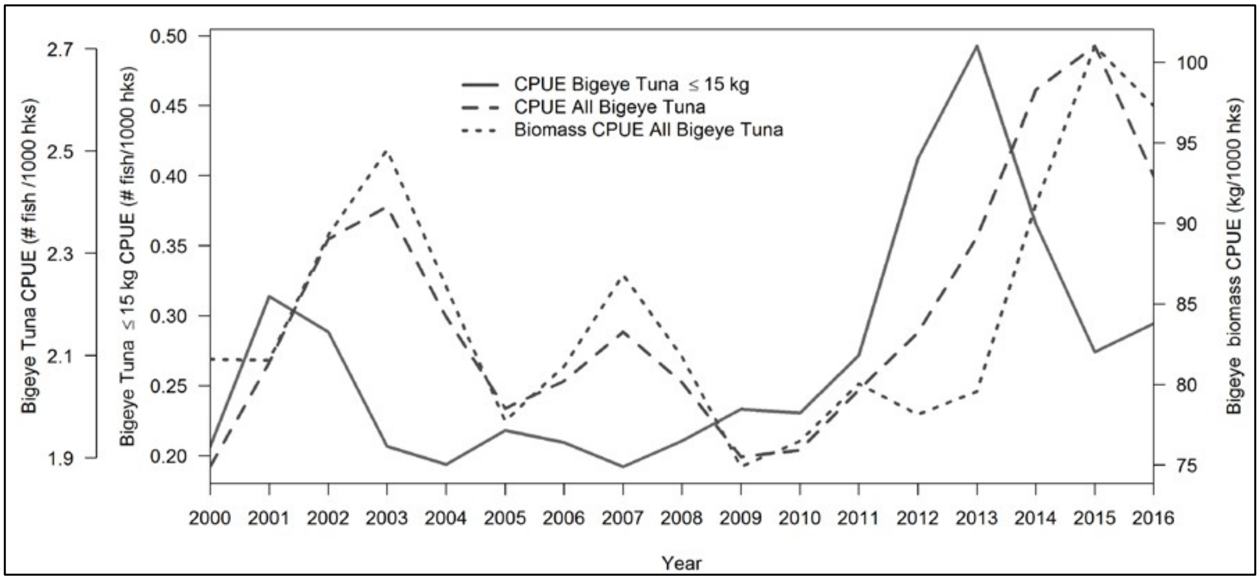

Figure 184. Temporally- and spatially-adjusted annual catch per 1000 hooks.

Note: (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 influence of environmental impacts on tuna populations can be found in Lehodey et al. (2010) and Lehodey et al. (2013).

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APPENDIX A: SUPPORTING DATA TABLES FOR FIGURES IN CHAPTER 2 AND SECTION 3.1

Table **Page**

TABLES FOR SECTION 2.1: AMERICAN SAMOA

Table A-1. Summary of creel survey boat-based 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
2017	200	41	74	142	52

Table A-2. Supporting Data for Figure 2. Number of American Samoa boats landing any pelagic species by longlining, trolling, and all methods.

Year	Boats Landing All Methods	Boats Landing Longline Boats	Boats Landing Trolling
2008	53	29	16
2009	44	26	10
2010	40	26	7
2011	39	24	10
2012	38	25	9
2013	42	22	13
2014	47	23	22
2015	37	21	11
2016	33	20	12
2017	25	15	8
Average	**39**	**22**	**12**
Standard Deviation	**20**	**10**	**6**

Table A-3. Supporting Data for

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

Year	All Pelagic Species Troll Trips	All Pelagic Species Longline Sets
2008	143	4,754
2009	81	4,910
2010	53	4,537
2011	141	3,891
2012	84	4,210
2013	132	3,411
2014	157	2,748
2015	167	2,786
2016	128	2,451
2017	179	2,333
Average	**161**	**3,544**
Standard Deviation	**25**	**1,712**

Table A-4. Supporting Data for Figure 4. American Samoa annual estimated total landings of tuna species and non-tuna PMUS.

Year	Total Pounds Landings Tuna	Total Pounds Landings Non Tuna PMUS
2008	9,507,555	372,707
2009	10,812,698	459,967
2010	10,878,482	395,090
2011	7,522,215	368,285
2012	9,361,244	333,268
2013	5,850,490	295,564
2014	4,898,171	251,590
2015	5,388,351	232,658
2016	4,580,694	237,608
2017	4,524,738	249,860
Average	**7,016,147**	**311,284**
Standard Deviation	**3,523,384**	**86,866**

Table A-5. Supporting Data for Figure 5. American Samoa annual commercial landings of tuna species and non-tuna PMUS.

Year	Commercial Landings Pounds Tuna	Commercial Landings Pounds Non Tuna PMUS
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	3,888,325	145,644
2017	32,188	59,680
Average	**4,640,353**	**224,840**
Standard Deviation	**6,516,929**	**233,571**

Table A-6. Supporting Data for Figure 6. American Samoa annual estimated total landings of yellowfin tuna

Year	Estimated Yellowfin Longline Pounds	Estimated Yellowfin Trolling Pounds
2008	803,202	20,089
2009	941,766	2,785
2010	1,080,597	2,052
2011	1,306,703	12,379
2012	828,636	8,479
2013	808,271	7,137
2014	1,067,080	6,617
2015	1,003,907	3,981
2016	850,849	9,492
2017	1,175,128	14,983
Average	**989,165**	**17,536**
Standard Deviation	**262,991**	**3,610**

Table A-7. Supporting Data for Figure 7. American Samoa annual estimated total landings of skipjack tuna

Year	Estimated Skipjack Longline Pounds	Estimated Skipjack Trolling Pounds
2008	409,006	16,294
2009	390,801	2,775
2010	277,946	2,043
2011	311,604	19,862
2012	727,981	9,703
2013	161,136	8,459
2014	286,397	12,941
2015	250,832	6,925
2016	207,970	9,817
2017	138,684	7,058
Average	**273,845**	**11,676**
Standard Deviation	**191,147**	**6,531**

Table A-8. Supporting Data for Figure 8. American Samoa annual estimated total landings of wahoo

Year	Estimated Wahoo Longline Pounds	Estimated Wahoo Trolling Pounds
2008	243,696	165
2009	277,152	0
2010	240,776	64
2011	193,780	55
2012	165,186	597
2013	149,619	1,109
2014	122,369	1,072
2015	121,750	496
2016	103,172	1,872
2017	105,789	890
Average	**174,743**	**528**
Standard Deviation	**97,515**	**513**

Table A-9. Supporting Data for Figure 9. American Samoa annual estimated total landings of mahimahi

Year	Estimated Mahimahi Longline Pounds	Estimated Mahimahi Trolling Pounds
2008	27,889	931
2009	35,151	113
2010	18,081	0
2011	23,153	611
2012	23,977	157
2013	39,138	300
2014	23,012	2,077
2015	11,822	893
2016	8,969	1,297
2017	29,907	1,381
Average	**28,898**	**1,156**
Standard Deviation	**1,427**	**318**

Table A-10. Supporting Data for Figure 10. American Samoa annual estimated total landings of Blue Marlin

Year	Blue Marlin Longline Pounds	Blue Marlin Trolling Pounds
2008	74,441	0
2009	89,085	0
2010	92,479	0
2011	81,874	0
2012	73,928	0
2013	60,795	0
2014	55,941	2,007
2015	55,836	1,765
2016	66,073	476
2017	82,791	812
Average	**78,616**	**406**
Standard Deviation	**5,904**	**574**

Table A-11. Supporting Data for Figure 11. American Samoa annual estimated total landings of Sailfish

Year	Sailfish Longline Pounds	Sailfish Trolling Pounds
2008	1,489	148
2009	4,538	0
2010	3,616	0
2011	8,296	73
2012	3,333	0
2013	3,546	0
2014	3,616	195
2015	5,106	1,391
2016	5,106	0
2017	3,262	0
Average	**2,376**	**74**
Standard Deviation	**1,254**	**105**

Table A-12. Supporting Data for Figure 13. Thousands of American Samoa longline hooks set (Federal Logbook Data).

Year	Longline Hook Set
2008	14,444
2009	15,076
2010	13,184
2011	11,074
2012	12,112
2013	10,184
2014	7,667
2015	7,806
2016	6,909
2017	6,623
Average	**10,534**
Standard Deviation	**5,530**

Table A-13. Supporting Data for Figure 14. American Samoa annual estimated total landings of bigeye tuna by longlining.

Year	Bigeye Tuna Longline Pounds
2008	298,424
2009	465,829
2010	463,890
2011	386,653
2012	408,805
2013	191,554
2014	210,869
2015	183,849
2016	157,772
2017	141,008
Average	**219,716**
Standard Deviation	**111,310**

Table A-14. Supporting Data for Figure 15. American Samoa annual estimated total landings of albacore by longlining.

Year	Albacore Longline Pounds
2008	7,960,125
2009	9,008,539
2010	9,050,894
2011	5,482,753
2012	7,376,076
2013	4,673,320
2014	3,313,739
2015	3,937,366
2016	3,344,004
2017	3,045,774
Average	**5,502,950**
Standard Deviation	**3,474,971**

Table A-15. Supporting Data for Figure 16. American Samoa total annual estimated landings of swordfish by longlining.

Year	Swordfish Longline Pounds
2008	12,726
2009	23,270
2010	20,437
2011	24,477
2012	26,081
2013	20,474
2014	17,736
2015	14,615
2016	12,194
2017	12,347
Average	**12,537**
Standard Deviation	**268**

Table A-16. Supporting Data for Figure 17. Number of Fish Released by American Samoa Longline Vessels.

Year	Release Tunas	Release Non Tuna PMUS	Release Other Pelagics	Release Sharks
2008	5,542	13,039	761	5,833
2009	9,733	19,034	1,093	5,933
2010	16,703	17,957	1,025	5,108
2011	5,575	12,175	373	4,836
2012	6,924	16,062	900	6,932
2013	1,095	11,838	936	3,879
2014	846	6,760	342	4,946
2015	1,722	7,983	156	6,352
2016	996	5,116	33	5,397
2017	767	2,852	38	4,177
Average	**3,155**	**7,946**	**400**	**2,469**
Standard Deviation	**3,376**	**7,203**	**511**	**2,415**

Table A-17. Supporting Data for Figure 18. American Samoa Albacore catch/1,000 hooks by Monohull Vessels from Longline Logbook Data.

Year	Alias Catch per 1000 Hooks	Monohulls Catch per 1000 Hooks
2008	0.0	14.2
2009	0.0	14.8
2010	0.0	17.4
2011	0.0	12.1
2012	0.0	14.8
2013	0.0	11.7
2014	0.0	10.6
2015	0.0	12.7
2016	0.0	11.9
2017	0.0	11.7
Average	**0.0**	**13.0**
Standard Deviation	**0.0**	**1.8**

Table A-18. Supporting Data for Figure 19. American Samoa pelagic catch-per-hour of trolling and number of trolling hours.

Year	Troll Catch Pounds Per Hour	Effective Troll Hours
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	660
2017	14	2,149
Average	**32**	**1,479**
Standard Deviation	**26**	**948**

Table A-19. Supporting Data for Figure 20. American Samoa trolling CPUE for Skipjack and Yellowfin Tuna.

Year	Trolling Catch Rates Skipjack	Trolling Catch Rates Yellowfin Tuna
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
2017	3.56	7.53
Average	**12.53**	**17.22**
Standard Deviation	**12.69**	**13.70**

Table A-20. Supporting Data for Figure 21. American Samoa trolling CPUE for Blue Marlin, Mahimahi, and Wahoo.

Year	Trolling Catch Rates Blue Marlin	Trolling Catch Rates Mahimahi	Trolling Catch Rates Wahoo
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	2.98	3.83
2017	0.48	0.66	0.52
Average	**0.24**	**0.78**	**0.37**
Standard Deviation	**0.34**	**0.17**	**0.21**

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
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	2	161	149	2	147
2014	74	155	2	153	141	1	140
2015	68	110	1	109	102	1	101
2016	80	108	4	104	91	4	87
2017	74	121	7	114	109	3	106
Average	**71**	**133**	**4**	**129**	**124**	**4**	**120**
Std. Dev.	**6.4**	**21.8**	**2.0**	**22.4**	**22.7**	**2.0**	**22.6**

Table A-22. Supporting Data for Figure 22. CNMI Fishermen (Boats) with Commercial Pelagic Landings.

Year	Number of Fishermen Landing Pelagic Species from Commercial Receipt Invoices
2008	52
2009	50
2010	40
2011	48
2012	35
2013	28
2014	21
2015	12
2016	63
2017	31
Avg.	**42**
Std. Dev.	**15**

Table A-23. Supporting Data for Figure 23. Numbers of Trips Catching Any Pelagic Fish from Commercial Receipt Invoices.

Year	Number of Trips Catching Pelagic Fish from Commercial Receipt Invoices
2008	1,192
2009	1,202
2010	791
2011	549
2012	895
2013	1,640
2014	1,229
2015	583
2016	667
2017	649
Avg.	**921**
Std. Dev.	**384**

Table A-24. Supporting Data for Supporting data shown in Table A-23.

Figure 24. CNMI Boat-based Creel Estimated Number of Trolling Trips.

Year	Estimated Total Trolling Trips	Estimated Trolling Trips Non Charter	Estimated Trolling Trips Charter
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	2,434	59
2014	3,567	3,541	27
2015	2,654	2,654	0
2016	3,601	3,584	17
2017	2,599	2,599	0
Avg.	**3,760**	**3,658**	**102**
Std. Dev.	**1,642**	**1,498**	**144**

Table A-25. Supporting Data for Figure 25. CNMI Boat-based Creel Estimated Number of Trolling Hours.

Year	Estimated Trolling Hours Total	Estimated Trolling Hours Non Charter	Estimated Trolling Hours Charter
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	12,413	246
2014	19,489	19,377	112
2015	14,084	14,084	0
2016	19,260	19,176	84
2017	14,498	14,498	0
Avg.	**20,570**	**20,234**	**337**
Std. Dev.	**8,587**	**8,111**	**476**

Table A-26. Supporting Data for Figure 26. CNMI Boat-Based Creel Average Trip Length – Hours per Trip.

Year	Estimated Trolling Hours per Trip	Estimated Trolling Hours per Trip Non Charter	Estimated Trolling Hours per Trip Charter
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	5.1	4.2
2014	5.5	5.5	4.1
2015	5.3	5.3	0.0
2016	5.3	5.4	4.9
2017	5.6	5.6	0.0
Avg.	**5.5**	**5.6**	**1.7**
Std. Dev.	**0.1**	**0.1**	**2.3**

Table A-27. Supporting Data for Figure 27. .

Year	Estimated Total Landings All Pelagic	Estimated Total Landings Tuna PMUS	Estimated Total Landings Non Tuna PMUS
2008	602,371	470,059	132,312
2009	378,203	301,895	76,308
2010	516,663	425,969	90,694
2011	335,472	263,340	72,131
2012	478,910	408,157	70,753
2013	476,955	389,640	87,315
2014	395,701	262,059	133,642
2015	411,118	309,485	101,633
2016	307,901	212,856	84,662
2017	340,869	280,239	57,876
Avg.	**471,620**	**375,149**	**95,094**
Std. Dev.	**184,910**	**134,223**	**52,634**

Table A-28. Supporting Data for Figure 28. .

Year	Estimated Total Landings Pelagic	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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	473,050	3,905
2014	395,701	394,366	1,335
2015	411,118	411,118	0
2016	307,901	306,409	1,492
2017	340,869	340,869	0
Avg.	**471,620**	**470,187**	**1,433**
Std. Dev.	**184,910**	**182,883**	**2,027**

Table A-29. Supporting Data for Figure 29. .

Year	Estimated Landings Tuna PMUS	Estimated Landings Non Charter	Estimated Landings Charter
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	389,640	0
2014	262,059	262,059	0
2015	309,485	309,485	0
2016	212,856	211,364	1,492
2017	280,239	280,239	0
Avg.	**375,149**	**374,445**	**704**
Std. Dev.	**134,223**	**133,227**	**996**

Table A-30. Supporting Data for Figure 30..

Year	Estimated Landings Total Non Tuna PMUS	Estimated Landings Non Charter	Estimated Landings Charter
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	83,410	3,905
2014	133,642	132,307	1,335
2015	101,633	101,633	0
2016	84,662	84,662	0
2017	57,876	57,876	0
Avg.	**95,094**	**94,365**	**729**
Std. Dev.	**52,634**	**51,603**	**1,031**

Table A-31. Supporting Data for Figure 31. .

Year	Estimated Total Landings Skipjack	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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	248,670	0
2014	240,823	240,823	0
2015	287,171	287,171	0
2016	191,108	189,616	1,492
2017	235,063	235,063	0
Avg.	**327,187**	**326,483**	**704**
Std. Dev.	**130,283**	**129,287**	**996**

Table A-32. Supporting Data for Figure 32. .

Year	Estimated Total Landings Yellowfin	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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	23,278	0
2014	18,570	18,570	0
2015	15,760	15,760	0
2016	19,609	19,609	0
2017	16,968	16,968	0
Avg.	**25,437**	**25,437**	**0**
Std. Dev.	**11,977**	**11,977**	**0**

Table A-33. Supporting Data for Figure 33. .

Year	Estimated Total Landings Mahimahi	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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	52,933	974
2014	87,027	85,692	1,335
2015	88,798	88,798	0
2016	79,656	79,656	0
2017	45,099	45,099	0
Avg.	**63,506**	**63,062**	**444**
Std. Dev.	**26,031**	**25,404**	**627**

Table A-34. Supporting Data for Figure 34. .

Year	Estimated Total Landings Wahoo	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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	5,223	1,954
2014	10,673	10,673	0
2015	4,264	4,264	0
2016	4,968	4,968	0
2017	9,811	9,811	0
Avg.	**8,168**	**7,883**	**286**
Std. Dev.	**2,324**	**2,727**	**404**

Table A-35. Supporting Data for Figure 35. .

Year	Estimated Total Landings Blue Marlin	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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	1,347	0
2014	5,568	5,568	0
2015	0	0	0
2016	0	0	0
2017	2,966	2,966	0
Avg.	**7,527**	**7,527**	**0**
Std. Dev.	**13,583**	**13,583**	**0**

Table A-36. Supporting Data for Figure 36. .

Year	Estimated Total Landings All Pelagics	Estimated Total Landings Tuna PMUS	Estimated Total Landings Non Tuna PMUS
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
2017	65,320	55,630	6,907
Avg.	**142,254**	**124,114**	**12,681**
Std. Dev.	**108,800**	**96,851**	**8,165**

Table A-37. Supporting Data for Figure 37. .

Year	Commercial Purchase Landings Skipjack	Commercial Purchase Landings Yellowfin
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
2017	42,957	12,552
Avg.	**106,508**	**15,624**
Std. Dev.	**89,875**	**4,344**

Table A-38. Supporting Data for Figure 38. Annual commercial landings for mahimahi, wahoo, and blue marlin.

Year	Commercial Purchase Landings Mahimahi	Commercial Purchase Landings Wahoo	Commercial Purchase Landings Blue Marlin
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
2017	5,116	1,595	196
Avg.	**9,152**	**1,632**	**1,112**
Std. Dev.	**5,707**	**52**	**1,295**

Table A-39. Supporting Data for Figure 39. .

Year	Troll Catch Rate Average Pounds per Hour	Troll Catch Rate Non Charter	Troll Catch Rate Charter
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	26.9	11.9
2014	20.5	20.6	4.6
2015	28.0	28.0	0.0
2016	15.9	15.9	6.9
2017	23.4	23.4	0.0
Avg.	**23.0**	**23.3**	**2.1**
Std. Dev.	**0.6**	**0.2**	**3.0**

Table A-40. Supporting Data for Figure 40. .

Year	Troll Catch Rate Pounds per Hour Skipjack	Troll Catch Rate Non Charter	Troll Catch Rate Charter
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	20.0	0.0
2014	12.0	12.0	0.0
2015	20.4	20.4	0.0
2016	10.0	10.0	6.9
2017	16.2	16.2	0.0
Avg.	**15.9**	**16.1**	**1.0**
Std. Dev.	**0.4**	**0.2**	**1.4**

Table A-41. Supporting Data for Figure 41. .

Year	Troll Catch Rate Pounds per Hour Yellowfin Tuna	Troll Catch Rate Non Charter	Troll Catch Rate Charter
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	1.9	0.0
2014	1.2	1.2	0.0
2015	1.1	1.1	0.0
2016	0.9	0.9	0.0
2017	1.2	1.2	0.0
Avg.	**1.3**	**1.3**	**0.0**
Std. Dev.	**0.1**	**0.1**	**0.0**

Table A-42. Supporting Data for Figure 42. .

Year	Troll Catch Rate Pounds per Hour Mahimahi	Troll Catch Rate Non Charter	Troll Catch Rate Charter
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	4.3	4.0
2014	6.0	6.0	4.1
2015	6.2	6.2	0.0
2016	4.2	4.2	0.0
2017	3.0	3.0	0.0
Avg.	**3.1**	**3.1**	**0.7**
Std. Dev.	**0.1**	**0.1**	**0.9**

Table A-43. Supporting Data for Figure 43. .

Year	Troll Catch Rate Pounds per Hour Wahoo	Troll Catch Rate Non Charter	Troll Catch Rate Charter
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	0.4	7.9
2014	0.5	0.5	0.5
2015	0.3	0.3	0.0
2016	0.2	0.2	0.0
2017	0.7	0.7	0.0
Avg.	**0.5**	**0.5**	**0.4**
Std. Dev.	**0.4**	**0.4**	**0.6**

Table A-44. Supporting Data for Figure 44. .

Year	Troll Catch Rate Pounds per Hour Blue Marlin	Troll Catch Rate Non Charter	Troll Catch Rate Charter
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	0.1	0.0
2014	0.3	0.3	0.0
2015	0.0	0.0	0.0
2016	0.0	0.0	0.0
2017	0.2	0.2	0.0
Avg.	**0.9**	**0.9**	**0.0**
Std. Dev.	**1.0**	**1.0**	**0.0**

Table A-45. Supporting Data for Figure 45. .

Year	Troll Catch Rate Pounds per Trip Skipjack	Troll Catch Rate Pounds per Trip Yellowfin	Troll Catch Rate Pounds per Trip Skipjack Creel
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
2017	53	15	94
Avg.	**73**	**13**	**91**
Std. Dev.	**28**	**4**	**4**

Table A-46. Supporting Data for Figure 46. Estimated trolling catch rates (lbs. /trip) for mahimahi, wahoo, and blue marlin.

Year	Troll Catch Rate Pounds per Trip Mahimahi	Troll Catch Rate Pounds per Trip Wahoo	Troll Catch Rate Pounds per Trip Blue Marlin
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
2017	6.3	2.0	0.2

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Table A-47. Numbers of Trips and Interviews for Creel Trolling Method, Guam.

Year	Survey Days	Trips in Boat Log	Interviews
2008	96	785	406
2009	96	1,128	715
2010	96	1,128	715
2011	96	877	496
2012	96	498	274
2013	96	799	456
2014	90	964	511
2015	95	904	540
2016	96	1,128	715
2017	92	1,018	643
Average	**95**	**923**	**547**
Std. Dev.	**2.1**	**198.4**	**149.3**

Table A-48. Supporting Data for Figure 47..

Year	Estimated Trolling Boats	Upper 95 Percent	Lower 95 Percent
2008	385	523.0	322.0
2009	368	468.0	316.0
2010	432	508.0	390.0
2011	454	563.0	396.0
2012	351	457.0	298.0
2013	496	588.0	446.0
2014	447	537.0	395.0
2015	372	460.0	326.0
2016	408	581.0	501.0
2017	318	486.0	369.0
Avg.	**352**	**505**	**346**
Std. Dev.	**47**	**26**	**33**

Table A-49. Supporting Data for Figure 48. Total estimated annual landings in Guam for all pelagics, tuna PMUS, and non-tuna PMUS.

Year	Estimated Total Landings All Pelagic	Estimated Total Landings Tuna PMUS	Estimated Total Landings Non Tuna PMUS
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
2017	705,637	576,399	116,968
Avg.	**624,250**	**448,334**	**169,781**
Std. Dev.	**115,099**	**181,112**	**74,689**

Table A-50. Supporting Data for Figure 49. .

Year	Estimated Total Landings Pelagic	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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	958,260	896,758	61,080
2016	836,066	797,825	36,959
2017	705,637	676,180	28,018
Avg.	**624,250**	**584,212**	**39,318**
Std. Dev.	**115,099**	**130,062**	**15,981**

Table A-51. Supporting Data for Figure 50. .

Year	Estimated Landings Tuna PMUS	Estimated Landings Non Charter	Estimated Landings Charter
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
2017	576,399	568,749	7,650
Avg.	**448,334**	**436,924**	**11,410**
Std. Dev.	**181,112**	**186,429**	**5,317**

Table A-52. Supporting Data for Figure 51. .

Year	Estimated Total Landings Skipjack	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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
2017	508,840	502,706	6,134
Avg.	**402,612**	**392,833**	**9,779**
Std. Dev.	**150,230**	**155,384**	**5,154**

Table A-53. Supporting Data for Figure 52. .

Year	Estimated Total Landings Yellowfin	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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
2017	67,463	65,947	1,516
Avg.	**43,542**	**42,291**	**1,252**
Std. Dev.	**33,829**	**33,455**	**374**

Table A-54. Supporting Data for Figure 53. .

Year	Estimated Total Landings Non Tuna PMUS	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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
2017	116,968	97,424	19,544
Avg.	**169,781**	**142,285**	**27,497**
Std. Dev.	**74,689**	**63,442**	**11,247**

Table A-55. Supporting Data for Figure 54. .

Year	Estimated Total Landings Mahimahi	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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
2017	47,310	40,005	7,305
Avg.	**79,079**	**69,187**	**9,893**
Std. Dev.	**44,928**	**41,269**	**3,659**

Table A-56. Supporting Data for Figure 55. .

Year	Estimated Total Landings Wahoo	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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
2017	27,475	24,525	2,950
Avg.	**63,025**	**51,515**	**11,511**
Std. Dev.	**50,275**	**38,169**	**12,106**

Table A-57. Supporting Data for Figure 56. .

Year	Estimated Total Landings Blue Marlin	Estimated Total Landings Non Charter	Estimated Total Landings Charter
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
2017	42,183	32,894	9,289
Avg.	**25,912**	**19,818**	**6,094**
Std. Dev.	**23,011**	**18,492**	**4,519**

Table A-58. Supporting Data for Figure 57. Annual estimated commercial landings for all pelagics, tuna PMUS, and non-tuna PMUS.

Year	Estimated Commercial Landings All Pelagic	Estimated Commercial Landings Tuna PMUS	Estimated Commercial Landings Non Tuna PMUS
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	173,064	34,509	138,555
2014	105,557	43,508	62,049
2015	106,590	63,786	42,794
2016	89,977	32,247	57,716
2017	110,383	55,588	54,566
Avg.	**127,247**	**45,799**	**76,387**
Std. Dev.	**23,849**	**13,844**	**30,859**

Table A-59. Supporting Data for Figure 58. Total estimated number of trolling trips in Guam from 2008-2017.

Year	Estimated Trolling Hours Total	Estimated Trolling Hours Non Charter	Estimated Trolling Hours Charter
2008	32,393	26,307	6,087
2009	62,015	57,737	4,279
2010	62,015	57,737	4,279
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
2017	54,780	50,099	4,681
Avg.	**43,587**	**38,203**	**5,384**
Std. Dev.	**15,830**	**16,823**	**994**

Table A-60. Supporting Data for Figure 59. Total estimated .

Year	Estimated Trolling Hours Total	Estimated Trolling Hours Non Charter	Estimated Trolling Hours Charter
2008	32,393	26,307	6,087
2009	62,015	57,737	4,279
2010	62,015	57,737	4,279
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
2017	54,780	50,099	4,681
Avg.	**43,587**	**38,203**	**5,384**
Std. Dev.	**15,830**	**16,823**	**994**

Table A-61. Supporting Data for Figure 60. Estimated fishing trip length (hrs.) in Guam .

Year	Estimated Trolling Hours per Trip Average	Estimated Trolling Hours per Trip Non Charter	Estimated Trolling Hours per Trip Charter
2008	4.7	5.2	3.2
2009	5.5	5.8	3.4
2010	5.5	5.8	3.4
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
2017	5.3	5.5	3.7
Avg.	**5.0**	**5.4**	**3.5**
Std. Dev.	**0.4**	**0.2**	**0.4**

Table A-62. Supporting Data for Figure 61. .

Year	Troll Catch Rate Average Pounds per Hour	Troll Catch Rate Pounds per Hour Non Charter	Troll Catch Rate Pounds per Hour Charter
2008	16.8	18.8	8.3
2009	11.6	11.5	12.8
2010	11.9	11.7	14.3
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	14.2	14.5	9.3
2017	12.9	13.5	6.0
Avg.	**14.9**	**16.2**	**7.2**
Std. Dev.	**2.8**	**3.7**	**1.6**

Table A-63. Supporting Data for Figure 62. .

Year	Troll Catch Rate Pounds per Hour Skipjack	Troll Catch Rate Pounds per Hour Non Charter	Troll Catch Rate Pounds per Hour Charter
2008	9.1	10.8	2.2
2009	5.4	5.6	2.0
2010	5.5	5.7	2.1
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	7.4	7.8	1.3
2017	9.3	10.0	1.3
Avg.	**9.2**	**10.4**	**1.8**
Std. Dev.	**0.1**	**0.6**	**0.6**

Table A-64. Supporting Data for Figure 63. for Yellowfin.

Year	Troll Catch Rate Pounds per Hour Yellowfin Tuna	Troll Catch Rate Pounds per Hour Non Charter	Troll Catch Rate Pounds per Hour Charter
2008	0.6	0.7	0.2
2009	0.7	0.8	0.3
2010	0.4	0.4	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
2017	1.2	1.3	0.3
Avg.	**0.9**	**1.0**	**0.3**
Std. Dev.	**0.4**	**0.4**	**0.1**

Table A-65. Supporting Data for Figure 64. for Mahimahi.

Year	Troll Catch Rate Pounds per Hour Mahimahi	Troll Catch Rate Pounds per Hour Non Charter	Troll Catch Rate Pounds per Hour Charter
2008	3.4	3.7	2.1
2009	2.4	2.2	5.3
2010	4.5	4.2	8.6
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	3.1	3.0	3.9
2017	0.9	0.8	1.6
Avg.	**2.2**	**2.3**	**1.9**
Std. Dev.	**1.8**	**2.1**	**0.4**

Table A-66. Supporting Data for Figure 65. for Wahoo.

Year	Troll Catch Rate Pounds per Hour Wahoo	Troll Catch Rate Pounds per Hour Non Charter	Troll Catch Rate Pounds per Hour Charter
2008	3.0	3.0	3.3
2009	2.1	2.1	2.1
2010	0.7	0.7	0.7
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	0.6	0.5	1.3
2017	0.5	0.5	0.6
Avg.	**1.8**	**1.8**	**2.0**
Std. Dev.	**1.8**	**1.8**	**1.9**

Table A-67. Supporting Data for Figure 66. for Blue Marlin.

Year	Troll Catch Rate Pounds per Hour Blue Marlin	Troll Catch Rate Pounds per Hour Non Charter	Troll Catch Rate Pounds per Hour Charter
2008	0.3	0.3	0.5
2009	0.5	0.4	2.8
2010	0.5	0.4	2.6
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
2017	0.8	0.7	2.0
Avg.	**0.6**	**0.5**	**1.3**
Std. Dev.	**0.4**	**0.3**	**1.1**

Table A-68. Supporting Data for Figure 67. Guam foreign longline transshipment landings for longliners fishing outside the Guam EEZ.

Year	Longline Transshipment Landings Total	Longline Transshipment Landings Bigeye Tuna	Longline Transshipment Landings Yellowfin Tuna
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
2017	1,245	910	307
Avg.	**2,730**	**1,918**	**661**
Std. Dev.	**2,100**	**1,426**	**500**

TABLES FOR SECTION 2.4: HAWAI`I

Table A-69. Supporting Data for Figure 68. Hawai`i commercial tuna, billfish, other PMUS and PMUS shark catch from 2008-2017.

	Hawaii pelagic catch (1,000 pounds)					
Year	Tunas	Billfish	Other PMUS	PMUS Sharks	non-PMUS	Total
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	25,038	5,687	6,167	168	24	37,083
2017	26,470	7,050	5,513	166	11	39,209
Average	**21,301.2**	**6,172.6**	**5,809.2**	**208.0**	**26.7**	**33,517.8**
SD	**3,573.8**	**756.0**	**796.9**	**88.1**	**11.1**	**4,289.8**

Table A-70. Supporting Data for Figure 69. Total commercial pelagic catch by gear type from 2008-2017.

	Hawaii pelagic total catch (1,000 pounds)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
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	31,434	1,849	2,582	785	366	67	37,083
2017	32,727	2,993	2,146	933	318	92	39,209
Average	**25,429.1**	**3,128.3**	**2,986.5**	**1,079.4**	**475.1**	**419.5**	**33,517.8**
SD	**5,169.2**	**726.5**	**429.8**	**260.5**	**173.2**	**302.2**	**4,289.8**

Table A-71. Supporting Data for Figure 70. Hawai`i commercial tuna catch by gear type from 2008-2017.

Year	Hawaii tuna catch by gear type (1,000 pounds)						
	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
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	22,450	106	1,368	703	362	48	25,038
2017	23,727	274	1,220	861	305	83	26,470
Average	**17,784.7**	**165.3**	**1,524.3**	**981.4**	**462.4**	**383.1**	**21,301.2**
SD	**3,871.1**	**69.5**	**214.4**	**254.3**	**170.7**	**287.3**	**3,573.8**

Table A-72. Supporting Data for Figure 71. Species composition of the tuna catch from 2008-2017.

Year	Hawaii tuna catch (1,000 pounds)						
	Bigeye tuna	Yellowfin tuna	Skipjack tuna	Albacore	Bluefin tuna	Other tunas	Total
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	18,663	4,956	801	602	1	14	25,038
2017	17,928	7,518	724	286	3	11	26,470
Average	**15,380.4**	**4,075.3**	**905.9**	**913.8**	**0.7**	**25.2**	**21,301.2**
SD	**2,904.6**	**1,370.1**	**226.7**	**540.6**	**0.8**	**17.0**	**3,573.8**

Table A-73. Supporting Data for Figure 72. Hawai`i bigeye tuna catch by gear type from 2008-2017.

	Hawaii bigeye tuna catch (1,000 pounds)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
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	18,070	75	75	93	310	40	18,663
2017	17,479	126	78	47	180	17	17,928
Average	**14,441.0**	**99.6**	**206.4**	**110.5**	**396.2**	**126.7**	**15,380.4**
SD	**3,043.9**	**37.5**	**103.1**	**48.1**	**167.7**	**77.3**	**2,904.6**

Table A-74. Supporting Data for Figure 73. Hawai`i yellowfin tuna catch by gear type from 2008-2017.

	Hawaii yellowfin tuna catch (1,000 pounds)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
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	3,304	29	1,024	542	51	5	4,956
2017	5,560	137	927	725	123	45	7,518
Average	**2,184.5**	**40.4**	**1,040.7**	**693.3**	**63.0**	**53.4**	**4,075.3**
SD	**1,341.7**	**35.8**	**136.1**	**150.2**	**27.3**	**30.6**	**1,370.1**

Table A-75. Supporting Data for Figure 74. Hawai`i skipjack tuna catch by gear type from 2008-2017.

	Hawaii skipjack tuna catch (1,000 pounds)					
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Other gear	Total
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	529	0	258	11	3	801
2017	486	1	207	10	20	724
Average	**429.6**	**0.9**	**255.4**	**16.4**	**203.6**	**905.9**
SD	**99.6**	**0.6**	**57.1**	**5.1**	**222.1**	**226.7**

Table A-76. Supporting Data for Figure 75. Hawai`i albacore catch by gear type from 2008-2017.

	Hawaii albacore catch (1,000 pounds)					
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Other gear	Total
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	546	2	2	52	0	602
2017	200	9	1	75	1	286
Average	**729.0**	**24.3**	**4.7**	**154.0**	**2.0**	**913.8**
SD	**421.7**	**19.5**	**2.5**	**151.3**	**2.3**	**540.6**

Table A-77. Supporting Data for Figure 76. Hawai`i commercial billfish catch by gear type from 2008-2017.

	Hawaii billfish catch (1,000 lbs)						
Year	Deep-set longline	Shallow-set longline	MHI troll	MHI handline	Offshore handline	Other gear	Total
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	3,608	1,677	382	15	1	3	5,687
2017	4,073	2,611	339	19	4	3	7,050
Average	**2,904.7**	**2,852.6**	**390.6**	**16.9**	**2.2**	**5.6**	**6,172.6**
SD	**801.0**	**665.9**	**56.4**	**3.3**	**2.1**	**3.2**	**756.0**

Table A-78. Supporting Data for Figure 77. Species composition of the billfish catch from 2008-2017.

	Hawaii billfish catch (1,000 lbs)					
Year	Swordfish	Blue marlin	Striped marlin	Spearfish	Other marlins	Total
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	1,542	887	784	56	5,687
2017	3,580	1,815	919	688	47	7,050
Average	**3,469.7**	**1,335.9**	**820.2**	**506.3**	**40.4**	**6,172.6**
SD	**585.4**	**314.5**	**218.3**	**165.8**	**10.3**	**756.0**

Table A-79. Supporting Data for Figure 78. Hawai`i swordfish catch by gear type from 2008-2017.

	Swordfish catch (1,000 lbs)						
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
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
2017	1,009	2,556	1	12	1	0	3,580
Average	**671.4**	**2,783.5**	**1.1**	**12.5**	**0.2**	**1.0**	**3,469.7**
SD	**178.9**	**645.9**	**0.6**	**2.8**	**0.4**	**0.7**	**585.4**

Table A-80. Supporting Data for Figure 79. Hawai`i blue marlin catch by gear type from 2008-2017.

	Blue marlin catch (1,000 lbs)						
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
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	1,194	28	311	5	1	2	1,542
2017	1,494	14	296	6	2	2	1,815
Average	**964.8**	**26.8**	**335.1**	**3.9**	**1.7**	**3.5**	**1,335.9**
SD	**315.9**	**15.6**	**50.6**	**1.3**	**1.6**	**1.8**	**314.5**

Table A-81. Supporting Data for Figure 80. Hawai`i striped marlin catch by gear type from 2008-2017.

	Striped marlin catch (1,000 lbs)						
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
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	831	29	27	1	0	0	887
2017	871	34	13	0	0	0	919
Average	**758.9**	**37.5**	**22.9**	**0.2**	**0.1**	**0.6**	**820.2**
SD	**214.5**	**16.2**	**7.0**	**0.3**	**0.2**	**0.7**	**218.3**

Table A-82. Supporting Data for Figure 81. Hawai`i commercial catch of other PMUS by gear type from 2008-2017.

	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**
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	5,356	67	828	66	3	15	6,335
2017	4,919	107	583	53	10	7	5,679
Average	**4,717.8**	**110.4**	**1,068.1**	**80.4**	**10.3**	**30.3**	**6,017.3**
SD	**720.7**	**20.5**	**242.4**	**20.2**	**4.8**	**16.2**	**738.3**

Table A-83. Supporting Data for Figure 82. Species composition of other PMUS catch from 2008-2017.

	Catch of other PMUS by species (1,000 lbs)						
Year	**Mahimahi**	**Moonfish**	**Oilfish**	**Ono**	**Pomfret**	**PMUS shark**	**Total**
2008	1,443	1,338	455	975	681	390	5,282
2009	1,473	1,897	498	748	610	332	5,558
2010	1,703	1,781	521	758	580	244	5,587
2011	1,628	1,622	589	675	422	190	5,126
2012	2,007	1,593	563	809	710	181	5,863
2013	1,588	2,073	580	883	1,091	131	6,346
2014	1,819	2,242	516	1,176	1,179	129	7,061
2015	1,495	2,662	528	1,223	1,278	150	7,336
2016	1,232	2,166	481	1,204	1,084	168	6,335
2017	993	2,289	334	978	920	166	5,679
Average	**1,538.1**	**1,966.2**	**506.5**	**942.9**	**855.5**	**208.0**	**6,017.3**
SD	**287.3**	**395.3**	**74.0**	**202.4**	**292.7**	**88.1**	**738.3**

Table A-84. Supporting Data for Figure 83. Hawai`i moonfish catch by gear type from 2008-2017.

	Moonfish catch (1,000 lbs)			
Year	**Deep-set longline**	**Shallow-set longline**	**Other gear**	**Total**
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	2,148	19	0	2,166
2017	2,257	32	0	2,289
Average	**1,948.7**	**17.2**	**0.3**	**1,966.2**
SD	**385.3**	**12.1**	**0.6**	**395.3**

Table A-85. Supporting Data for Figure 84. Hawai`i mahimahi catch by gear type from 2008-2017.

	Mahimahi catch (1,000 lbs)						
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
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	16	558	19	1	3	1,232
2017	555	15	400	17	1	3	993
Average	**767.3**	**38.7**	**680.3**	**34.3**	**7.0**	**10.5**	**1,538.1**
SD	**121.8**	**16.0**	**168.8**	**12.2**	**4.7**	**5.3**	**287.3**

Table A-86. Supporting Data for Figure 85. Hawai`i ono (wahoo) catch by gear type from 2008-2017.

	Ono catch (1,000 lbs)						
Year	**Deep-set longline**	**Shallow-set longline**	**MHI troll**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
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	920	1	269	11	0	2	1,204
2017	782	3	182	8	1	2	978
Average	**536.6**	**1.9**	**386.7**	**13.0**	**1.0**	**3.7**	**942.9**
SD	**233.9**	**1.3**	**100.9**	**3.7**	**0.5**	**2.4**	**202.4**

Table A-87. Supporting Data for Figure 86. Hawai`i pomfret (monchong) catch by gear type from 2008-2017.

	Pomfret catch (1,000 lbs)					
Year	**Deep-set longline**	**Shallow-set longline**	**MHI handline**	**Offshore handline**	**Other gear**	**Total**
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	1,084
2017	885	0	26	7	1	920
Average	**808.9**	**1.4**	**30.1**	**2.0**	**13.0**	**855.5**
SD	**289.4**	**1.4**	**11.4**	**2.3**	**8.2**	**292.7**

Table A-88. Supporting Data for Figure 87. Hawai`i PMUS shark catch by gear type from 2008-2017.

	PMUS shark catch (1,000 lbs)			
Year	**Deep-set longline**	**Shallow-set longline**	**Non-longline**	**Total**
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
2017	115	49	2	166
Average	**177.4**	**26.2**	**4.4**	**208.0**
SD	**85.2**	**9.8**	**1.3**	**88.1**

Table A-89. Supporting Data for Figure 88. Number of Hawai`i-permitted deep-set longline vessels trips/sets from 2008-2017.

	Deep-set longline		
Year	Vessels	Trips	Sets
2008	128	1,384	17,923
2009	128	1,257	16,860
2010	123	1,211	16,152
2011	130	1,312	17,260
2012	129	1,365	18,180
2013	136	1,386	18,803
2014	140	1,355	17,831
2015	143	1,452	18,519
2016	142	1,480	19,391
2017	145	1,539	19,674
Average	**134.4**	**1,374.1**	**18,059.3**
SD	**7.7**	**99.6**	**1102.8**

Table A-90. Supporting Data for Figure 89. Number of hooks set by Hawai`i-permitted deep-set longline fishery from 2008-2017.

	Number of deep-set hooks by area (milions)			
Year	Outside EEZ	Hawaii EEZ	PRIA EEZ	Total
2008	23.2	15.6	1.3	40.1
2009	24.4	12.4	1.1	37.9
2010	28.1	7.9	1.4	37.4
2011	26.4	13.6	0.9	40.9
2012	28.4	14.0	1.9	44.3
2013	32.9	12.8	1.2	46.9
2014	34.2	10.8	0.8	45.8
2015	33.0	14.3	0.3	47.6
2016	38.6	12.5	0.1	51.2
2017	40.5	13.0	0.0	53.5
Average	**30.97**	**12.69**	**0.90**	**44.56**
SD	**5.84**	**2.12**	**0.61**	**5.47**

Table A-91. Supporting Data for Figure 90. Catch and revenue for Hawai`i-permitted deep-set longline fishery from 2008-2017.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
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	$90,387	$84,376	253.9
2014	26,615	$83,020	$78,617	257.6
2015	32,136	$95,384	$91,229	260.2
2016	31,434	$101,707	$99,190	265.3
2017	32,727	$96,135	$96,135	272.0
Average	**25,429.1**	**$84,294.1**	**$78,751.9**	
SD	**5,169.2**	**$13,180.6**	**$15,567.1**	

Table A-92. Supporting Data for Figure 91. Tuna CPUE for the Hawai`i-permitted deep-set longline fishery from 2008-2017.

	Deep-set longline CPUE (fish per 1,000 hooks)		
Year	Bigeye tuna	Yellowfin tuna	Albacore
2008	3.8	0.8	0.3
2009	3.1	0.4	0.2
2010	3.7	0.4	0.5
2011	3.8	0.8	0.8
2012	3.6	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
2017	4.2	1.5	0.1
Average	**4.02**	**0.68**	**0.35**
SD	**0.53**	**0.35**	**0.24**

Table A-93. Supporting Data for Figure 92. Billfish CPUE for the Hawai`i-permitted deep-set longline fishery from 2008-2017.

	Deep-set longline CPUE (fish per 1,000 hooks)		
Year	**Swordfish**	**Striped marlin**	**Blue marlin**
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
2017	0.1	0.2	0.1
Average	**0.10**	**0.25**	**0.11**
SD	**0.00**	**0.08**	**0.03**

Table A-94. Supporting Data for Figure 93. Blue shark CPUE for the Hawai`i-permitted deep-set longline fishery from 2008-2017.

	Deep-set CPUE (fish per 1000 hooks)
Year	**Blue shark**
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
2017	1.6
Average	**1.20**
SD	**0.21**

Table A-95. Supporting Data for Figure 94. Number of Hawai`i-permitted shallow-set longline vessels, trips and sets from 2008-2017.

	Shallow-set longline		
Year	**Vessels**	**Trips**	**Sets**
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
2017	18	61	949
Average	**20.9**	**79.8**	**1,312.3**
SD	**5.3**	**22.3**	**372.0**

Table A-96. Supporting Data for Figure 95. Number of hooks set by the Hawai`i-permitted shallow-set longline fishery from 2008-2017.

	Number of hooks set by area (milions)			
Year	**Outside EEZ**	**Hawaii EEZ**	**PRIA EEZ**	**Total**
2008	1.3	0.2	0.0	1.5
2009	1.4	0.4	0.0	1.7
2010	1.4	0.4	0.0	1.8
2011	1.2	0.2	0.0	1.5
2012	1.2	0.3	0.0	1.4
2013	0.9	0.1	0.0	1.1
2014	1.3	0.2	0.0	1.5
2015	1.1	0.2	0.0	1.3
2016	0.7	0.1	0.0	0.8
2017	0.9	0.1	0.0	1.0
Average	**1.14**	**0.22**	**0.00**	**1.35**
SD	**0.24**	**0.11**	**0.00**	**0.33**

Table A-97. Supporting Data for Figure 96. Catch and revenue for the Hawai`i-permitted shallow-set longline fishery from 2008-2017.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
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	$3,406	$3,180	253.9
2014	3,255	$4,302	$4,074	257.6
2015	2,778	$2,938	$2,810	260.2
2016	1,849	$2,549	$2,486	265.3
2017	2,993	$4,229	$4,229	272.0
Average	**3,128.3**	**$5,354.2**	**$4,899.0**	
SD	**726.5**	**$2,102.6**	**$1,733.8**	

Table A-98. Supporting Data for Figure 97. Tuna CPUE for the Hawai`i-permitted shallow-set longline fishery from 2008-2017.

	Shallow-set longline CPUE (fish per 1,000 hooks)		
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**
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	0.4
2015	1.1	0.1	0.2
2016	1.2	0.4	0.1
2017	1.4	1.4	0.3
Average	**0.84**	**0.31**	**0.82**
SD	**0.33**	**0.40**	**0.69**

Table A-99. Supporting Data for Figure 98. Billfish CPUE for the Hawai`i-permitted shallow-set longline fishery from 2008-2017.

	Shallow-set longline CPUE (fish per 1,000 hooks)		
Year	**Swordfish**	**Striped marlin**	**Blue marlin**
2008	13.6	0.6	0.2
2009	10.8	0.3	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	0.2	0.1
2015	11.9	0.2	0.0
2016	12.4	0.4	0.1
2017	12.9	0.4	0.1
Average	**11.22**	**0.32**	**0.09**
SD	**1.42**	**0.15**	**0.06**

Table A-100. Supporting Data for Figure 99. Blue shark CPUE for the Hawai`i-permitted shallow-set longline fishery from 2008-2017.

	Shallow-set CPUE (fish per 1000 hooks)
Year	**Blue shark**
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
2017	9.0
Average	**7.65**
SD	**3.02**

Table A-101. Supporting Data for Figure 100. Number of MHI troll fishers and days fished from 2008-2017.

Year	Fishers	Days fished
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	1,478	23,329
2017	1,394	20,742
Average	**1,584.1**	**27,083.2**
SD	**94.0**	**3,186.6**

Table A-102. Supporting Data for Figure 101. Catch and revenue for the MHI troll fishery from 2008-2017.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
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	$7,874	$7,350	253.9
2014	3,486	$8,837	$8,368	257.6
2015	3,094	$8,117	$7,763	260.2
2016	2,582	$7,750	$7,558	265.3
2017	2,146	$6,419	$6,419	272.0
Average	**2,986.5**	**$7,265.0**	**$6,771.4**	
SD	**429.8**	**$1,218.3**	**$1,314.9**	

Table A-103. Supporting Data for Figure 102. Tuna CPUE for the MHI troll fishery from 2008-2017.

MHI troll tuna CPUE (pounds per day fished)		
Year	**Yellowfin tuna**	**Skipjack tuna**
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	43.9	11.0
2017	44.7	10.0
Average	**38.91**	**9.47**
SD	**6.25**	**1.92**

MHI troll tuna CPUE (pounds per hour fished)		
Year	**Yellowfin tuna**	**Skipjack tuna**
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	6.8	1.7
2017	7.0	1.6
Average	**6.28**	**1.54**
SD	**0.82**	**0.33**

Table A-104. Supporting Data for Figure 103. Marlin CPUE for the MHI troll fishery from 2008-2017.

MHI troll marlin CPUE (pounds per day fished)		
Year	**Blue marlin**	**Striped marlin**
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	13.4	1.2
2017	14.3	0.6
Average	**12.50**	**0.84**
SD	**2.04**	**0.24**

MHI troll marlin CPUE (pounds per hour fished)		
Year	**Blue marlin**	**Striped marlin**
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	2.1	0.2
2017	2.2	0.1
Average	**2.03**	**0.14**
SD	**0.33**	**0.05**

Table A-105. Supporting Data for Figure 104. Mahimahi and Ono CPUE for the MHI troll fishery from 2008-2017.

MHI troll mahimahi and ono CPUE (pounds per day fished)		
Year	Mahimahi	Ono (wahoo)
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	23.9	11.5
2017	19.3	8.8
Average	25.09	14.14
SD	5.16	2.87

MHI troll mahimahi and ono CPUE (pounds per hour fished)		
Year	Mahimahi	Ono (wahoo)
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	3.7	1.8
2017	3.0	1.4
Average	4.06	2.30
SD	0.80	0.50

Table A-106. Supporting Data for Figure 105. Number of MHI handline fishers and days fished from 2008-2017.

Year	Fishers	Days fished
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	474	3,980
2017	484	4,526
Average	498.8	4,827.1
SD	33.9	728.0

Table A-107. Supporting Data for Figure 106. Catch and revenue for the MHI handline fishery from 2008-2017.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
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	$3,606	$3,366	253.9
2014	1,161	$3,105	$2,940	257.6
2015	1,200	$3,028	$2,896	260.2
2016	785	$2,424	$2,364	265.3
2017	933	$2,835	$2,835	272.0
Average	**1,079.4**	**$2,670.5**	**$2,496.5**	
SD	**260.5**	**$664.3**	**$683.2**	

Table A-108. Supporting Data for Figure 107. Tuna CPUE for the MHI handline fishery from 2008-2017.

	MHI handline CPUE (pounds per day fished)			
Year	Yellowfin tuna	Albacore	Bigeye tuna	Total
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	136.2	13.1	23.5	172.8
2017	160.3	16.6	10.3	187.2
Average	**144.07**	**28.99**	**23.36**	**196.42**
SD	**24.36**	**22.73**	**11.11**	**26.90**

	MHI handline CPUE (pounds per hour fished)			
Year	Yellowfin tuna	Albacore	Bigeye tuna	Total
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	20.2	1.9	3.5	25.6
2017	22.2	2.3	1.4	26.0
Average	**21.03**	**4.21**	**3.42**	**28.67**
SD	**3.31**	**3.24**	**1.64**	**3.54**

Table A-109. Supporting Data for Figure 108. Number of offshore handline fishers and days fished from 2008-2017.

Year	Fishers	Days fished
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	178
2017	6	226
Average	**10.5**	**302.9**
SD	**3.5**	**123.9**

Table A-110. Supporting Data for Figure 109. Catch and revenue for the offshore tuna handline fishery from 2008-2017.

Year	Catch (1,000 lbs)	Adjusted revenue ($1,000)	Nominal revenue ($1,000)	Honolulu CPI
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	$1,926	$1,798	253.9
2014	416	$822	$778	257.6
2015	409	$849	$812	260.2
2016	366	$946	$923	265.3
2017	318	$891	$891	272.0
Average	**475.1**	**$1,001.2**	**$932.6**	
SD	**173.2**	**$411.7**	**$385.0**	

Table A-111. Supporting Data for Figure 110. Tuna CPUE for the offshore tuna handline fishery from 2008-2017.

Year	Offshore handline CPUE (pounds per trip) Bigeye tuna	Yellowfin tuna	Mahimahi	Total
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	1,744	289	3	2,036
2017	797	546	7	1,349
Average	**1,317.8**	**236.5**	**23.0**	**1,577.3**
SD	**242.8**	**138.0**	**15.4**	**223.2**

TABLES FOR SECTION 3.1: SOCIOECONOMICS

Table A-112. Data for Figure 127. American Samoa Employment Estimates from 2007-2016[1].

Labor force status	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total Employment	17,047	16,990	14,108	18,862	18,028	14,806	16,089	17,565	17,853	17,930
Total Government	6,052	6,035	6,004	6,782	6,177	5,258	6,198	6,556	6,804	6,585
Canneries	4,633	4,861	1,562	1,553	1,815	1,827	2,108	2,500	2,759	2,843
Other/Private Sector	6,362	6,094	6,542	10,527	10,036	7,721	7,783	8,509	8,290	8,502

Table A-113. Data for Figure 128, the Commercial Participation, Landings, Revenue, and Price for American Samoa Longline from 2008-2017 adjusted to 2017 dollars.

Year	Est. Pounds landed (million lbs.)	Est. Revenue ($million Nominal)	Est. Revenue ($million Adjusted)	Fish Price ($/lb. Nominal)	Fish Price ($/lb. Adjusted)	CPI adjustor

2008	9.8	9.4	11.8	0.96	1.20	1.26
2009	11.3	10.8	13.1	0.95	1.16	1.22
2010	11.3	11.0	12.7	0.97	1.13	1.16
2011	7.9	8.9	9.6	1.13	1.22	1.07
2012	9.7	10.1	10.5	1.05	1.09	1.04
2013	6.1	6.4	6.5	1.04	1.06	1.02
2014	5.1	5.2	5.3	1.01	1.03	1.01
2015	5.6	5.8	5.9	1.02	1.05	1.02
2016	4.8	4.8	4.9	1.00	1.02	1.02
2017	4.8	4.7	4.7	0.99	0.99	1.00

Data source: Pacific Islands Fisheries Science Center: Fishery Economic Performance Measures (Tier 1 indicators). https://inport.nmfs.noaa.gov/inport/item/46097.

Table A-114. Albacore price (whole weight) reported from fishermen of American Samoa from 2012-2017.

Year	Albacore Price ($/MT)	Albacore Price ($/lb)	Adjusted Price ($/MT)	Adjusted Price ($/lb)	CPI
2012	3193	1.45	3315	1.51	1.038
2013	2254	1.02	2294	1.04	1.018
2014	2707	1.23	2736	1.24	1.011
2015	2651	1.20	2704	1.22	1.020
2016	2498	1.13	2551	1.15	1.021
2017	2559	1.16	2559	1.16	1.000

Table A-115. Cost, Revenue, Net Revenue per Set of American Samoa Longline from 2008-2017.

Year	Cost per set ($/set)	Cost per set ($/set Adjusted)	Rev per set ($/set)	Rev per set ($/set Adjusted)	Net Rev ($/set Adjusted)	CPI Adjustor
2008	1537	1929	2016	2,530	601	1.255
2009	1003	1218	2166	2,631	1413	1.215
2010	1294	1500	2378	2,756	1256	1.159
2011	1352	1450	2315	2,482	1032	1.072
2012	1834	1903	2306	2,394	491	1.038
2013	1571	1599	2006	2,042	443	1.018
2014	1325	1340	1807	1,827	487	1.011
2015	1053	1074	2056	2,097	1023	1.020
2016	1051	1073	1822	1,861	788	1.021
2017	1078	1078	2069	2,069	991	1

Table A-116. Data of Revenue per Day at Sea, Revenue per Vessel, and Gini Coefficient from 2008-2017.

Year	Revenue per day at sea ($/set)	Revenue per day at sea ($/set adjusted)	Revenue per vessel ($/vessel)	Revenue per vessel ($/vessel adjusted)	Gini Coefficient	CPI adjustor
2008	1307	1,640	324,557	407,320	0.35	1.255
2009	1553	1,887	413,789	502,753	0.26	1.215
2010	1682	1,949	421,250	488,229	0.28	1.159
2011	1476	1,583	371,546	398,297	0.29	1.072
2012	1658	1,721	389,816	404,629	0.34	1.038
2013	1279	1,302	289,848	295,065	0.27	1.018
2014	1279	1,293	226,453	228,944	0.42	1.011
2015	1325	1,352	274,143	279,626	0.42	1.020
2016	1303	1,330	237,792	242,786	0.49	1.021
2017	1419	1,419	313,854	313,854	0.35	1

Table A-117. The commercial landings and revenue information of PMUS for troll fishery of American Samoa from 2008-2017.

Year	Estimated pounds caught (lb)	Estimated pounds sold (lb)	Estimated revenue ($)	Estimated fevenue ($ adjusted)	% of pounds sold	Fish price ($)	Fish price ($ adjusted)	CPI adjustor
2008	34,089	2,630	4,555	5,717	5%	1.73	2.17	1.255
2009	4,928	3,044	3,069	3,729	70%	1.01	1.22	1.215
2010	3,417	635	635	736	19%	1.00	1.16	1.159
2011	32,254	187	187	201	1%	1.00	1.08	1.075
2012	17,293	9,800	13,294	13,803	59%	1.36	1.41	1.038
2013	15,931	6,557	9,059	9,221	43%	1.38	1.41	1.018
2014	22,864	6,828	9,661	9,766	33%	1.41	1.43	1.011
2015	13,315	5,830	12,041	12,282	55%	2.07	2.11	1.020
2016	20,823	5,838	13,340	13,621	37%	2.29	2.33	1.021
2017	25,876	8,974	24,769	24,769	40%	2.76	2.76	1

Table A-118. The fishing trip costs of troll trip in American Samoa troll fishery from 2011-2017.

Year	Total trip costs ($)	Total trip costs ($) (adjusted)	Fuel cost ($)	Fuel cost ($) (adjusted)	Ice cost ($)	Ice cost ($) (adjusted)	Gear losted cost ($)	Gear losted cost ($) (adjusted)	Bait & chum cost ($)	Bait & chum cost ($) (adjusted)	CPI adjustor
2009*	-	-	-	-	-	-	-	-	-	-	1.215
2010*	-	-	-	-	-	-	-	-	-	-	1.159
2011	85	92	81	87	-	-	4	5	0	0	1.072
2012	90	93	69	72	11	12	10	10	0	0	1.038
2013	88	90	68	69	15	15	6	6	0	0	1.018
2014	69	69	59	60	5	5	2	2	2	2	1.011
2015	80	82	63	65	15	15	2	2	0	0	1.020
2016	75	77	49	50	19	19	7	7	1	1	1.021
2017	102	102	79	79	20	20	2	2	1	1	1.000

Table A-119. The commercial landings and revenue information for all PMUS in CNMI from 2008-2017.

Year	Estimated pounds caught (lb)	Estimated pounds sold (lb)	Estimated revenue ($)	Estimated fevenue ($ adjusted)	% of pounds sold	Fish price ($)	Fish price ($ adjusted)	CPI adjustor
2008	597,995	209,481	341,010	378,640	35%	1.63	1.81	1.110
2009	374,937	185,551	314,939	331,736	49%	1.7	1.79	1.053
2010	517,241	181,533	326,505	325,978	35%	1.8	1.8	1.000
2011	335,474	105,018	202,936	198,029	31%	1.93	1.89	0.979
2012	478,914	154,949	310,881	300,052	32%	2.01	1.94	0.965
2013	335,568	252,752	529,156	523,795	75%	2.09	2.07	0.990
2014	394,881	226,691	522,352	511,469	57%	2.3	2.26	0.983
2015	396,264	185,465	423,984	432,843	47%	2.29	2.33	1.017
2016	298,535	237,757	508,972	508,972	80%	2.14	2.14	1.000
2017	338,117	62,537	166,915	166,915	18%	2.67	2.67	1

Table A-120. Fishing costs of the troll fishing trips of CNMI PMUS fishery from 2008-2017.

Year	Total trip costs ($)	Total trip costs ($ adjusted)	Fuel cost ($)	Fuel cost ($ adjusted)	Ice cost ($)	Ice cost ($ adjusted)	Gear losted cost ($)	Gear losted cost ($ adjusted)	Bait & chum cost ($)	Bait & chum cost ($ adjusted)	CPI adjustor
2009	73	77	64	68	8	9	0.78	0.8	0	0	1.053
2010	73	73	65	65	8	8	0.00	0.0	0	0	0.998
2011	81	79	73	72	7	6	1.18	1.1	0	0	0.976
2012	91	88	81	79	8	7	2.31	2.2	0	0	0.965
2013	97	96	90	89	7	7	0.00	0.0	0	0	0.990
2014	94	92	84	82	9	9	0.00	0.0	0	0	0.979
2015	79	80	69	71	9	9	0.00	0.0	0	0	1.021
2016	69	69	60	60	9	9	0.00	0.0	0	0	1.000
2017	76	76	68	68	8	8	0.19	0.2	0	0	1.000

Table A-121. The commercial landings and revenue information for all PMUS in Guam from 2008-2017.

Year	Estimated pounds caught (lb)	Estimated pounds sold (lb)	Estimated revenue ($)	Estimated revenue ($ adjusted)	% of pounds sold	Fish price ($)	Fish price ($ adjusted)	CPI adjustor
2008	540,249	134,005	235,799	285,540	25%	1.76	2.13	1.211
2009	694,181	129,527	264,318	314,725	19%	2.0406	2.43	1.191
2010	721,868	219,076	452,588	523,736	30%	2.0659	2.39	1.157
2011	579,032	137,632	279,699	313,328	24%	2.0322	2.28	1.120
2012	394,381	113,777	236,176	256,382	29%	2.0758	2.25	1.086
2013	789,671	172,948	391,986	425,471	22%	2.2665	2.46	1.085
2014	744,982	116,739	232,431	250,274	16%	1.991	2.14	1.077
2015	937,066	106,453	208,583	226,645	11%	1.9594	2.13	1.087
2016	863,640	95,579	204,876	210,006	11%	2.1435	2.20	1.025
2017	693,436	110,123	246,302	246,302	16%	2.2366	2.24	1

Table A-122. Fishing costs of trolling trips in Guam from 2011-2017.

Year	Total trip costs ($)	Total trip costs ($ adjusted)	Fuel cost ($)	Fuel cost ($ adjusted)	Ice cost ($)	Ice cost ($ adjusted)	Gear losted cost ($)	Gear losted cost ($ adjusted)	Bait & chum cost ($)	Bait & chum cost ($ adjusted)	CPI adjustor
2011	96	108	72	81	10	12	10	11	4	5	1.120
2012	116	126	76	82	11	12	24	26	5	5	1.086
2013	92	100	63	68	12	12	17	18	1	1	1.085
2014	101	109	64	69	11	12	22	24	4	4	1.077
2015	92	100	48	52	11	12	26	29	7	8	1.087
2016	76	78	42	43	10	11	20	21	4	4	1.025
2017	99	99	47	47	20	20	23	23	10	10	1.000

Table A-123. Total commercial landings and revenue of Hawaii longline fleet (sold in Hawaiian markets) from 2008-2017.

Year	Pounds sold Hawaii	Revenue from Hawaii	Revenue adjusted	CPI adjustor
2008	25.6	86.1	102.4	1.189
2009	21.7	68.9	81.4	1.182
2010	22.7	80.3	93.0	1.158
2011	24.1	86	96.1	1.117
2012	24.6	99.9	108.9	1.090
2013	25.8	93.8	100.5	1.071
2014	27.8	87.8	92.7	1.056
2015	31.3	98.4	102.9	1.046
2016	30.2	104.2	106.8	1.025
2017	32.7	100.4	100.4	1

Data source: Pacific Islands Fisheries Science Center: Fishery Economic Performance Measures (Tier 1 indicators). https://inport.nmfs.noaa.gov/inport/item/46097.

Table A-124. Revenue composition of Hawaii longline fleet from PMUS sold in Hawaii from 2008-2017 (in millions of dollars, adjusted to 2017 dollars).

Year	Bigeye revenue	Yellowfin revenue	Swordfish revenue	Others revenue	Bigeye adjusted	Yellowfin adjusted	Swordfish adjusted	Others adjusted	CPI adjustor
2008	48	6	7	11	58	7	9	14	1.189
2009	39	3	7	9	46	4	9	11	1.182
2010	49	4	7	10	56	5	8	11	1.158
2011	52	6	7	13	58	7	7	14	1.117
2012	64	8	7	13	70	9	7	14	1.090
2013	62	7	4	14	67	7	5	15	1.071
2014	59	6	5	14	62	6	6	14	1.056
2015	70	6	5	14	73	6	5	15	1.046
2016	71	9	5	17	73	10	5	17	1.025
2017	64	15	6	16	64	15	6	16	1

Table A-125. Ex-vessel prices of bigeye, yellowfin, and swordfish, both adjusted and unadjusted, from 2008-2017.

Year	Bigeye price	Bigeye price adj.	Yellowfin price	Yellowfin price adj.	Swordfish price	Swordfish price adj.	CPI adjustor
2008	3.78	4.49	2.81	3.34	1.87	2.22	1.189
2009	3.71	4.39	2.80	3.31	1.89	2.23	1.182
2010	4.07	4.71	3.19	3.69	2.31	2.67	1.158
2011	4.22	4.71	3.00	3.35	2.57	2.87	1.117
2012	4.74	5.17	3.92	4.27	2.81	3.06	1.090
2013	4.41	4.72	4.20	4.50	2.69	2.88	1.071
2014	3.88	4.10	3.80	4.01	2.18	2.30	1.056
2015	3.83	4.01	3.02	3.16	2.26	2.36	1.046
2016	4.16	4.26	2.90	2.97	2.93	3.00	1.025
2017	3.85	3.85	2.76	2.76	2.27	2.27	1.000

Data source: Pacific Islands Fisheries Science Center pelagic module data request.

Table A-126. Trip fuel costs and other costs of the Deep-set tuna trips from 2008-2017.

Year	Fuel Cost ($)	Other Costs ($)	Fuel Cost adjusted ($)	Other costs adjusted	STD
2008	15,893	9,707	18,880	11,532	9,768
2009	10,455	10,602	12,368	12,543	6,561
2010	12,494	10,709	14,468	12,402	8,378
2011	16,378	11,719	18,294	13,090	9,620
2012	17,506	12,476	19,081	13,598	9,850
2013	16,498	12,765	17,670	13,672	11,025
2014	16,654	13,096	17,587	13,829	9,169
2015	12,425	13,456	12,984	14,061	7,779
2016	10,768	13,474	11,037	13,811	6,502
2017	10,531	12,974	10,531	12,974	8,426

Data Source: Pan (2018 in review).

Table A-127. Trip fuel costs and other costs of the shallow-set swordfish trips from 2008-2017.

Year	Fuel cost ($)	Other costs ($)	Fuel Ccst adjusted ($)	Other costs adjusted ($)	STD
2008	30,554	20,008	36,298	23,769	17,949
2009	18,508	19,109	21,895	22,606	10,203
2010	23,362	18,392	27,053	21,298	13,880
2011	35,527	20,981	39,684	23,436	13,533
2012	35,251	22,352	38,423	24,363	12,486
2013	28,820	20,919	30,866	22,404	11,989
2014	29,822	22,008	31,492	23,240	17,784
2015	20,725	21,241	21,658	22,197	10,509
2016	17,131	22,780	17,560	23,350	11,066
2017	17,176	20,391	17,176	20,391	10,882

Data Source: Pan (2018 in review).

Table A-128. Fishing costs, revenue, and net revenue of the Deep-set tuna trips from2008-2017.

Year	Trip costs ($)	Trip costs adjusted ($)	Trip revenue ($)	Revenue adjusted ($)	Net revenue adjusted ($)	CPI Adjustor
2008	25,600	30,412	60,554	60,554	30,142	1.188
2009	21,057	24,910	51,423	51,423	26,513	1.183
2010	23,204	26,870	65,413	65,413	38,543	1.158
2011	28,097	31,384	65,994	65,994	34,610	1.117
2012	29,981	32,680	75,787	75,787	43,107	1.090
2013	29,264	31,341	70,172	70,172	38,831	1.071
2014	29,750	31,416	65,011	65,011	33,595	1.056
2015	25,881	27,045	70,403	70,403	43,358	1.045
2016	24,242	24,848	80,416	80,416	55,568	1.025
2017	23,630	23,630	67,682	67,682	44,052	1

Data Source: Pan (2018 in review).

Table A-129. Fishing costs, revenue, and net revenue of the shallow-set swordfish trips from 2008-2017.

Year	Trip costs ($)	Trip costs adjusted ($)	Trip revenue ($)	Revenue adjusted ($)	Net revenue adjusted ($)	CPI Adjustor
2008	50,562	60,067	101,716	101,716	41,649	1.188
2009	37,617	44,501	80,534	80,534	36,033	1.183
2010	41,754	48,351	83,742	83,742	35,391	1.158
2011	56,508	63,119	117,213	117,213	54,093	1.117
2012	57,602	62,786	110,129	110,129	47,342	1.090
2013	49,739	53,270	113,509	113,509	60,239	1.071
2014	51,829	54,732	91,589	91,589	36,857	1.056
2015	41,966	43,854	81,560	81,560	37,705	1.045
2016	39,912	40,909	115,802	115,802	74,893	1.025
2017	37,568	37,568	108,788	108,788	71,220	1

Data Source: Pan (2018 in review).

Table A-130. Revenue per-day-at-sea, revenue per vessel and Gini of Hawaii longline fleet, 2008-2017.

Year	Revenue per-day-at-sea ($)	Revenue per vessel ($)	Revenue per-day-at-sea adjusted	Revenue per vessel adjusted ($)	Gini Coefficient	CPI adjustor
2008	2,314	578,059	2,751	687,312	0.22	1.189
2009	1,874	467,216	2,215	552,249	0.23	1.182
2010	2,285	581,160	2,646	672,983	0.22	1.158
2011	2,653	646,282	2,963	721,897	0.22	1.117
2012	2,934	745,875	3,198	813,003	0.19	1.090
2013	2,792	685,995	2,990	734,700	0.22	1.071
2014	2,624	623,647	2,771	658,571	0.23	1.056
2015	3,054	726,216	3,195	759,622	0.22	1.046
2016	3,268	784,756	3,350	804,375	0.21	1.025
2017	3,129	749,120	3,129	749,120	0.20	1.000

Table A-131. Pound sold (in thousands of lbs.) of PMUS by non-longline gears from 2008-2017.

Year	CPI adjustor	Longline	MHI trolling	MHI handline	Offshore handline	Other gears
2008	1.189	3.35	2.87	2.90	2.66	1.73
2009	1.182	3.17	2.82	2.42	2.47	1.77
2010	1.158	3.53	3.01	2.77	2.42	2.56
2011	1.117	3.55	3.18	2.77	2.64	2.94
2012	1.090	4.08	3.59	2.77	3.21	2.88
2013	1.071	3.64	3.59	2.77	2.38	2.34
2014	1.056	3.16	3.14	3.01	2.44	2.44
2015	1.046	3.13	3.24	2.84	2.38	2.76
2016	1.025	3.44	3.40	3.20	2.67	2.84
2017	1.000	3.06	3.40	3.25	2.90	2.99

Table A-132. Revenue of PMUS (in thousands of dollars adjusted to 2017 dollars) by non-longline gear types from 2008-2017.

Year	CPI adjustor	MHI troll	MHI handline	Offshore handline	Other gears
2006	1.267	6,539	1,652	882	1,873
2007	1.209	6,537	1,971	927	1,456
2008	1.159	6,340	1,715	637	1,617
2009	1.153	5,993	2,145	656	1,148
2010	1.129	6,280	2,120	1,340	701
2011	1.089	6,279	2,322	908	1,183
2012	1.063	9,135	3,573	1,163	1,282
2013	1.045	7,624	3,498	1,879	1,232
2014	1.030	8,619	3,028	802	402
2015	1.020	7,919	2,954	829	413
2016	1	7,540	2,419	1,065	217

Table A-133. Average fish price of PMUS (adjusted to 2017 dollars) by gear types from 2008-2017.

Year	Pounds sold (1000 lbs)					Revenue adjusted ($1000)			
	MHI trolling	MHI handline	Offshore handline	Other gears	CPI adjustor	MHI trolling	MHI handline	Offshore handline	Other gears
2008	2,270	607	246	957	1.189	6,504	1,760	654	1,659
2009	2,175	907	272	664	1.182	6,144	2,199	673	1,177
2010	2,139	786	568	281	1.158	6,441	2,175	1,375	719
2011	2,023	860	353	413	1.117	6,441	2,381	932	1,213
2012	2,609	1,322	371	457	1.090	9,367	3,663	1,192	1,315
2013	2,176	1,294	809	539	1.071	7,814	3,585	1,926	1,263
2014	2,811	1,033	336	169	1.056	8,837	3,105	822	412
2015	2,510	1,066	357	153	1.046	8,120	3,029	850	423
2016	2,276	774	409	79	1.025	7,729	2,479	1,092	223
2017	1,888	873	308	86	1.000	6,419	2,835	891	256

Table A-134. Hawaii small boat trip costs: pelagic fishing trips, 2014 (adding offshore handline later).

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: PIFSC Hawaii small-boat cost-earnings data, 2014 at https://inport.nmfs.noaa.gov/inport/item/29820.

APPENDIX B: LIST OF PROTECTED SPECIES AND DESIGNATED CRITICAL HABITAT

Table B-1. 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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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
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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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 haul out 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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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
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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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	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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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	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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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
Elasmobranchs					
Giant manta ray	*Manta birostris*	Threatened	N/A	Found worldwide in tropical, subtropical, and temperate waters. Commonly found in upwelling zones, oceanic island groups, offshore pinnacles and seamounts, and on shallow reefs.	Dewar et al. 2008, Marshall et al. 2009, Marshall et al. 2011.
Oceanic whitetip shark	*Carcharhinus longimanus*	Threatened	N/A	Found worldwide in open ocean waters from the surface to 152 m depth. It is most commonly found in waters > 20°C	Bonfil et al. 2008, Backus et al, 1956, Strasburg 1958, Compagno 1984
Scalloped hammerhead shark	*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	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
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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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
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-4.

Table B-2. 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 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
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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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 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
Sooty Tern	*Onychoprion*	Not Listed	N/A	Breeding visitor	Pyle & Pyle

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
	fuscatus				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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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
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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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
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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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
Elasmobranchs					
Giant manta ray	*Manta birostris*	Threatened	N/A	Found worldwide in tropical, subtropical, and temperate waters. Commonly found in upwelling zones, oceanic island groups, offshore pinnacles and seamounts, and on shallow reefs.	Dewar et al. 2008, Marshall et al. 2009, Marshall et al. 2011.
Oceanic whitetip shark	*Carcharhinus longimanus*	Threatened	N/A	Found worldwide in open ocean waters from the surface to 152 m depth. It is most commonly found in waters > 20°C	Bonfil et al. 2008, Backus et al, 1956, Strasburg 1958, Compagno 1984
Scalloped hammerhead shark	*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 shark	*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-4 .

Table B-3. 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 heraldica*	Not Listed	N/A	Resident	Craig 2005

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
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 U.S. 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

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
Pantropical Spotted Dolphin	*Stenella attenuata attenuata*	Not Listed	Non-strategic	Found in tropical and subtropical waters worldwide.	Perrin et al. 2009
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
Elasmobranchs					
Giant manta ray	*Manta birostris*	Threatened	N/A	Found worldwide in tropical, subtropical, and temperate waters. Commonly found in upwelling zones, oceanic island groups, offshore pinnacles and seamounts, and on shallow reefs.	Dewar et al. 2008, Marshall et al. 2009, Marshall et al. 2011.
Oceanic whitetip shark	*Carcharhinus longimanus*	Threatened	N/A	Found worldwide in open ocean waters from the surface to 152 m	Bonfil et al. 2008, Backus et al, 1956,

Common name	Scientific name	ESA listing status	MMPA status	Occurrence	References
				depth. It is most commonly found in waters > 20°C.	Strasburg 1958, Compagno 1984
Scalloped hammerhead shark	*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
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

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 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-4.

Table B-4. 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.html.

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APPENDIX C: LIST OF PLAN TEAM MEMBERS

Member; Title	Plan 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	Hawaii
Tom Graham; NMFS PIRO	International Fisheries
Melanie Brown: NMFS PIRO	Sustainable Fisheries
Minling Pan; NMFS PIFSC Economics Program	Economics
Russell Ito; PIFSC Fisheries Research and Monitoring Division	Pelagics
Tepora Lavatai; A.S. Dept. of Marine & Wildlife Resources	Pelagics
William Dunn; CNMI Division of Fish & Wildlife	Marianas
Brent Tibbatts; Guam Division of Aquatic & Wildlife Resources	Archipelagic Pelagics
Michael Parke, NMFS PIFSC	Habitat Science
Sarah Pautzke	Marine Planning
Kimberly Lowe, NMFS PIFSC	Ex-Officio
Jon Brodziak, NMFS PIFSC	Ex-Officio
Annie Yau, NMFS PIFSC	Ex-Officio
Eileen Shea	Ex-Officio
Reginald Kokubun; Hawai`i Division of Aquatic Resources	Ex-Officio