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NOAA, National Marine Fisheries Service

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U.S.A. Fisheries and Research on Tuna and Tuna-like Species in the North Pacific Ocean

NOAA, National Marine Fisheries Service

Executive Summary

Various U.S.A. fishing fleets harvest tuna and tuna-like species in the north Pacific Ocean (NPO) from coastal waters of North America to the archipelagoes of Hawaii, Guam and the Commonwealth of the Northern Mariana Islands (CNMI) in the central and western Pacific Ocean (WCPO). Small-scale gillnet, harpoon, tropical pole-and-line, troll, and handline fleets operate primarily in coastal waters, whereas large-scale purse seine, albacore troll and pole-and-line, and longline fleets, which account for most of the tuna catches, operate both within U.S.A. Exclusive Economic Zones and on the high seas. Thousands of small-scale troll and handline vessels operate in waters around the tropical Pacific Islands; however, these fleets account for only a minor fraction of the total tuna catch.

The National Oceanic and Atmospheric Administration (NOAA) Fisheries continued to conduct research in 2014 on Pacific tunas and associated species at its Southwest and Pacific Islands Fisheries Science Centers and also in collaboration with scientists from other organizations. Fishery monitoring and socio-economic research was conducted on tunas, billfishes, and bycatch species in U.S.A. Pacific coastal and high-seas fisheries. As in previous years, fishery monitoring and angler effort information were compiled in 2014, and economic performance indicators in the Hawaii longline and small-boat fisheries were assessed.

Stock assessment research on tuna and tuna-like species was conducted primarily through collaboration with participating scientists of the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC) and international Regional Fisheries Management Organizations (RFMOs).

NOAA Fisheries successfully completed biological and oceanographic research on tunas, billfishes, and sharks. These research efforts provided empirical information to quantify fish movements, habitat preferences, post-release survival, feeding habits, and age and growth. Important results included new information about: age-validation of shortfin mako sharks (*Isurus oxyrinchus*); CPUE standardizations for four billfish species in the Hawaii longline fishery; ecosystem impacts of climate change and fishing in the central North Pacific; socio-economic evaluations of Hawaii's seafood; sex-structured population dynamics of blue marlin; and tuna foraging ecology.

I. Introduction

Various U.S.A. fleets harvest tuna and tuna-like species in the North Pacific Ocean. Large-scale purse seine, albacore troll, and longline fisheries operate both in coastal waters and on the high seas. Small-scale coastal purse seine, gillnet, harpoon, troll, handline and recreational hook and line fisheries as well as commercial and recreational troll and hook and line fisheries usually operate in coastal waters. Overall, the range of U.S.A. fisheries in the North Pacific Ocean is extensive, from coastal waters of North America to Guam and the Commonwealth of the Northern Mariana Islands (CNMI) in the western Pacific Ocean and from the equatorial region to the upper reaches of the North Pacific Transition Zone.

In the U.S.A., the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries or federal agency) shares monitoring responsibilities for tunas and billfishes with partner fisheries agencies in the states of California, Oregon, Washington, Hawaii, and territories of American Samoa, Guam, and the CNMI. NOAA's West Coast Regional Office (WCRO) and the Southwest Fisheries Science Center (SWFSC) in California, and the Pacific Islands Regional Office (PIRO) and the Pacific Islands Fisheries Science Center (PIFSC) in Hawaii conduct federal monitoring. NOAA Fisheries monitors the landings and sales records, federally-mandated logbook statistics on fishing effort and catch, observer data, and biological sampling data. In California, Washington, and Oregon, landings receipts are collected by state agencies and maintained in the Pacific Fisheries Information Network (PacFIN) system (http://pacfin.psmfc.org/). Some state agencies also collect logbook and size-composition data. In the WCPO, monitoring by partner agencies also involves market sampling and surveys of fishing activity and catch and is coordinated by the Western Pacific Fishery Information Network (WPacFIN) system (http:// http://www.pifsc.noaa.gov/wpacfin/), a federally funded program managed by the PIFSC. The SWFSC, WCRO, PIFSC, and PIRO share management of data on U.S.A. Pacific fisheries for tuna and tuna-like species.

This report provides information on the number of active vessels by fleet and their catches of tunas and billfishes in the NPO based on the data available through 15 March 2015. Data for 2014 are considered preliminary and are subject to change. Although the report is focused on tunas and billfishes, many of the fisheries' catch includes catch of other pelagic fish important to the fishing fleets and local economies; catch data for these species are not included in this report but are included in the ISC data submissions.

NOAA Fisheries also conducts scientific research programs in support of marine resource conservation and management both domestically and internationally. These studies include stock assessments, biological and oceanographic studies, socio-economic analysis, and more. This report includes highlights of recent and ongoing scientific work by NOAA Fisheries of relevance to the ISC.

II. Fisheries

A. Purse Seine

Currently, the U.S.A. purse-seine fishery consists of two separate fleets, one composed of large purse-seine vessels that operate in the WCPO, and a small coastal purse-seine fleet that operates in the eastern Pacific Ocean (EPO). Historically, the purse-seine fishery started in the EPO in the mid-1900s and most catch came from that ocean area until 1993 when vessels moved to the WCPO in response to dolphin conservation measures in the EPO. Vessels also moved to the WCPO because fishing access was granted by the South Pacific Tuna Treaty (SPTT) in 1987. The WCPO fleet operates mainly in areas between 10°N and 10°S latitude and 130°E and 150°W longitude, with the majority of the fishing effort south of the equator. The EPO fleet operates off the coast of Southern California and outside the exclusive economic zone (EEZ) of Mexico, off Baja California. The number of unique U.S.A. purse-seine vessels (WCPO and EPO) fishing north of the equator decreased from a high of 74 in 1988 to 11 in 2006 (Table 1) then increased to 46 in 2009. In 2014, there were 48 purse seine vessels fishing in the North Pacific. Prior to 1995 the fleet fished mainly on free-swimming schools of tunas in the WCPO and on schools associated with dolphins in the EPO. Since 1995, most catches have been made on fish aggregation devices (FADs) and other floating objects in the WCPO. The EPO purse-seine fishery now targets mostly small coastal pelagics, such as sardine, mackerel and squid, and targets tunas opportunistically. Larger vessels from the WCPO occasionally fish in the EPO.

The Inter-American Tropical Tuna Commission (IATTC) monitors the purse-seine fleets fishing in the EPO. U.S.A. purse-seine vessels fishing in the WCPO have been monitored by NOAA Fisheries under the SPTT since 1988. Logbook and landings data are submitted as a requirement of the Treaty (coverage 100%). Landings are sampled for species and size composition as vessels land their catches in American Samoa by NOAA Fisheries personnel and by SPC samplers in other ports (coverage approximately 1-2% of landings). The Forum Fisheries Agency (SPTT Treaty Manager) places observers on 100% of the vessel trips. In the EPO, logbooks are submitted by vessel operators to NOAA Fisheries or the IATTC, and landings are obtained for each vessel trip from canneries or fish buyers. IATTC observers are placed on all large purse-seine vessels in the EPO. Data for the NPO portion of the catch are not available for 2013 or 2014.

B. Longline

The U.S.A. longline fishery targeting tunas and tuna-like species in the NPO is made up of the Hawaii-based fleet, the California-based fleet, and the American Samoa-based fleet. Vessels operated freely in an overlapping area managed by two domestic management regimes until 2000 when domestic regulations placed restrictions on moving between the two domestic management regimes. The Hawaii-based component of the U.S.A. longline fishery currently comprises a majority of the vessels, fishing effort, and catch.

Regulatory restrictions, due to interactions with endangered sea turtles, curtailed Hawaii-based longline effort for swordfish (*Xiphias gladius*) in 2000 and 2001 followed by a prohibition altogether in 2002 and 2003, during which the Hawaii-based longline fishery targeted tunas exclusively. The Hawaii-based fishery for swordfish (shallow-set longline) was reopened in April 2004 under a new set of regulations to reduce sea turtle interactions. The year 2005 was the first complete year in which the Hawaii-based longline fishery was allowed to target swordfish. In the following year, the shallow-set longline fishery reached the annual interaction limit of 17 loggerhead sea turtles (*Caretta caretta*) and the fishery was closed on March 20, 2006. The majority of vessels that targeted swordfish converted to deep-set longline and targeted tunas for the remainder of the year. In the Hawaii-based shallow-set longline fishery in 2012, the interaction limits for leatherback (*Dermochelys coriacea*) and loggerhead sea turtles were increased for the Hawaii shallow-set longline fishery to 26 and 34, respectively. Neither cap has subsequently been attained, though both the leatherback and the loggerhead interaction limits were reached in separate previous years and the fishery shut down.

The number of vessels in the California-based fishery has always been low compared to the Hawaii-based fishery, and composed mainly of vessels that target swordfish. Most vessels with landings to California also participated in the Hawaii-based fishery. The California-based shallow-set longline fishery for swordfish was closed in 2004, resulting in relocation of most of those vessels back to Hawaii. Only one California-based vessel fished between 2005 and 2013 using deep-set longline to target tunas. Additionally, up to nine Hawaii-permitted vessels have landed from 300 t to over 500 t of swordfish caught with shallow-set longline gear to the West Coast in recent years.

In the North Pacific, the longline fishery extended from outside the U.S.A. West Coast EEZ to

175°W longitude and from the equator to almost 40°N latitude in 2014 (Figures 1 and 2). The number of vessels participating in the longline fishery increased from 36 in 1985 to a high of 141 vessels in 1991 (Table 1). Since then, the number of vessels has remained relatively stable. Approximately 141 vessels participated in 2014. In Hawaii and California, swordfish are generally landed dressed (headed, tailed, and gutted). Tunas and large marlins are landed gilled and gutted while other bony fishes are usually landed whole. Sharks are landed headed and gutted. In Hawaii, the landed catch biomass is the reported total fish weight by species recorded at the fish auction. Dressed weights are converted to whole weight for reporting of total catches using standard conversion factors.

Catch levels and catch-species composition in the U.S.A. longline fishery have changed over the past years in response to fishery and regulatory changes. The majority of the longline catch now consists of tunas and billfishes and exceeded 10,000 t in 1993, 1999, 2000, 2008, 2011, 2013 and 2014 (Table 2). Bigeye tuna (*Thunnus obesus*) dominates the tuna catch with landings over 4,000 t during the past eleven years. The 2014 bigeye tuna catch was 7,161 t. Swordfish has been the dominant component of the billfish catch since 1990 and reached a peak of 5,936 t in 1993 before decreasing to 1,185 t in 2004. The U.S.A. 2014 swordfish catch by longline was 1,663 t.

The Hawaii-based longline fishery is monitored by combined sampling efforts of the NOAA Fisheries and the State of Hawaii’s Division of Aquatic Resources (DAR). Longline fishermen are required to complete and submit federal longline logbooks for each fishing operation. The logbook data include information on fishing effort, area fished, catch by species and amount, and other details of the fishing operations. Logbook coverage for the Hawaii-based longline fishery is at or near 100% coverage of vessel by trip. The Hawaii DAR also requires fish dealers to submit reports of landings data, and coverage for the longline fishery and the reporting rate for dealers are very close to 100%. Observers contracted by NOAA Fisheries are also placed on longline vessels to monitor protected species interactions, vessel operations, and multi-species catches. These observers are required by court decree to be aboard Hawaii-based longline vessels at a rate of coverage of no less than 20% for deep-set (tuna-target) vessels and 100% for shallow-set (swordfish-target) vessels. Information on the sizes of fish caught in the Hawaii-based longline fishery indicate, that in general, a higher proportion of smaller tuna and tuna-like fish species are captured in the shallow-set longline fishery (Figures 3-5).

The California-based longline fishery is monitored by NOAA Fisheries and the California Department of Fish and Wildlife (CDFW). Data are collected for 100% of longline landings by the CDFW. Logbooks, developed by the fishing industry (similar to the federal logbooks used in Hawaii), were submitted voluntarily to NOAA Fisheries until 1994 when logbooks became mandatory. Landed swordfish were measured for cleithrum to fork length by CDFW port samplers until 1999. NOAA Fisheries has placed observers on all California-based longline trips since 2002. The observers collect data on fishing location, protected species interactions, fish catch, disposition of catch and bycatch, and size measurements of catch and bycatch (retained catch and discards).

C. Albacore troll and pole-and-line

The U.S.A. albacore troll and pole-and-line fishery in the NPO started in the early 1900s. The fishery currently operates in waters between the U.S.A. West Coast and 160°W longitude (Figures 6 and 7). Fishing usually starts in May or June and ends in October or November. In 2014, 619 vessels participated in the fishery, down from 841 in 2012 (Table 1).

The troll and pole-and-line fishery catches almost exclusively albacore with minor incidental catches of skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), and bluefin (*Thunnus orientalis*) tunas, eastern Pacific bonito (*Sarda chiliensis lineolata*), yellowtail (*Seriola lalandi*), and mahi mahi (*Coryphaena hippu*rus). Since 1985, the albacore catch has ranged from a low of 1,845 t in 1991 to a high of 16,962 t in 1996 (Table 2). In 2013 and 2014, 12,310 and 13,414 t were caught, respectively. U.S.A. troll and pole-and-line vessels voluntarily submitted logbook records to NOAA Fisheries from 1973 until 1995 when those vessels fishing on the high-seas were required to submit logbooks.

Since 2005, all vessels have been required to submit logbooks under a provision of the Highly Migratory Species Fishery Management Plan (HMS FMP). NOAA Fisheries and various state fisheries agencies monitor 100% of the fleet's landings through sales receipts (fish tickets). Since 1961, a port sampling program has been in place for collecting size data from albacore landings along the U.S.A. Pacific coast. Size distribution of the catch for 2014 is shown in Figure 8. State fishery personnel collect the size data according to sampling instructions provided by NOAA Fisheries, who maintain the database. In recent years, cooperative fishermen have also collected size data on selected fishing trips to augment data collected through the port sampling program.

D. Tropical pole-and-line

The tropical pole-and-line fishery targets skipjack around the Hawaiian Islands. The number of vessels participating declined from a high of 27 in 1985 to a low of one in 2012. Skipjack tuna is usually the largest component of the catch by Hawaii pole-and-line vessels. The highest skipjack tuna catch for this fishery was 3,450 t in 1988 (Table 2). The highest yellowfin tuna catch for the pole-and-line fishery was 2,636 t, recorded in 1993. One or two vessels have participated in the tropical pole-and-line fishery since 2010.

Hawaii DAR monitors the tropical pole-and-line fishery using Commercial Fish Catch reports submitted by fishers and Commercial Marine Dealer reports submitted by fish dealers. Since 2010, too few vessels have participated to publicly report catch data.

E. Tropical Troll and Tropical Handline

Tropical troll fishing fleets for tuna and tuna-like species operates in Hawaii, Guam, and the CNMI. Tropical handline fishing fleets also operates in Hawaii. The vessels in these fisheries are relatively small coastal vessels (typically around 8 m in length) and primarily make one-day fishing trips in coastal waters. Historically, the number of U.S.A. troll and handline vessels combined ranged from 1,878 in 1988 to 2,502 in 1999, and there were 2,060 troll vessels and 494 handline vessels in 2014 (Table 1). The operations range from recreational, subsistence, and part-time commercial to full-time commercial. The small vessel catches generally were landed fresh and whole, although some catches were gilled and gutted.

Weights of individual fish were obtained when fish were landed for commercial sale. The size distributions of tunas (skipjack and yellowfin) and marlins (striped marlin and blue marlin, *Kajikia nigricans* and *Makaira mazara*) caught in the Hawaii fishery in 2014 were also summarized (Figures 9 and 10).

The total retained catch from these tropical troll and handline fisheries combined ranged from 1,162 t in 1992 to 2,326 t in 2012 (Table 2). Yellowfin and skipjack tuna made up 50% and 19% of the total troll and handline catch in 2014, respectively. The next largest species catch components were bigeye tuna, and blue marlin.

The Guam Division of Aquatic and Wildlife Resources (DAWR) monitors the troll fishery using a statistically designed creel survey and commercial landings data. The Guam DAWR, with the assistance of NOAA Fisheries, extrapolated the creel survey data to produce estimates of total catch, fishing effort, and fishermen participation estimates by gear type. Similarly, the Hawaii tropical troll and handline fisheries catch and effort summaries are compiled from Hawaii DAR Commercial Fish Catch reports and Commercial Marine Dealer reports. The CNMI monitors the tropical troll fishery in the CNMI region using creel surveys and commercial landings.

F. Drift Gillnet

The U.S.A. large mesh drift gillnet fisheries target swordfish and common thresher sharks in areas within the EEZ in California waters and historically off the coast of Oregon. Swordfish, sharks, and small amounts of tunas and other pelagic species are caught by large mesh drift gillnet vessels. The number of vessels participating in this fishery has steadily decreased from a high of 220 in 1986 to 17 in 2012 and 2014 (Table 1). Swordfish catches are the major portion of the catch and peaked in 1985 at 2,990 t. Since then, swordfish catches have fluctuated while decreasing to 182 in 2004 and rebounding to 490 in 2007 (Table 2). The estimate of swordfish caught in the drift gillnet fishery for 2014 is 71 t.

Gillnet fishery landings data (100% coverage) are collected by state agencies in California and Oregon (no landings have occurred in Oregon since 2004). Logbook data for gillnet fisheries are required to be submitted to the CDFW for all trips. CDFW also collected length data for swordfish landings between 1981 and 1999 from less than 1% of the landings. NOAA Fisheries observers on large mesh drift gillnet vessels have also collected data on fishing location, protected species interactions, fish catch, disposition of catch and bycatch, and length since about 1990; observer coverage is about 20% of effort.

G. Harpoon

The harpoon fishery targets swordfish and operates in areas within the EEZ in California waters between 32°N and 34°N latitude. The number of vessels participating in the fishery greatly decreased from 113 in 1986 to nine in 2012. Ten vessels participated in the fishery in 2014 (Table 1). Trends in swordfish catches have fluctuated from a high of 305 t in 1985 to 5 t in 2012 and 2014 (Table 2).

Landings and logbook data for the harpoon fishery are collected by the CDFW with 100% coverage of the fleet. Length measurements were taken by CDFW between 1981 and 1999, covering less than 1% of swordfish landings.

H. Sport

Sport (recreational) catch and effort data are available from commercial passenger fishing vessels (CPFVs) and catch data are available from private vessels that target tunas and other pelagic fish.

Logbook data for CPFVs are obtained from fisheries agencies in California while CPFV logbook data from vessels fishing out of Oregon and Washington are submitted to SWFSC. Estimates of landings for CPFV and private vessels are obtained through surveys and maintained in the Recreational Fisheries Information Network (RecFIN) database (http://www.recfin.org/) for California, Oregon, and Washington. Total sport catches of tunas, sharks and billfish are estimated from data collected from RecFIN and augmented by state and federal logbook data sets where needed. Pacific bluefin catch estimates from sport fisheries for 1993-2014 were revised as described in ISC/15/PBFWG-1/02.

The spatial distribution of reported logbook fishing effort by the 2014 U.S. harpoon, gillnet, and west coast sport fisheries in the North Pacific Ocean are depicted in Figure 11.

III. Research

NOAA Fisheries research on tunas and billfishes in the Pacific Ocean has largely been focused on improving understanding of the biology and ecology of the animals to support needs for assessing the effects of fishing and the environment on the population or stock. Described below are highlights of a few studies that have recently been completed or are ongoing by NOAA Fisheries. These studies are carried out largely in cooperation with stakeholders and in collaboration with colleagues both in the U.S.A. and abroad.

Oxytetracycline Age Validation of Shortfin Makos – In July of 2014 a large adult male mako which had been injected with oxytetracycline (OTC) in 2008 was recaptured after more than 6 years at liberty (2,196 days). This represents the first recapture of a large adult male mako injected with OTC and subsequently recaptured in the northeastern Pacific after an extended period at liberty. Originally measured at 194 cm fork length (FL), the animal measured 217 cm FL upon recapture, indicating that over a six-year period the animal had grown 23 cm, an average of 3.8 cm per year. This is well below estimated growth rates for juvenile makos (27-36 cm between their first and second summer and 20-29 cm in the following year). Previous ageing work on makos in the northeastern Pacific indicated that juveniles deposit band pairs in their vertebrae at a rate of two band pairs per year. The band pair count from this adult animal clearly indicates that, post OTC injection, the shark displayed annual band pair deposition (5+ bands in six years). Based on the juvenile age validation work done by Wells et al. (2013) the results from this animal indicate that male makos experience a shift in deposition rates from two band pairs per year as juveniles, to one band pair per year as adults. The findings will result in more reliable growth models (length-at-age) for shortfin mako in the northeast Pacific.

Ecosystem impacts of climate change and fishing in the central North Pacific –NOAA scientists compare two ecosystem models projections of 21st century climate change and fishing impacts in the central North Pacific (Woodworth-Jefcoats et al., 2015). Both a species-based and a size-based ecosystem modeling approach are examined. While both models project a decline in biomass across all sizes in response to climate change and a decline in large fish biomass in response to increased fishing mortality, the models vary significantly in their handling of climate and fishing scenarios. For example, based on the same climate forcing the species-based model projects a 15% decline in catch by the end of the century while the size-based model projects a 30% decline. Disparities in the models' output highlight the limitations of each approach by showing the influence model structure can have on model output. The aspects of bottom-up change to which each model is most sensitive appear linked to model structure, as does the propagation of inter-annual variability through the food web and the relative impact of combined top-down and bottom-up change. Incorporating integrated size- and species-based ecosystem modeling approaches into future ensemble studies may help separate the influence of model structure from robust projections of ecosystem change.

***Socioeconomic impacts of Hawaii's 2010 bigeye tuna longline closure* –** Results are presented from a NOAA study to monitor the socioeconomic impacts of the first extended closure of the western and central Pacific Ocean (WCPO) bigeye tuna (bigeye) fishery to US longliners from the state of Hawaiʻi (Richmond et al., 2015). We applied qualitative and quantitative approaches to examine how diverse members of Hawaiʻi's 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 of the WCPO bigeye fishery at the end of 2010. The analysis revealed that there was reduced supply and reduced quality of bigeye landed along with increased prices for bigeye during the closure period. In addition, Hawaiʻi longliners were forced to travel longer distances to fish during the closure. However, overall impacts to the bigeye community were not as severe as what had been anticipated at the outset. Several mitigating factors meant this was not a true closure, as US boats could continue to fish for bigeye in the Eastern Pacific Ocean and foreign and dual permitted vessels could still fish in the WCPO. This study highlights the challenges and equity considerations inherent in efforts to achieve meaningful conservation benefits from localized management actions within a global fishery. It also demonstrates the importance of interdisciplinary socioeconomic monitoring to examine how global fisheries policies scale down to individual fishing communities.

***Summary of consumer-level fish price data from Hawaii retail seafood markets* –** Retail (consumer-level) fish price data were collected from Honolulu seafood markets during 2007 to 2011 (Hospital and Beavers, 2014). The goal was to advance a preliminary understanding of the prevalence of the following: local species and product forms in Honolulu retail fish markets; price differentials along the value chain; consumer demand for various species; and the role of imports in the Hawaii seafood market. A small sample (n=7) of local seafood retailers was selected to participate in the data collection and monitoring effort. These included owners, operators, or representatives of local seafood outlets and both local and remotely owned grocery stores and supermarkets. Retailers were visited on a weekly basis and posted price data were collected for fish species and product forms common in the marketplace. Observations regarding country of origin labeling practices were documented in conjunction with pricing. Data summaries include: retail market presence/absence estimates; weekly retail price averages by species, product form and origin; retail pricing time series by month; and annual retail price spreads for the study period.

***CPUE standardizations for four billfish species in the Hawaii longline fishery* –** This NOAA study presents catch per unit effort (CPUE) standardizations and model selection procedures for four billfish species (Family Istiophoridae) caught primarily as bycatch in the Hawaii-based pelagic longline fishery during 1995–2011: Blue marlin; striped marlin shortbill spearfish *Tetrapturus angustirostris*; and sailfish *Istiophorus platypterus* (Walsh and Brodziak, 2014). The first three species were analyzed on a fishery-wide basis. For sailfish, the fishery data came exclusively from tuna-targeted longline sets in the deep-set sector of the Hawaii-based fishery. We used fishery observer data from the NOAA Fisheries Pacific Islands Regional Observer Program to fit the CPUE standardization models. In this context, the objective was to investigate the quality of model fit for five types of generalized linear models (GLMs: Poisson; negative binomial; zero-inflated Poisson; zero-inflated negative binomial; delta-Gamma). The best-fitting model selected for each species was a zero-inflated negative binomial GLM (ZINB). For each species, the important explanatory variables for standardizing CPUE were fishing year, fishing (i.e., calendar) quarter, and fishing region. The best-fitting models indicated that standardized CPUE for striped and blue marlins decreased significantly during the study period. Because the ZINB model was selected as the best fitting model for all species, we suggest that longline CPUE for incidentally caught billfishes is best represented as a process characterized by zero inflation and overdispersion in the positive catches and expected zero catches. The study recommends that ZINB models be considered as an a priori model for CPUE standardizations of billfishes and other bycatch species in longline fisheries.

Sex-structured population dynamics of blue marlin – The population dynamics of the blue marlin stock in the Pacific Ocean were estimated for 1971–2011 using a fully integrated length-based, age-, and sex-structured model (Lee et al., 2014). Fishery-specific catch, size composition, and catch-per-unit of effort were used in the modeling as likelihood components. Estimated dynamics were consistent with a stock that is fully exploited and stable over the last several years. No significant trends in recruitment were noted; however, female blue marlin were estimated to make up a majority of the catch, and historical exploitation has disproportionately changed the age structure of females relative to males. This result is due to differences in assumed life history and estimated selectivity. Changes to important life history parameters that are responsible for the productivity of the stock would potentially change the interpretation of current stock status.

Tuna Foraging Ecology –To determine the trophic relationships of highly migratory species in the California Current, NOAA Fisheries scientists have been investigating the foraging ecology of a range of species since 1999.

Analyses of stomach contents of tunas conducted to date reveal a number of interesting patterns across species, regions and years. Looking across years for albacore and yellowfin tuna it becomes apparent that there was a shift in the available prey species in the SCB from 2007-2008. By comparing these results to other studies and across years, it is apparent that tuna in the Southern California Bight showed an increase in diet diversity, a reduced reliance on anchovies and sardines, and an increased reliance on squid, crustaceans, and other fish species. This likely relates to shifts in prey availability associated with changes in oceanography that have also been documented in other biological indices. Stomach content analysis is helping to better understand both tuna behavior, and how fluctuations in the availability of forage fish relate to changes in oceanography. Detailed data on tuna behavior and forage fish abundance are important components of stock assessments and integral to making informed management decisions. Stomach content data on the abundance of juvenile fish and other forage in the SCB could be valuable additions to the metrics used in stock assessment models for forage fish. As tuna feed primarily on juvenile fish and squid, stomach content analysis can further our understanding of how egg and larval trawl data translates into the availability of forage for larger predators later in the year. Stomach content processing is currently ongoing with samples collected through 2014; a manuscript is being drafted for publication containing the current results.

Cooperative Data Sampling Program with the U.S. Surface Albacore Fishery – NOAA Fisheries scientists are working with the American Fishermen's Research Foundation (AFRF) to collect biological data during selected fishing trips. Following procedures established by NOAA Fisheries scientists, size data were collected from two cooperating vessels in 2013 and 2014, with 726 and 755 fish measured, respectively. These onboard samples augment the size data collected through the port sampling program. These data are all sent to the SWFSC for processing.

Albacore distribution and environmental effects – NOAA Fisheries scientists, in collaboration with scientists of Canada's Department of Fisheries and Oceans (DFO), received funding in 2012 from

NOAA's Fisheries and the Environment (FATE) program to study the "Influence of the North Pacific Current on the spatial distribution and availability of North Pacific albacore in the northeast Pacific Ocean." As a result of this collaborative study, two manuscripts have been published in a special issue of *Progress in Oceanography*. These studies have improved the development of abundance indices for albacore in the Northeast Pacific.

Albacore genetic sex marker project **–** A collaborative project between scientists from Canada, Japan, Taiwan, and the U.S.A. entitled "Improving the stock assessment of north Pacific albacore tuna by developing cost-effective genetic markers to identify sex" was funded by NOAA's Improve a Stock Assessment program in early 2015. The main driver for this project is that north Pacific albacore show evidence of sex-differentiated growth and movements, and the 2014 assessment performed by the ISC ALBWG uses a sex-differentiated population model. However, data on albacore gender is very limited, and the 2014 assessment did not include any sex data. Sex data on tunas are difficult to obtain because gonadal samples are needed to identify the sex of the tuna. A cost-effective method to identify the sex of albacore is therefore needed. This project aims to develop a genetic sex marker for albacore using modern genetic techniques. If the genetic markers are successfully developed, each sample is expected to cost US$3-5 to analyze subsequently. To date, genetic samples of known sex have been obtained from Japan and the U.S.A. The initial project is expected to run for two years.

Foraging Ecology of Swordfish in the SCB– In support of ecosystem based studies, the foraging ecology of swordfish is being investigated to examine predator-prey interactions and niche overlap with other pelagic predators. Stomach contents for this work have been predominantly provided through the California drift gillnet observer program. Since 2013, 56 stomachs have been analyzed. Current levels of analysis have allowed SWFSC researchers to identify some of the most frequently encountered prey species (F=Frequency of prey occurrence). Broadbill swordfish stomachs in season 2013 contained jumbo squid (*Dosidicus gigas*) (F=47), *Gonatopsis borealis* squid (F=31), and *Abraliopsis* sp. squid (F=28). These preliminary results show a possible shift in feeding trends. In 2012-13 jumbo squid showed a resurgence in dietary importance for swordfish compared to the previous season.

IV. NOAA Fisheries Literature from the Past Year

Published

Bradford, A.L., K.A. Forney, E.M. Oleson, J. Barlow. 2014. Accounting for subgroup structure in line-transect abundance estimates of false killer whales (*Pseudorca crassidens*) in Hawaiian waters. PLoS ONE 9(2):e90464 (11 p.).

Chang, Y.J., J.M. O'Malley, J. Brodziak, H.H. Lee, G. DiNardo. 2015. Model selection uncertainty and multi-model inference in the generalized fishery production modeling: simulation study of the Pacific blue marlin and WCNPO striped marlin stocks. Fish. Res. 166:129-139. DOI: http://dx.doi.org/10.1016/j.fishres.2014.08.023

Evans K., F. Abascal, D. Kolody, T. Sippel, J. Holdsworth, P. Maru. 2014. The horizontal and vertical dynamics of swordfish in the South Pacific Ocean. J. Exp. Mar. Biol. Ecol. 450:55–67. doi:

10.1016/j.jembe.2013.10.025.

Hyde, J.R., K.E. Underkoffler, M.A. Sundberg. 2014. DNA barcoding provides support for a cryptic species complex within the globally distributed and fishery important opah (*Lampris guttatus*). Mol. Ecol. Res. doi: 10.1111/1755-0998.12268

Lee, H.H., K.R. Piner, M.G. Hinton, Y.-J. Chang, A. Kimoto, M. Kanaiwa, N.-J. Su, W. Walsh, C.-L. Sun, G. DiNardo. 2014. Sex-structured population dynamics of blue marlin *Makaira nigricans* in the Pacific Ocean. Fish. Sci. 80:869-878. DOI: http://dx.doi.org/10.1007/s12562-014-0762-6

Lee, H.-H., K.R.. Piner, R.D. Methot Jr., M.N. Maunder. 2014. Use of likelihood profiling over a global scaling parameter to structure the population dynamics model: An example using blue marlin in the Pacific Ocean. Fish. Res. 158:138-146.

Lyons K., A. Preti, D. J. Madigan, R. J. D. Wells, M. E. Blasius, O. E. Snodgrass, D. Kacev, J. D. Harris, H. Dewar, S. Kohin, K. MacKenzie C.G. Lowe. 2015. Insights into the life history and ecology of a large shortfin mako shark (*Isurus oxyrinchus*) captured in southern California. J. Fish. Biol. doi:10.1111/jfb.12709.

Madigan, D. J., Z. Baumann, A. B. Carlisle, D. K. Hoen, B. N. Popp, H. Dewar, O. E. Snodgrass, B. A. Block, N. S. Fisher. 2014. Reconstructing trans-oceanic migration patterns of Pacific bluefin tuna using a chemical tracer toolbox. Ecology. 95:1674–1683. doi: 10.1890/13-1467.1.

Martin, S. L., Stohs, S. M., Moore, J. E. 2014. Bayesian inference and assessment for rare-event bycatch in marine fisheries: a drift gillnet fishery case study. Ecol. Apps. 25:416–429. doi: 10.1890/14-0059.1.

Maunder, M. N. and K. R. Piner. 2014. Contemporary fisheries stock assessment: many issues still remain. ICES J Mar Sci.doi:10.1093/icesjms/fsu015.

Meyer C.G., J.M. O'Malley, Y.P. Papastamatiou, J.J. Dale, M.R. Hutchinson, J.M. Anderson, M.A. Royer, K.N. Holland. 2014. Growth and maximum size of tiger sharks (*Galecerdo cuvier*) in Hawaii. PLoS ONE 9(1): e84799. DOI: 10.1371/journal.pone.0084799.

Mourato B., E. Hazin, K. Bigelow, M. Musyl, F. Carvalho, H. Hazin. 2014. Spatio-temporal trends of sailfish (*Istiophorus platypterus*) catch rates in relation to spawning ground and environmental factors in the equatorial and southwestern Atlantic Ocean. Fish. Ocean. 23(1): 32-44. DOI: 10.1111/fog.12040.

Nieto, K., Y. Xu, S. L. H. Teo, S. McClatchie, J. Holmes. 2015. Coastal upwelling fronts: a key habitat for albacore tuna (*Thunnus alalunga*) in the Northeast Pacific Ocean. Prog Oceanogr. http://dx.doi.org/10.1016/j.pocean.2015.05.004.

Nosal, A.P., S. Cailliet, E.K. Kisfaludy, M.A. Royer, N.C. Wegner. 2014. Aggregation behavior and seasonal philopatry in male and female leopard sharks (*Triakis semifasciata*) along the open coast of southern California, USA. MarEcol-ProgSer.499: 157-175.doi: 10.3354/meps10632.

O'Bryhim, J.R., J. Spaet, J.R. Hyde, K.L. Jones, S.L. Lance. 2014. Development of microsatellite markers for globally distributed populations of the threatened Silky Shark, *Carcharhinus falciformis*. doi: 10.1007/s12686-014-0396-0

Pan M. 2014. Economic characteristics and management challenges of the Hawaii pelagic longline fisheries: Will a catch share program help? Mar. Pol. 44: 18-26. DOI: 10.1016/j.marpol.2013.08.008.

Pan M., K. Criddle, C. Severance. 2014. Guest editors' introductions: Catch shares and Pacific Islands Region fisheries. Mar. Pol. 44: 1-2. DOI: 10.1016/j.marpol.2013.08.010.

Pan, M., and S. Li. In Press. Evaluation of fishing opportunities under the sea turtle interactions caps – a decision support model for the Hawaii-based longline swordfish fishery management. Our Living Oceans.

Renck, C. L., D.M. Talley, R. J. D. Wells, H. Dewar. 2014. Regional growth patterns of juvenile albacore (*Thunnus alalunga*) in the eastern North Pacific. Cal. Coop. Ocean. Fish. Vol. 55.

Richmond, L., D. Kotowicz. 2015. Equity and access in marine protected areas: The history and future of 'traditional indigenous fishing' in the Marianas Trench Marine National Monument. Ap. Geog. 59: 117-124.

Sepulveda, C.A., C. Heberer, S. A. Aalbers, N. Spear, M. J. Kinney, D. Bernal, S. Kohin. 2015. Post-release survivorship studies on common thresher sharks (*Alopias vulpinus*) captured in the southern California recreational fishery. Fish Res. 161: 102-108. doi:10.1016/j.fishres.2014.06.014

Sippel T., J. Eveson, B. Galuardi, C. Lam, S. Hoyle, M. Maunder, P. Kleiber, F. Carvalho, V. Tsontos, S. L. H. Teo, A. Aires-da-Silva, S. Nicol. 2015. Using movement data from electronic tags in fisheries stock assessment: A review of models, technology and experimental design. Fish. Res. 163: 152-160. doi: 10.1016/j.fishres.2014.04.006

Soykan, C. U., T. Eguchi, S. Kohin, H. Dewar. 2014. Prediction of fishing effort distributions using boosted regression trees. Ecol Appl. 24(1), 71-83.doi: 10.1890/12-0826.1.

Thomas, L.R., G. DiNardo, H. H. Lee, K. R. Piner, S.E. Kahng. In Press. Factors influencing the catch rates of Kona crabs *Ranina ranina* (Brachyura: Raninidae) in the Main Hawaiian Islands. J. Crus. Biol. 33(5).doi: 10.1163/1937240X-00002171.

Walsh. W.A., J. Brodziak. 2014. Billfish CPUE standardization in the Hawaii longline fishery: model selection and multimodel inference. Fisheries Research 166: 151-162. DOI: 10.1016/j.fishres.2014.07.015 .

Wang J.H., J. Barkan, S. Fisler, Y. Swimmer. 2014. Illuminating Innovations in Fisheries Technology Reduce Bycatch. State of the World's Sea Turtles (SWOT) Vol 9, 26-28.

Wang, S.-P., M.N. Maunder, K. Piner, A. Aires-da-Silva, H.H. Lee. 2014. Evaluation of R0 profiling as a diagnostic for selectivity curve structure in integrated stock assessment models. Fish. Res. DOI: http://dx.doi.org/10.1016/j.fishres.2013.12.009

Wang, S.-P., M.N. Maunder, K.R.. Piner, A. Aires-da-Silva, H.-H. Lee. 2014. Evaluation of virgin recruitment profiling as a diagnostic for selectivity curve structure in integrated stock assessment models. Fish. Res. 158:158-164.

Watson, J.T., K.A. Bigelow. 2014. Trade-offs among catch, bycatch, and landed value in the American Samoa longline fishery. Cons. Bio. DOI: 10.1111/cobi.12268.

Wegner, N. C., C. A. Sepulveda, S. A. Aalbers, J. B. Graham. 2013. Structural adaptations for ram ventilation: Gill fusions in scombrids and billfishes. J. Morphol. 274:108–120.doi: 10.1002/jmor.20082.

Wells, R.J., Kinney, M.J., Kohin, S., Dewar, H., Rooker, J.R., Snodgrass, O.E. 2015. Natural tracers reveal population structure of albacore (*Thunnus alalunga*) in the eastern North Pacific. ICES J Mar Sci. doi:fsv051.

Woodworth-Jefcoats, P.A., J.J. Polovina, E.A. Howell, J.L. Blanchard. 2015. Two takes on the ecosystem impacts of climate change and fishing: Comparing a size-based and a species-based ecosystem model in the central North Pacific. rog. Ocean. DOI: 10.1016/j.pocean.2015.04.004.

Wootton, T.P., Sepulveda, C.A., Wegner, N.C. 2015. Gill morphometrics of the thresher sharks (genus *Alopias*): Correlation of gill dimensions with aerobic demand and environmental oxygen. J. Morphol. DOI: 10.1002/jmor.20369

Xu, Y., K. Nieto, S. L. H. Teo, S. McClatchie, J. Holmes. 2015. Influence of subtropical fronts on the spatial distribution of albacore tuna (*Thunnus alalunga*) in the Northeast Pacific over the past 30 years (1982-2011). Prog Oceanogr. http://dx.doi.org/10.1016/j.pocean.2015.04.013.

Technical Reports, Administrative Reports, and Working Papers

Bradford. A.L., K.A. Forney. 2014. Injury determinations for cetaceans observed interacting with Hawaii and American Samoa longline fisheries during 2007-2011. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TM-NMFS-PIFSC-39, 20 p. + Appendix.

Dewar, H., T. Eguchi, J. Hyde, D. Kinzey, S. Kohin, J. Moore, B. L. Taylor, and R. Vetter. 2013. Status Review of the Northeastern Pacific Population of White Sharks (*Carcharodon carcharias*) Under the Endangered Species Act. NMFS, NOAA, Southwest Fisheries Science Center. La Jolla, CA.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2014. PIFSC Report on the American Samoa longline fishery year 2013. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-14-006, 13 p.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2015. PIFSC Report on the American Samoa longline fishery year 2014. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-15-01x, 13 p.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center.

2014. The Hawaii-based Longline Logbook Summary Report, January-December 2013. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-14-016, 14 p.

Fisheries Research and Monitoring Division, Pacific Islands Fisheries Science Center. 2015. The Hawaii-based Longline Logbook Summary Report, January-December 2014. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-15-007, 14 p.

Hospital, J., C. Beavers. 2014. Economic and social characteristics of small boat fishing in the Commonwealth of the Northern Mariana Islands. Pacific Islands Fisheries Science Center Administrative Report H-14-02, 58 p. + Appendices.

Lowe, M.K., M.M.C. Quach, K.R. Brousseau, A.S. Tomita. 2014. Fishery statistics of the western Pacific, Volume 29. Pacific Islands Fisheries Science Center, PIFSC Administrative Report H-14-0x, var. pag.

McCracken, M.L. 2014. Prediction of future bycatch of sea turtles and certain cetaceans in the Hawaii deep-set longline fishery. Pacific Islands Fisheries Science Center, PIFSC Internal Report, IR-13-029, 47 p.

McCracken, M.L. 2014. Estimation of incidental interactions with sea turtles and seabirds in the 2013 Hawaii deep-set longline fishery. Pacific Islands Fisheries Science Center, PIFSC Internal Report, IR-14-022, 4 p.

McCracken M. 2014. Assessment of incidental interactions with marine mammals in the Hawaii longline deep and shallow set fisheries from 2008-2012. Pacific Islands Fisheries Science Center, PIFSC Internal Report, IR-14-006, 1 p.

National Marine Fisheries Service, National Oceanic and Atmospheric Administration. 2014. 2014 Annual Report to the Western and Central Pacific Fisheries Commission. United States of America. Part 1. Information on Fisheries, Research, and Statistics (For 2013). Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-14-012, 42 p.

National Marine Fisheries Service, National Oceanic and Atmospheric Administration. 2014. Submission of 2012-2013 U.S. fishery statistics for the Western and Central Pacific Ocean and other areas to the Western and Central Pacific Fisheries Commission. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-14-008, 11 p.

National Marine Fisheries Service, National Oceanic and Atmospheric Administration. 2015. Submission of 2013-2014 U.S. fishery statistics for the Western and Central Pacific Ocean and other areas to the Western and Central Pacific Fisheries Commission. Pacific Islands Fisheries Science Center, PIFSC Data Report, DR-15-010, 11 p.

Pan, M. H.L. Chan, K. Kalberg. 2014. Tracking the Changes of Economic Performance Indicators for the Main Commercial Fisheries in the Western Pacific Areas 2012 Update. Pacific Islands Fisheries Science Center (PIFSC) Internal Report IR-14-017, Issued 7 May 2014.

Teo, S.L.H., J.M. Suter, J. Childers, A. Aires-da-Silva. 2015. Revision of estimates of catch in weight from the US recreational fishery from 1993 to 2014. ISC/15/PFBWG-1/0

Xu, Y., S.L.H. Teo, and J. Holmes. 2013. An update of the standardized abundance index of U.S. and Canadian albacore troll fisheries in the North pacific (1966-2012). Working Paper to the International Scientific Committee Albacore Working Group. ISC/13/ALBWG-03/06.

Xu, Y., S.L.H. Teo, and J. Holmes. 2013. An update of the standardized abundance index of U.S. and Canadian albacore troll fisheries in the North pacific (1966-2011). Working Paper to the International Scientific Committee Albacore Working Group. ISC/14/ALBWG/03.

Xu, Y., T. Sippel, S.L.H. Teo, K. Piner, K. S. Chen, and R. J. D. Wells. 2013. A comparison study of North Pacific albacore (*Thunnus alalunga*) age and growth among various sources. Working Paper to the International Scientific Committee Albacore Working Group. ISC/14/ALBWG/04.

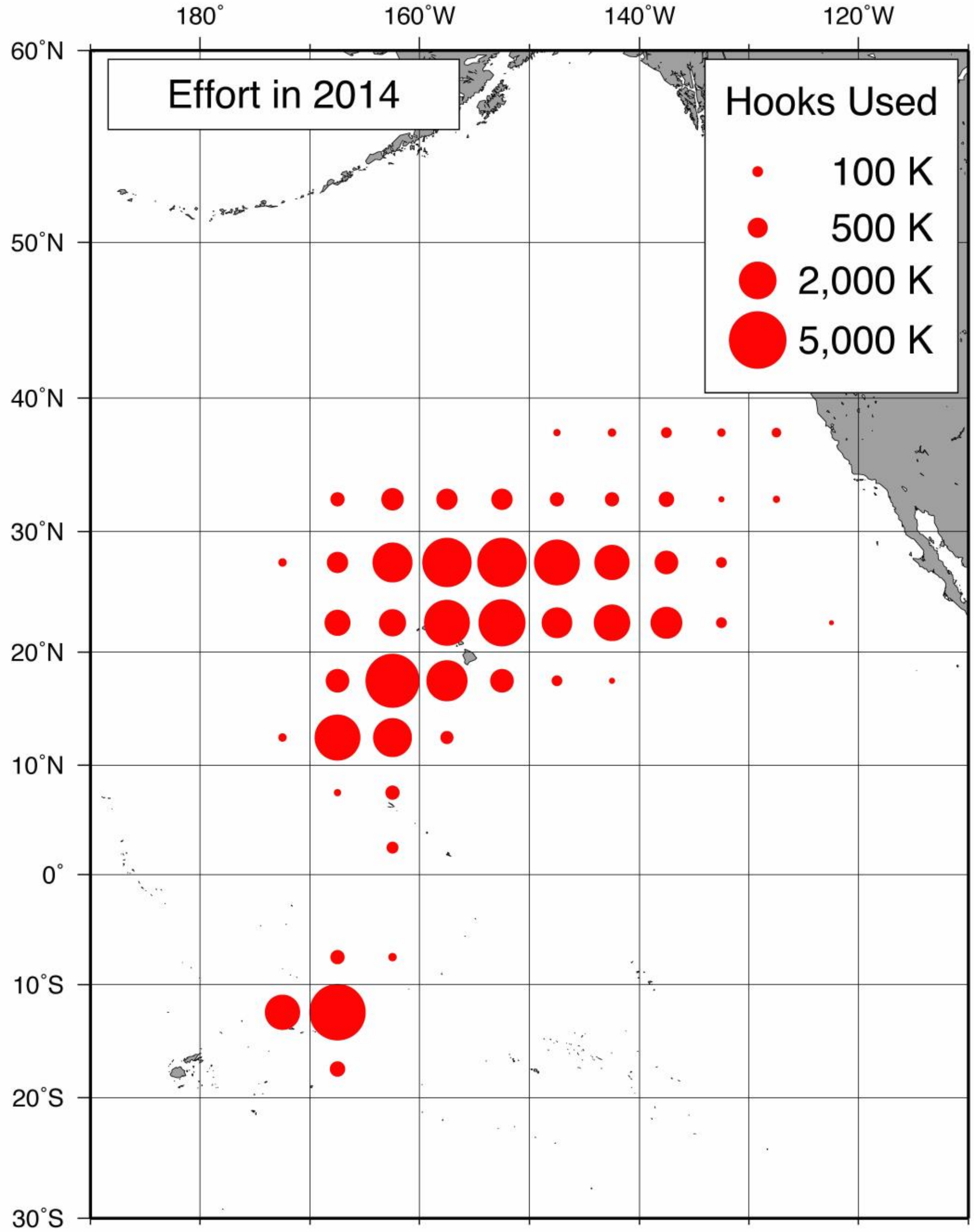


Figure 1. Spatial distribution of reported logbook fishing effort by the 2013 U.S. longline fishery in the Pacific Ocean, in 1,000s of hooks. The size of circles is proportional to the amount of effort. Effort in some areas is not shown in order to preserve data confidentiality.

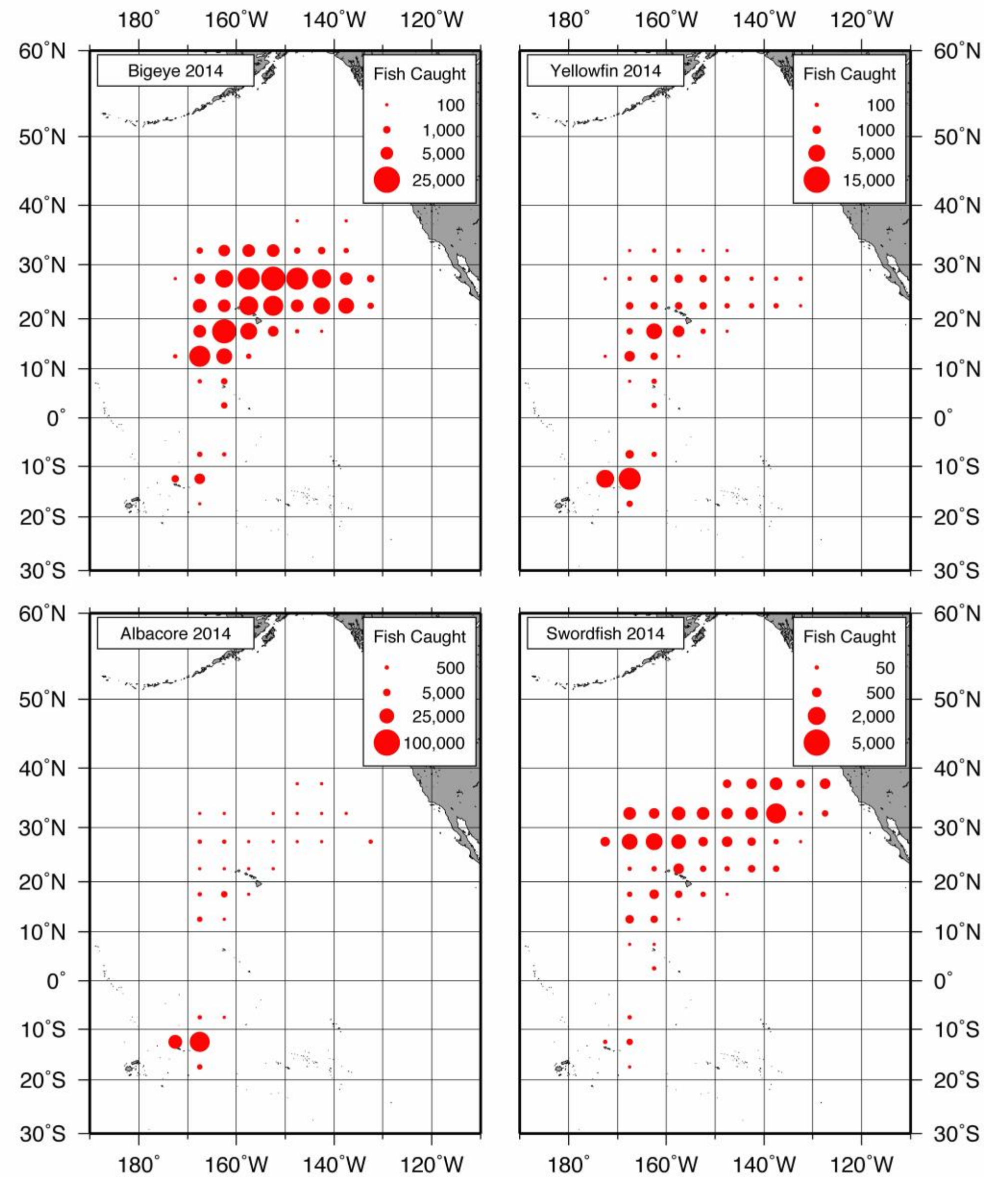
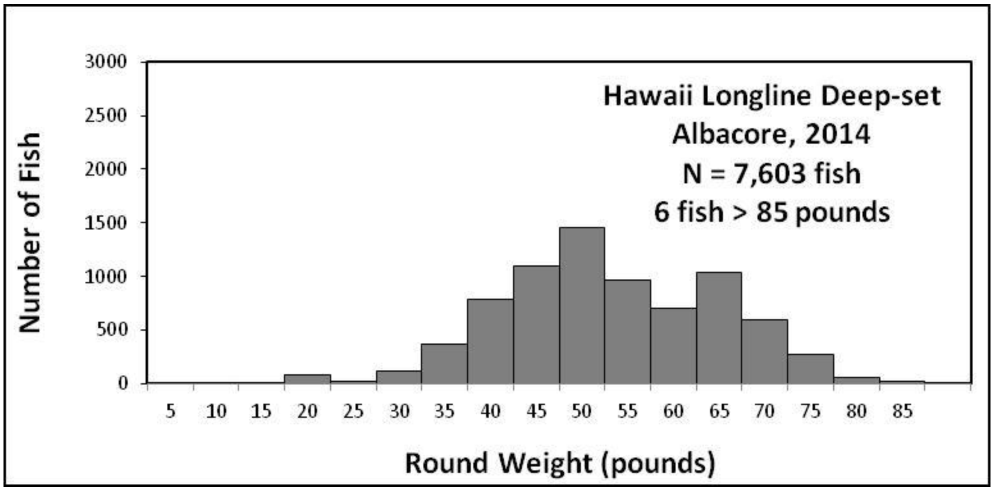
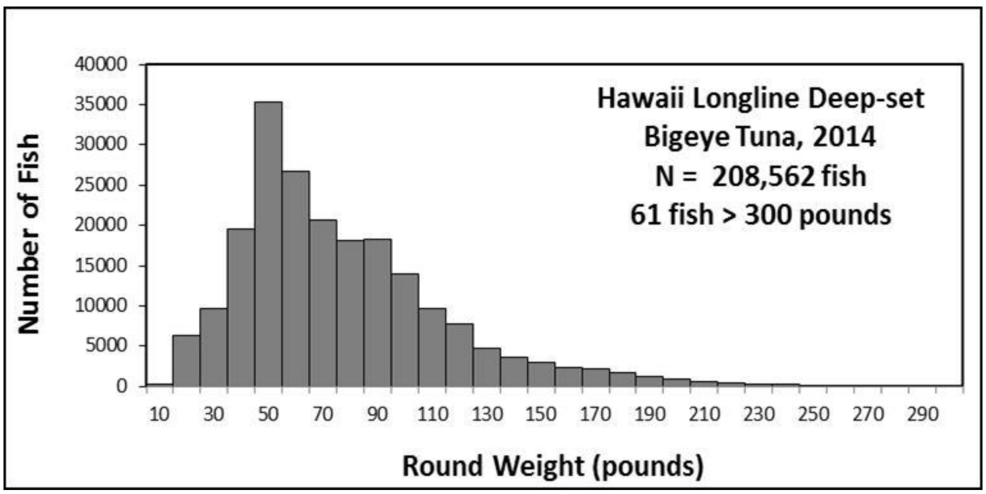


Figure 2. Spatial distribution of reported logbook fishing catch by the U.S. longline fishery in the Pacific Ocean, in numbers of fish, in 2014 for bigeye (*Thunnus obesus*), albacore (*T. alalunga*), yellowfin (*T. albacares*) and swordfish (*Xiphias gladius*). The size of circles is proportional to the amount of catch. Catch in some areas is not shown in order to preserve data confidentiality.





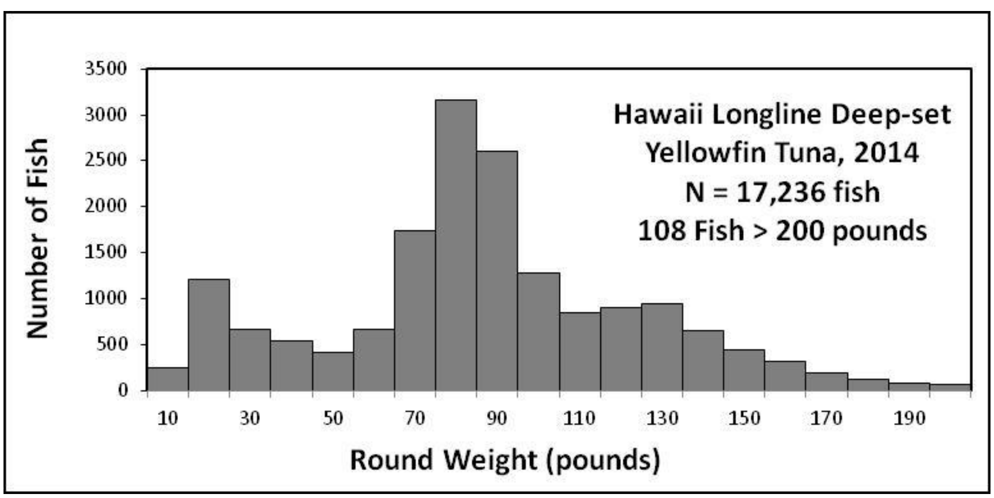


Figure 3. Size distribution of (top) albacore (*Thunnus alalunga*), (middle) bigeye tuna (*Thunnus obesus*), and (bottom) yellowfin tuna (*Thunnus albacares*) caught by the Hawaii-based deep-set longline fishery in the north Pacific Ocean, 2014.

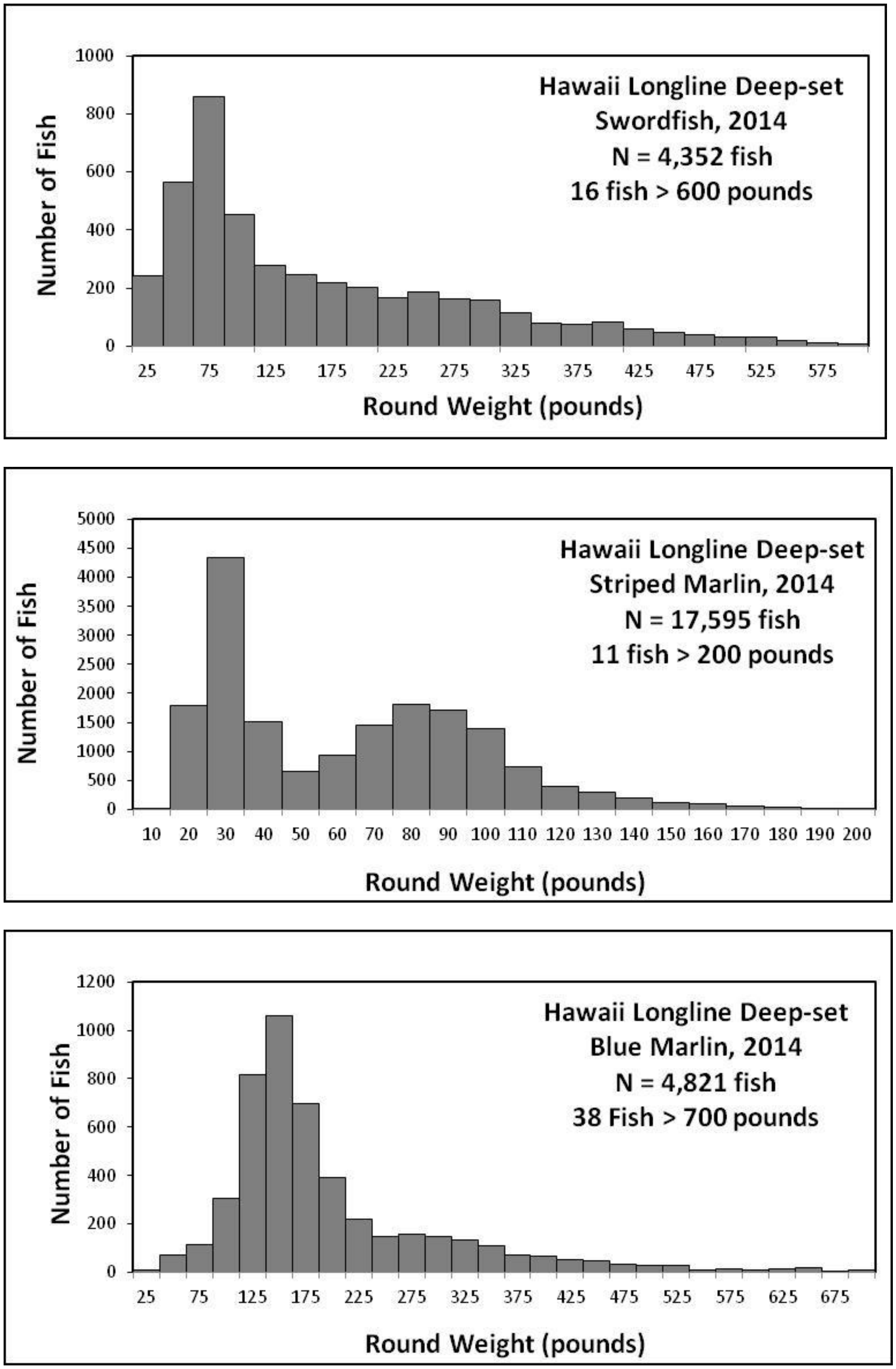
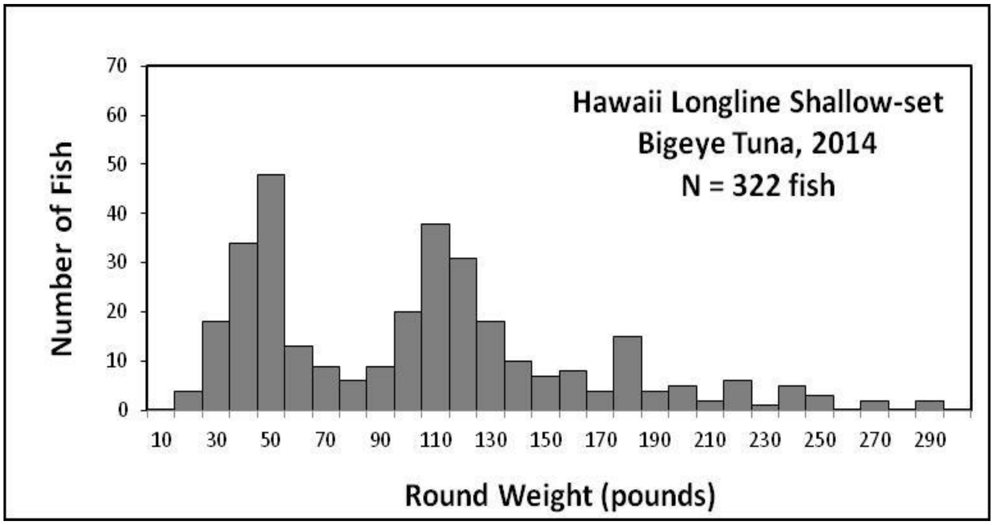


Figure 4. Size distribution of (top) swordfish (*Xiphias gladius*), (middle) striped marlin (*Kajikia nigricans*), and (bottom) blue marlin (*Makaira mazara*) caught by the Hawaii-based deep-set longline fishery in the north Pacific Ocean, 2014.



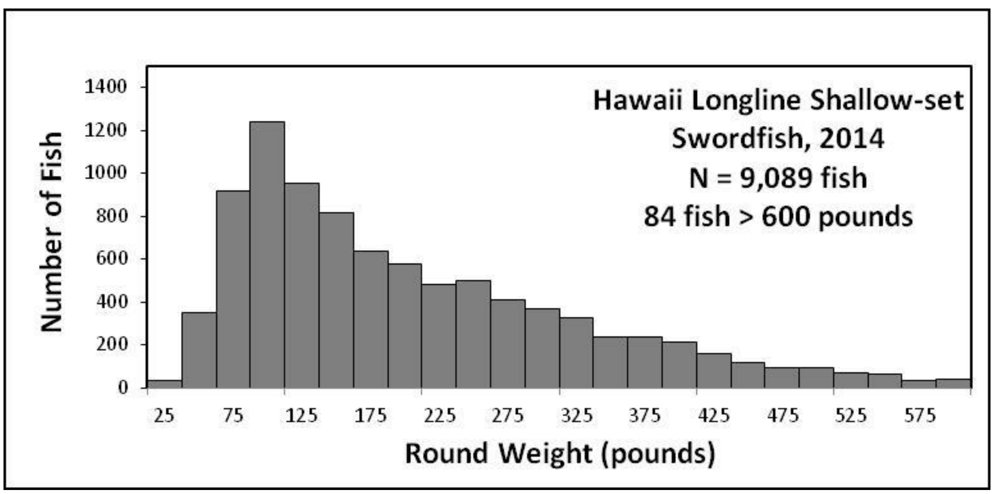


Figure 5. Size distribution of (top) bigeye tuna (*Thunnus obesus*), and (bottom) swordfish (*Xiphias gladius*) caught by the Hawaii-based shallow-set longline fishery in the north Pacific Ocean, 2014.

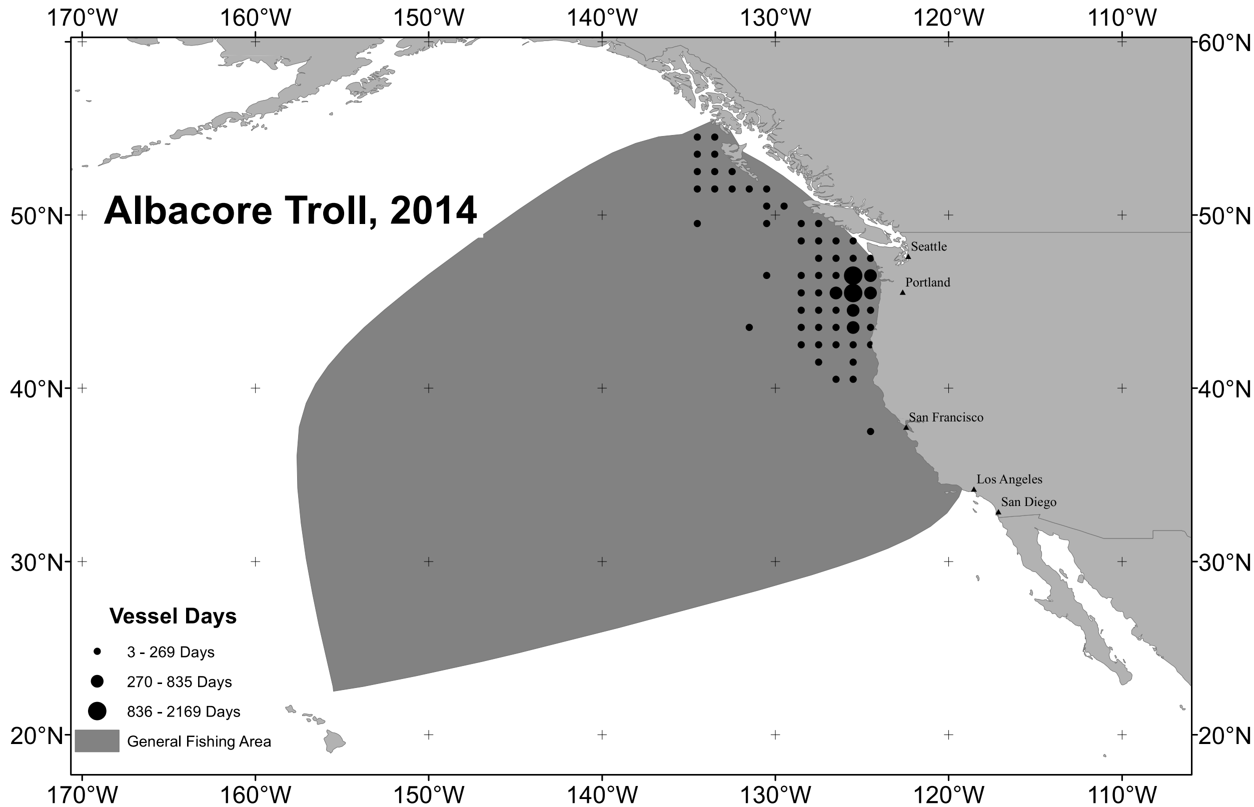


Figure 6. Spatial distribution of reported logbook fishing effort by the 2014 U.S. albacore troll and pole-and-line fishery in vessel days. The size of circles is proportional to the amount of effort. Effort in some areas is not shown in order to preserve data confidentiality.

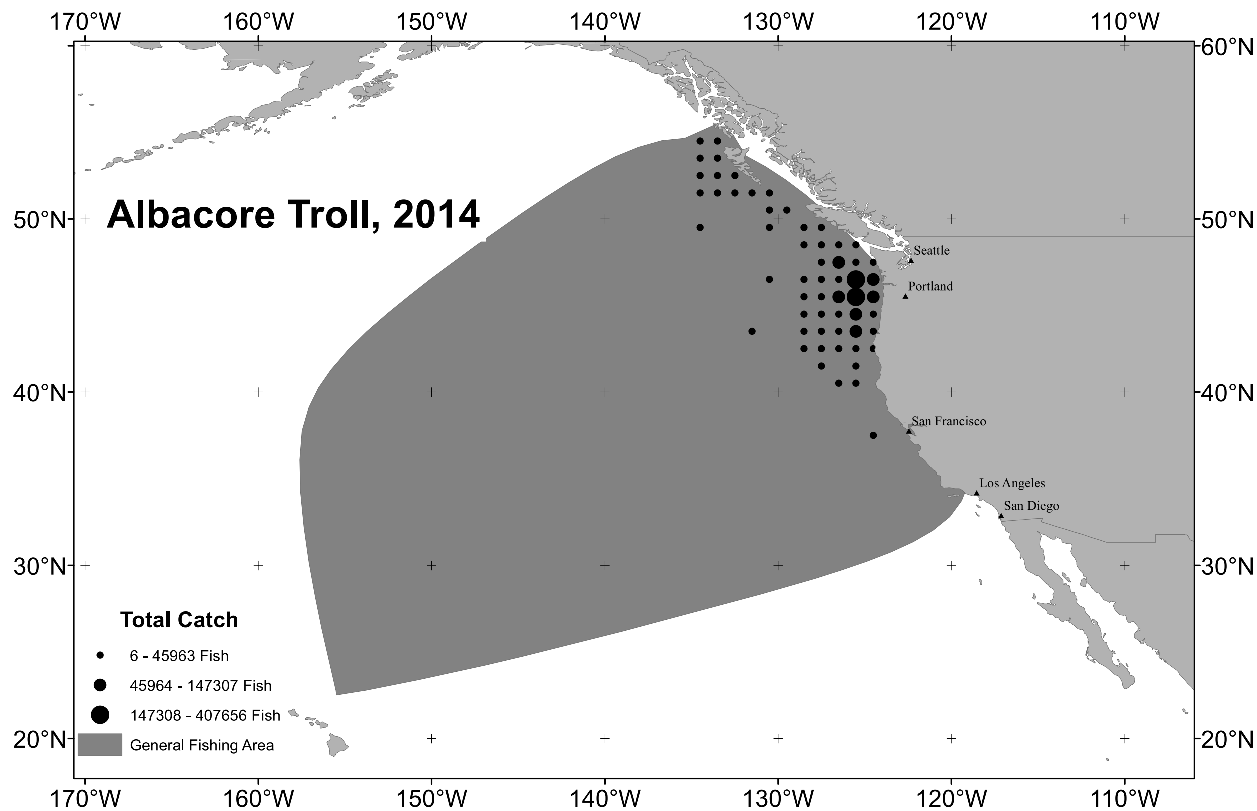


Figure 7. Spatial distribution of reported logbook fishing catch by the 2014 U.S. albacore troll and pole-and-line fishery in number of fish. The size of circles is proportional to the amount of catch. Catch in some areas is not shown in order to preserve data confidentiality.

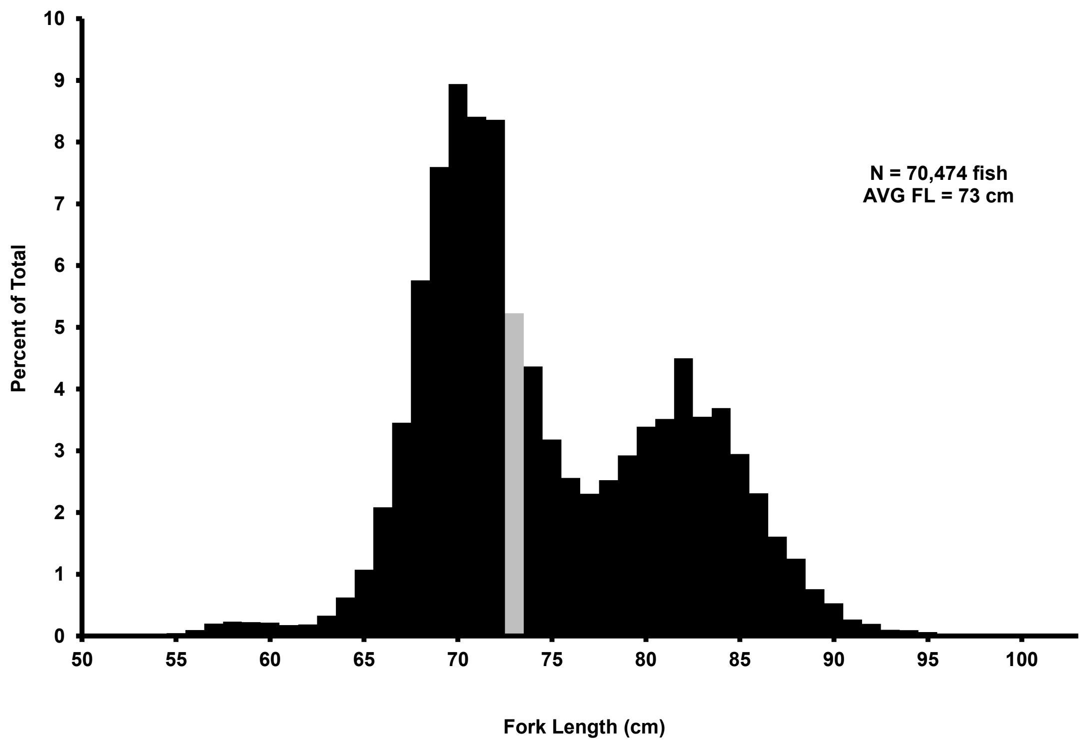


Figure 8. Size distribution of albacore catch by the U.S.A. north Pacific albacore (*Thunnus alalunga*) troll and pole-and-line fishery in 2014.

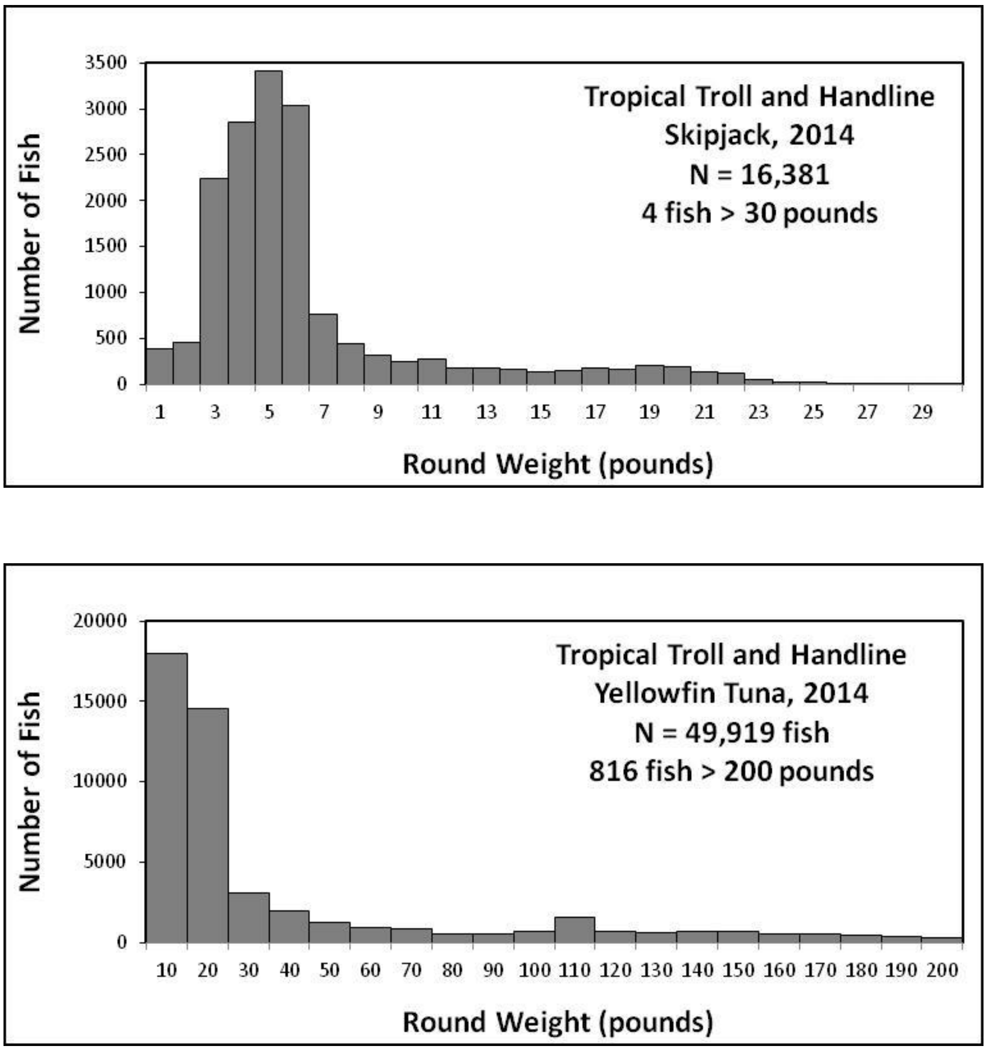


Figure 9. Size distribution of (top) skipjack tuna (*Katsuwonus pelamis*) and (bottom) yellowfin tuna (*Thunnus albacares*) caught by the Hawaii troll and handline fisheries, 2014.

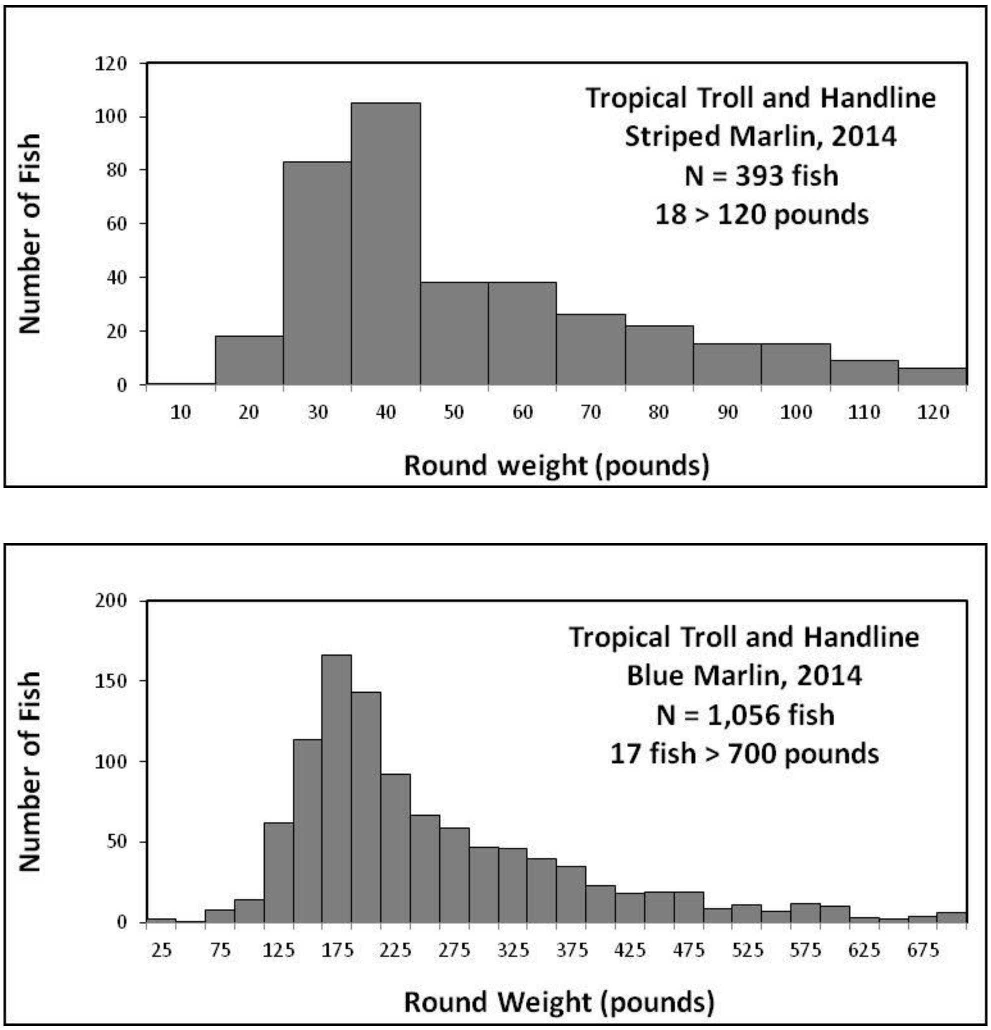


Figure 10. Size distribution of (top) striped marlin (*Kajikia nigricans*) and (bottom) blue marlin (*Makaira mazara*) caught by the Hawaii troll and handline fisheries, 2014.

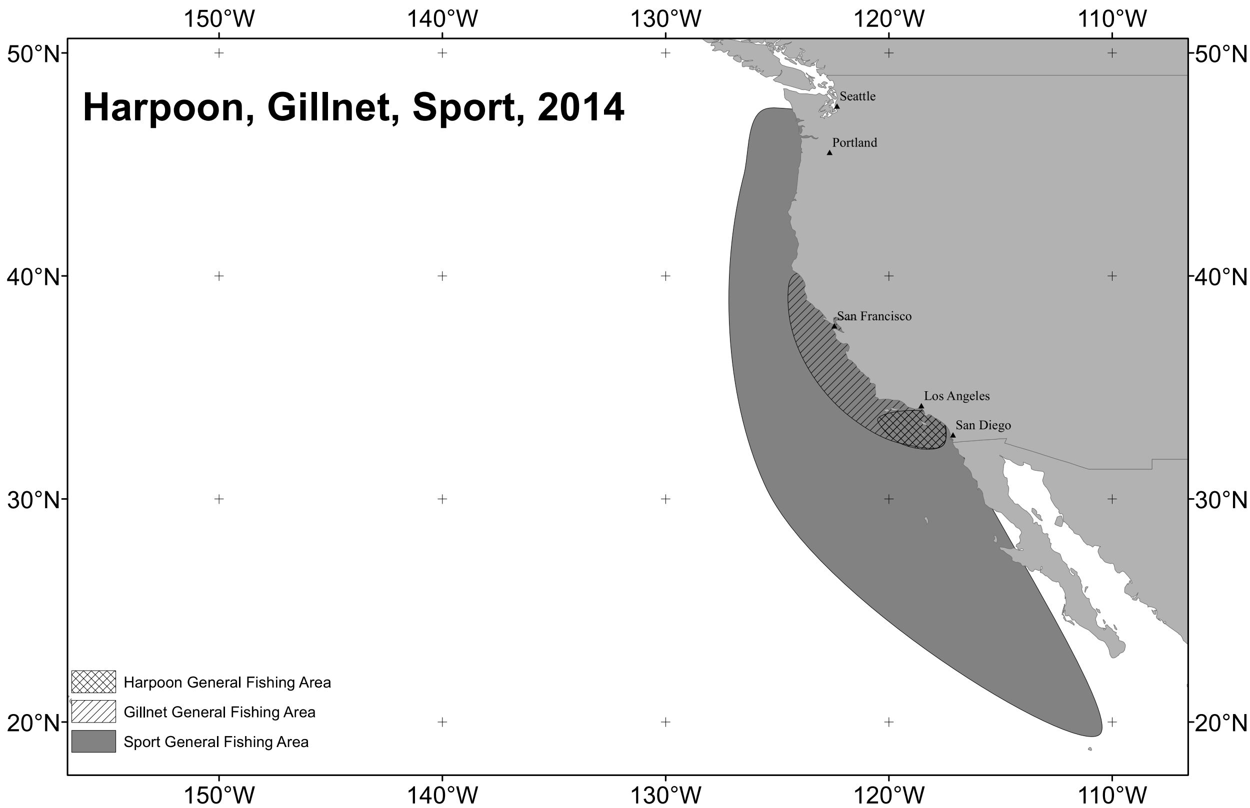


Figure 11. Spatial distribution of reported logbook fishing effort by the 2014 U.S. harpoon, gillnet, and west coast sport fisheries for HMS in the North Pacific Ocean. Effort in some areas is not shown in order to preserve data confidentiality.

Table 2. U.S. catches (metric tons) of tunas and tuna-like species by fishery in the North Pacific Ocean, north of the equator. Data for 2014 are preliminary. Species codes: ALB = albacore, YFT = yellowfin tuna, SKJ = skipjack tuna, BET = bigeye tuna, PBF = Pacific bluefin tuna, SWO = swordfish, BUM = blue marlin, MLS = striped marlin, BIL = other billfish, TUN = other tunas, ALV = common thresher shark, PTH = pelagic thresher shark, BTH = bigeye thresher shark, SMA = shortfin mako shark, BSH = blue shark, SKH = other sharks. Zeros indicate less than 0.5 metric tons. -- indicates data are not available.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL [5]	ALV	PTH	BTH	SMA	BSH	SKH	TOTAL
Purse Seine [1]																	
1985	26	92,623	47,634	1,751	3,320												145,354
1986	47	102,736	52,817	264	4,851												160,715
1987	1	123,044	48,667	222	861												172,795
1988	17	88,302	78,250	1,120	923												168,612
1989	1	77,744	35,671	516	1,046												114,978
1990	71	63,722	53,213	674	1,380												119,060
1991		26,789	50,107	415	410												77,721
1992		29,668	74,234	3,709	1,928												109,539
1993		23,805	60,485	3,035	580												87,905
1994		10,516	30,183	2,472	906												44,077
1995		16,934	60,036	5,803	657												83,430
1996	11	6,653	20,646	6,884	4,639												38,833
1997	2	20,866	37,525	8,702	2,240												69,335
1998	33	20,831	25,258	3,645	1,771												51,538
1999	48	4,989	18,710	3,236	184												27,167
2000	4	1,670	5,508	454	693												8,329
2001	51	5,362	17,794	1,122	292												24,621
2002	4	6,612	4,002	580	50												11,248
2003	44	3,562	21,212	3,528	22												28,368
2004	1	3,810	6,860	1,437													12,108
2005		6,792	19,171	3,992	201												30,156
2006		1,112	5,075	1,492													7,679
2007	77	1,112	5,075	1,492	42												7,797
2008		2,725	11,045	555													14,325
2009	31	3,694	14,378	512	410												19,025
2010		7,136	41,523	1,557			0	1	1	15						34	50,267
2011		3,996	30,348	1,893		65		6	0	10				0		30	36,348
2012		5,837	42,479	1,038													49,354
2013		--	--	--													-
2014		949	14	--	401												1,365
Longline [2]																	
1985							2										2
1986							2										2
1987	150	261	1	815			24	51	272	45							1,619
1988	307	594	4	1,239			24	102	504	68							2,842
1989	248	986	10	1,442			218	356	612	132							4,004
1990	177	1,098	5	1,514			2,437	378	538	58							6,205
1991	312	733	30	1,555	2		4,535	297	663	69							8,196
1992	334	346	22	1,486	38		5,762	347	459	142							8,936
1993	438	633	36	2,124	42		5,936	339	471	100							10,119
1994	544	610	53	1,827	30	5	3,807	362	326	99							7,663
1995	882	984	101	2,099	29		2,981	570	543	182							8,371
1996	1,185	634	41	1,846	25	2	2,848	467	418	115							7,581
1997	1,653	1,143	106	2,526	26	2	3,393	487	352	143							9,831
1998	1,120	724	76	3,274	54	9	3,681	395	378	172							9,883
1999	1,542	477	99	2,820	54	10	4,329	357	364	242							10,294
2000	940	1,137	93	2,708	19		4,834	314	200	152							10,397
2001	1,295	1,029	211	2,418	6		1,969	399	351	136							7,814
2002	525	572	127	4,396	2		1,524	264	226	160							7,796
2003	524	809	207	3,618	1		1,958	363	538	248							8,266
2004	361	715	142	4,339	1	9	1,185	283	376	200							7,611
2005	296	712	91	4,999	1		1,622	337	511	216							8,785
2006	270	958	94	4,466	1		1,211	409	611	174							8,194
2007	250	844	93	5,822	0	0	1,735	262	276	160	44			128	8	7	9,629
2008	354	875	120	5,959	0	0	2,014	349	427	238	41			133	7	4	10,521
2009	203	527	136	4,628	1	0	1,817	360	258	124	30			120	9	6	8,219
2010	421	568	153	5,440	0	0	1,676	306	165	131	18			94	7	3	8,982
2011	708	937	207	5,701	0	0	1,623	373	362	249	19			68	13	2	10,262
2012	660	887	245	5,873	0	0	1,395	298	282	173	14			68	16	1	9,912
2013	317	736	233	6,504	1	0	1,270	406	398	227	6			52	1	0	10,151
2014	209	656	187	7,161	0	0	1,663	535	426	239	7			53	0	0	11,136

Table 2. Continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL [5]	ALV	PTH	BTH	SMA	BSH	SKH	TOTAL
Albacore Troll and Pole-and-Line																	
1985	6,415	5															6,420
1986	4,708	1															4,709
1987	2,766	76															2,842
1988	4,212	7															4,219
1989	1,860	1															1,861
1990	2,718																2,718
1991	1,845																1,845
1992	4,572																4,572
1993	6,254	137	62			1											6,454
1994	10,978	769	352														12,099
1995	8,125	211	1,157														9,493
1996	16,962	606	393		2												17,963
1997	14,325	4	2		1												14,332
1998	14,489	1,246	2		128												15,865
1999	10,120	52	16		20												10,208
2000	9,714	3	4		1	1											9,723
2001	11,349	1	1		6												11,357
2002	10,768				1												10,769
2003	14,161		2														14,163
2004	13,473	1															13,474
2005	8,479																8,479
2006	12,547																12,547
2007	11,908																11,908
2008	11,761																11,761
2009	12,340		0		0									0			12,340
2010	11,689		0														11,690
2011	10,143		0		0												10,143
2012	14,149		0		0												14,149
2013	12,310		0		0										0		12,310
2014	13,414	0			0												13,414
Tropical Pole-and-Line																	
1985		472	1,328														1,800
1986		554	1,367			1											1,922
1987		1,861	2,087														3,948
1988		1,140	3,450	5													4,595
1989		1,318	2,456			3											3,777
1990		154	553			2											709
1991		942	1,840														2,782
1992		1,928	1,744			2											3,674
1993		2,636	2,850			5											5,491
1994		1,844	2,422			18											4,284
1995		394	2,393														2,787
1996		696	1,331			1											2,028
1997		468	1,755														2,223
1998		2,206	1,067														3,273
1999		57	601	4													662
2000		3	320	1													324
2001		4	448														452
2002		2	420			2											424
2003		35	587			4											626
2004		18	279							1							298
2005		68	353			1											422
2006		4	294			3											301
2007		23	272			1											296
2008		23	293			4											320
2009		17	214			1											232
2010																	-
2011																	-
2012																	
2013																	
2014																	-

Table 2. Continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL [5]	ALV	PTH	BTH	SMA	BSH	SKH	TOTAL
Tropical Troll [3]																	
1985	7	967	101	8		2		145	18	12							1,260
1986	5	1,493	120	5		4		220	19	14							1,880
1987	6	1,616	137	8		11		261	29	20							2,088
1988	9	941	172	17		11		266	54	20							1,490
1989	36	828	153	14		11		326	24	23							1,415
1990	15	891	138	25		11		295	27	17							1,419
1991	72	802	237	25		9		346	41	25							1,557
1992	54	602	167	13		10		260	37	17							1,160
1993	71	861	157	3		6		311	67	20							1,496
1994	90	870	138	7		8		298	35	22							1,468
1995	177	978	152	20		7		315	52	29							1,730
1996	188	934	224	7		5		409	53	18							1,838
1997	133	770	196	26		4		378	37	17							1,561
1998	88	766	143	9		6		242	26	19							1,299
1999	331	1,019	181	24		4		293	27	33							1,912
2000	120	1,080	415	207		15		235	15	20							2,107
2001	194	878	523	226		13		291	44	32							2,201
2002	235	632	355	586		6		225	30	13							2,082
2003	85	735	268	213		25		210	29	18							1,583
2004	157	746	251	381		45		188	31	23							1,822
2005	175	679	259	295		14		187	20	15							1,644
2006	95	508	296	303		12		160	21	14							1,409
2007	3	501	266	63		8	1	127	13	12							994
2008	1	451	481	74		7		198	14	14							1,240
2009	3	471	412	59		12	0	15	10	8							990
2010	2	426	416	118		25		148	19	12						1	1,167
2011	4	496	385	110		16		199	16	18						1	1,245
2012	3	644	381	155		18	1	141	11	16						1	1,371
2013	2	528	535	148		5	1	137	8	16						1	1,381
2014	3	574	364	128		14	1	159	12	12	1					1	1,269
Tropical Handline																	
1985							4										4
1986							4										4
1987							4		1								5
1988							6										6
1989							7		0								7
1990							5		0								5
1991							6		0								6
1992							1		1								2
1993							4		1								5
1994							4		0								4
1995							6		0								6
1996							5		1								6
1997							7		1								8
1998							7		0								7
1999							9		1								10
2000																	-
2001																	-
2002									0								-
2003							10		0								10
2004							7		2								9
2005							5		0								5
2006							4		0								4
2007	94	254	7	324		1	5	1									686
2008	28	227	9	148		1	6	1									420
2009	97	317	11	136		3	5	1									570
2010	53	265	7	340		4	3	2			1			1			676
2011	84	357	9	296		1	5	2									754
2012	253	381	12	298		1	6	2			1			1			955
2013	46	442	14	393		1	6	3			1						906
2014	49	381	7	205		2	7	4									655

Table 2. Continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL [5]	ALV	PTH	BTH	SMA	BSH	SKH	TOTAL
Gillnet																	
1985	2	12		2	8		2,990				856	0	90	129	0		4,089
1986	3	14		3	16	4	2,069				455	0	34	250	1		2,849
1987	5	3		6	2	5	1,529				354	2	18	208	1		2,133
1988	15	7		5	4	2	1,376				352	1	7	106	0		1,875
1989	4	1	5		3	3	1,243				430	0	16	117			1,822
1990	29	1	1	1	11	2	1,131				266	1	30	229	0		1,702
1991	17	1	3	3	4	3	944				542		31	125	0		1,673
1992		4	1	1	9	6	1,356				256	0	18	118	1		1,770
1993		7	2		32	9	1,412				243	1	41	87	0		1,834
1994	38				28	2	792				292	0	32	80	0		1,264
1995	52	2	70	1	20	1	771				234	5	30	79	0		1,265
1996	83	2	2		43		761				298	1	20	85	0		1,295
1997	60	3	2	5	58		708				291	35	29	118	0		1,309
1998	80	2	3	4	40	2	931				332	2	11	85	0		1,492
1999	149			2	22	1	606				285	10	5	52	0		1,132
2000	55	1		2	30		649				252	3	4	64	0		1,060
2001	94	5	1		35		375				319	1	1	30			861
2002	30	1			7		302				271	2		69			682
2003	16		9	6	14		216				280	4	6	57	0		608
2004	12	1			10		182				94	2	5	38			344
2005	20	2			5		220				167	0	10	25			449
2006	3	1	2		1	1	443				132	0	4	38			625
2007	4	0	0		2		490				184	2	5	37	9		733
2008	1	0	0		1		405				128		6	27			568
2009	4	1	0		3		253				38		7	21			326
2010	5				1		62				41		1	10			120
2011	5		0		18		119				55	0	1	8			206
2012	8		1	0	4		118				37			9		1	177
2013	5		0		7		95				48		1	16		0	172
2014	0				4		71				10	1		5			91
Harpoon																	
1985							305				0			1			306
1986							291						0	1			292
1987							235						0	3			238
1988							198				0			3			201
1989							62							1			63
1990							64				0			3			67
1991							20				0			1			21
1992							75				0			3			78
1993							168							1			169
1994							157				0			1			158
1995							97				0			1			98
1996							81				0			1			82
1997							84							3			87
1998							48				0		0	1			49
1999							81							0			81
2000							90							0			90
2001							52							1			53
2002							90				0			0			90
2003							107							0			107
2004							69							1			70
2005							77							1			78
2006							71				2			0			73
2007							59							0			59
2008							48							1			49
2009							50				0			1			51
2010							37				0			0			37
2011							24				0			0			24
2012							5				0			0			5
2013							6							0			6
2014							5							0			5

Table 2. Continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL [5]	ALV	PTH	BTH	SMA	BSH	SKH	TOTAL
Sport																	
1985	1,176				89				42								1,307
1986	196				12				19								227
1987	74				34				28								136
1988	64				6				30								100
1989	160				112				52								324
1990	24				65				23								112
1991	6				92				12								110
1992	2				110				25								137
1993	25				283				11								319
1994	106				86				17								209
1995	102				245				14								361
1996	88				40				20								148
1997	1,018				131				21								1,170
1998	1,208				422				23								1,653
1999	3,621				408				12								4,041
2000	1,798				319				10								2,127
2001	1,635				344				0								1,979
2002	2,357				613				0								2,970
2003	2,214				355				0								2,569
2004	1,506				50				0								1,556
2005	1,719				73				0								1,792
2006	385				94				0								479
2007	461				12				0								473
2008	418				63												481
2009	944	766	2		156												1,868
2010	862	276			88												1,226
2011	421	324			225												970
2012	1,212	708			400												2,320
2013	839	433	4		809												2,085
2014	1,048	1,832	53		398												3,331
Other [4]																	
1985	118	58	5	1	20	468	104				332		5	19	1		1,131
1986	66	227		6	41	6	109				93		14	59	1		622
1987	139	2,159	633	1	18	67	31				116		1	188	1		3,354
1988	76	936	372	1	46	2	64				67		2	214	3		1,783
1989	10	849	103		18		56				65		1	137	6		1,245
1990	20	508	147		81	1	43				90		0	141	20		1,051
1991	20	235	137		0		44				42		0	91	1		570
1992	40	1,119	1,014		14	2	47				35		3	19	1		2,294
1993	194	2,031	2,279		29		161				25		2	32	0		4,753
1994	66	3			1		24				37		4	46	12		193
1995	4	5	263		0		29				34		1	14	5		355
1996	10			4	0		15				21		0	9	0		59
1997	12		83		48		11				27	0	3	11	0		195
1998	15	43			59	1	19				22	0	0	12	1		172
1999	61				88		27				32	1	0	9	0		218
2000	24	1			11		33				44	0	0	12	0		125
2001	39				1		19				40	1	0	10	0		110
2002	13	27	1		2	1	3	1			30			12	0		90
2003	8	8	2	3	3		11				21		0	9	0		65
2004	3	27	2	132	0		44	5			21		0	13	0		247
2005	1				1		5				11	0		8	0		26
2006	0	349	12		0		5				24	0	0	7	0		397
2007	0	0	0		0						20	0	0	6	0		26
2008	0	2	0	5	0		19				19	0	0	5			50
2009		7	1		2		0				66	0	1	7	1		85
2010	0	0			0						55		0	10	0		65
2011	0	1			100	0					20		0	8	0		130
2012	2	0	0		38		1				30	1		11	0		84
2013	0	2	1		3		7				18	6	0	12	0		49
2014		5	0	8	1		18				13	0	1	9	0		55

[1] For 2014, catch only include EPO fleet becasue data from the WCPO fleet are not yet available; 2013 data are not yet available. Purse Seine catches include EPO and WCPO fisheries. Estimates from 2010 and 2011 include incidental catches recorded in logbooks.

[2] Longline includes American Samoa, Hawaii, and California fisheries. Thresher and mako shark catches are not reported at the species level in the longline fishery but are listed under ALV and SMA, respectively.

[3] Tropical troll 1985-2006 includes tropical handline catches

[4] Other catches include incidental catches from non-HMS fisheries

[5] BIL catches for Tropical Troll and Longline include Black Marlin, Sailfish, Spearfish, and other billfish