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SUMMARY

U.S. fishing fleets harvest highly migratory species (HMS), including tuna and tuna-like species, from the North Pacific Ocean (NPO) in the U.S. exclusive economic zones and in the high seas. Fisheries operate within the eastern Pacific Ocean (EPO) and western and central Pacific Ocean (WCPO) from coastal waters of North America to the archipelagoes of Hawaii, Guam, Commonwealth of the Northern Mariana Islands (CNMI), and American Samoa. Small-scale gillnet, harpoon, pole-and-line, troll, and handline fleets operate primarily in coastal waters; while most of the tuna catches are from large-scale purse seine, albacore troll, and longline fleets that operate both within the U.S. exclusive economic zone and on the high seas. In addition, thousands of small-scale troll and handline vessels operate in waters of the tropical Pacific; however, these fleets account for a small fraction of the total tuna catch.

On September 15, 2023, the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration (NOAA Fisheries) authorized deep-set buoy gear (DSBG) as an additional gear type for catching swordfish and other highly migratory species (HMS) on the U.S. West Coast to minimize bycatch. DSBG fishing would be permitted on an open-access basis outside of the Southern California Bight (SCB), in Federal waters off California and Oregon. In 2023, 21 vessels were engaged in deep-set buoy gear fishery. The Swordfish catch for the year amounted to 31 t.

In 2023, NOAA Fisheries continued research on Pacific tunas and associated species at its Southwest and Pacific Islands Fisheries Science Centers, often in collaboration with scientists from other organizations. Stock assessment research on tuna and tuna-like species was conducted primarily through collaboration with participating scientists of the International Scientific Committee (ISC) for Tuna and Tuna-Like Species in the NPO and international Regional Fisheries Management Organizations. Research studies were also conducted that will help improve stock assessments, including an analysis by Hoyle et al. (2024) on good practices for standardizing catch per unit effort and a reproductive study by Humphreys and Brodziak (2024) on the striped marlin in the central North Pacific Ocean.

Fishery monitoring and socio-economic research was also conducted on tunas, billfishes, and bycatch species in the U.S. Pacific coastal and high-seas fisheries. NOAA reports summarized monitoring data collected for longline, purse seine, and small-boat fisheries. In addition, a NOAA data report (Stahl et. al. 2024) outlined which data fields historically collected by at-sea observers in the Hawaii longline fisheries are collectable by electronic monitoring or other sources (e.g. VMS or logbooks).

NOAA Fisheries successfully completed biological and oceanographic studies on tunas and billfishes in 2023. Highlighted research includes studies that examine the micronekton

(Domokos et al. 2023) and scattering layers (Arostegui et al. 2023) that create structure and aggregate predators in the open ocean; effects of warming oceans on food webs (Gomes et al. 2024; Reum et al. 2024; Welch et al. 2023), and foraging studies on swordfish (Preti et al. 2023) and albacore tuna (Gleiber et al. 2023). In addition, Frawley et al. (2023) examined factors that drive longline fisheries interactions with North Pacific albacore tuna.

1. INTRODUCTION

Various U.S. fishing fleets harvest tuna and tuna-like species in the NPO. Large-scale commercial purse seine, albacore troll, and longline fisheries operate both in coastal waters and in the high seas. Small-scale commercial fisheries generally operate in coastal waters along the North American coast using purse seine, gillnet, harpoon, troll, handline, and hook-and-line gears and around the archipelagos of Hawaii, Guam, CNMI, and American Samoa using troll and handline gears. Recreational sport fisheries also operate in these areas, including guided (charter) trips. In some areas, fishers may sell fish and retain fish for personal use. Overall, the range of U.S. fisheries harvesting tuna and tuna-like species in the NPO is extensive, from coastal waters of North America to the U.S. territories of Guam, CNMI, and American Samoa in the WCPO, and from the equatorial region to the upper reaches of the North Pacific Transition Zone.

In the U.S. the federal government (NOAA Fisheries) 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. Monitoring of tunas and billfishes by the federal government is performed by NOAA fisheries offices based in California (West Coast Regional Office, WCRO, and Southwest Fisheries Science Center, SWFSC) and in Hawaii (Pacific Islands Regional Office, PIRO, and the Pacific Islands Fisheries Science Center, PIFSC). NOAA Fisheries monitors HMS fisheries catch and effort and biological information from landings and sales records, fisher self-reported logbooks, fisheries observer data, and creel surveys (that may include shoreside fisher interviews, biological sampling, and collection of effort data). In California, Washington, and Oregon, landings receipts are collected by state agencies and maintained in the federally-funded Pacific Fisheries Information Network (PacFIN) data system (http://pacfin.psmfc.org/) at the Pacific States Marine Fisheries Commission (PSMFC). State agencies also collect fisher reports (logbooks) and size composition data for some fisheries. In the WCPO, monitoring by U.S. territory partner agencies includes market sampling and creel surveys of fishery activities and is managed by PIFSC and coordinated by the federally-funded Western Pacific Fishery Information Network (WPacFIN, http:// http://www.pifsc.noaa.gov/wpacfin/). Together, the SWFSC, WCRO, PIFSC, and PIRO share responsibilities for managing data collected from the U.S. 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 2024. The U.S. fisheries data reported for 2023 are considered preliminary. Although this report focuses on tunas and billfishes, some of the U.S. fisheries catch other pelagic fish important to the fishing fleets and local economies. Catch data for these species are not reported here but are included in the U.S. data submissions to the ISC for 2023.

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 interest to the ISC.

2. FISHERIES

2.1. Purse Seine

Currently, the U.S. purse-seine fishery consists of two separate fleets, one composed of large purse-seine vessels that operate mostly in the WCPO (most of effort is within the WCPFC management area but some is in the IATTC management area), and a small coastal purse-seine fleet that operates in the EPO off the coast of Southern California. Prior to 1995, the purse-seine fleet targeted free-swimming schools of tuna in the WCPO and fished on tuna schools associated with dolphins in the EPO. Since 1995, most catches in the WCPO have been associated with fish aggregation devices (FADs) or other floating objects. Historically, most of the U.S. purse-seine tuna catch was from the EPO where the fishery began in the 1950s. However around 1993, fishing operations shifted to the WCPO as many vessels moved to the WCPO in response to dolphin conservation measures in the EPO and with fishing possible in the WCPO as access was granted to the U.S. by the South Pacific Tuna Treaty (SPTT) in 1987. The WCPO purse seine fleet has generally operated in areas between 10°N and 10°S latitude and 130°E and 150°W longitude. However, in recent years the fishing effort has declined with a reduced spatial distribution. In 2023, fishing effort was limited to above the equator to 10°N latitude and between 180°E and 140°W longitude (Figure 1). The number of unique large purse-seine vessels fishing north of the equator in the WCPO has fluctuated from a high of 74 vessels in 1988 to a low of 11 in 2006. In 2023, 13 large purse-seine vessels fished north of the equator around the WCPO, which was below the 5-year average of 19 vessels. In 2023, the small coastal purse seine fleet in the EPO only caught 3 t of Pacific bluefin tuna which is well below the 5-year average of 119 mt.

The Inter-American Tropical Tuna Commission (IATTC) monitors the purse-seine fleets fishing in the EPO; while the U.S. purse seine vessels fishing in the WCPO are monitored by NOAA

Fisheries under the SPTT (since 1988). The SPTT requires submission of purse seine landings data and fisher self-reported logbooks with logbooks at 100% coverage of fishing operations in the WCPO. Historically, catch was sampled for species and size composition from vessels landing in American Samoa by NOAA Fisheries personnel or by SPC samplers in other ports; however, this sampling program was discontinued. Instead, biological data are derived from fisheries observers with the Forum Fisheries Agency (SPTT Treaty Manager) placing observers on 100% of the purse seine trips in the WCPO. In the EPO, logbooks are submitted by vessel operators to either NOAA Fisheries or the IATTC, and landings data are obtained for each vessel trip from canneries or fish buyers. IATTC fishery observers are required on all large purse-seine vessels in the EPO.

2.2. Longline

The U.S. longline fisheries targeting tuna and tuna-like species in the NPO includes fleets based in Hawaii, California, and American Samoa. The fishing fleets are separated into a deep-set sector defined by ≥15 hooks set between floats that targets bigeye tuna (*Thunnus obesus*) and a shallow-set sector with <15 hooks set between floats that targets swordfish (*Xiphias gladius*). The majority of effort and catch occur by the Hawaii-based deep-set fleet with a small subset of vessels that also participate in the shallow-set fishery and may land fish in California.

The Hawaii shallow-set fishery overlaps spatially and temporally with seasonal abundance of sea turtles, which resulted in recent closures in 2018 and 2019 when annual loggerhead sea turtle interaction limits were reached (34 loggerhead sea turtles in 2018; 17 loggerhead sea turtles in 2019). However, it is less likely that this fishery will close as there are no longer annual interaction limits on loggerhead sea turtles, the species most commonly interacted with by this fishery. Current regulations include an annual interaction limit of 16 leatherback sea turtles and trip limits of 5 loggerhead and 2 leatherback sea turtles.

In 2023, the U.S. longline fisheries operated in both the north and south Pacific Oceans with fishing in the NPO between 125°W to 180°W longitude and from 10°N to 40°N latitude (Figures 2). The total number of U.S. vessels (including territories) fishing in the NPO was 150 vessels in 2023, which is slightly above the 5-year average of 148 vessels. The spatial distribution of catches of bigeye tuna, yellowfin tuna, albacore tuna, and swordfish in the NPO were similar; however, the areas with the highest concentrations of swordfish catches are further north (between 30°N and 40°N) compared to the areas with the highest concentrations of catches for bigeye tuna and yellowfin tuna (between 10°N and 20°N; Figure 3).

The U.S. longline catch (including catch by territories) in the NPO is dominated by bigeye tuna with annual landings totalling over 4,000 t for the past twenty years with a 2023 bigeye tuna catch of 6,401 t, which is below the 5-year average of 6,992 t. Swordfish was the dominant component of the longline catch from 1990 through 2000 with a peak catch of 5,936 t in 1993 and a low of 543 t in 2020. In 2023, the U.S. swordfish catch (including catch by territories) in the NPO was 856 t, which was above the 5-year average of 749 t. Note that whole weights are used for reporting. However, in Hawaii and California, swordfish are generally landed headed, tailed, and gutted, tunas and large marlins are landed gilled and gutted, and other bony fishes landed whole. Landed weights are converted to whole weight using standard conversion factors.

The size distribution (in weight) of retained fish (that were landed) are shown by selected species of tuna and marlin for 2022 and 2023 in the Hawaii-based deep-set and shallow-set fisheries (Figures 4–7). In the Hawaii deep-set fishery, there is a distinct bimodal size distribution for landed albacore tuna catch with the largest peak around 20 kg in 2022 but closer to 15 kg in 2023. For yellowfin tuna the largest peak in size distribution occurs around 40 kg in 2022 and 2023; however, another peak of smaller fish occurs around 20 kg in both years but with fewer fish in 2023. In the deep-set fishery, the bigeye tuna catch size composition is more balanced compared to the shallow-set fishery with peaks in the deep-set fishery in 2022 at 30 kg and 50 kg and in 2023 at 40 kg. With swordfish catch in both the deep-set and shallow-set fisheries is generally right skewed with a larger proportion of fish caught at the smaller sizes in the range.

The Hawaii-, California-, and American Samoa- based longline fisheries are monitored by NOAA Fisheries through mandatory fisher reports (federal longline logbooks), landing reports, and fisheries observers. Logbooks provide information on fishing effort, area fished, catch by species and amount, and other details of fishing operations. Commercial Marine Dealer landing reports are required by Hawaii’s Division of Aquatic Resources (DAR) and California’s Department of Fish and Wildlife (CDFW) and provide weight data for retained fish. Trip coverage rates are close to 100% for both logbooks and landing reports. Fisheries observers contracted by NOAA Fisheries provide information for fish species that are discarded, protected species interactions, length data for retained and discarded catch, and other data on vessel operations. Hawaii-based longline vessels have historically had about 20% coverage of deep-set fishing trips; however, coverage dropped to 17.4% of fishing trips for 2024. While the shallow-set longline fishery has maintained coverage rates of 100%.

2.3. Albacore troll and pole-and-line

The U.S. troll and pole-and-line fisheries in the NPO consist of small and large vessels that target albacore with operations ranging between the U.S. West Coast and 160°W longitude with 2023 spatial distribution staying with the coast and 150°W (Figure 8–9) with fishing usually from summer through fall. The fishery catches almost exclusively albacore with minor incidental catches of Pacific bluefin tuna (*Thunnus orientalis*), eastern Pacific bonito (*Sarda chiliensis lineolata*), yellowtail (*Seriola lalandi*), and mahi mahi (*Coryphaena* *hippurus*).

NOAA fisheries monitor the U.S. albacore troll and pole-and-line fisheries through mandatory fisher reports (logbooks), dealer landing reports, and biological data collected from landed fish. Logbooks have been submitted to NOAA fisheries since 2005, and the requirements have been dictated by the Highly Migratory Species Fishery Management Plan. Since 1961, albacore size data have been collected from landings in Oregon and Washington ports by state staff, and sampling instructions and database maintenance have been provided by NOAA Fisheries.

In 2023, 319 vessels participated in the NPO fisheries, below the 5-year average of 405 vessels. The albacore catch in 2023 was 3,161 t, the lowest since 1992. The proportion of U.S. vessels caught in the high seas was 22% in 2023, and there was no fishing activity in Canada's EEZ or landings in Canadian ports due to the U.S.-Canada Albacore Tuna Treaty expiration at the end of 2022. In 2023, the nominal CPUE was 106 albacore per day, a decrease from 166 albacore per day in 2022. The average price of albacore was $2.02 per pound in 2023 compared to $2.42 per pound in 2022.

Generally, sizes of albacore caught in the albacore troll and pole-and-line fishery range between 55 cm fork length (3.9 kg) and 90 cm (14.5 kg). In 2023, a total of 10,464 fish were measured for lengths. The 2023 average albacore sampling weight of 7.4 kg was similar to the 2022 weight of 7.5 kg. The weight distribution for landed albacore catch is shown for 2022 and 2023 (Figure 10).

2.4. Tropical Troll and Tropical Handline

A large number of small vessels (typically around 8 m in length) operate from the archipelagos of Hawaii, Guam, and the CNMI and target tuna and tuna-like species in the NPO using mostly tropical troll fishing gear with some fishers operating out of Hawaii also using handline fishing gear. Generally these fishers make one-day fishing trips that may be for commercial, recreational, or subsistence purposes with trips often including fish that are both sold and retained for personal use. Commercial fishing trips may also include charter fishing trips where fish are not sold but instead profit is derived from paid clients. Generally commercially sold fish are landed whole with some catch gilled and gutted.

The Hawaii-based tropical troll and handline fisheries are monitored through Hawaii DAR Commercial Fish Catch reports and Commercial Marine Dealer landing reports. Fisher catch reports are required for trips by fishers that have commercial permits (including charter fishers) no matter if fish are being sold on a trip. However, if Hawaii troll or handline fishing trips are performed solely for subsistence, personal use, or recreational purposes and a fisher is not commercially permitted, then no catch reports are required.

Territorial troll data are monitored through creel surveys where local staff collect size composition and catch and effort data through shoreside interviews of fishers, with additional effort data collected through logging boat activity across the islands. Local staff from the CNMI Division of Fish and Wildlife (DFW) and Guam Division of Aquatic and Wildlife Resources (DAWR) conduct creel surveys and sampling according to a statistical design and enter data into WPacFin data warehouse where it can be accessed by NOAA fisheries to extrapolate estimates of total catch, fishing effort, and fishermen participation estimates by gear type.

In 2023, a total of 2,069 tropical troll and handline vessels operated in the NPO. The 2023 total retained catch from tropical troll and handline fisheries in the NPO was 1,524 t, which was below the 5-year average (1,793 t). The catch composition has been similar in the last 5 years with the majority of catch from yellowfin and skipjack tuna with other catch mostly composed of mahimahi (*Coryphaena hippurus*), bigeye tuna, and wahoo. In 2023 catch consisted of 561 t of yellowfin tuna and 374 t skipjack tuna followed by 210 t mahimahi, 137 t bigeye tuna, 113 t wahoo (*Acanthocybium solandri*), and 97 t blue marlin.

The size distributions of tunas (skipjack, *Katsuwonus pelamis*; yellowfin, *Thunnus albacares*; and bigeye) and marlins (striped marlin, *Kajikia audax*; and blue marlin, *Makaira nigricans*) caught in the Hawaii tropical troll and handline fishery are summarized for 2022 and 2023 based on landed fish weights obtained from Hawaii DAR dealer data (Figures 11–13).

2.5. Drift Gillnet

The U.S. large-mesh drift-gillnet fishery targets swordfish and common thresher sharks with other pelagic sharks, small amounts of tunas, and other pelagic species caught with fishing operations occurring within the EEZ in California waters and historically off the coast of Oregon (no landings since 2004). This fishery is set to be terminated in the next few years with changes in fishery regulations. The number of vessels participating in this fishery has steadily decreased from a high of 220 in 1986 to the lowest of 6 in 2023. Swordfish dominate the catch and peaked in 1985 at 2,990 t; The 2023 swordfish catch was 37 t, which is above the 5-year average (2019–2023) of 33 t. In 2023, there was an estimated total of 16 t bluefin tuna caught, which is below the 5-year average of 26 t.

The drift gillnet fishery is monitored through mandatory fisher reports (federal logbooks), landing reports, and fisheries observers. Federal logbooks have been used since 2019, with state agency-issued logbooks before that time. Size (length) composition data were historically (1981–1999) collected by CDFW for landed swordfish from less than 1% of landings. NOAA fisheries observers have collected size (length) data since 1990 and information on fishing location, protected species interactions, fish catch, and disposition of catch and bycatch. A total of 4 drift gillnet vessels were monitored by fisheries observers in 2023.

2.6. Harpoon

A small fishery that targets swordfish with harpoon gear operates within the EEZ in California waters between 32°N and 34°N latitude. In 2023, 18 vessels participated in this fishery. Of those 18 vessels, 9 also participated in the deep-set buoy fishery, and 5 participated in the Hook and Line fishery. The size of the harpoon fishing fleet has fluctuated over the years and was at its largest in 1986, with 113 vessels. Along with the size of the fleet, swordfish catches have fluctuated from a high of 305 t in 1985 to a low of 5 t in 2012 and 2015. The 2023 swordfish catch was 37 t, above the 5-year average of 18 t.

NOAA fisheries monitor the harpoon fishery through landing reports and fisher reports (logbooks). Size (length) composition data were collected historically (1981–1999) by CDFW, covering less than 1% of swordfish landings.

2.7. Sport

Sport (recreational) fisheries that catch tuna and other pelagic fish occur along the U.S. West Coast, with fishers operating from private vessels and commercial passenger fishing vessels (CPFV). Most of the HMS catch from these sport fisheries is albacore, yellowfin, and Pacific bluefin tuna. The 2023 albacore tuna catch was 568 t, below the 5-year average (605 t). In 2023, the Pacific bluefin tuna catch was at a high with 1,887 t caught, above the 5-year average (1197 t).

Catch and effort are monitored through fisher reports (logbooks) and surveys conducted by the states of California, Oregon, and Washington, with data maintained within the Recreational Fisheries Information Network (RecFIN; http://www.recfin.org/) at the PSMFC. Fishers submit logbook data for California-based trips to the CDFW, while logbooks for Oregon- and Washington-based fishing trips are submitted directly to NOAA Fisheries.

In addition, size composition data are collected for Pacific bluefin tuna and are used to estimate catch according to methods outlined in the Pacific Ocean stock assessment report from 2020: http://isc.fra.go.jp/pdf/ISC20/ISC20_ANNEX11_Stock_Assessment_Report_for_Pacific_Bluefin_Tuna.pdf. Bluefin tuna size composition data were collected from CPFV at fishing ports, with sampling by NOAA fisheries staff since 2014 and by IATTC staff from 1993 to 2012. The 2022 and 2023 size distribution for Pacific bluefin tuna is shown in Figure 14.

3. Climate-related Research

NOAA Fisheries is currently working nationwide to implement a new initiative called the Climate, Ecosystems, and Fisheries Initiative (CEFI). CEFI is a cross-NOAA effort to build nationwide, operational ocean modeling and decision support systems needed to reduce impacts, increase resilience, and help adapt to changing ocean conditions. The hope is that this system will provide decision makers with the actionable information and capacity they need to prepare for and respond to changing climate conditions in the future.

The goal of CEFI is to address four core requirements for climate-ready decision-making for marine resources:

1. Robust forecasts and projections of ocean and Great Lakes conditions for use in developing climate-informed advice
2. Operational capability to assess risks, evaluate options, and provide robust advice on adapting to changing conditions
3. Decision-maker capability to use climate-informed advice to reduce risks and increase the resilience of resources and the people that depend on them
4. Continuous validation and innovation through observations and research

In the Pacific, initial CEFI efforts will be focused on regional downscaling of the oceans surrounding California and the Hawaiian Islands archipelago (including the main and northwest Hawaiian Islands) with coupled fisheries and socioeconomic modeling efforts. The modeling effort will focus on a range of timescales, including hindcasts of the recent 30-year period, short term forecasts (1 year in the future with updated predictions seasonally), decadal outlooks (conditions over the next ten years, updated annually), and long-term projections under future greenhouse-gas emissions scenarios.

The physical circulation model applied will include dynamic biogeochemical properties (e.g. nutrients, oxygen, and carbon cycling with several plankton functional types) that will provide input for higher-trophic-level ecosystem models of target and non-target species. Short-term predictions and long-term projections of species abundance and distribution will be used in fisher location-choice models, trip-cost and trip-distance models, and market price models.

One of the ultimate goals will be to take the models developed through CEFI and operationalize real-time and near real-time data to predict potential impacts of climate change to fish and fisheries, using both long-term and short term projections. This is similar to the idea behind Eco-Cast, which is a tool that has been created to help fishers and managers evaluate how to allocate fishing effort to maintain target fish catch while minimizing bycatch of protected or threatened species. EcoCast uses habitat suitability models and satellite-derived environmental data to predict where broadbill swordfish and three bycatch species (leatherback turtle, blue shark and California sea lion) are likely to be each day. Daily EcoCast maps help fishers identify fishing spots to minimize fisheries bycatch and maximize fisheries target catch.

NOAA Fisheries is also continuing efforts related to operationalizing Ecosystem-Based Fisheries Management (EBFM), which includes climate change considerations. NOAA's EBFM Policy (NMFS Policy 01-120) recognizes that the evaluation and communication of trade-offs between management objectives requires continuously improving our understanding about the socio-ecological system in which they occur. "*In the face of accelerating climate change, recognizing* *the interconnectedness of these ecosystem components is essential to maintain resilient and productive ecosystems and associated human communities, activities, and well-being, even as these ecosystems and communities respond to climate, habitat, ecological, other environmental changes, and other ocean-uses*”. Management strategy/procedure evaluation (MSE/MPE) has become a key method to evaluate trade-offs between management objectives and to communicate with decision makers. Progress has been made in incorporating ecosystem science and climate change into this process in a number of US based MSEs. In some instances, ecosystem models (e.g., Atlantic or EcoCast) are used as operating models, generating realistic scenarios for climate-driven time-varying growth and mortality in the future to identify estimation model configurations that successfully provide advice when challenged with complex ecosystem effects. Further, the performance of management procedures under alternative hypotheses about current and future environmental conditions and changes in species (i.e., Pacific hake) distribution and movement have been explored. Here again more complicated operating models are being developed so ecosystem considerations can be included implicitly in the form of climate change scenarios that force fish movement. These explorations are aimed at understanding the robustness of current management procedures to the anticipated impact of climate change and highlight the importance of testing management procedures against model misspecification in the light of anticipated non-stationarity in population and ecosystem dynamics with climate change.

In addition to these broader efforts, below is a list of climate-related research recently published by the Southwest and Pacific Islands Fisheries Science Centers:

Trait-based Indicators of Resource Selection by Albacore Tuna in the California Current Large Marine Ecosystem

Gleiber et al. (2023) aims to identify taxonomic and trait-based indicators of diet selection in albacore tuna (*Thunnus alalunga*), which offer a promising avenue for predicting predator foraging decisions by considering morphological, behavioral, and nutritional characteristics of prey, ultimately aiding in forecasting predator-prey interaction strengths in changing environments. As global climate change reorganizes marine ecosystems, understanding how predators will respond to variable prey resources is critical to forecasting future community dynamics. Prey traits that affect the foraging process and recur across unrelated taxa offer a means to better anticipate predator resource use by simplifying complex foraging dynamics. This study compares taxonomic and trait-based indicators of resource use and selection for albacore tuna, a commercially valuable pelagic predator undergoing climate-driven range shifts. Synthesized datasets from 2005 to 2019 were used to evaluate diets of albacore tuna in relation to prey availability estimates from shipboard surveys in the California Current Large Marine Ecosystem. Analyses with these data reveal that albacore and trawl surveys sample different aspects of the pelagic system, with albacore consuming a subset of taxa identified within trawls. Albacore consistently selected coastal prey that are schooling, undefended, silvered and countershaded, and have high energy density — suggesting that ecological mechanisms driving albacore foraging outcomes may be conserved across time and space. Ecological traits mediating predator-prey interactions consistently distinguished albacore diets from assemblages sampled by trawls across years and regions. Gleiber et al. (2023) demonstrates that a traits-based approach simplifies taxonomically diverse predator-prey interactions and may be a valuable tool to facilitate predictions of prey resource use in changing environments.

Marine Heatwaves Disrupt Ecosystem Structure and Function via Altered Food Webs and Energy Flux

Gomes et al. (2024) investigated the effects of marine heatwaves on ecosystem and function through models developed with data on 361 taxa from six long-term surveys and diet information. While the ecosystem-level contribution (prey) and demand (predators) of most functional groups changed following the heatwaves, gelatinous taxa experienced the largest transformations with the arrival of northward-expanding pyrosomes. Altered trophic relationships and energy flux are demonstrated to have profound consequences for ecosystem structure and function and raise concerns for populations of threatened and harvested species.

Divergent Responses of Highly Migratory Species to Climate Change in the California Current

Lezama-Ochoa et al. (2024) provide valuable species distribution projections that contribute to the understanding of climate change effects on marine biodiversity and offer critical insight and support for developing climate-ready management of protected and fished species. Their research reveals a divergent response among species to climate impacts. Specifically, four species were projected to undergo significant poleward shifts exceeding 100 km and gain habitat (~7%–60%) and six species to shift towards the coast, resulting in a loss of habitat (10% to 66%). These divergent responses could typically be characterized by the mode of thermoregulation (i.e. ectotherm vs. endotherm) and species' affiliations with cool and productive upwelled waters that are characteristic of the region. Furthermore, our study highlights an increase in niche overlap between protected species and those targeted by fisheries, which may lead to increased human interaction events under climate change.

Projecting Climate Change Impacts from Physics to Fisheries: A View from Three California Current Fisheries

Smith et al. (2023) leverages a suite of climate, ocean, ecosystem, and economic models to project physical, ecological, and socio-economic change, evaluate management strategies, and quantify uncertainty in model projections. Their focus was on three key fisheries, Pacific sardine, swordfish, and albacore tuna, in the California Current System. In general, their results indicate that all three species will likely shift their distributions (predominantly poleward) in the future, which impacts accessibility to fishing fleets, spatial management, and quota allocation. Their broad aims is to (i) synthesize a large body of climate and fisheries research that has been conducted, and continues, under the Future Seas umbrella, and (ii) provide insight and recommendations to those pursuing similar efforts for other applications and in other regions. They describe the components of the modeling framework, considerations underlying choices made in model development, engagement with stakeholders, and key physical, ecological, and socio-economic results to date, including projections to 2100. For similar integrative climate-to-fisheries projections, they recommend attention is given to: recognizing potential biases arising from differences between the climate products used for ecological model fitting and those used for model projection; how sources of projection uncertainty are prioritized, incorporated, and communicated; and quantitatively linking scenarios – especially socio-economic scenarios – with climate and ecological projections.

Temperature-Dependence Assumptions Drive Projected Responses of Diverse Size-Based Food Webs to Warming

Reum et al. (2024) evaluated potential effects of warming temperatures on size-dependent processes, food intake, metabolism, and non-predation mortality in fishes using size-structured food web models that link physiological processes to population and community dynamics in different marine ecosystems. Higher food intake in warmed conditions increased total fish biomass, catches, and mean body weight; however, these effects were offset by the negative effects of warming on metabolism and mortality, which combined resulted in lower total biomasses and catches for most food webs. These effects were enhanced when warming increased metabolic rates more than food intake, and the outcomes were also sensitive to size dependency of temperature responses. Importantly, these general patterns were not uniform across all food webs—individual functional groups and fish species within food webs responded to warming in different ways depending on their position in the food web and its structure. Hence, caution is warranted when generalizing food web or species outcomes to warming because they are mediated by community interactions. Uncertainty related to temperature dependence and ecological interactions will impact food web projections and should be represented in climate change projections.

Impacts of Marine Heatwaves on Top Predator Distributions are Variable but Predictable

Welch et al. (2023) seeks to determine the effects of marine heatwaves on marine species, aiming to enhance proactive management strategies for coping with extreme and diverse weather events. Marine heatwaves cause widespread environmental, biological, and socio-economic impacts, placing them at the forefront of 21st-century management challenges. However, heatwaves vary in intensity and evolution, and a paucity of information on how this variability impacts marine species limits our ability to proactively manage for these extreme events. The effects of four recent heatwaves (2014, 2015, 2019, 2020) in the Northeastern Pacific were modeled on the spatial distributions of 14 top predators, spanning several major guilds: sharks, tunas, seabirds, mammals, and turtles of ecological, cultural, and commercial importance. Predicted responses were highly variable across species and heatwaves, ranging from near total loss of habitat to a two-fold increase. Heatwaves rapidly altered political bio-geographies, with up to 10% of predicted habitat across all species shifting jurisdictions during individual heatwaves. The variability in predicted responses across species and heatwaves portends the need for novel management solutions that can rapidly respond to extreme climate events. As proof-ofconcept, Welch et al. (2023) developed an operational dynamic ocean management tool that predicts predator distributions and responses to extreme conditions in near real-time. These early warning systems would allow for proactive—as opposed to reactive—responses to new human-wildlife conflicts, changing marine resource availability, and emergent refugia caused by MHWs, allowing managers to plan ahead for a fundamentally dynamic world.

4. Other Highlighted Research

A Shallow Scattering Layer Structures the Energy Seascape of an Open Ocean Predator

Arostegui et al. (2023) uses data from archival tags deployed on albacore tuna (*Thunnus alalunga*), to assess how the bioenergetics of scattering layer forays vary across North Pacific biomes in order to better understand how predators achieve energy balance in the unproductive open ocean. The tag-measured depth and relative light levels allowed reconstruction of the subsurface light attenuation environment experienced by the predators, including increased attenuation putatively caused by chlorophyll maxima in the euphotic zone and scattering layers below. With a bioenergetics model of total metabolic rate as a function of vertical swimming speed and in situ water temperature, researchers estimated the energetic cost of deep diving to scattering layers across oligotrophic to mesotrophic and subtropical to temperate waters. In concert, these analyses helped assess how the specific scattering layer that a thermally limited predator targets may transition across oceanographic regimes with differing energy seascapes. This study shows that the mean metabolic cost rate of daytime deep foraging dives to scattering layers decreases as much as 26% from coastal to pelagic biomes. The more favorable energetics offshore are enabled by the addition of a shallow scattering layer that, if not present, would otherwise necessitate costlier dives to deeper layers. The unprecedented importance of this shallow scattering layer challenges assumptions that the globally ubiquitous primary deep scattering layer constitutes the only mesopelagic resource regularly targeted by apex predators.

Spatiotemporal variability of micronekton at two central North Pacific Fronts

Domokos et al. (2023) investigated the spatiotemporal variability of micronekton, forage for top predators, at the North Pacific Subtropical Frontal Zone (STFZ) where economically important fish and protected species seasonally aggregate. Oceanographic data were collected in situ to determine any effects of Subtropical Front and Transition Zone Chlorophyll Front on micronekton. An increase in micronekton biomass and change in composition was observed at the Subtropical Front while no significant effect in composition or biomass was linked to the Transition Zone Chlorophyll Front. Contrary to expectation, significantly higher relative micronekton biomass was associated with higher temperatures, the mechanisms of which still need to be determined.

Dynamic Human, Oceanographic, and Ecological Factors Mediate Transboundary Fishery Overlap Across the Pacific High Seas

Frawley et al. (2023) uses vessel tracking data, archival tags, observer records, and machine learning to examine inter- and intra-annual variability in fisheries overlap (2013–2020) of five pelagic longline fishing fleets with North Pacific albacore tuna (*Thunnus alalunga*, Scombridae) to better understand the oceanographic, ecological and socioeconomic factors mediating fishery overlap and interactions, and how these factors vary across expansive, open ocean habitats. Despite advances in fisheries monitoring and biologging technology, few attempts have been made to conduct integrated ecological analyses at basin scales relevant to pelagic fisheries and the highly migratory species they target. Although progressive declines in catch and biomass have been observed over the past several decades, the North Pacific albacore Pacific tuna stocks targeted by pelagic longlines are not currently listed as overfished or experiencing overfishing. This study finds that fishery overlap varies significantly across time and space as mediated by (1) differences in habitat preferences between juvenile and adult albacore; (2) variation of oceanographic features known to aggregate pelagic biomass; and (3) the different spatial niches targeted by shallow-set and deep-set longline fishing gear. These findings may have significant implications for stock assessment in this and other transboundary fishery systems, particularly the reliance on fishery-dependent data to index abundance. Additional consideration of how overlap, catchability, and size selectivity parameters vary over time and space may be required to ensure the development of robust, equitable, and climate-resilient harvest control rules.

Catch per unit effort modeling for stock assessment: A summary of good practices

Hoyle et al. (2024) provides advice on good practices for standardizing catch-per-unit-effort (CPUE) as stock assessment outcomes and management decisions can substantially change based on how CPUE is standardized. CPUE indices of relative abundance are especially important for fisheries where fishery-independent surveys are unavailable. Understanding the population and the fishery allows analysts to make the most appropriate decisions for standardizing CPUE. Advice is provided in 16 areas, focusing on decision points: fishery definitions, exploring and preparing data, misreporting, data aggregation, density and catchability covariates, environmental variables, combining CPUE and survey data, analysis tools, spatial considerations, setting up and predicting from the model, uncertainty estimation, error distributions, model diagnostics, model selection, multispecies targeting, and using CPUE in stock assessments.

Reproductive Dynamics of Striped Marlin (*Kajikia audax*) in the Central North Pacific

Humphreys and Brodziak (2024) performed histological analysis of striped marlin gonads collected from the Hawaii longline fishery to develop new maturity estimates and determine the spawning season for striped marlin in the central North Pacific Ocean. Length distributions and sex ratios were determined to be seasonally dynamic around Hawaii, differing from other Pacific regions with females spawning between May and July and males capable of spawning yearround. Length-at-maturity estimates were lower than other Pacific regions with length (eye-fork length) at 50% maturity estimates for females of 152 cm and for males of 109 cm. These data will improve determinations of stock resilience and productivity in international assessments.

Vertebral Chemistry Distinguishes Nursery Habitats of Juvenile Shortfin Mako in the Eastern North Pacific Ocean

LaFreniere et al. (2023) opportunistically sampled vertebrae from juvenile Shortfin Mako (*Isurus oxyrinchus)* to gain deeper insights into essential habitats and the contribution of nursery areas to adult populations. Shortfin Mako (*Isurus oxyrinchus*) are ecologically and economically important predators throughout the global oceans. The eastern North Pacific Ocean contains several coastal nurseries for this species, where juveniles can forage and grow until venturing into offshore pelagic habitats. Male and female juvenile Shortfin Mako samples (65.5–134.4 cm total length, neonate to age 2) were sourced from two distinct nurseries in the eastern North Pacific: the Southern California Bight (n = 12), USA, and Bahía Sebastián Vizcaíno (n = 11), Mexico. Mineralized vertebral cartilage was analyzed to determine concentrations of selected elements (Li, Mg, Mn, Zn, Sr, Ba, standardized to Ca) using laser ablation inductively coupled plasma mass spectrometry, targeting growth bands at specific life stages, including postparturition at the birth band and the recent life history of the individual at the vertebral edge. Comparing the vertebral core revealed significant differences between the two nursery grounds in Zn:Ca, Sr:Ca, and Ba:Ca. These differences are likely associated with factors such as temperature and water chemistry. Comparing the core with the recent history edge revealed variability across ontogeny in Li:Ca, Mg:Ca, and Zn:Ca which could relate to regional differences and/or developmental shifts in mineralization. Understanding what drives element variations in vertebrae is likely complicated but will further efforts to use elements as a tool in species management. The ability to determine the origin of highly migratory species allows fishery managers to better understand essential habitat and how nursery habitats contribute to adult populations.

Feeding Ecology of Broadbill Swordfish (*Xiphias gladius*) in the California Current

Preti et al (2023) analyzes the relative importance of different prey types and dietary variation inter-annually, by sub-period (within years), by area, in relation to body size, and sea surface temperature, in order to expand the knowledge of swordfish feeding ecology in the CCLME and inform the development of alternative approaches to better manage this economically and ecologically important species. This study describes the feeding ecology of broadbill swordfish (*Xiphias gladius*) in the California Current based on the analysis of stomach contents collected by fishery observers aboard commercial drift gillnet boats from 2007 to 2014. Prey were identified to the lowest taxonomic level and diet composition was analyzed using univariate and multivariate methods. Of 299 swordfish sampled (74 to 245 cm eye-to-fork length), 292 non-empty stomachs contained remains from 60 prey taxa. Genetic analyses were used to identify prey that could not be identified visually. Diet consisted mainly of cephalopods but also included epipelagic and mesopelagic teleosts. Jumbo squid (*Dosidicus gigas*) and *Gonatopsis borealis* were the most important prey based on the geometric index of importance. Swordfish diet varied with body size, location and year. Jumbo squid, *Gonatus* spp. and Pacific hake (*Merluccius productus*) were more important for larger swordfish, reflecting the ability of larger specimens to catch large prey. Jumbo squid, *Gonatus* spp. and market squid (*Doryteuthis opalescens*) were more important in inshore waters, while G. borealis and Pacific hake predominated offshore. Jumbo squid was more important in 2007–2010 than in 2011–2014, with Pacific hake being the most important prey item in the latter period. Diet variation by area and year probably reflects differences in swordfish preference, prey availability, prey distribution, and prey abundance. The range expansion of jumbo squid that occurred during the first decade of this century may particularly explain their prominence in swordfish diet during 2007–2010. Some factors (swordfish size, area, time period, sea surface temperature) that may influence dietary variation in swordfish were identified. Standardizing methods could make future studies more comparable for conservation monitoring purposes.

Insights into vertebral band pair deposition rate in the juvenile common thresher shark (*Alopias vulpinus*) in the northeastern Pacific Ocean

Spear et al. (2024) present a validation study of the vertebral band pair deposition rate for juvenile common thresher sharks *Alopias vulpinus* in the northeastern Pacific Ocean (NEPO) using tag and recapture with oxytetracycline (OTC) injection in an essential step to accurately estimate age using band pair counting techniques. A total of 14 juvenile *A. vulpinus* marked with OTC from 1998 through 2013 were recaptured with times at liberty ranging from 1.08 to 3.81 years with an average of 2.14 years (±0.97 years standard deviation, SD). Shark size ranged from 80 to 128 cm fork length (LF) at the time of OTC injection and from 112 to 168 cm LF for those measured at recapture. The slopes of the relationships between band pairs post OTC and years at liberty for each reader ranged from 0.84 to 0.95, slightly lower than the 1.0 slope expected from annual band pair formation. These findings preliminarily support previous age and growth assumptions based on a one-band pair per year deposition rate. However, high variation in band pair deposition rates between samples, coupled with regression slopes falling just under one band pair per year, indicates that further investigation is needed to refine band pair deposition rate estimates.

5. Relevant NOAA Fisheries Publications from the Past Year

Peer-Reviewed Publications

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6. FIGURES

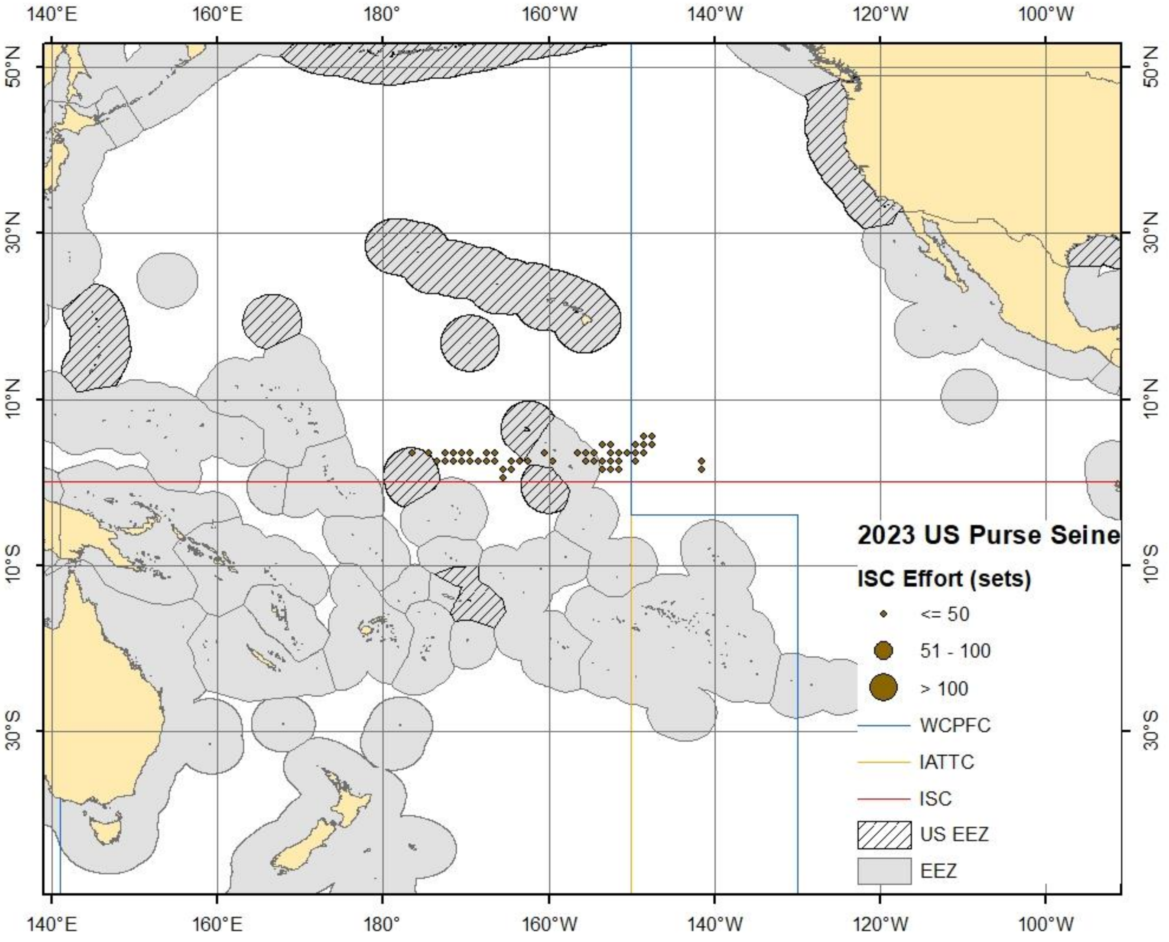


Figure 1. Spatial distribution of reported logbook fishing effort by the U.S. Western Pacific purse seine fishery. Effort in some areas is not shown in order to preserve data confidentiality.

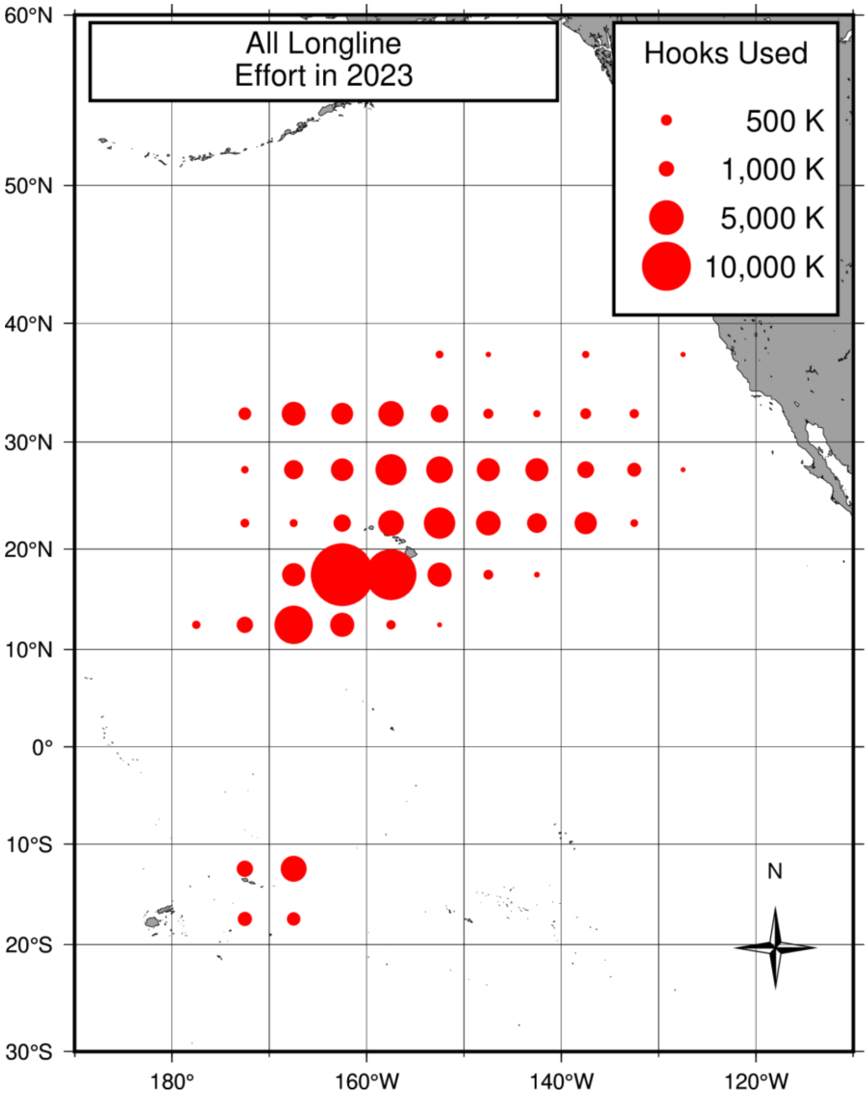


Figure 2. Spatial distribution of U.S. longline fisheries in the Pacific Ocean in 2023 (based on fisher reports in federal logbooks). Data are based on fisher reports in federal logbooks. Effort in some areas is not shown in order to preserve data confidentiality.

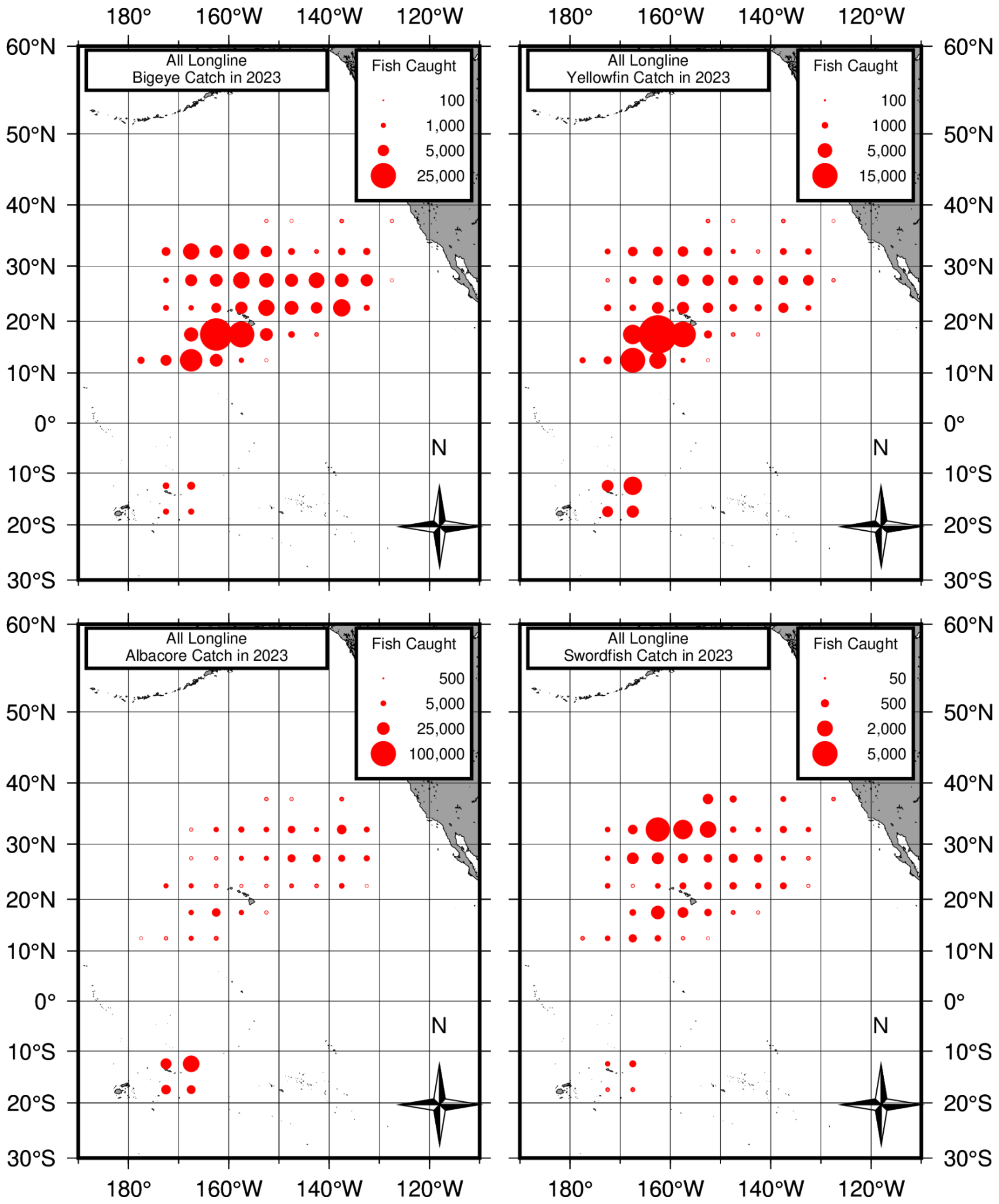
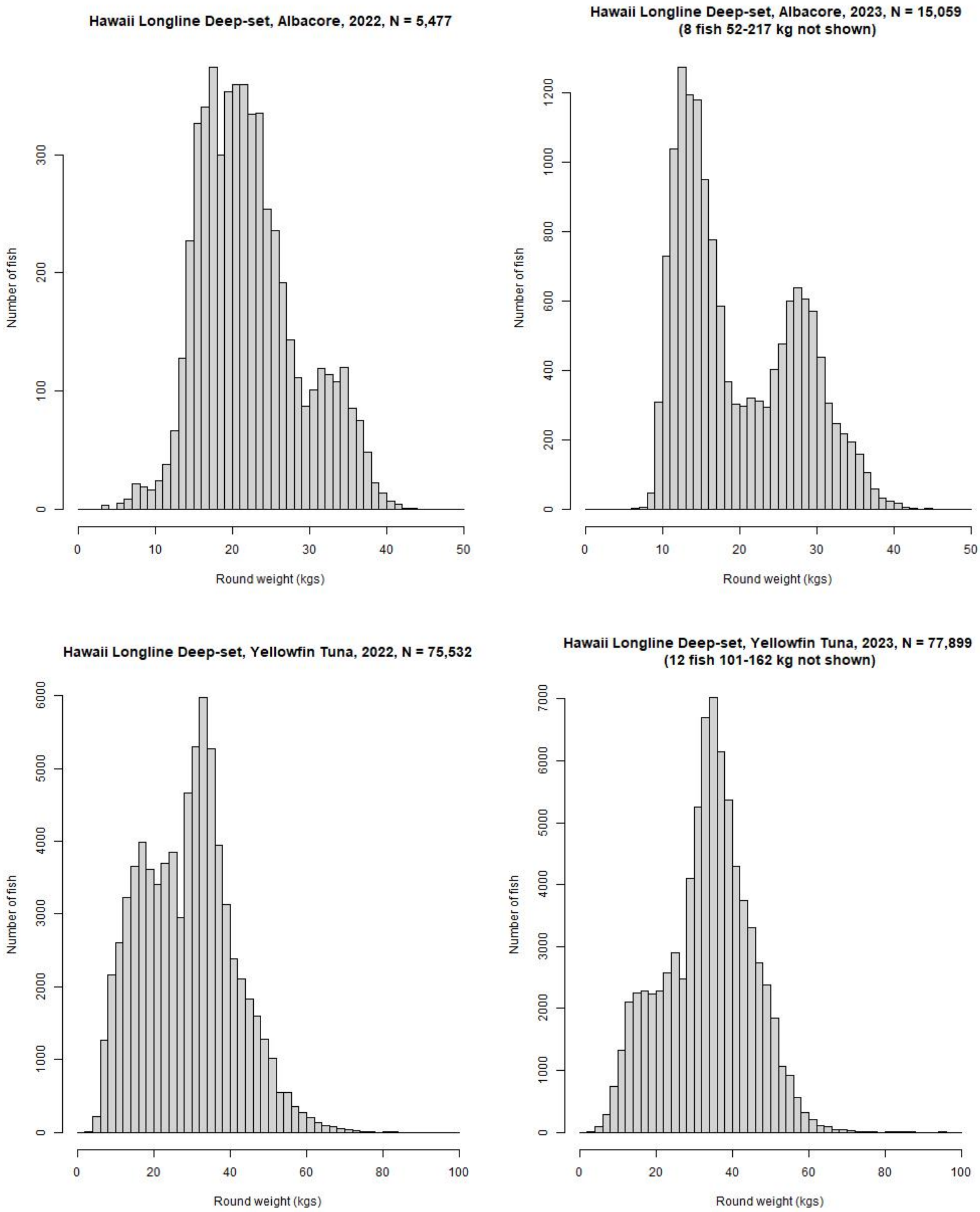


Figure 3. Spatial distribution of U.S. longline fisheries retained catch in the Pacific Ocean in 2023 for bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*), albacore tuna (*Thunnus alalunga*), and swordfish (*Xiphias gladius*). Data are based on fisher reports in federal logbooks. Effort in some areas is not shown in order to preserve data confidentiality.



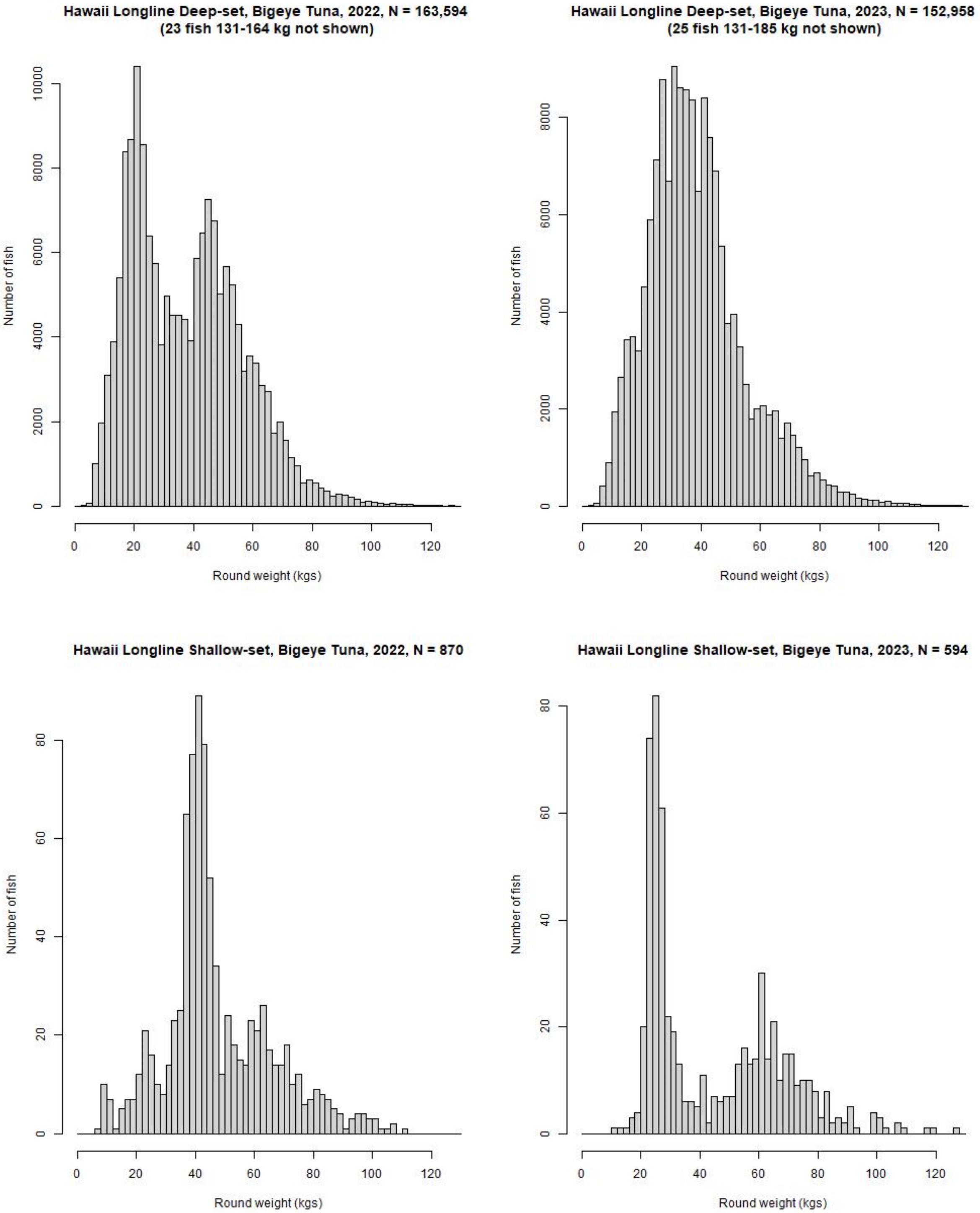
Hawaii Longline Deep-set, Albacore, 2022, N = 5,477

Hawaii Longline Deep-set, Albacore, 2023, N = 15,059
(8 fish 52-217 kg not shown)

Hawaii Longline Deep-set, Yellowfin Tuna, 2022, N = 75,532

Hawaii Longline Deep-set, Yellowfin Tuna, 2023, N = 77,899
(12 fish 101-162 kg not shown)

Figure 4. Size distribution landed catch of (top) albacore tuna (*Thunnus alalunga*) and (bottom) yellowfin tuna (*T. albacares*) caught by Hawaii-based deep-set longline fishery in 2022–2023.

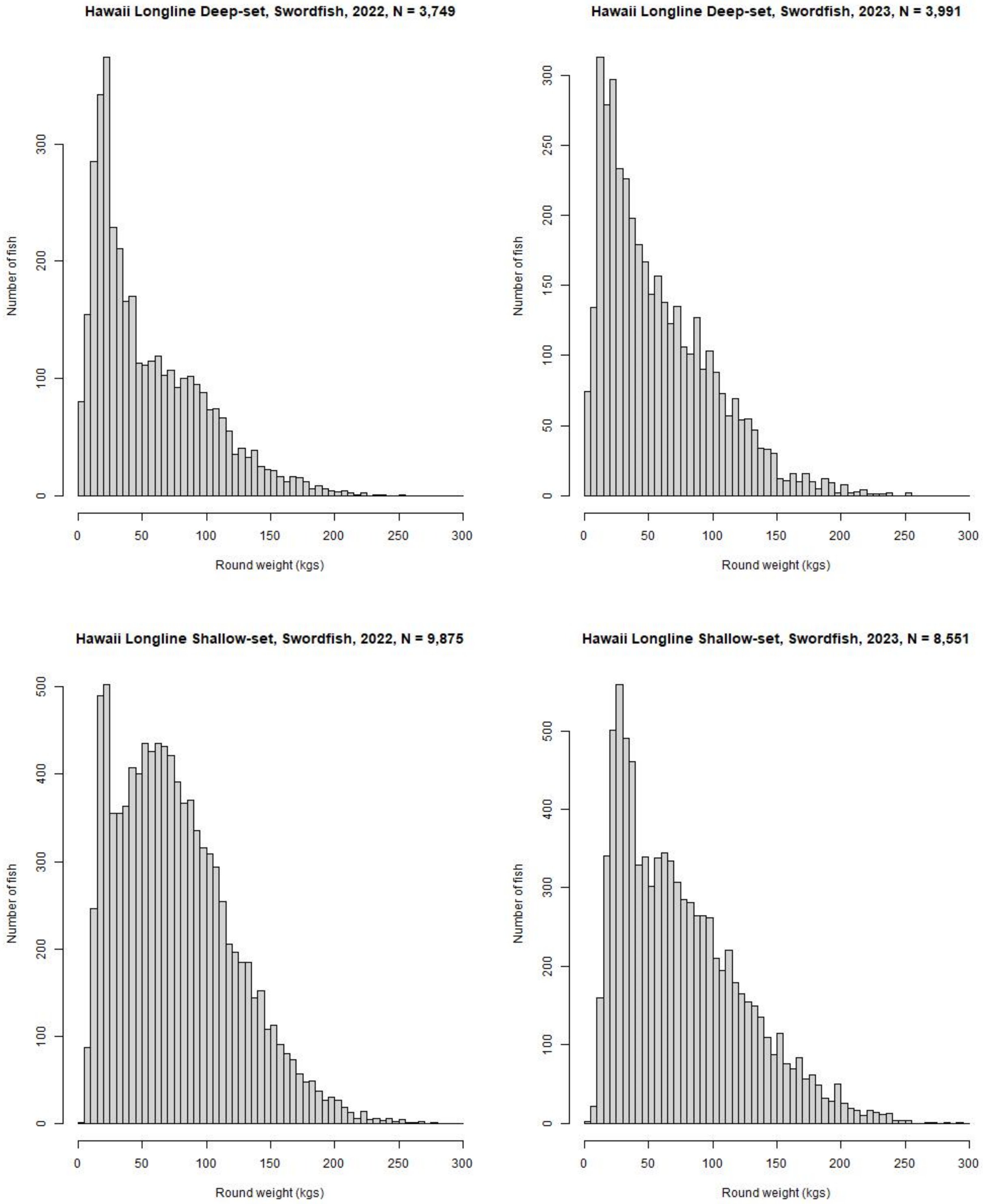

Hawaii Longline Deep-set, Bigeye Tuna, 2022, N = 163,594
(23 fish 131-164 kg not shown)

Hawaii Longline Deep-set, Bigeye Tuna, 2023, N = 152,958
(25 fish 131-185 kg not shown)

Hawaii Longline Shallow-set, Bigeye Tuna, 2022, N = 870

Hawaii Longline Shallow-set, Bigeye Tuna, 2023, N = 594

Figure 5. Size distribution of landed catch of (top) bigeye tuna (*T. obesus*) caught in the Hawaii-based (top) deep-set and (bottom) shallow-set longline fisheries in 2022–2023.



Hawaii Longline Deep-set, Swordfish, 2022, N = 3,749

Hawaii Longline Deep-set, Swordfish, 2023, N = 3,991

Hawaii Longline Shallow-set, Swordfish, 2022, N = 9,875

Hawaii Longline Shallow-set, Swordfish, 2023, N = 8,551

Figure 6. Size distribution of landed catch of swordfish (*Xiphias gladius*) caught in the Hawaii-based (top) deep-set and (bottom) shallow-set longline fisheries in 2022–2023.

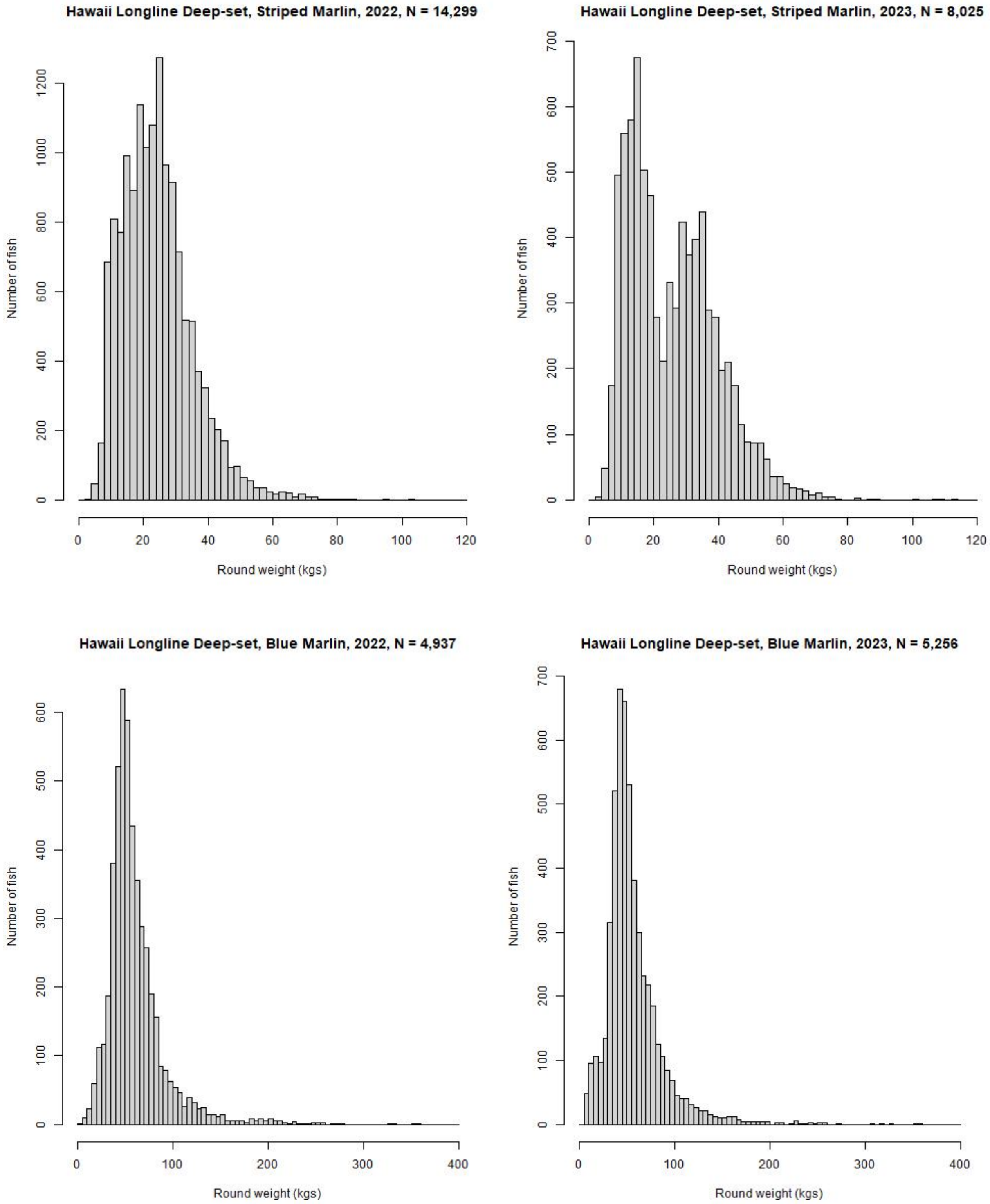


Figure 7. Size distribution of landed catch of (top) striped marlin (*Tetrapturus audax*), and (bottom) blue marlin (*Makaira nigricans*) caught by the Hawaii-based deep-set longline fishery in 2022–2023.

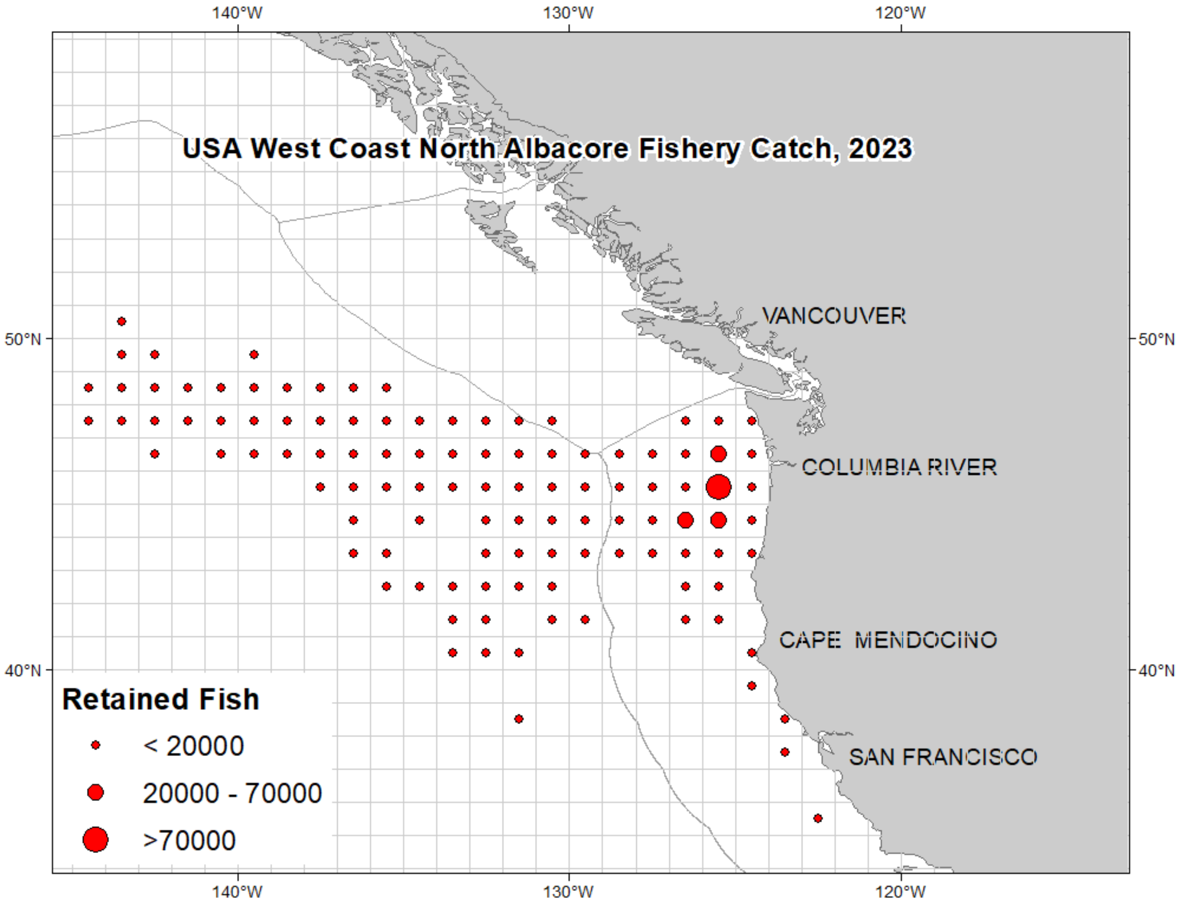


Figure 8. Spatial distribution of reported logbook catch by the 2023 U.S.A albacore troll and pole-and-line fishery in number of fish. The size of the circles is proportional to the amount of catch. Some catch areas are not shown to preserve data confidentiality.

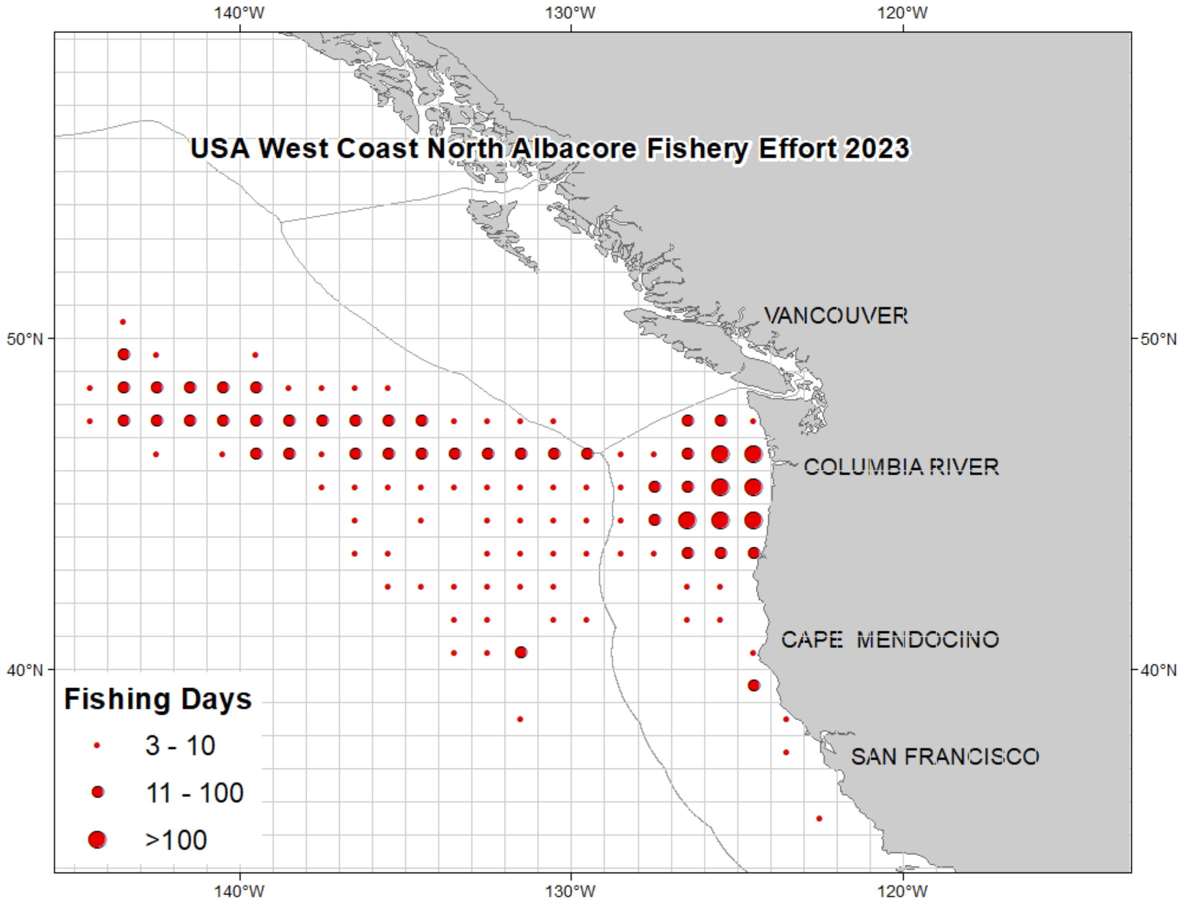


Figure 9. Spatial distribution of reported logbook fishing effort by the 2023 U.S. albacore troll and pole-and-line fishery in vessel days. The size of circles is proportional to the amount of effort. Some effort areas are not shown to preserve data confidentiality.

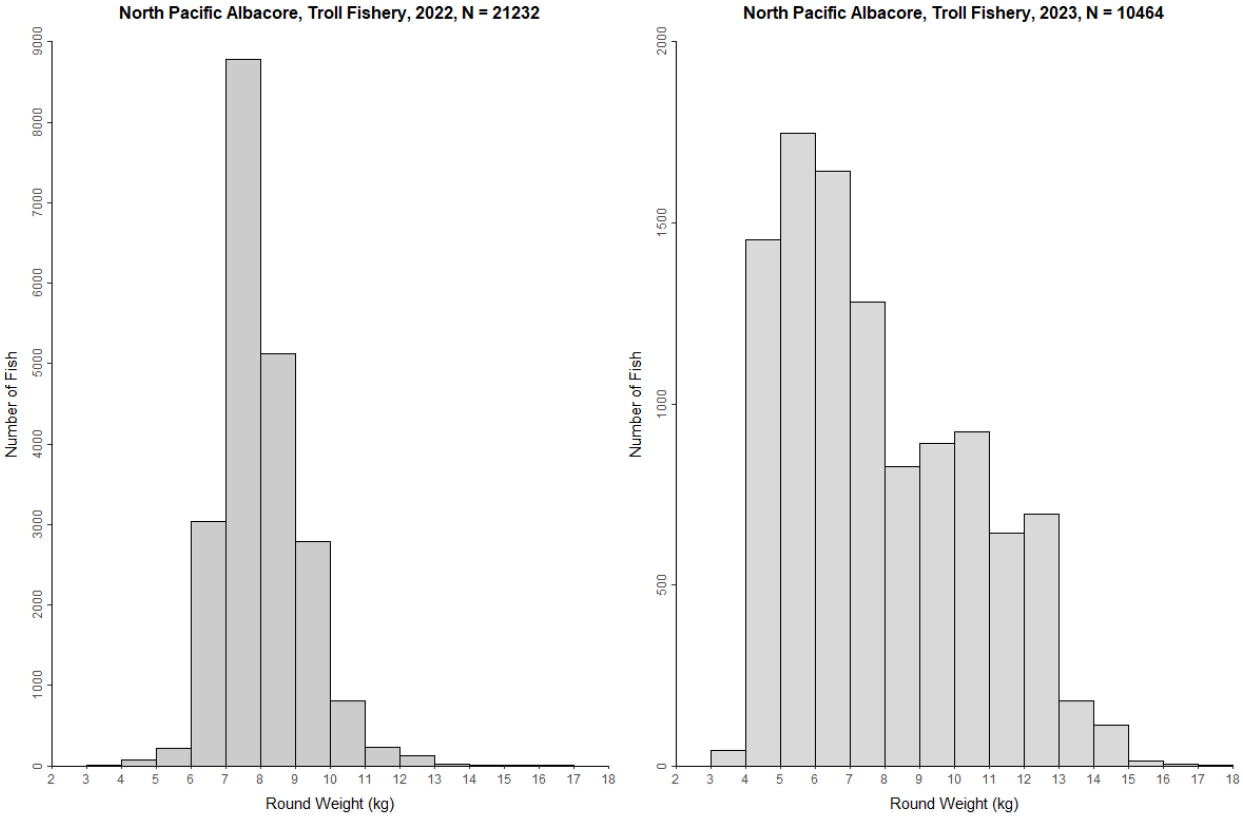
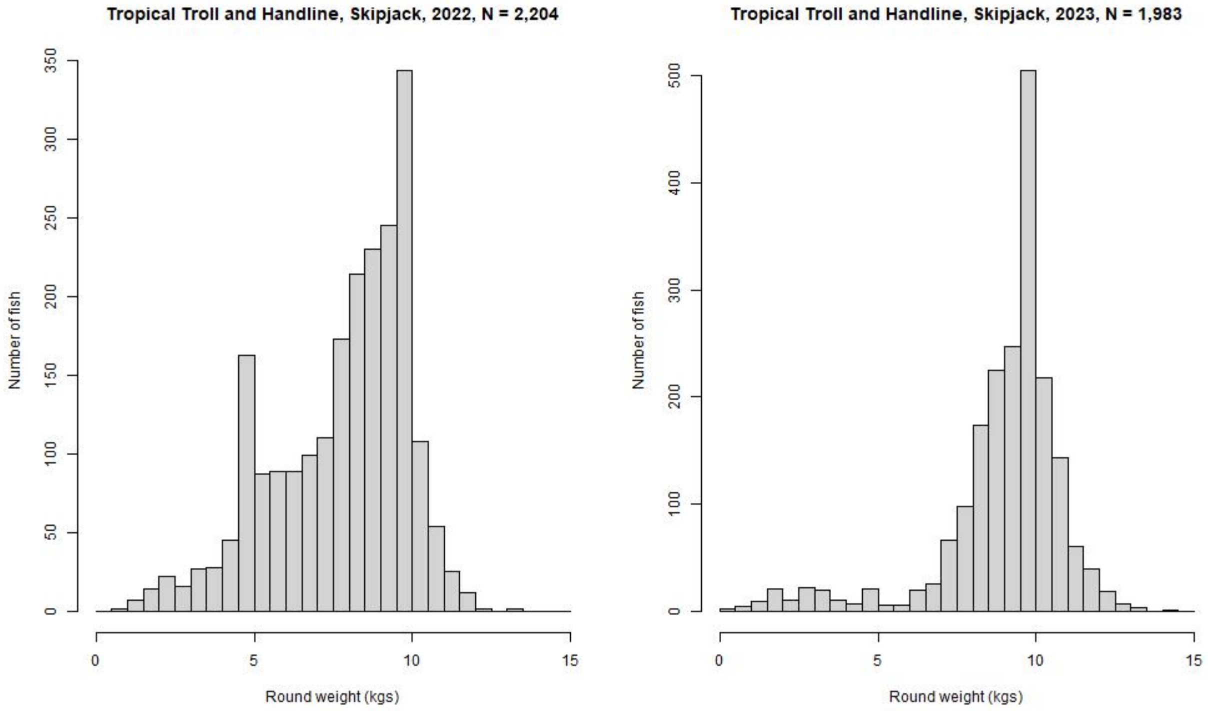
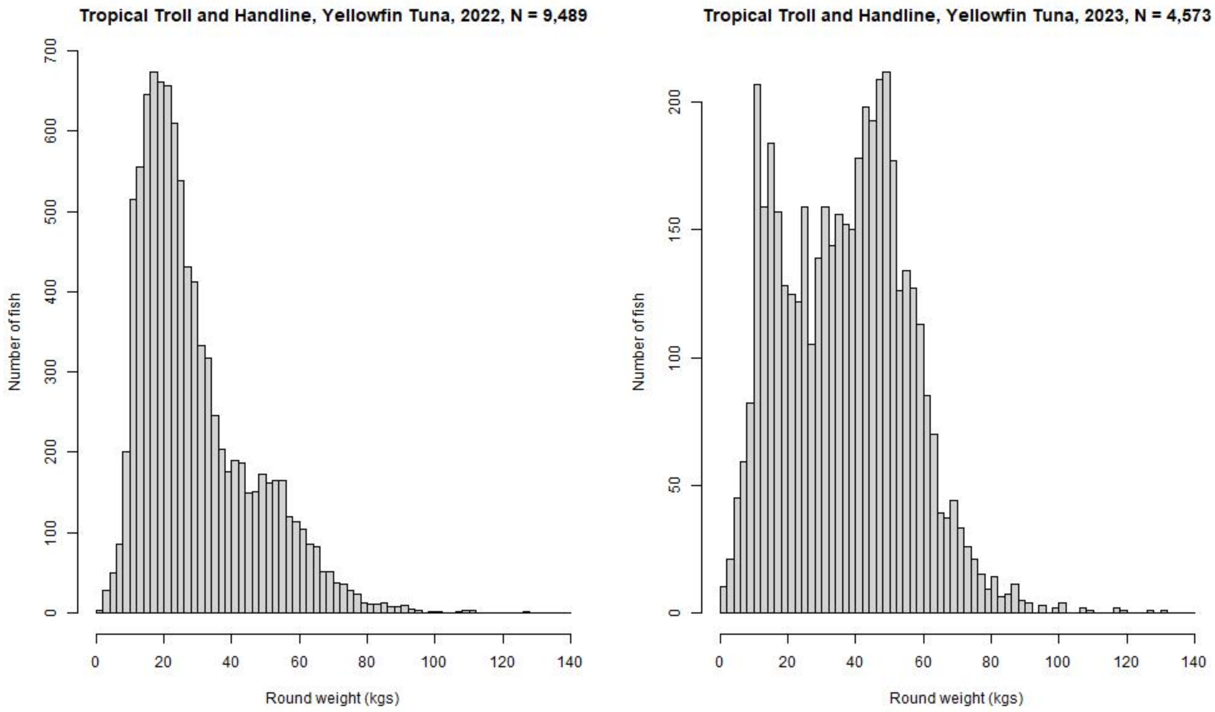


Figure 10. Size distribution of albacore (*Thunnus alalunga*) caught in 2022–2023 in the U.S. albacore troll and pole-and-line fishery.


Tropical Troll and Handline, Skipjack, 2022, N = 2,204

Tropical Troll and Handline, Skipjack, 2023, N = 1,983

Figure 11. Size distribution of landed catch of skipjack tuna (*Katsuwonus pelamis*) caught by the Hawaii troll and handline fisheries in 2022–2023.


Tropical Troll and Handline, Yellowfin Tuna, 2022, N = 9,489

Tropical Troll and Handline, Yellowfin Tuna, 2023, N = 4,573

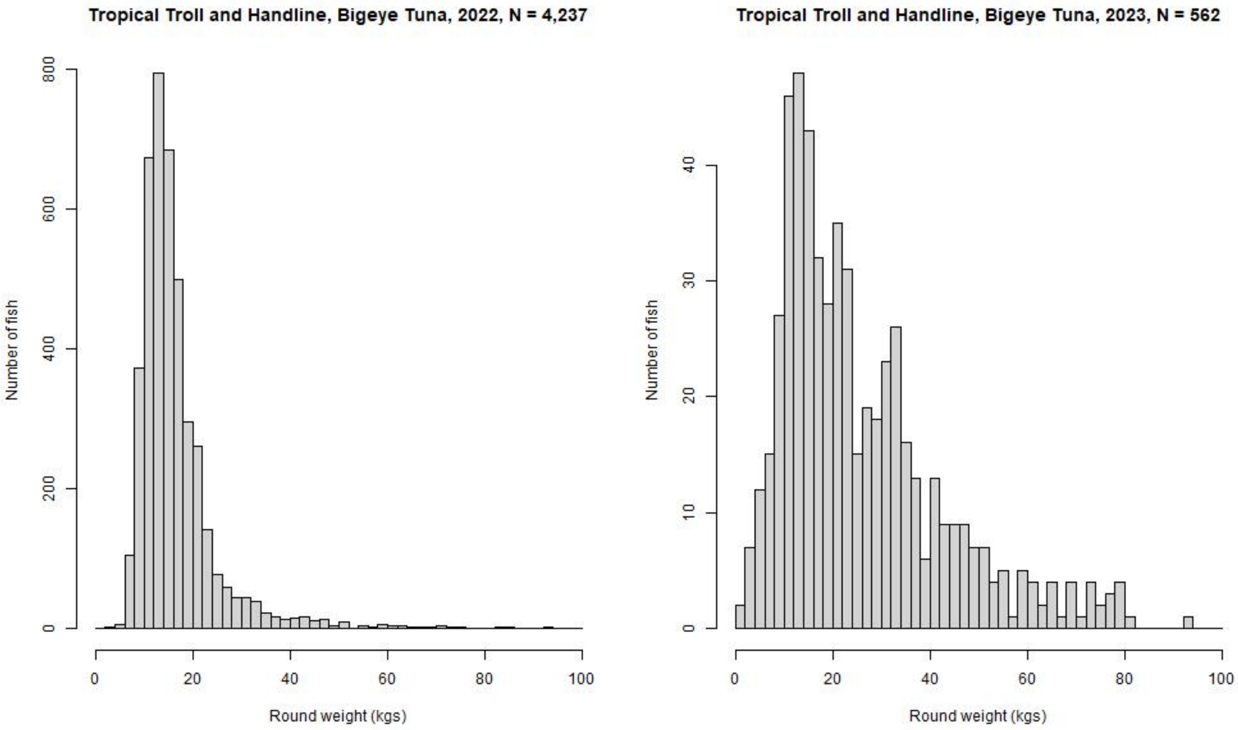


Figure 12. Size distribution of landed catch of (top) yellowfin tuna (*T. albacares*) and (bottom) bigeye tuna (*T. obesus*) caught by the Hawaii troll and handline fisheries in 2022–2023.

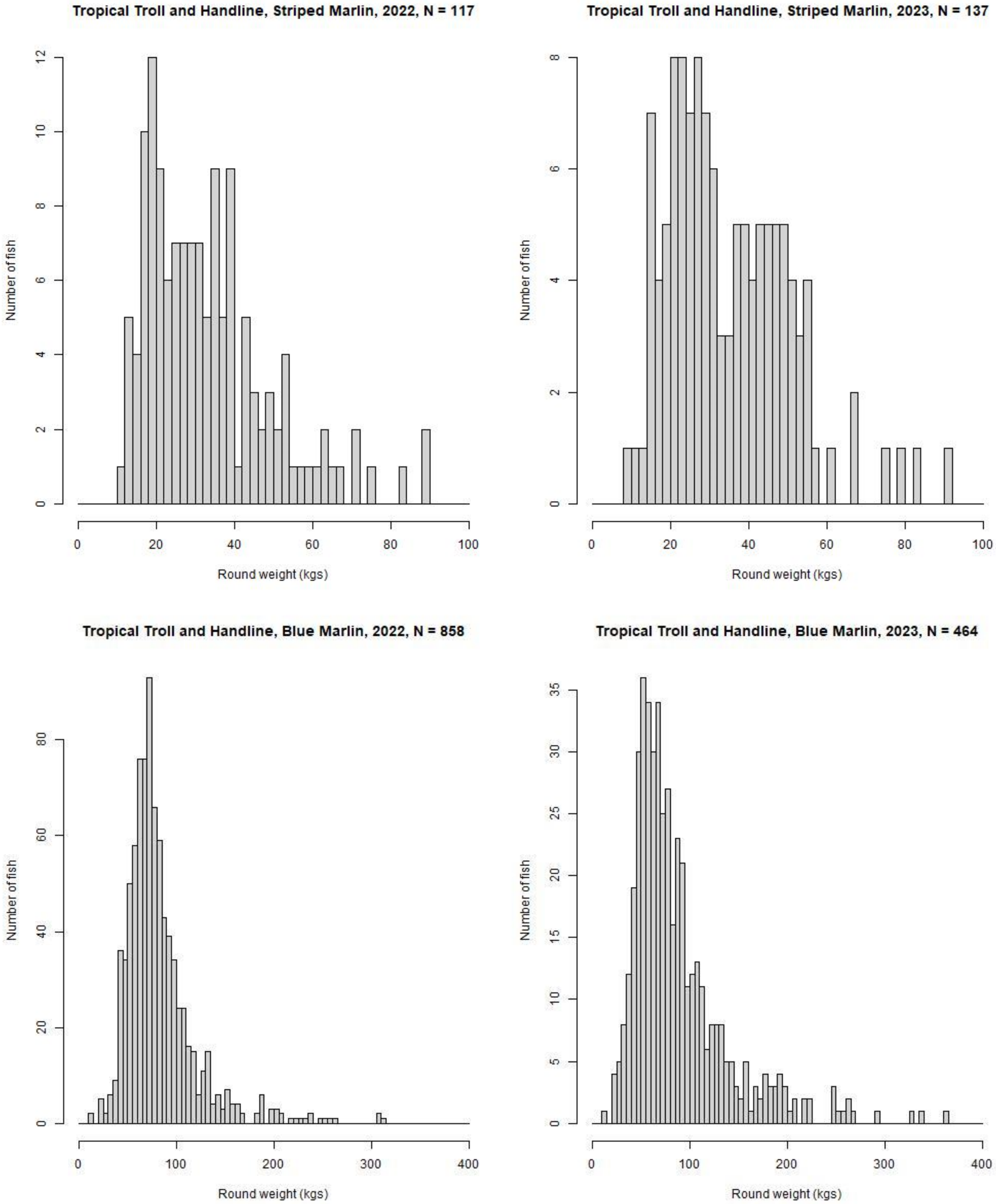


Figure 13. Size distribution of landed catch of (top) striped marlin (*Tetrapturus audax*) and (bottom) blue marlin (*Makaira nigricans*) caught by the Hawaii troll and handline fisheries, 2022–2023.

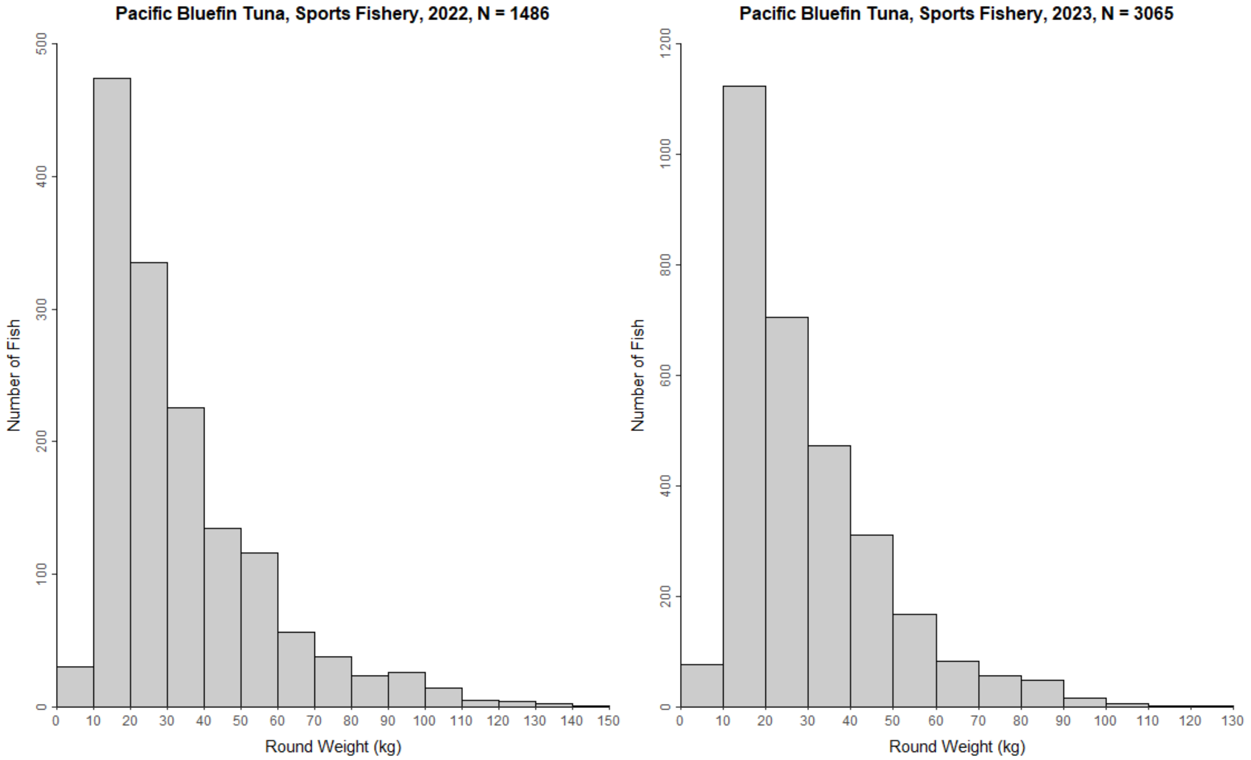


Figure 14. Size distribution of Pacific Bluefin Tuna (*Thunnus orientalis*) caught in 2022–2023 in the U.S. West Coast sportfishing industry.

7. Tables

Table 1. Number of vessels fishing in the North Pacific Ocean in various U.S. fisheries. Data for 2023 are peliminary. -- indicates data are not available

	Purse Seine	Longline	Albacore Troll and Pole-and-Line	Tropical Pole and	Tropical Troll (2)	Tropical Handline	Gillnet	Harpoon	Surface Hook
1985	53	36	792	27			210	99	
1986	51	39	419	19			220	113	
1987	47	37	486	18	1,899		210	98	
1988	74	50	531	17	1,878		192	83	
1989	73	88	338	18	2,002		158	44	
1990	71	138	368	12	2,042		146	49	
1991	59	141	172	12	2,117		123	32	
1992	72	124	602	11	2,160		113	48	
1993	68	122	608	13	2,132		105	44	
1994	72	127	721	11	2,210		112	49	
1995	65	116	471	11	2,387		127	39	
1996	61	114	676	9	2,411		100	30	
1997	68	117	1,172	9	2,400		104	31	
1998	68	122	841	9	2,370		87	26	
1999	42	140	776	9	2,502		78	30	
2000	40	130	645	7	2,229		77	26	
2001	43	125	860	9	2,208		64	23	
2002	31	123	644	13	2,045		45	29	
2003	29	128	729	14	1,960		37	34	
2004	28	126	695	11	2,012		33	29	
2005	23	126	541	10	1,917		37	24	
2006	11	128	601	11	1,916		45	24	
2007	22	130	676	3	1,869	424	49	28	
2008	36	130	525	3	1,978	475	51	32	
2009	46	128	687	6	2,083	552	35	28	
2010	37	125	635	2	2,042	480	26	26	
2011	39	129	656	2	2,100	508	22	17	
2012	40	129	841	1	2,084	576	17	10	
2013	40	136	703	2	2,185	534	18	13	
2014	46	141	615	2	2,115	499	20	15	81
2015	44	143	574	2	1,957	478	19	15	123
2016	41	141	568	2	1,915	475	21	23	89
2017	41	145	517	2	1,866	494	18	21	82
2018	46	143	452	2	1,840	429	21	14	98
2019	41	149	555	2	1,810	445	15	16	101
2020	35	147	404	2	1,661	398	12	17	128
2021	19	146	312	2	1,818	389	7	11	157
2022	23	147	433	2	1,714	435	7	17	223
2023	21	150	319	2	1,694	375	6	18	194

(1) Number of Purse Seine vessels include vessels from the WCPO and EPO fleets

(2) Number of tropical troll vessels for 1987-2006 include tropical handline vessels

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 2023 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,

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL 5	ALV 6	PTH	BTH	SMA 6	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		4,658	62,904	1,988													69,550
2014	0	6,624	57,474	855	401		0	1		0							65,355
2015		10,501	42,658	752	86			0		2							53,999
2016		6,462	52,859	1,663	316			0		1							61,301
2017		10,673	45,964	3,435	466			3									60,541
2018		10,112	55,662	5,269	12			2									71,057
2019		10035	62460	3135	226	1	0	3	0	0	0						75,860
2020		8081	49445	6379	116	0	0	3	0	0	0						64,024
2021		2961	34994	4734	43	0	0	2	0	0	0						42,734
2022		3376	27487	6015	198	0	0	1	1	0	0						37,078
2023		5475	16286	5012	3	0	0	2	0	0	0						26,778
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	6,493	1	0	1,270	406	398	227	6			52	1	0	10,141
2014	208	658	187	7,131	0		1,665	535	426	238	7			53			11,108
2015	243	921	212	8,774	0	0	1,516	631	493	279	7			59			13,135
2016	248	1,512	240	8,229	0	0	1,092	554	390	361	4			70	0	0	12,701
2017	95	2,594	221	7,993	1	0	1,618	687	406	1				71	0	0	13,687
2018	87	2,500	150	7,591	1	0	1,052	664	465	1				60	0		12,571
2019	104	2029	261	7691	2	0	734	901	545	1				47	0		12,315
2020	147	1732	168	7441	2	0	543	531	336	2				16	0		10,918
2021	226	2500	153	7041	1	0	684	382	247	1				5	0		11,240
2022	201	2426	103	6386	1	0	928	445	283	0				2	0		10,775
2023	505	2794	62	6401	2	0	856	338	195	5				2	0		11,160

Table 2. Continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL	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	13,398	0			0												13,398
2015	11,595		0											0		0	11,595
2016	10,777				0												10,777
2017	7,431	0	0		0									0			7,431
2018	7,728		0		0									0			7,728
2019	7744				0									0			7,744
2020	7509				0									0			7,509
2021	4210	0	2		0												4,212
2022	8441	0			0									0			8,441
2023	3161		0		0									0			3,161
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																	-
2015																	-
2016																	-
2017																	-
2018																	-
2019																	-
2020																	-
2021																	
2022																	-
2023																	-

Table 2. Continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL 5	ALV 6	PTH	BTH	SMA 6	BSH	SKH	TOTAL
Tropical Troll																	
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	579	364	143		14	1	159	12	12	1					1	1,289
2015	2	556	398	59		15	1	196	11	17						1	1,256
2016	1	531	402	34		5		161	12	20						1	1,167
2017		466	389	37		16		155	6							1	1,070
2018	1	594	531	27		5	1	166	12					0		1	1,338
2019	1	455	478	35		3	0	176	13							0	1,161
2020	0	332	345	18		1	0	111	10							0	817
2021	1	386	510	13		3	0	128	8							0	1,049
2022	1	370	353	13		2	0	117	9							0	865

2023	0	312	366	5		2	0	94	6							0	785
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	385	8	206		2	7	4									661
2015	62	401	5	202		1	5	3			1						680
2016	24	269	5	183		2	4	2						1			490
2017	35	400	6	106		2	6	4	0	0							559
2018	20	340	5	117		1	3	3									489
2019	10	249	9	226		1	3	5									503
2020	3	243	5	145		1	2	3									402
2021	5	277	4	123		1	1	3									414
2022	5	425	5	239		1	1	3									679
2023	5	249	8	132		1	1	3	0								399

Table 2. Continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL	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		0	0	5		127				26	6	1	7			171
2015	1	1	0		4		99				31	2	0	7			145
2016	1	0	0		9	0	173				28	0	1	12		0	225
2017	0	1	0	0	1		179				42	4	1	13		0	241
2018		0	1		18		148				26	0	1	11		0	205
2019		0	0		10		52				25	4	0	7			98
2020					28		35				31			3			97
2021			0		55		14				3			5			77
2022	1	0			20		29				30			2			82
2023		0	0	0	16		37				15		0	6			74
Harpoon		0	0	0	16		37				15		0	6			
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							6							0			7
2015							5				0						5
2016							25							0			26
2017							28							0			28
2018							10				0						10
2019							11										11
2020							6							1			7
2021							7							0			7
2022							32										32
2023							36				0						36

Table 2. Continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL	ALV	PTH	BTH	SMA	BSH	SKH	TOTAL
Surface Hook and Line 3																	
1985																	-
1986																	-
1987																	-
1988																	-
1989																	-
1990																	-
1991																	-
1992																	-
1993																	-
1994																	-
1995																	-
1996																	-
1997																	-
1998																	-

1999																-
2000																-
2001																-
2002																-
2003																-
2004																-
2005																-
2006																-
2007																-
2008																-
2009																-
2010																-
2011																-
2012																-
2013																-
2014		8	0		2	0	0				2			3			16
2015		15	1		7	0	1				2			1			27
2016		5	0		31		11				5			1			52
2017		4	0		18	0	1				5			1			29
2018		5	1		31		0				1			1			39
2019		6	0		36		1				1			1			45
2020		6	0		87		1				1			1			96
2021		0	1	0	116		2				0			1			120
2022		3		0	149	0	2				0			1	0		155
2023		44		1	162		1				1			1			210
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	1,042				420						1				0		1,463
2015	932				399						1				0		1,331
2016	675				368						2			0	0		1,045
2017	372				451						1						824
2018	381				513						1						895
2019	1364				483						1			0	0		1,848
2020	260				742										0		1,002
2021	248				1293						0						1,541
2022	587				1579						1				0		2,167
2023	568				1887										0		2,455

Table 2 continued.

FISHERY/YEAR	ALB	YFT	SKJ	BET	PBF	TUN	SWO	BUM	MLS	BIL	ALV	PTH	BTH	SMA	BSH	SKH	TOTAL
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		0	0		0		4				12			6	0		22
2015	2	1	0		0		13		0		24	0	1	4	0		46
2016	0	2	0	1	0	0	42				16	0	1	4	0		68
2017	14	0		5	0		44				19		1	5	1		89
2018			5		4		67				17			4	3		100
2019	4	0		1	1		186				31		0	19	14		256
2020	8	0	0		0		125				28	0	1	2	3		167
2021	64	0			4		53				28		0	2	2	0	153
2022	65	47	0	79	1	0	26				14		0	2	3		237
2023	10	44	1	156	2		30				15		0	6	2		266

1 Purse Seine catches include EPO and WCPO fisheries. Bluefin catches are from EPO only.

2 Longline includes American Samoa, Hawaii, and California fisheries.

3 Tropical troll 1985-2006 includes tropical handline catches

4 Other catches include incidental catches, non-HMS fisheries, and Buoy Gear Fishery

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

6 Thresher and mako shark catches are not reported at the species level in the Longline, Tropical Troll and Tropical Handline fisheries but are listed under ALV and SMA, respectively.

7 Sports catches includes Oregon and Washington only, except PBF catch