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NATIONAL REPORT OF JAPAN (JAPANESE TUNA AND TUNA-LIKE FISHERIES IN THE NORTH PACIFIC OCEAN IN 2021)[1]

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SUMMARY

Japanese tuna fisheries consist of the three major fisheries (i.e., longline, purse seine, and pole-and-line) and other miscellaneous fisheries like troll, driftnet, and setnet fisheries. This paper described the recent trend of the Japanese tuna fisheries in the North Pacific Ocean and updated the statistics given in the previous National Report for ISC21 (Matsubara et al., 2021). The total catch of tunas excluding skipjack caught by Japanese fisheries in the North Pacific Ocean was 166,340 metric ton (t) in 2020 and 185,242 t in 2021. The total catch of tunas including skipjack caught by Japanese fisheries in the North Pacific Ocean was 196,647 t in 2020 and 212,248 t in 2021. The total catch of swordfish and striped marlin was 7,519 t in 2020 and 4,113 t in 2021. In addition to fisheries description, a brief description was given on Japanese research activities in 2021 for tuna and tuna-like species in the Pacific Ocean.

1 TRENDS IN FLEET SIZE

Tables 1-A and B show the number of Japanese tuna fishing vessels engaged in fishing by type of fishery and by vessel size class during 1980-2006 (Ministry of Agriculture, Forestry and Fishery, MAFF 1982-2008) and 2006-2021. The number of active vessels during 2006-2021 was estimated based on logbook data. The coastal longline vessels less than 20 Gross Register Tonnage (GRT), which are regulated operating only within Japan’s Exclusive Economic Zone (EEZ), the research and training vessels of both longline and pole-and-line were not included in Table 1-B. The coastal longline vessels less than 20 GRT, which have no license of tuna fishing and are regulated operating only within Japan’s EEZ, were not included in Table 1-B. The research and training vessels of both longline and pole-and-line were not included in Table 1-B. The values of number of vessels in 2020 and 2021 were provisional in Table 1-B.

The total number of longline vessels showed a continuous declining trend since the early 1990s (Table 1-A). The number of longline vessels of the largest size class (> 200 GRT) was nearly constant in the period between the beginning of the 1980s and the mid-1990s. In accordance with the agreement of the Food and Agriculture Organization of the United Nations (FAO)’s international action plan on fishing capacity, the Japanese government implemented the fleet reduction program and decreased its large longline vessels by 20% in 1998. The number of longline vessels continued to decline thereafter. In 2009, the Japanese government implemented the second fleet reduction program for its fishery following the management measures adopted by the Western and Central Pacific Fisheries Commission (WCPFC). Recent declining trend for the fleet size larger than 50 GRT was remarkable. The number of vessels of 100-199 GRT was 15 in 2020 which is 29% of that in 2006, and the number of vessels of 50-99 GRT was 11 in 2020 which is 25% of that in 2006 (Table 1-B). This large reduction was mainly derived from high price of fuel especially since 2007 and the fleet reduction programs implemented twice by the Government of Japan. As for the fleet size under 50 GRT, the number of vessels for 20-49 GRT showed a sharp decline since the late 1980s whereas the number of vessels of smallest size class (< 20 GRT) fluctuated at around 700 during 1980-2006 (Table 1-A). The number of vessels of 10-49 GRT was relatively stable ranging between 270 and 290 during 2006-2011 and then decreased to 196 in 2021 (Table 1-B).

The total number of purse seine vessels was 52 in 2006, and it was nearly 80% of that in the 1980s (Table 1-A). After 2006, the total number of purse seine vessels fluctuated ranging between 62 and 75 until 2021. The purse seine vessels which are allowed to operate in the tropical waters are larger vessels (currently, 349 GRT or larger). The limitation of the number of such vessels has been 35 and has not changed since 1995.

The total number of pole-and-line vessels showed a continuous declining trend since 1980 (Tables 1-A and B). Suppose vessel size categories 20-49 GRT, 50-199 GRT, and over 200 GRT for 1980-2006 to compare with that for 2006-2021, the number of vessels for each category showed declining trend throughout the period (Table 1-A). The number of vessels both for 50-199 GRT and over 200 GRT showed declining trend throughout the period (Table 1-B). The number of vessels for 50-199 GRT was 34 in 2021 which is 41% of that in 2006. The number of vessels for over 200 GRT showed a declining trend until 2013, and then became stable until 2017, and then showed a declining trend again, was 21 in 2021, which is 70% of that in 2006.

2 CATCH AND EFFORT TRENDS OF THE MAJOR FISHERIES

2.1 Longline

Longline is classified by the type of license issued by the Government of Japan, i.e., coastal (< 20 GRT and can fish only in Japanese EEZ), small offshore (10-20 GRT), offshore (10-120 GRT), and distant water (> 120 GRT).

Annual distributions of fishing effort of longline in 2020 and 2021 are shown in Fig. 1. In those years, the fishing grounds were located in the east-west direction off Japan to Hawaii, the equatorial area between 15˚S and 15˚N, off Australia and off Peru. The fishing effort of the distant water and offshore longline remained stable at around 200 million hooks in the North Pacific in the 1980s, and then it decreased continuously to 100 million hooks in the early 2000s, and it had further decreased until 2009 (Fig. 2). After 2009, the amount of effort showed a trend of gradual decrease at a level of 35-50 million hooks.

Total catch of four tuna and four billfish species caught by distant water and offshore longline in the North Pacific has been decreased since the highest catch of 119,752 t in 1980 and was 10,261 t in 2020 which is 9% of that in 1980 (Fig. 2). Bigeye has been the dominant species in this fishery in the North Pacific. The bigeye catch, which was stable in the 1980s and about 50,000 t in the late 1980s, showed a declining trend since the 1990s, was less than 10,000 t since 2009, and was less than 5,000 since 2016. Yellowfin tuna catch ranged between 30,000 t and 50,000 t until the early 1980s. It had gradually decreased to less than 5,000 t in 2007. Albacore catch, which has fluctuated around 10,000 t until 2001, decreased to about 2,000-6,000 t and kept stable at a low level during the period 2003-2020.

2.2 Purse Seine

There are two types of Japanese purse seiners targeting tunas, i.e., single and group purse seine. Other than those, coastal purse seiner takes relatively small number of tunas as a by-catch. Historically, typical group seiner consists of one purse seiner, one searching vessel, and two carrier vessels, but the group seiner tended to reduce the number of vessels within each group to reduce a cost in recent years.

Fishing grounds of the purse seine were widely spreads ranging from 40˚N and 10˚S, from 120˚E to 180˚. The fishing grounds of north and south were separated by the zone from 15˚N and 25˚N (Fig. 3). The group seiner operates mainly in the temperate northwestern Pacific. The carrier holds fish in chilled water with ice and unloads those catches. Meanwhile, the single purse seiner (> 349 GRT) operates mainly in the tropical waters of the central and western Pacific, but a part of the vessels seasonally operates in the temperate waters.

The fishing effort and catch for the purse seine, excluding the coastal purse seine, in the North Pacific is shown in Fig. 4. The fishing effort was around 9,000 sets in the late 1980s, and then decreased to about 6,000 sets in 1998. The fishing effort generally stayed at the level about 4,000-6,000 sets in the last decade. The fishing effort in 2021 was provisional. The skipjack catch was dominant among species in this fishery, followed by yellowfin. The skipjack catch was about 150,000 t until 2008, and then decreased to 80,000 t in 2011. After 2011, the skipjack catch showed no clear trend between 80,000 t and 140,000 t. It may be exceptional in such stable situation after 2011 that the skipjack catch was 49,523 t in 2021, which correspond to the lowest level in the early 1980s.

2.3 Pole-and-line

The pole-and-line is composed of three distinct categories, i.e., coastal (< 20 GRT), offshore (10-120 GRT) and distant water (> 120 GRT) vessels in terms of the license of this fishery. Note that some of 19 GRT type vessels obtained offshore licenses since 2007, which are included in offshore category in this document. The pole-and-line can be categorized into large, middle, and small sized vessels which correspond to larger than 300 GRT, 20-300 GRT and less than 20 GRT in vessel size.

Fishing grounds of the pole-and-line were widely spread ranging from 45˚N and 10˚S, from 120˚E to 180˚. The fishing ground was rather sequential from north to south and was unlike that in the purse seine fishery. (Figs. 5). The middle-sized vessels generally operate in near shore waters of Japan and their trips are within 10 days. Southernmost fishing area for these vessels, in recent years, is near 15˚N, but the important fishing ground is waters north of 25˚N, around Japan and adjacent areas (Fig. 5). These vessels primarily fish skipjack and albacore from spring through autumn off the Pacific side of Japan, and harvest relatively small amount of yellowfin tuna and bigeye. They hold fish in cooled water and unload it as fresh fish. The activity of the small pole-and-line vessels is like that of the middle vessels but the area of fishing is limited within the Japanese EEZ, and the trip of these vessels is shorter. On the contrary, the large vessels tend to operate farther off waters from Japan and their trips last for two to three months. Usually, they primarily target for albacore from summer through autumn season in the waters north of 20˚N, and skipjack in winter and spring in the waters south of 20˚N (Fig. 5). These vessels equip a brine freezer, in which fish caught are immediately stored into a tank filled with cooled brine, and then unloads it as frozen fish.

Generally, fishing effort expressed by fishing days for offshore and distant water pole-and-line rapidly decreased from around 62,000 days in the early 1980s to around 20,000 days in 1994, increased to around 23,000 days in 2000, and then decreased to 7,268 days (preliminary) in 2021 (Fig. 6). Total catch of five tuna species for those fisheries rapidly decreased from around 280,000 t to around 170,000 t during the 1980s, and then gradually decreased from around 130,000 t to 60,000 t until the latest year (Fig. 6). Skipjack is a dominant species for this fishery, but the proportion of skipjack tended to decrease, from 87-78% in 1980-1986 to 87-50% in 2011-2021.

3 RECENT TRENDS FOR MAJOR SPECIES

3.1 Pacific Bluefin Tuna (Table 2-A)

Preliminary total catch of Pacific bluefin tuna (PBF) in 2021 was 8,374 t (Table 2-A), which are similar to the catch in 2020 (7,873 t). This was around the average level of past five years (2016-2020: 7,787 t). The annual catches of PBF by major fisheries in 2021 as follows; purse seine: 4,198 t, troll: 653 t, setnet: 1,642 t, longline: 1,436 t, and other fisheries: 445 t. Because of strict catch upper limit for PBF implemented since January 2015 in accordance with the WCPFC conservation and Management Measure, the annual catch since 2015 have been lower than those of the years before.

Although the most of fisheries have reduced or maintained their PBF catch since 2015, longline fishery has increased their PBF catch during the same period under the current management framework. This would not be either the failures in the fishing effort control or catch control, but the increase in the availability for this fleet (Tsukahara et al., 2021). Japanese longline fishery usually catches large adult PBF, which are about 200 cm FL (Fork Length), but the length composition in recent years showed multimodal distribution which has the several peaks for less than 200 cm FL (Fig. 7). The peaks found between 110 and 160 cm FLs in 2021 composition are corresponding to the recruitments occurred between 2016 and 2018, which were fully protected cohorts by the current management measures. Increase in PBF catch by longline and its size composition possibly indicate an influx of new migrants that are smaller in the observed size as the population rebuilds.

3.2 Albacore (Table 2-B)

Preliminary total catch of albacore in 2021 was 56,109 t, which was about same as the catch in 2020 (56,229 t) and was larger than the average of past five years (2016-2020: 37,545t). Albacore catch by the pole-and-line fluctuated largely but catch by longline did not show such fluctuations. Japanese pole-and-line fisheries target on both skipjack and albacore but particularly, large class pole-and-line vessels (> 200 GRT) primary target on albacore during summer. Recent 10 year’s catch by this fishery fluctuated largely between 4,700 t and 24,000 t. Preliminary albacore catch by longline in 2021 (12,535 t) was about same as the catch in 2020 (12,655 t). Size of albacore caught by the longline fisheries in 2021 was found from 59 cm to 126 cm FL, whereas much smaller individuals (FL: 43 to 94 cm) were caught by pole-and-line (Fig. 8).

3.3 Swordfish (Table 2-C)

Total swordfish catch in 2021 was 3,096 t which is 51.1% of the catches in 2020 (6,054 t). These statistics are preliminary and smaller than the average over the past five years (2017-2021: 5,107 t). Swordfish have been caught mainly by offshore and distant water longline, whose catch in 2021 was 1,831 t. The coastal longline catch in 2021 was 480 t. Length composition data was collected from longline fishery. The distribution range was approximately from 90 to 220 cm eye-fork length in 2020 and 2021 (Fig. 9).

3.4 Striped Marlin (Table 2-D)

The total striped-marlin catch in 2021 was 1,016 t which is 69.4 % of the catch in 2020 (1,465 t). These statistics are preliminary and smaller than the average over the past five years (2017-2021: 1,333 t). In recent years, Japanese pelagic fisheries catch striped marlin as bycatch except for coastal driftnet and part of other longline fisheries that target striped marlin seasonally. Length-composition data was collected from longline fishery. The distribution range was approximately from 100 to 180 cm eye-fork length in 2020 and 2021 (Fig. 10).

3.5 Blue Shark (Table 2-E)

ISC SHARK WG had conducted a benchmark stock assessment of blue shark in 2022. The catch for 2015-2020 was updated using the annual catch used in the stock assessment (Kai, 2021a; Kai and Yano, 2021a). A total catch of blue shark in 2020 was estimated at 8,252 t. The decreasing trends in total catch since 2016 was mainly due to continuous decline of the fishing effort for longline fisheries. In addition, the changes in the standardization method from GLM (generalized linear model) to GLMM (generalized linear mixed model) changed the catch rates of blue sharks for distant-water and offshore longline fisheries that resulted in the lower catches compared to the previous estimates.

3.6 Shortfin Mako (Table 2-F)

ISC SHARK WG had conducted an indicator-based analysis of shortfin mako shark in 2021. The annual catch for 2015-2020 of shortfin mako was updated using the similar approaches used in the indicator analysis (Kai, 2021b; Kai and Yano, 2021b). A total catch of shortfin mako in 2020 was estimated at 832 t. The decline of the catch in 2020 was due to the decline of catches for longline fisheries and large mesh driftnet fishery.

3.7 Others (Bigeye, Skipjack and Yellowfin Tunas) (Table 2-G, H and I)

Preliminary total catch of bigeye in 2021 was 6,027 t which corresponds to 41% of the catch in 2020 (14,548 t) and was lower than the average of past five years (2017-2021: 13,325 t). Total catch of bigeye by Japanese fisheries showed no clear trend in the last six years and longline has been the highest proportion among gears in the North Pacific.

Preliminary total catch of skipjack in 2021 was 114,732 t which corresponds to 8% increase of the catch in 2020 (87,671 t) and was lower than the average of past five years (2017-2021: 145,092 t). Most of skipjack was caught by pole-and-line and purse seine in the North Pacific Ocean. Total catch of skipjack by Japanese fisheries showed no clear trend in the last six years in the North Pacific Ocean. The lower total catch in 2020 and 2021 were due to lower catch by both pole-and-line and purse seine fisheries.

Preliminary total catch of yellowfin tuna in 2021 was 27,006 t which corresponds to 86% of the catch in 2020 (30,307 t) and was lower than the average of past five years (2017-2021: 38,477 t). The yellowfin tuna caught by purse seine has been the highest proportion among gears in the North Pacific Ocean. The lower total catch in 2021 were due to lower catch by the purse seine fisheries in the tropical waters in the North Pacific Ocean.

4 RESEARCH ACTIVITIES

The Fishery Agency of Japan, in cooperation with the Fisheries Resources Institute (FRI) and local prefectural fisheries experimental stations, has run the nationwide port sampling project for collection of catch, effort and size data of tunas, skipjack, billfishes, and sharks at the major landing ports since the early 1990s. The tagging studies using conventional, archival and popup have been conducted by research and training vessels as well as commercial vessels. In addition, there were cooperative works with prefectural fisheries experimental stations and universities. Several cooperative studies were also conducted with foreign countries.

4.1 Pacific Bluefin Tuna

4.1.1 Pacific Bluefin Tuna Larvae/Juveniles Research Cruise

Since 2011, larval and juvenile surveys have been conducted to estimate current main spawning area and period of PBF. In 2021, research cruises were designed to focus on ecological studies of larval/juvenile PBF by R/Vs Shunyo-Maru, Yoko-Maru, Hokko-Maru and four prefectural R/Vs. Surveys for larval/juvenile PBF were conducted in the south of Japan around Nansei Islands area, where is a major spawning ground of PBF, from May to August and also in the Sea of Japan, which is another spawning ground of PBF, from July to August. In addition to these two spawning grounds, the survey was conducted in Joban area in the coastal area of northeastern Japan in July and August. In 2021, over 1,000 of PBF larvae were captured in the spawning grounds. Small juveniles of PBF around 2-5 cm FL were also captured in Nansei Island area and Joban area by small surface-trawl net. Particularly, 370 PBF juveniles were captured in Kuroshio Current around Nansei Island area. This is the first record of mass collection of small PBF juveniles.

Collected samples are being examined by a variety of approaches such as genetic identification, aging, growth analysis, stable isotope, microchemistry and stomach contents analyses to elucidate the survival processes of larval and juvenile PBF in relation to biological and environmental factors, which should help to understand the recruitment mechanism to PBF fisheries around Japan.

4.1.2 *Troll Survey on Age-0 Pacific Bluefin Tuna*

Recruitment abundance index (standardized CPUE from the Japanese troll fishery) for current stock assessment is based on the sales slips issued by the commercial markets. Since 2017, a new fishery management scheme for PBF by the local government, which includes substantial Individual Quota and the obligation to make effort for the minimum size limitation, was introduced, and the troll fishery operation had to be affected by this new management. Due to this change, the abundance index from the Japanese troll fishery lost its continuity before and after 2016. The FRI commenced a real-time monitoring survey of troll fishery's operations in 2011, which has been targeting age-0 PBF, to make an alternative recruitment index. Currently, the data logger and transmitter were installed on 70 troll fishing boats in six prefectures (Mie, Wakayama, Kochi, Miyazaki, Nagasaki and Shimane). Once the fishermen input their catch number of age-0 fish during the fishing operation, the catch information with geographic position and Sea Surface Temperature (SST) data are sent to the FRI via a cellular network on a real time basis.

Using a part of those data, totally 2,840 days operational data from 14 real-time monitoring vessels, which targeted for age-0 PBF (i.e., 40-60 cm fork length) during the winter season (November to following February) in the East China Sea were used to standardize the CPUE by Vector Autoregressive Spatio-Temporal (VAST) model formulated a delta-generalized linear mixed model. The FRI reported this new recruitment index to the PBFWG meeting of the ISC (Fujioka et al., 2021). In the PBFWG meeting held in March 2022, the feasibility of this index as an input data for the assessment was discussed, and the WG agreed to use this recruitment index after 2016 fishing year for one of the sensitivity analyses and robustness tests for the update of stock assessment.

4.1.3 Tissue Sampling and Technical Development for Close-kin Analysis for PBF

Tissue sampling for close-kin analysis has started since 2015 and around 2,500 individuals were sampled in 2021. The tissues of large mature adult PBFs (about 120-300 kg in BW; Body Weight) were sampled by coastal longline fishery around Okinawa Islands in late April to early July, while those of young-of-the-year juveniles (about 0.1-0.3 kg in BW) were sampled by troll fishery during summer in the Pacific coastal water off Western Japan, such as Kochi Prefecture. The hatching area of these samples can be identified as the water around Nansei archipelago based on the knowledge about the migration of age-0 PBF. For the other spawning ground, The Sea of Japan, those of young adults and either nearly-matured or matured individuals (about 20-60 kg in BW) were sampled in Sakai-minato in summer, while those of young-of-the-year juveniles were sampled in Oki islands in autumn. Additionally, there are several samples to assure the randomness of sampling from all over Japan, especially in the Tsugaru straits. All of muscle tissues sampled were preserved in specific buffer (TNES-Urea 6M buffer) because of the higher stability of content DNA.

The close-kin project team, which consists of FRI, Fisheries Technologies Institute, and collaborating academic researchers, has been working to develop practical procedures of close-kin analysis in PBF. The team began to conduct genotyping of actual samples in 2018 and have completed it for more than 2,500 samples of matured individuals and young-of-the-year juveniles so far. Alongside, the team is addressing development of statistical approaches for estimating stock abundance.

4.2 Sharks, billfishes and swordfish

4.2.1 Port Sampling and the Onboard Research Program in Kesennuma Fishing Port

In 2021, size and sex data of both blue shark and shortfin mako were collected from port sampling in Kesennuma fishing port, located in northeastern Honshu (the main island of Japan), and the onboard research project for Kesennuma offshore longline fleet throughout the year. In the port sampling, size data from 20,587 blue shark were collected, and 78% of individuals measured were males. In addition, 53% of males and 57% of females were juveniles.

Regarding blue shark, the number of catch by four size categories was recorded in the onboard research program for Kesennuma-offshore longline fleet. Total of 190,535 blue sharks were recorded by size category. Large (processed weight: ≥ 15 kg) consisted 59% of all catch with 25% of middle (11 kg ≤ processed weight < 15 kg), 15% of small (5 kg ≤ processed weight < 11 kg) and 1% of extra small (processed weight: < 5 kg).

For shortfin mako, size data from 7,114 individuals (male: 3,121, female:3,348, and unknown:645) were collected from port sampling, and 64% of males and 100% of females were juveniles. In contrast to blue shark, almost all of sampled female were juvenile in shortfin mako. Total of 5,278 sharks was recorded by size category from the onboard research by Kesennuma-offshore longline fleet. Large (precaudal length: > 200 cm) consisted 6% of all catch with 41% of middle (150 cm < precaudal length ≤ 200 cm), 42% of small (100 cm < precaudal length ≤ 150 cm) and 11% of extra small (precaudal length ≤ 100 cm).

4.2.2 Tagging for Swordfish and Sharks

In the research cruise by No.37 Den-Maru (chartered longline vessel) conducted between 16th April and 27th May in 2021, conventional tag was attached to 13 blue sharks and 2 shortfin mako. Pop-up Satellite Archival Tag (PSAT) was attached to one shortfin mako and one blue shark, respectively. Smart Position and Temperature (SPOT) Transmitting tags were attached to two blue sharks. For these four sharks, conventional tags were also attached, simultaneously. Within the same cruise, PSTAs were also attached to four swordfish.

In the research cruise of Japanese research and training vessel (JRTV), conventional tags were attached to nine blue sharks.

4.2.3 Biological Sample Collection

Samples of whole body were collected from 14 pelagic sharks, two swordfish, 15 striped marlin, one blue marlin, and one shortbill spearfish for the biological study including the improvement of species identification. For the study of genetic population structure and other ecological study, blood and/or muscle tissue were collected from 19 blue sharks, 83 swordfish, 77 striped marlin, and 14 blue marlin. Reproductive organ, muscle, and vertebrae were collected from two adult female shortfin mako to investigate the reproductive cycle, growth, and distribution pattern. In addition, aging character (i.e., otolith, anal fin, and dorsal fin) and reproductive organ (i.e., testes/ovary) were collected from 54 swordfish, 80 striped marlin, and 11 blue marlin for the study of their life history parameters.

All the samples above were collected by the research cruise (including chartered vessel) and commercial/training longline operation conducted in the North Pacific Ocean in 2021.

4.3 Skipjack

4.3.1 *Tagging for Skipjack*

The FRI has been conducting skipjack tagging research mainly to investigate the migration patterns around the fishing ground off Japan. One offshore pole-and-line vessel (20-119 GRT) and one distant water pole-and-line vessel (> 199 GRT) were fully chartered to conduct the research off Japan in October and November 2021 and in tropical areas (5°-25°N, 140°-180°E) in January and February 2022, respectively. A total of 7,700 skipjack tuna (1,199 off Japan and 6,501 in tropical areas) including 384 individuals (216 off Japan and 168 in tropical areas) with archival tags (Lotek LAT2910) were released. In addition, skipjack tagging has been conducted in cooperation with Ajinomoto Co., Inc. in the coastal area of southwestern Japan since 2009. In 2021, skipjack tuna tagging was planned, however, the tagging was postponed due to the COVID-19 pandemic.

Besides above studies, five research/training cruises on pole-and-line vessels conducted skipjack tagging in 2021 around Japanese water. A total of 491 skipjack tuna including 33 individuals with archival tags were released in the south off Japan, around Izu Islands, around Hachijo Island (33˚N, 139˚E), Wakayama (33.15˚N, 135.75˚E), and Okinawa (28.20˚N, 128.22˚E).

4.4 Albacore

4.4.1 Tagging for Albacore

The FRI has been conducting tagging research to investigate female and male albacore distribution and migration in the northwestern Pacific Ocean. In the 2021 research, 40 archival tags were attached to albacore in off Wakayama in March 2022.

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6 TABLE

Table 1. Number of Japanese tuna fishing vessels.

A. Number of Japanese tuna fishing vessels operated in the Pacific Ocean by type of fisheries and vessel size based on MAFF (1980-2006).

	Longline fishery[*1]						Purse seine fishery			Pole-and-line fishery					
Year	1-19 GRT	20-49 GRT	50-99 GRT	100-199 GRT	200- GRT	Total	50-199 GRT[*2]	200- GRT	Total	1-19 GRT[*3]	20-49 GRT	50-99 GRT	100-199 GRT	200- GRT	Total
1980	821	57	715	103	645	2,341	50	16	66	3,232	14	350	10	198	3,804
1981	774	55	706	100	661	2,296	50	23	73	3,064	10	353	6	179	3,612
1982	722	43	634	90	589	2,078	52	33	85	3,011	11	320	6	138	3,486
1983	561	38	589	93	550	1,831	59	36	95	3,021	12	297	9	116	3,455
1984	523	32	538	108	610	1,811	54	33	87	2,904	8	273	10	105	3,300
1985	620	28	512	131	628	1,919	47	35	82	2,754	8	244	9	95	3,110
1986	536	25	435	168	632	1,796	53	38	91	2,455	6	224	9	91	2,785
1987	661	23	348	197	649	1,878	47	34	81	2,404	6	210	9	89	2,718
1988	586	21	289	233	649	1,778	48	39	87	2,613	5	191	11	70	2,890
1989	650	20	248	238	653	1,809	43	37	80	2,254	3	187	12	67	2,523
1990	685	21	227	241	664	1,838	43	35	78	2,228	4	176	9	66	2,483
1991	768	19	199	222	682	1,890	38	35	73	2,277	3	166	10	63	2,519
1992	793	19	164	206	681	1,863	31	38	69	2,093	3	156	11	46	2,309
1993	790	18	138	201	682	1,829	27	36	63	1,927	3	147	10	43	2,130
1994	819	21	110	198	675	1,823	23	33	56	1,830	3	124	10	48	2,015
1995	738	20	92	187	667	1,704	20	31	51	481	3	104	20	46	654
1996	711	17	91	155	640	1,614	21	32	53	512	3	89	29	43	676
1997	698	11	88	145	631	1,573	20	35	55	436	2	76	39	45	598
1998	712	11	80	129	623	1,555	20	35	55	382	2	73	40	46	543
1999	703	6	78	119	567	1,473	22	36	58	416	1	62	54	46	579
2000	732	3	76	111	496	1,418	23	37	60	357	1	56	57	47	518
2001	777	4	76	110	494	1,461	19	36	55	285	1	49	59	47	441
2002	780	4	69	110	484	1,447	18	36	54	251	1	45	58	48	403
2003	764	3	64	99	460	1,390	17	36	53	292	1	44	56	44	437
2004	702	2	55	77	455	1,291	17	36	53	284	1	38	57	43	423
2005	694	2	46	59	432	1,233	17	36	53	247	1	36	58	45	387
2006	709	1	43	54	401	1,208	16	36	52	213	1	27	58	36	335

*1 Longline vessels larger than 50 GRT include those operated in the area other than the Pacific.
*2 50-199 GRT class vessels only include those operated in the Pacific side of northern Japan.
*3 1–19 GRT class vessels before 1995 include those engaged in trolling.

B. Number of Japanese tuna fishing vessels operated in the North Pacific Ocean by type of fisheries and vessel size based on logbook. Values in 2020 and 2021 are provisional.

	Longline fishery					Purse seine fishery				Pole-and-line fishery			
Year	10-49 GRT	50-99 GRT	100-199 GRT	200- GRT	Total	50-199 GRT*4	200-499 GRT	500- GRT	Total	20-49 GRT	50-199 GRT	200- GRT	Total
2006	277	44	52	113	486	31	35	1	67	1	83	30	114
2007	279	42	48	89	458	34	36	1	71	1	77	29	107
2008	277	42	40	90	449	35	37	1	73	1	69	29	99
2009	277	38	33	81	429	33	36	3	72	1	68	28	97
2010	290	29	28	98	445	31	35	4	70	1	66	28	95
2011	273	24	25	99	421	33	36	4	73	0	63	28	91
2012	265	21	21	92	399	34	37	4	75	0	60	27	87
2013	260	20	23	87	390	34	37	4	75	0	55	25	80
2014	250	18	21	90	379	33	37	3	73	1	54	25	80
2015	239	18	24	80	361	30	35	5	70	1	51	24	76
2016	234	16	16	64	330	32	33	4	69	1	50	25	76
2017	233	15	16	59	323	37	34	4	75	1	48	31	80
2018	229	14	16	63	322	34	30	4	68	1	43	25	69
2019	230	13	17	51	311	36	31	5	72	1	41	24	66
2020	226	11	15	44	296	33	30	6	69	1	36	22	59
2021	196	10	15	32	253	33	22	7	62	1	34	21	56

*4 50-199 GRT class vessels only include those operated in the Pacific side of northern Japan.

Table 2. Catch in weight (t) by species by fisheries in the North Pacific.

A. Pacific bluefin tuna

Year	Purse Seine		Dist. & Off. Longline*5		Coastal Longline*5	Troll	Pole and Line	Set Net	Others*7	Total
	Tuna PS	Small PS	North Pacific	South Pacific						
2016	3,267	1,828	14	4	677	778	54	1,228	508	8,359
2017	3,341	1,199	21	6	892	605	49	2,221	665	9,000
2018	3,225	825	21	0	679	371	9	645	431	6,205
2019	3,213	1,251	25	0	977	720	0	941	372	7,500
2020	3,208	752	75	0	1,341	760	1	1,234	502	7,873
2021 *6	3,150	1,048	80	0	1,356	653	0	1,642	445	8,374

*5: Distant-water and Offshore longline vessels are mainly 20 GRT or larger, and most of coastal longline vessels are smaller than 20 GRT

*6: Most recent year's catch value is provisional.

*7: Others include drift net, handline, trawl, other longline, and unclassified fisheries.

B. Albacore

Year	Longline		Pole-and-line			Drift-net	Purse seine	Troll	Set-net	Others	Total
	Distant Water + Offshore*8	Coastal	Distant Waters	Offshore	Coastal						
2016	3,431	13,118	8,648	5,754	33	19	3,679	148	28	128	34,986
2017	3,712	13,597	12,108	8,753	30	40	1,251	107	48	119	39,765
2018	3,071	10,121	9,362	8,394	119	35	3,039	78	13	70	34,302
2019	4,830	7,386	4,669	3,662	177	9	1,045	543	27	95	22,443
2020	2,413	10,242	23,806	12,578	254	7	5,961	784	25	159	56,229
2021	(2,014)	(10,521)	(23,806)	(12,578)	(254)	(7)	(5,961)	(784)	(25)	(159)	(56,109)

*8 Category Distant Warter + Offshore LL includes training/research vessels

( ) different data source or carry over from previous year

C. Swordfish

Year	Longline: Distant Water + Offshore	Longline: Coastal	Longline: Others	Drift-net	Bait fishing	Net fishing	Trap-net	Others	Total
2016	3,509	2,094	2	303	256	NA	2	169	6,335
2017	2,860	1,975	2	291	289	NA	3	274	5,694
2018	3,212	1,801	2	230	267	NA	5	480	5,997
2019	2,596	1,301	2	242	210	0	6	339	4,697
2020*9	3,836	1,433	4	290	305	0	7	179	6,054
2021*9	1,831	480	4	290	305	0	7	179	3,096

*9 Catch between 2020 and 2021 are preliminary.

D. Striped Marlin

Year	Longline: Distant Water + Offshore	Longline: Coastal	Longline: Others	Drift-net	Bait fishing	Net fishing	Trap-net	Others	Total
2016	245	778	33	308	32	NA	25	41	1,462
2017	160	764	53	241	28	NA	28	23	1,296
2018	147	711	28	278	36	NA	28	52	1,280
2019	252	956	29	241	39	NA	29	61	1,607
2020*10	216	951	49	155	25	0	37	32	1,465
2021*10	123	595	49	155	25	0	37	32	1,016

*10 Catch between 2020 and 2021 are preliminary.

E. Blue shark

Year	Longline: Distant Water	Longline: Offshore	Longline: Coastal	Longline: Others	Large mesh drift-net	Bait fishing	Trap-net	Others	Total
2015	4,173	5,352	573	402	697	2	21	0	11,220
2016	4,541	4,366	375	225	1,832	2	26	1	11,367
2017	4,387	4,853	343	212	1,366	1	4	0	11,166
2018	4,081	4,608	263	159	1,236	1	40	0	10,388
2019	3,726	4,351	209	162	1,149	1	35	0	9,634
2020	3,134	3,540	213	185	1,119	2	59	1	8,252

F. Shortfin mako

Year	Longline: Offshore and Distant water (Shallow set)	Longline: Offshore and Distant water (Deep set)	Longline: Coastal and other	Large mesh drift-net	Trap-net and others	Total
2015	605	242	2	334	11	1,194
2016	784	182	32	446	16	1,460
2017	564	99	23	271	10	968
2018	638	186	19	223	28	1,095
2019	585	223	15	214	3	1,040
2020	481	140	4	194	12	832

G. Bigeye

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2016	11,598	1,012	1,310	0	1	87	109	14,117
2017	11,425	1,444	2,201	1	0	119	89	15,279
2018	11,631	1,432	3,471	1	0	80	84	16,699
2019	11,838	549	1,444	1	0	110	113	14,055
2020	11,763	959	1,621	0	1	69	135	14,567
2021	3,119	1,366	1,337	0	1	69	135	6,027

H. Skipjack

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2016	34	68,981	82,658	111	264	1,642	53	153,743
2017	30	61,940	93,396	61	401	1,615	81	157,524
2018	21	78,998	125,119	91	494	1,154	133	206,010
2019	38	73,592	84,054	96	246	1,387	110	159,523
2020	25	48,889	55,303	70	335	949	86	87,671
2021	35	54,814	58,443	70	335	949	86	114,732

I. Yellowfin tuna

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2016	7,978	3,218	21,300	16	120	2,250	806	35,688
2017	7,966	3,201	24,195	7	135	1,877	690	38,071
2018	7,955	3,519	38,868	6	77	1,738	587	52,750
2019	11,223	2,930	27,039	4	208	2,070	778	44,252
2020	6,996	3,065	18,223	13	125	2,008	846	30,307
2021	5,988	2,947	15,079	13	125	2,008	846	27,006

7 FIGURES

Longline fishery

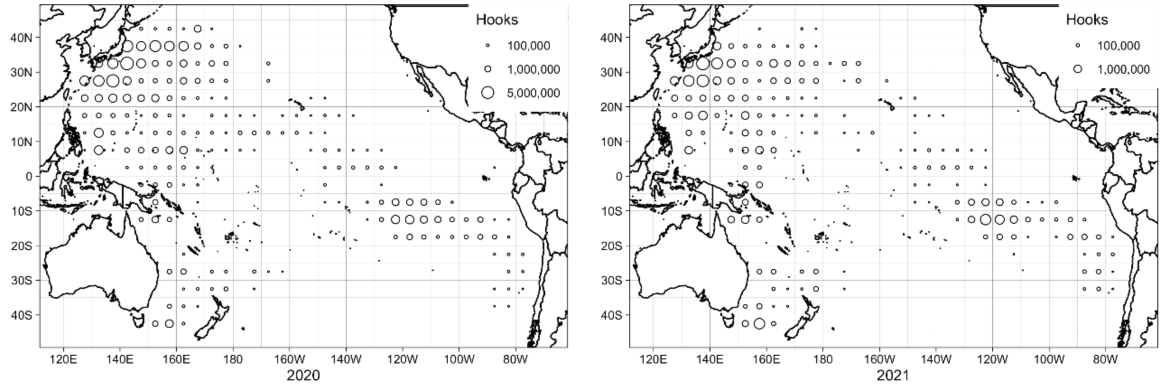

Fig 1. Distribution of fishing effort (Number of hooks) for the Japanese distant water and offshore longline fisheries in the Pacific, 2020-2021.

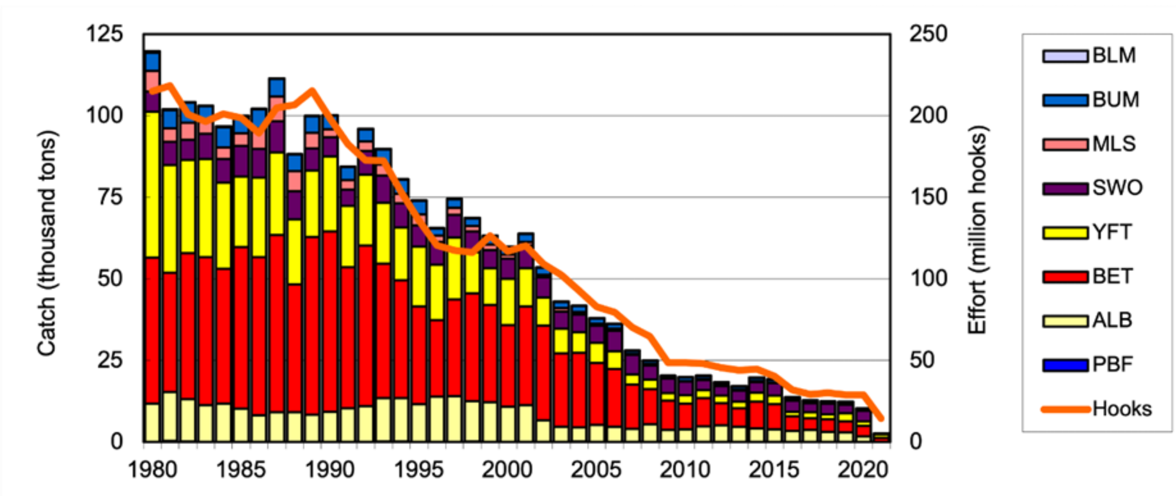

Fig 2. Historical catches in weight (t) for major species and fishing effort (Number of hooks in million) of the Japanese distant water and offshore longline fisheries (not including small offshore fishery) in the North Pacific Ocean. PBF: Pacific bluefin tuna, ALB: albacore, BET: bigeye, YFT: yellowfin tuna, SWO: swordfish, MLS: striped marlin, BUM: blue marlin, BLM: black marlin. Values in 2020 and 2021 are provisional.

Purse seine fishery

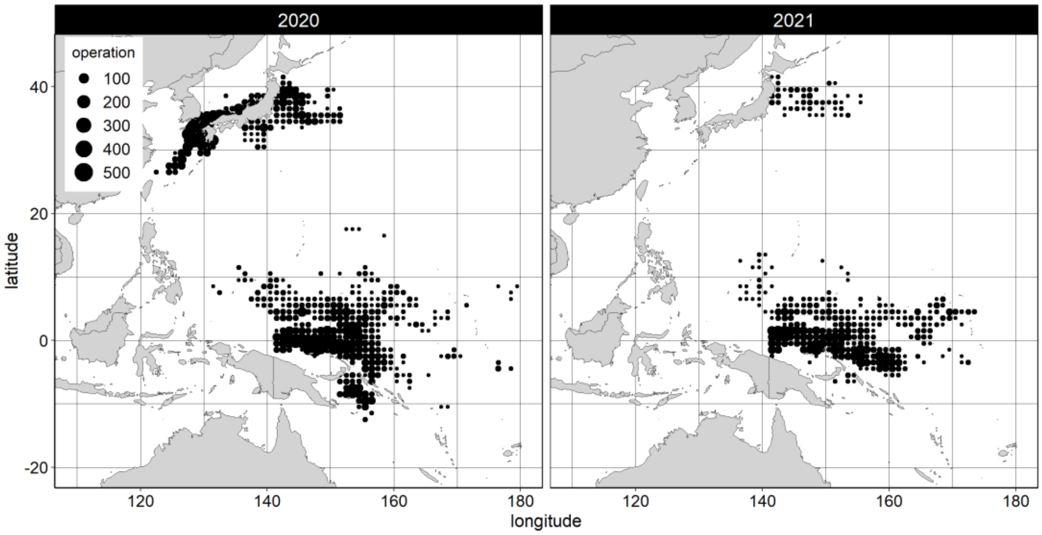

Fig 3. Distribution of fishing effort (number of sets) for the Japanese purse seine fishery in the Pacific, 2020-2021.

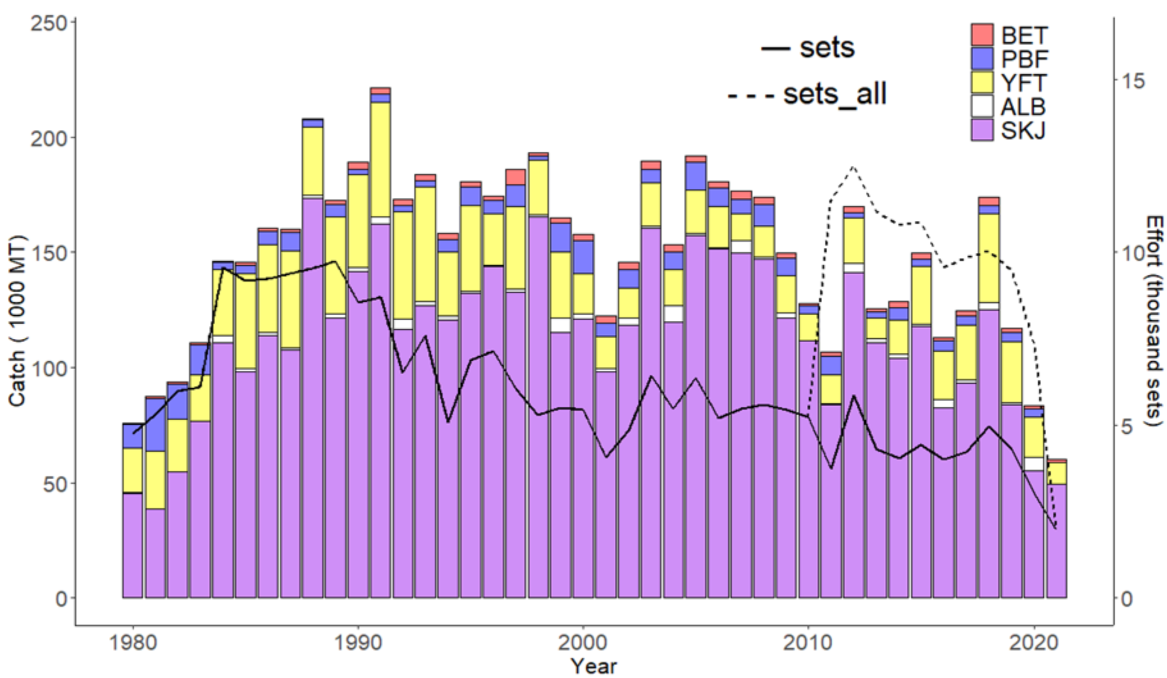

Fig 4. Historical catches in weight (t) for major species and fishing efforts (Number of sets) of the Japanese purse seine fishery in the North Pacific Ocean. SKJ: skipjack, YFT: yellowfin tuna, BET: bigeye, PBF: Pacific bluefin tuna, ALB: albacore. Solid and dashed line indicates number of sets including operations in the Sea of Japan and southern part of Japan, and excluding them, respectively. Value in 2021 is provisional.

Pole-and -line fishery

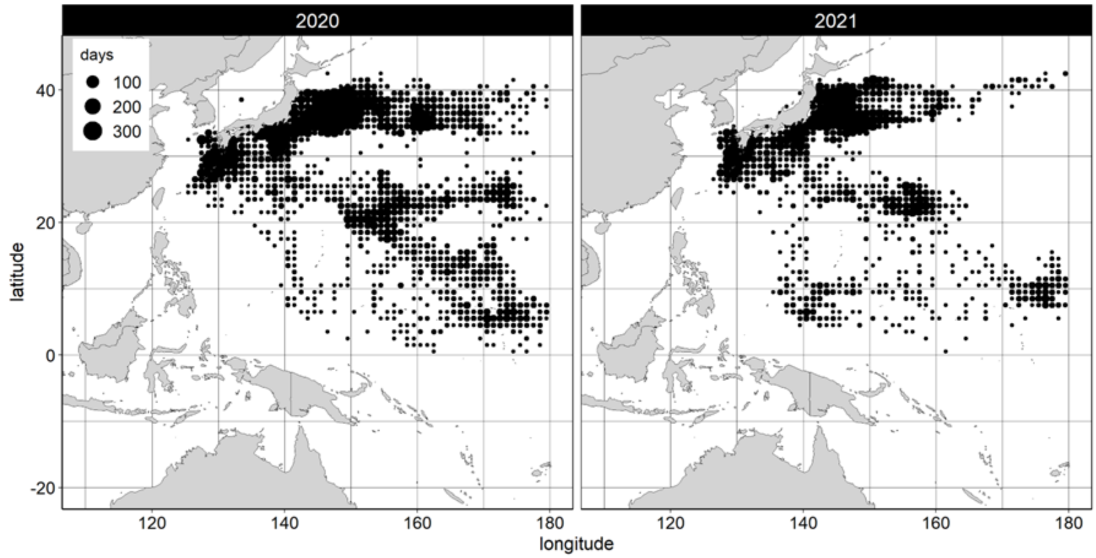

Fig 5. Distribution of fishing effort (number of days) of the Japanese pole-and-line fishery (larger than 20 GRT vessels) in the Pacific, 2020-2021. Distribution of effort in 2021 in vicinity of Japan is preliminarily in this right panel.

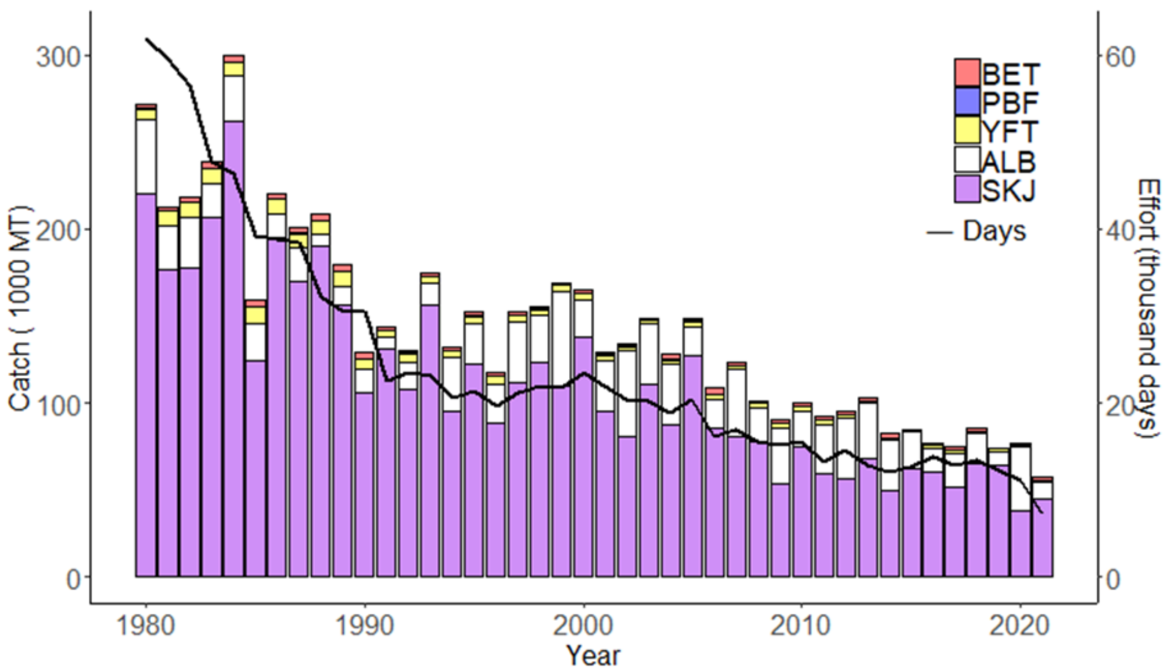

Fig 6. Historical catches in weight (t) for major species and fishing effort (Number of fishing days) of Japanese distant water and offshore fisheries in the North Pacific. SKJ: skipjack, ALB: albacore, YFT: yellowfin tuna, PBF: Pacific bluefin tuna, BET: bigeye. The catch for PBF includes the catch by coastal pole-and-line (less than 20 GRT vessels) fishery. Value in 2021 is provisional.

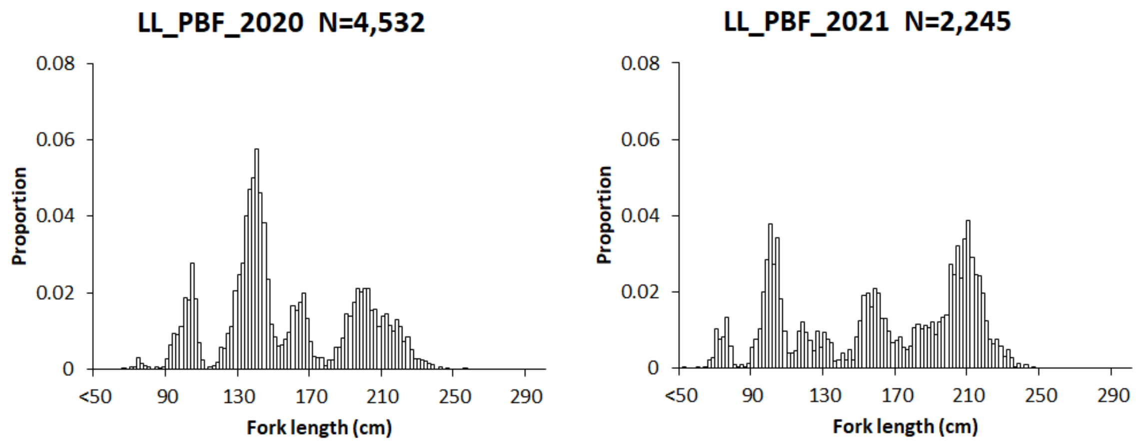

Fig 7. Annual relative length frequency distribution (simply summing up all measurements) for Pacific bluefin tuna (PBF) caught by longline in 2020 (left) and 2021 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

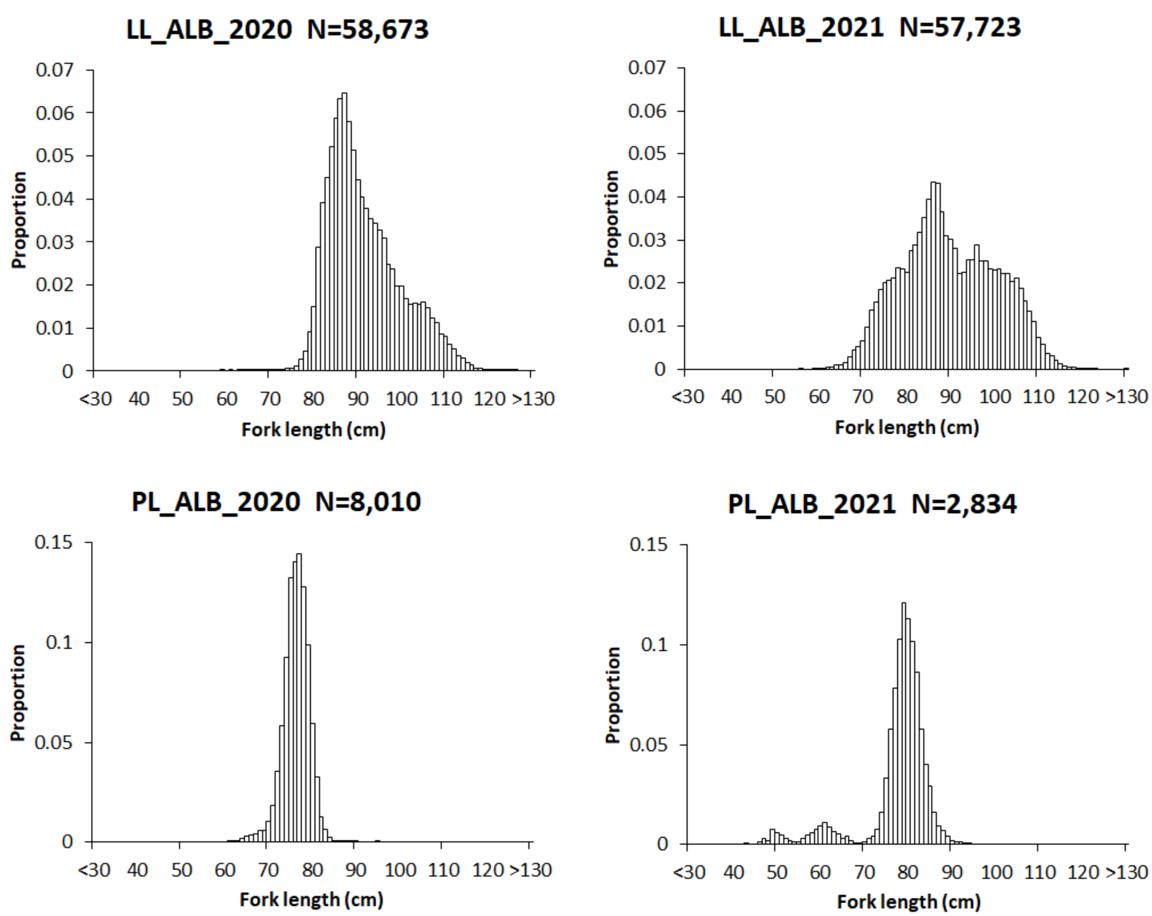

Fig 8. Annual relative length frequency distribution (simply summing up all measurements) for albacore (ALB) caught by longline (upper two panels) and pole-and-line (lower two panels) in 2020 (left) and 2021 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

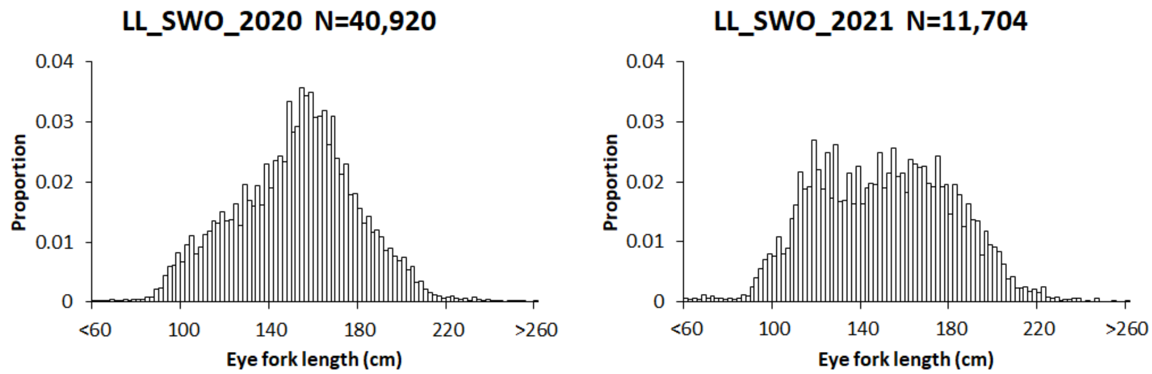

Fig 9. Annual relative length frequency distribution (simply summing up all measurements) for swordfish (SWO) caught by longline in 2020 (left) and 2021 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

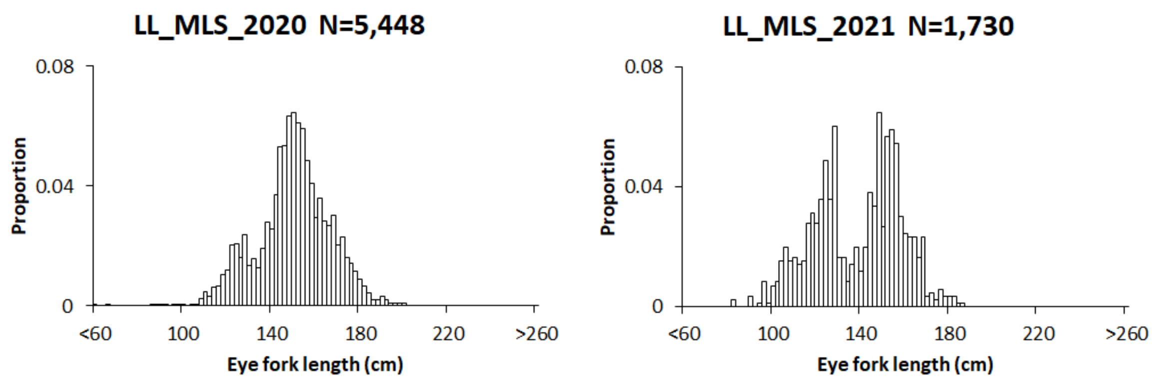

Fig 10. Annual relative length frequency distribution (simply summing up all measurements) for striped marlin (MLS) caught by longline in 2020 (left) and 2021 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.