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National Report of Japan
(Japanese Tuna and Tuna-like Fisheries in the North Pacific Ocean in 2019)

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SUMMARY

Japanese tuna fisheries consist of the three major fisheries (i.e., longline, purse seine, pole-and-line) and other miscellaneous fisheries like troll, drift-net, set-net 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 ISC19 (Tsukahara et al 2019). The total catch of tunas (excluding skipjack) caught by Japanese fisheries in the North Pacific Ocean was 262,503 metric ton (t) in 2018 and 212,941 t in 2019. The total catch of tunas (including skipjack) caught by Japanese fisheries in the North Pacific Ocean was 351,201 metric ton (t) in 2018 and 255,891 t in 2019. The total catch of swordfish and striped marlin was 7,003 t in 2018 and 6,841 t in 2019. In addition to fisheries description, a brief description was given on Japanese research activities on tuna and tuna-like species in the Pacific Ocean in 2019.

1 TRENDS IN FLEET SIZE

Tables 1-A and B show the number of Japanese tuna fishing vessels actually 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 2006-2019. The number of active vessels during 2006-2019 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 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 Gross Register Tonnage (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 2018 and 2019 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 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 WCPFC. Recent declining trend for the fleet size larger than 50 GRT was remarkable. The number of vessels of 100-199 GRT was 17 in 2019 which was 33% of that in 2006, and the number of vessels of 50-99 GRT was 13 in 2019 which was 30% 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 222 in 2019 (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 67 and 75 until 2019, at a peek in 2012, 2013 and 2017. 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 2006-2019, 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 41 in 2019 which is 49% of that in 2006. The number of vessels for over 200 GRT showed a declining trend until 2013, and then became stable, except for in 2017, was 24 in 2019.

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 2018 and 2019 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 12,898 t in 2019 which is 11% 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 in the 1990s and was less than 10,000 t in 2009. 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 3,000-6,000 t and kept stable at a low level during the period 2003-2019.

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 amount of tunas as a by-catch. Historically, typical group seiner consists of one purse seiner and one searching vessel and two carrier vessels, but the group seiner tends 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 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.

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 1991, increased to around 23,000 days in 2000, and then gradually decreased to 10,744 days in 2019 (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 80,000 t until the latest year (Fig. 6). Skipjack is a dominant species for this fishery, but the proportion of skipjack tends to decrease, from 80-78% in 1980-1986 to 78-60% in 2010-2019.

3 RECENT TRENDS FOR MAJOR SPECIES

3.1 Pacific bluefin tuna (Table 2-A)

Preliminary total catch of Pacific bluefin tuna (PBF) in 2019 was 7,498 t (Table 2-A), which corresponds to 21% increase from the catch in 2018 (6,205 t). This was around the average level of past five years (2014-2018: 7,906 t). The annual catches of PBF by major fisheries in 2019 as follows; purse seine: 4,464 t, troll: 718 t, set-net: 941 t, longline: 1,002 t, and other fisheries: 372 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 from 2015 to 2019 have been relatively 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 (Ohashi et al., 2019). Japanese longline fishery usually catches large adult PBF, which are about 200 cm FL, but the length

composition in 2019 showed multimodal distribution which has the highest and third highest peaks at around 110 and 140 cm FLs followed by the second highest peak at 210 cm FL (Fig. 7). The peaks found at around 110 and 140 cm FLs in 2019 composition are corresponding to the 2016 and 2015 year-classes, respectively, which were fully protected cohorts by the current management measures. It is also worth to note that the 2016 year-class, which consisted the highest peak in the length composition, was assessed as the moderately high recruitment cohort through the stock assessment. Increase in PBF catch by longline and its size composition possibly indicate the newly recruited large adult PBF to this fishery as the recovery of stock.

3.2 **Albacore (Table 2-B)**

Preliminary total catch of albacore in 2019 was 34,489 t, which was about same as the catch in 2018 (34,301 t) and was smaller than the average of past five years (2014-2018: 40,967t). 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 catch by this fishery fluctuated largely between 8,500 t and 23,000 t. Preliminary albacore catch by longline in 2019 (17,889 t) was about same as the catch in 2018 (17,875 t). Size of albacore caught by the longline fisheries in 2019 was found from 55 cm to 130 cm FL, whereas much smaller individuals (FL: 49 to 92 cm) were caught by pole-and-line (Fig. 8). No significant size differences between 2018 and 2019 were found in both fisheries.

3.3 Swordfish (Table 2-C)

Preliminary total catch of swordfish in 2019 was 5,161 t which corresponds to 89% of the catch in 2018 (5,785 t) and was smaller than the average of past five years (2015-2019: 5,693 t). Swordfish has been caught mainly by offshore and distant water longline, which catch in 2019 was 2,843 t. The coastal longline in the Tohoku area operates night-shallow sets targeting swordfish. The length frequency for longline mainly distributed from 90-220 cm eye-fork length in 2018 and 2019 (Fig. 9).

3.4 Striped marlin (Table 2-D)

Preliminary total catch of striped marlin in 2019 was 1,680 t which corresponds to 138% of the catch in 2018 (1,218 t) and was similar to the average of past five years (2015-2019: 1,467 t). Total catch of striped marlin experienced a sharp decline since the mid-1980s primarily due to the decline of the catch of offshore and distant water longline (from 6,378 t in 1980 to 264 t in 2019). In recent years, Japanese pelagic fisheries catch striped marlin as bycatch except for coastal drift-net and part of another longline which is seasonal targets striped marlin. The mode of the eye-fork length of striped marlin in 2018 was about 160 cm, while two peaks appeared in 2019 that was 125 cm and 160 cm, respectively (Fig. 10).

3.5 Blue shark (Table 2-E)

ISC SHARK WG had conducted an updated stock assessment of blue shark in 2020 and the recent three-year catches of blue shark by several fishing gears were updated using available Japanese species-specific data and statistics. A total catch of blue shark by Japanese fisheries was estimated at 12,198 t in 2018. The decrease in 2018 was due to the trends in

decrease of population biomass and fishing effort for offshore and distant water longline fisheries. Those had a slightly decreasing trend since 2013 due to continuous decline of the fishing effort for longline fisheries..

3.6 Shortfin mako (Table 2-F)

A total catch of shortfin mako by Japanese fisheries was estimated at 826 t in 2018. Those are stabilizing around 826-918 t since 2015 after decreasing those from around 1050 t. This is due to the decline of fishing effort for offshore and distant water longline fisheries.

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

Preliminary total catch of bigeye in 2019 was 14,422 t which corresponds to 13% decrease of the catch in 2018 (16,655 t) and was lower than the average of past five years (2014-2018: 17,658 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 2019 was 157,071 t which corresponds to 24% decrease of the catch in 2018 (205,342 t) and was lower than the average of past five years (2014-2018: 173,980 t). Most of skipjack was caught by pole-and-line and purse seine in the North Pacific. Total catch of skipjack by Japanese fisheries showed no clear trend in the last six years in the North Pacific.

Preliminary total catch of yellowfin tuna in 2019 was 42,950 t which corresponds to 18% decrease of the catch in 2018 (52,698 t) and was higher than the average of past five years (2014-2018: 38,610 t). The yellowfin tuna caught by purse seine has been the highest proportion among gears in the North Pacific. The higher total catches during the 2018-2019 period were mainly due to higher purse seine catch in tropical waters in the North Pacific and higher longline catch in the North Pacific.

4 RESEARCH ACTIVITIES

The Fishery Agency of Japan, in cooperation with the National Research Institute of Far Seas Fisheries (NRIFSF) and local prefectural fisheries experimental stations, has run the nationwide port sampling project for collection of catch, effort and size data 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 surveys have been conducted to estimate current main spawning area and period of PBF. In 2019, research cruises were designed to focus on ecological studies of larval/juvenile PBF by R/Vs Shunyo-Maru, Yoko-Maru, Hokko-Maru and five prefectural R/Vs. Larval surveys 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, larval survey was conducted in Joban area in the coastal area of northeastern Japan in July and August. In 2019, over 700 of PBF larvae were captured in the spawning grounds.

Juvenile surveys were also conducted in nursery areas in the Sea of Japan in September. Over 1958 of PBF juveniles were captured in the Sea of Japan in 2019.

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 of age-0 PBF) for current stock assessment is based on the sales slips of Japanese troll fishery in the East China Sea. The NRIFSF has conducted monitoring survey of troll fishery's operations to make alternative indices, which are targeting age-0 PBF for both fresh fish and farming pens. Currently, the data logger and transmitter were installed on 76 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 data is sent to the NRIFSF via a cellular network on a real time basis.

The data from 68 boats in 2019 were available for evaluation of recruitment. The annual number of recorded data in the last couple of years were lower than those in the years before because of the reduction in demand for farming pens caught by troll fishery and/or regulation of catch limit for juveniles. As a result, the quality of data for statistical approach was degraded due to not only just decreasing the number of data but also the lack of data in some strata, e.g. particular month and area. The NRIFSF reported the preliminary recruitment indices, which was standardized CPUE obtained through this monitoring system, on the website of the Fishery Agency since September 2014.

4.1.3 Size sampling for Pacific Bluefin tuna farming operation

Japanese small pelagic fish purse seine (JSPF-PS) fishery which operated in the East China Sea has been catching age 0-1 PBF since early 1990s. The catch quota for PBF was firstly introduced for this fleet in 2011 as a voluntary measure. That quota was gradually reduced year after year in accordance with the amendments in the conservation and management measure (CMM) of the WCPFC for PBF. Given the major transformation of the CMM for the PBF fisheries, this fleet changed their operational strategy from a fishery supplying sashimi to the market into a fishery for farming. The farming operation has gradually increased since 2012, and it occupied about 50% of total catch of this fleet in recent years.

Due to the difficulty to measure the size of live fish during farming operation, the size of removal from the stock by this type of fishery had been assumed to be similar with a same JSPF-PS fleet supplying fish to the market for the stock assessment purpose.

Since 2017, stereoscopic cameras have been introduced in the bluefin ranch sector and are utilized to obtain counts and estimates of individual length and weight of penned PBF. The NRIFSF conducted an experiment to validate (or not) the reliability of the length data obtained by the stereoscopic cameras and concluded that the length composition data obtained by this new technology can provide a large volume of high-quality length data (Fukuda and Nakatsuka, 2019). Those data were included in the latest stock assessment to depict the number and size of PBF removed by the JSPF-PS operated for the farming.

4.1.4 Tissue sampling and technical development for close-kin analysis

Tissue sampling for close-kin analysis has started since 2015 and around 2,200 individuals were sampled in 2019. Large mature adults of PBF (about 120-300 kg in BW) were sampled from individuals fished by coastal longline fishery around Okinawa Islands in late April to early July, while young-of-the-year juveniles (about 0.1-0.3 kg in BW) being from marked fish caught by troll fishery during summer in the Pacific coastal water off Western Japan, such as Kochi Prefecture. The breeding or hatching area of these samples can be identified as water around Nansei archipelago. For the other spawning ground, The Sea of Japan, young adults and nearly-matured individuals (about 20-60 kg in BW) were sampled from fish landed at Sakai-minato, while young-of-the-year juveniles were sampled in Oki islands. Additionally, there are samples a lot of 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 Japan Fisheries Research and Education Agency, including NRIFSF, and collaborating academic researches has been working to develop practical procedures of close-kin analysis in PBF. The team began to conduct genotyping of actual samples since 2018 using random amplicon sequencing method developed through this project. Alongside, the team is addressing development of statistical approaches for estimating stock abundance. Furthermore, a numerical model which can keep all genealogical information among every individual has been developed with expecting application to the operating model of statistical approach and enhancement in the quality of sampling design.

4.2 Sharks

4.2.1 Port sampling and the onboard research program in Kesennuma fishing port

In 2019 size and sex data of both blue shark and shortfin mako shark were collected from port sampling in Kesennuma fishing port, located in northeastern Honshu (the main island of Japan), and the onboard research project throughout the year. For blue shark, size data from 32,165 individuals were collected from port sampling and 77% of individuals measured were males. In addition, 66% of males and 49% of females were juveniles. The number of size data decreased almost half compared to last year due to the change of handling of fish from advanced hygiene management and blue shark has been taken into a container, which makes difficult to measure as many blue shark as before.

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 241,708 blue sharks were recorded by size category and “large (processed weight: ≥ 15 kg)” consisted 45% of all catch with 23% of “middle (11 kg ≤ processed weight < 15 kg)”, 27% of “small (5 kg ≤ processed weight < 11 kg)” and 5% of ”extra small (processed weight: < 5 kg)”.

For shortfin mako, size and sex data from 6,285 individuals were collected from port sampling and 70% 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 12,416 sharks was recorded by size category from the onboard research by Kesennuma-offshore longline fleet and “large (precaudal length: > 200 cm)” consisted 4% of all catch with 32% of “middle (150 cm < precaudal length ≤ 200 cm)”, 52% of “small (100 cm < precaudal length ≤ 150 cm)” and 12% of “extra small (precaudal length ≤ 100 cm)”.

4.2.2 Research cruise

In the research cruise by No.37 Den-Maru (chartered longline vessel) conducted between 10th April and 6th June in 2019, pop-up satellite archival tag (PSAT) was deployed for 8 blue sharks, 4 shortfin mako, and one swordfish. SPOT was deployed for 12 blue sharks, of which 5 blue sharks were double-tagged with PAT. Within this cruise, normal tag was attached to 396 blue sharks, 13 shortfin mako, and one salmon shark.

In the research cruise research and training vessel (RTV), normal tag was attached to 12 blue sharks.

4.2.3 Biological sample collection

For the analysis of genetic population structure of billfish, the whole body of juvenile swordfish (N=26) was collected, as well as blood sample from 16 swordfish and one striped marlin. For the estimation of life history parameters of billfish, muscle tissue, anal/dorsal fin, and reproductive organ were collected from total of 54 swordfish and 3 striped marlins.

For the improvement life history parameter and ecological study of sharks, muscle tissue, reproductive organ, stomach were collected from 39 blue shark, 8 shortfin mako (whole body for 5 mako). Blood samples were collected from 8 blue sharks for reproductive/genetic analysis. Tip of upper caudal fin was collected from two bigeye thresher shark for the advancement of species identification of sharks on board.

All of the samples above were collected by the research cruise and commercial/training longline operation conducted in the North Pacific in 2019.

4.3 Skipjack

4.3.1 *Tagging for Skipjack*

The NRIFSF has been conducting skipjack tagging research mainly to investigate migration patterns to 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 2019 and in tropical areas (5°-25°N, 140°-180°E) in December 2019, respectively. A total of 6,404 skipjack tuna (1,302 off Japan and 5,102 in tropical areas) were released including 533 individuals (218 off Japan and 315 in tropical areas) with archival tags (Lotek LAT2910) and 50 individuals (20 off Japan and 30 in tropical areas) with Mini Pat (Wildlife Computers Inc, USA). In addition, skipjack tagging has been conducted in cooperation with Ajinomoto Co., Inc. in the coastal area of southwestern Japan since 2009. In 2019, 419 skipjack tuna were released including 78 individuals with archival tags at the east of Taiwan in March and December.

Besides above studies, five research/training cruises on pole-and-line vessels conducted skipjack tagging in 2019 around Japanese water. A total of 614 skipjack tuna including 140 individuals with archival tags were released in the south off Japan, around Izu Islands, around Hachijo Island (33˚N, 139˚E), and Wakayama (33.15˚N, 135.75˚E).

5 REFERENCE

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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 2018 and 2019 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	15	50	313	37	34	4	75	1	48	31	80
2018	218	14	16	52	300	34	30	4	68	1	43	25	69
2019	222	13	17	43	295	36	31	5	72	1	41	24	66

*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

	Purse Seine		Dist. & Off. Longline[*5]		Coastal		Pole-and-			
Year	Tuna PS	Small PS	Noth Pcific	South Pacific	Long line[*5]	Troll	line	Set-net	Others[*7]	Total
2014	2,250	3,206	11	4	672	1,023	5	1,907	499	9,577
2015	2,759	886	11	4	637	413	8	1,242	431	6,390
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[*6]	3,213	1,251	26	0	976	718	0	941	372	7,498

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

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

*7 Others include drift-net handline, trawl, other lingline, and unclassified fisheries.

B. Albacore

	Longline		Pole-and-line								
Year	Distant Water + Offshore[*8]	Coastal	Distant Waters	Offshore	Coastal	Drift-net	Purse seine	Troll	Set-net	Others[*9]	Total
2014	4,270	15,703	17,462	11,890	81	11	2,009	197	24	197	51,844
2015	3,907	17,106	11,498	9,710	86	138	1,072	239	17	167	43,940
2016	3,431	13,118	8,648	5,754	33	19	3,679	148	28	128	34,986
2017	3,710	13,598	12,108	8,753	30	40	1,250	107	48	119	39,763
2018	3,070	10,121	9,362	8,394	119	35	3,039	78	13	70	34,301
2019	(3,106)	(10,259)	(9,376)	(8,394)	(119)	(35)	(3,039)	(78)	(13)	(70)	(34,489)

*8 Category distant water + Offshore longline vessels include training/research vessels.

*9 Others include Troll catch for 1952-1994.

() Different data source or carry over from previous year.

C. Swordfish

	Longline								
Year	Distant Water + Offshore	Coastal	Others	Drift-net	Bait fishing	Net fishing	Trap-net	Others	Total
2014	3,279	1,101	2	269	291	-	7	0	4,948
2015	3,775	1,235	1	277	281	-	3	204	5,777
2016	3,534	1,961	2	303	256	-	2	169	6,227
2017	2,880	1,775	2	291	289	-	3	274	5,514
2018[*10]	3,230	1,570	2	230	267	-	5	480	5,785
2019[*10]	2,843	1,334	2	230	267	-	5	480	5,161

*10 Catch between 2018 and 2019 are preliminary.

D. Striped Marlin

	Longline								
Year	Distant Water + Offshore	Coastal	Others	Drift-net	Bait fishing	Net fishing	Trap-net	Others	Total
2014	265	855	35	173	22	-	35	0	1,385
2015	284	1,039	43	287	27	-	37	37	1,754
2016	257	737	33	308	32	-	25	41	1,433
2017	171	706	53	241	28	-	28	23	1,250
2018[*11]	157	639	28	278	36	-	28	52	1,218
2019[*11]	264	994	28	278	36	-	28	52	1,680

*11 Catch between 2018 and 2019 are preliminary.

E. Blue shark

Year	Longline				Large mesh drift-net	Bait fishing	Trap-net	Others	Total
	Distant Water	Offshore	Coastal	Others					
2013	6,491	8,965	1,124	622	1,103	2	6	4	18,319
2014	6,392	8,714	538	598	1,060	2	4	0	17,306
2015	6,163	5,370	551	386	1,080	2	21	0	13,573
2016	8,874	5,008	375	225	1,832	2	26	1	16,343
2017	8,611	5,621	342	212	1,366	1	4	0	16,158
2018	5,712	4,787	263	159	1,236	1	40	0	12,198

F. Shortfin mako

Year	Longline			Large mesh drift-net	Trap-net and others	Total
	Offshore and Distant water (Shallow set)	Offshore and Distant water (Deep set)	Coastal and other			
2013	554	99	47	345	9	1,054
2014	578	199	7	263	3	1,051
2015	466	85	2	334	11	898
2016	314	66	32	446	16	874
2017	457	157	23	271	10	918
2018	473	82	19	223	28	826

G. Bigeye

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2014	16,694	2,836	2,546	0	0	160	138	22,374
2015	16,030	780	2,855	4	3	140	114	19,926
2016	11,598	1,012	1,310	0	1	87	109	14,117
2017	11,412	1,395	2,201	1	0	119	89	15,217
2018	11,609	1,410	3,471	1	0	80	84	16,655
2019	12,291	531	1,435	1	0	80	84	14,422

H. Skipjack

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2014	132	58,621	104,159	119	131	954	93	164,209
2015	77	70,353	117,548	119	153	1,238	46	189,534
2016	34	68,981	82,658	111	264	1,642	53	153,743
2017	30	61,487	93,396	61	401	1,615	81	157,071
2018	21	78,330	125,119	91	494	1,154	133	205,342
2019	41	71,816	83,342	91	494	1,154	133	157,071

I. Yellowfin tuna

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2014	6,917	2,810	14,553	8	67	1,523	429	26,307
2015	9,147	2,971	25,503	12	56	2,014	599	40,302
2016	7,978	3,218	21,300	16	120	2,250	806	35,688
2017	7,954	3,195	24,195	7	135	1,877	690	38,053
2018	7,913	3,509	38,868	6	77	1,738	587	52,698
2019	10,919	3,050	26,573	6	77	1,738	587	42,950

7 FIGURES

Longline fishery

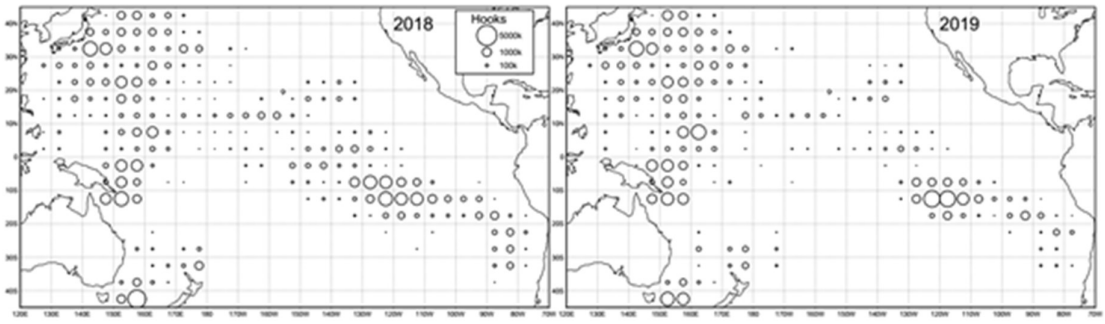

Fig 1. Distribution of fishing effort (Number of hooks) for the Japanese distant water and offshore longline fisheries in the Pacific, 2018-2019.

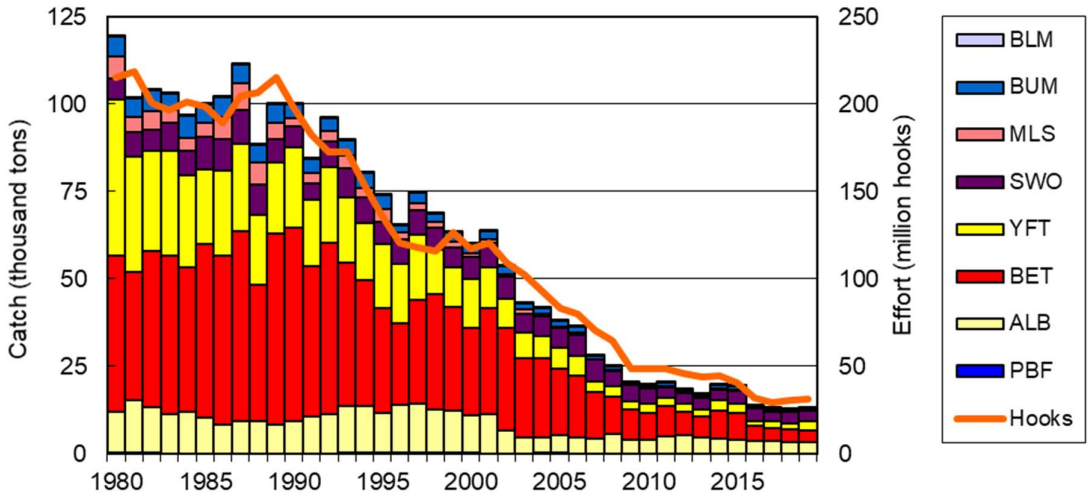

Fig 2. Historical catches in weight (t) for major species and fishing effort (Number of hooks in million) of the Japanese distant water and offshore longline fisheries (not including small offshore fishery) in the North Pacific Ocean. PBF: Pacific bluefin tuna, ALB: albacore, BET: bigeye, YFT: yellowfin tuna, SWO: swordfish, MLS: striped marlin, BUM: blue marlin, BLM: black marlin. Values in 2018 and 2019 are provisional.

Purse seine fishery

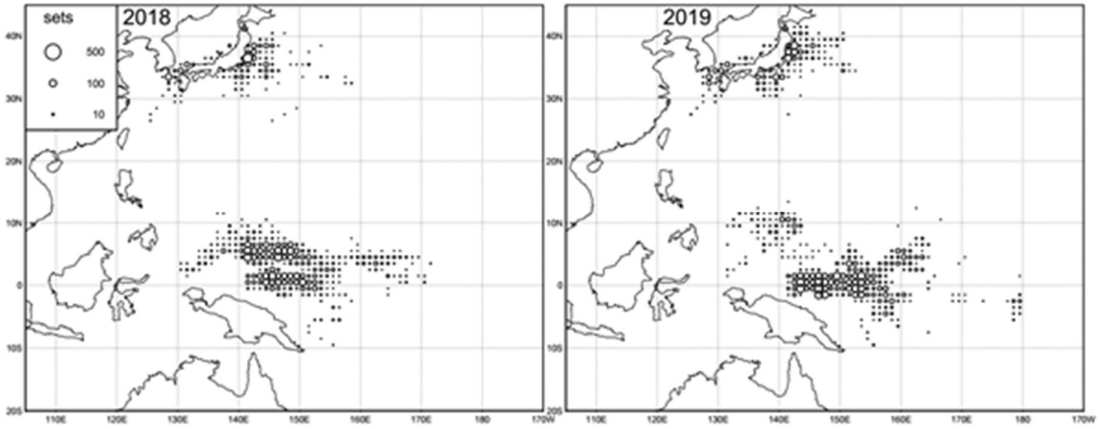

Fig 3. Distribution of fishing effort (number of sets) for the Japanese purse seine fishery in the Pacific, 2018-2019.

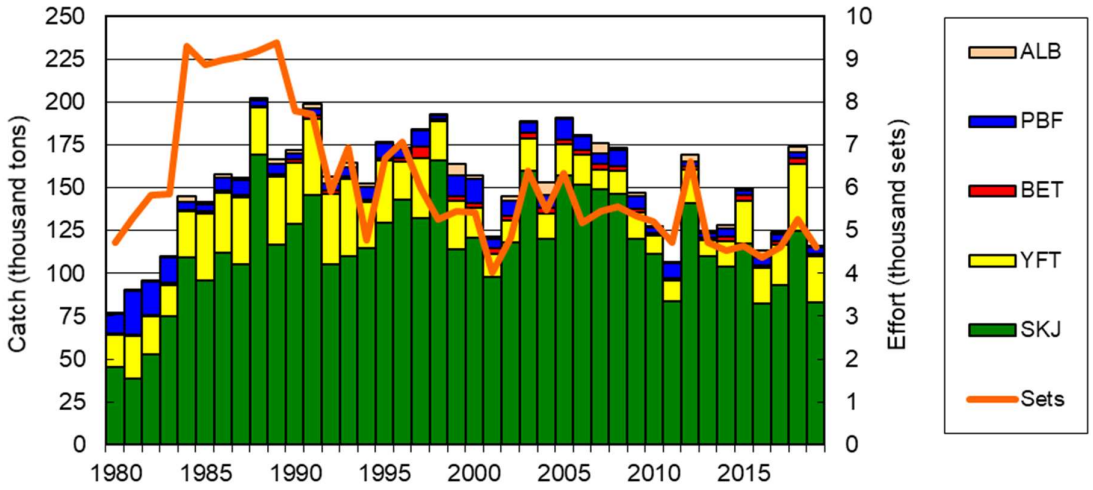

Fig 4. Historical catches in weight (t) for major species and fishing effort (Number of sets) of the Japanese purse seine fishery in the North Pacific Ocean. SKJ: skipjack, YFT: yellowfin tuna, BET: bigeye, PBF: Pacific bluefin tuna, ALB: albacore. Value in 2019 is provisional.

Pole-and -line fishery

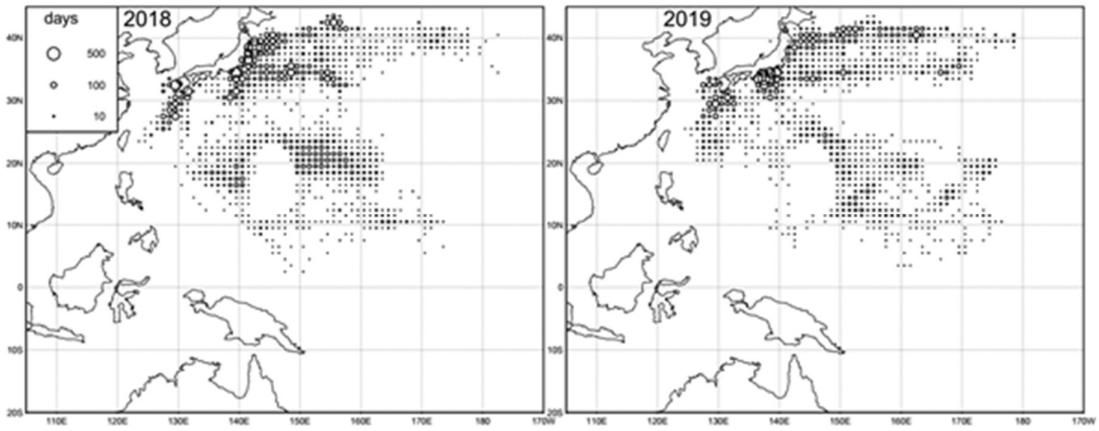

Fig 5. Distribution of fishing effort (number of days) of the Japanese pole-and-line fishery (larger than 20 GRT vessels) in the Pacific, 2018-2019.

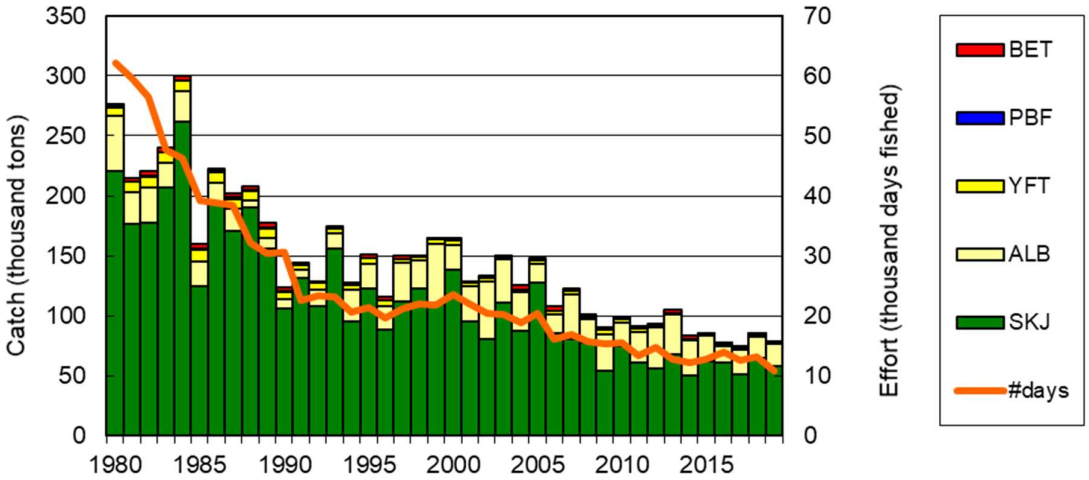

Fig 6. Historical catches in weight (t) for major species and fishing effort (Number of fishing days) of Japanese distant water and offshore fisheries in the North Pacific. SKJ: skipjack, ALB: albacore, YFT: yellowfin tuna, PBF: Pacific bluefin tuna, BET: bigeye. The catch for PBF includes the catch by coastal pole-and-line (less than 20 GRT vessels) fishery. Value in 2019 is provisional.

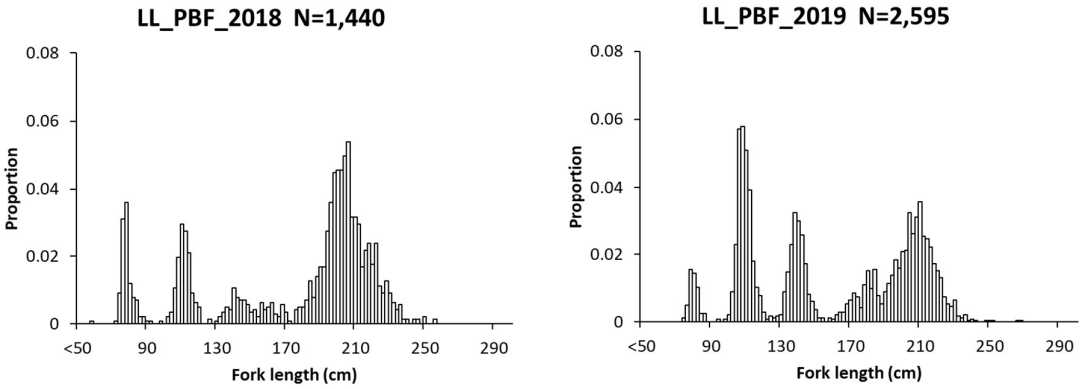

Fig 7. Annual relative length frequency distribution (simply summing up all measurements) for Pacific bluefin tuna (PBF) caught by longline in 2018 (left) and 2019 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

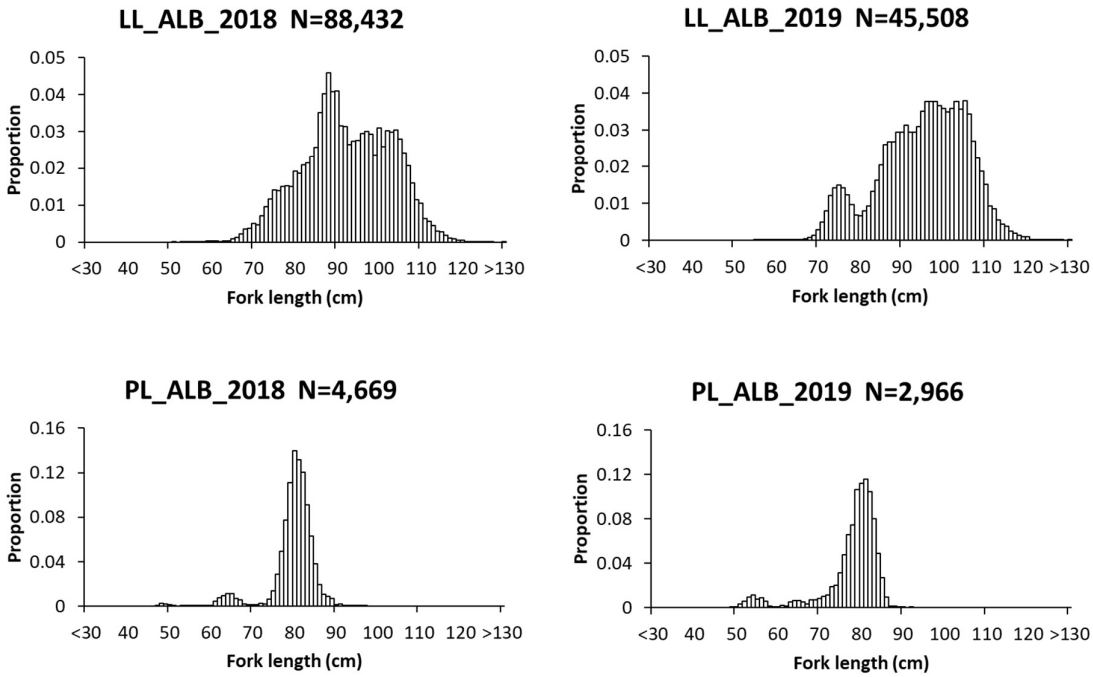

Fig 8. Annual relative length frequency distribution (simply summing up all measurements) for albacore (ALB) caught by longline (upper two panels) and pole-and-line (lower two panels) in 2018 (left) and 2019 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

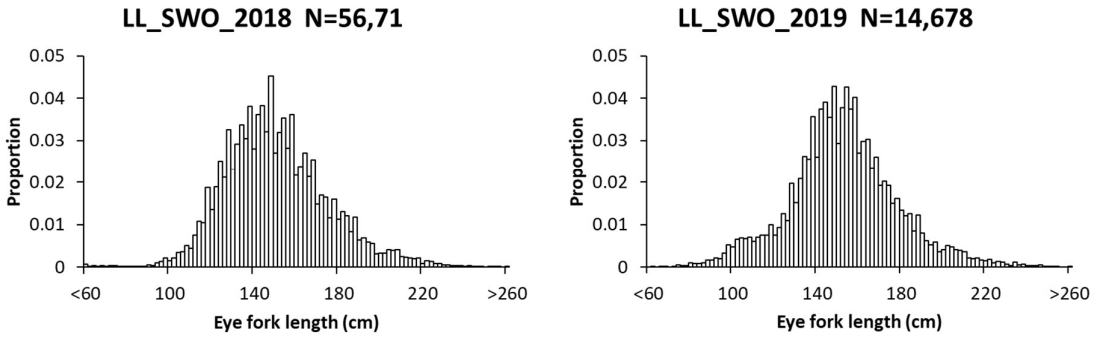

Fig 9. Annual relative length frequency distribution (simply summing up all measurements) for swordfish (SWO) caught by longline in 2018 (left) and 2019 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

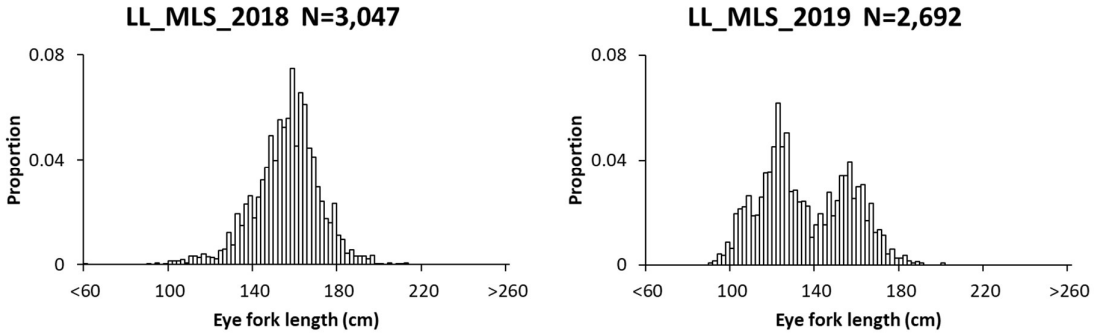

Fig 10. Annual relative length frequency distribution (simply summing up all measurements) for striped marlin (MLS) caught by longline in 2018 (left) and 2019 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.