17th Meeting of the
International Scientific Committee
for Tuna and Tuna-Like Species in the North Pacific Ocean
Vancouver, Canada
12-17 July 2017

NATIONAL REPORT OF JAPAN

(Japanese Tuna and Tuna-like Fisheries

in the North Pacific Ocean)[1]

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July 2017

[1]Prepared for the seventeenth Meeting of the International Scientific Committee on Tuna and Tuna-Like Species in the North Pacific Ocean (ISC), 12-17 July, 2017, Vancouver, Canada. Document should not be cited without permission of the authors.

National report of Japan

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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 ISC16 (Tsukahara et al 2016). The total catch of tunas (excluding skipjack) caught by Japanese fisheries in the north Pacific Ocean was 110,968 metric ton (t) in 2015 and 94,703 t in 2016. The total catch of tunas (including skipjack) caught by Japanese fisheries in the North Pacific Ocean was 300,505 metric ton (t) in 2015 and 247,244 t in 2016. The total catch of swordfish and striped marlin was 7,498 t in 2015 and 6,205 t in 2016. 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 2016. The brief reports of Pacific Bluefin Tuna and Albacore Tuna Aging Workshop were also provided.

1. TRENDS IN FLEET SIZE

Tables 1A and 1B show the number of Japanese tuna fishing vessels actually engaged in fishing by type of fishery and by vessel size class during 1980-2006 (MAFF 1982-2008) and 2006-2016. The number of active vessels 2006-2016 was estimated based on logbook data. The coastal longline vessels less than 20 Gross Register Tonnage (GRT), the research and training vessels of both longline and pole-and-line are not included in Table 1B. The values of number of vessels in 2015 and 2016 are provisional in Table 1B.

The total number of longline vessels shows continuous declining trend since the early 1990s (Table 1A). The number of longline vessels of the largest size class (> 200 GRT) was near constant in the period between the beginning of 1980s and the mid-1990s. In accordance with the agreement of the FAO's international action plan on fishing capacity, 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, Japanese government implemented the second fleet reduction program for this fishery following the management measures adopted in WCPFC. Recent declining trend for larger than 50 GRT is remarkable. According to the logbook data, the number of vessels of 100-199 GRT was 15 in 2016 which is 29% of that in 2006, and the number of vessels of 50-99 GRT was 16 in 2016 which is 36% of that in 2006 (Table 1B). 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. For the under 50 GRT vessel classes, the number of vessels for 20-49 GRT shows sharp decline since the late 1980s whereas the number of vessels of smallest size class (< 20 GRT) fluctuated at around 700 during the 1980-2006 (Table 1A). The number of vessels of 10-49 GRT was relatively stable, ranging between 270 and 290 during the 2006-2011 and then decreased to 195 in 2016 (Table 1B).

The total number of purse seine vessel was 52 in 2006, and it was nearly 80% of that in the 1980s (Table 1A). After 2006, the total number of purse seine vessels, however, shows a trend of slight increase, and was 75 at a peek in 2012 and 2013. After that, the number of vessels shows decrease trend. The purse seine vessel which is allowed to operate in the tropical waters is larger vessel (currently, > 348 GRT). The number of such vessel has been 35 and has not changed since 1995.

The total number of pole-and-line vessels shows continuous declining trend since 1980 (Table 1A and 1B). Suppose vessel size categories 20-49 GRT, 50-199 GRT, over 200 GRT for the 1980-2006 to compare with that in the 2006-2016, the number of vessels for each category shows declining trend throughout the period (Table 1A). According to the logbook data, the number of vessels for 50-199 GRT and over 200 GRT shows declining trend throughout the period (Table 1B). The number of vessels for 50-199 GRT was 50 in 2016 which is 60% of that in 2006, for over 200 GRT was 25 in 2016 which is 83% 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).

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 has further decreased until 2009 (Fig. 1). After 2009, the amount of effort shows a trend of gradual decrease at a level of 35-50 million hooks

(Fig. 1). Annual distribution of fishing effort of longline in 2015 and 2016 are shown in Fig. 2. In those years, the fishing grounds were located in east-west direction off Japan to Hawaii, equatorial area between 15 ˚S and 15 ˚N, off Australia and off Peru.

Total catch of four tuna and four billfish species of distant water and offshore longline in the North Pacific has been decreased since the highest catch of 119,752 t in 1980, and was 13,388 t in 2016 which is 11% of that in 1980 (Fig. 1). 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 late 1980s, shows 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 early 1980s. It has gradually decreased to less than 5,000 t in 2007. Albacore catch which have 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 2003-2016.

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 number of vessels within each group to reduce a cost in recent years. The group seiner operates mainly in the temperate northwestern Pacific (Fig. 4). 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 (Fig. 4).

The fishing effort and catch for the purse seine, excluding the coastal purse seine, in the North Pacific is shown in Fig. 3. The fishing effort was around 9,000 sets in the late 1980s, and then decreased to about 6,000 sets in 1998 (Fig. 3). 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 tuna. The skipjack catch was about 150,000 t until 2008, and then decreased to 80,000 t in 2011. After 2011, the skipjack catch shows no clear trend between 80,000 t and 140,000. The skipjack catch in 2016 was 82,105 t which is 74% of the recent 5-year average (2011-2015). The yellowfin tuna catch in 2016 was 20,958 t which is 130% of the recent 5-year average.

2.3 Pole-and-line

The pole-and-line is composed of three different 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 license since 2007, which are included into 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.

The middle-sized vessels generally operate in near shore waters of Japan and their trips are within 10 days. Southern most 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. 6). These vessels primarily fish skipjack and albacore from spring through autumn off Pacific side of Japan, and also 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 more or less similar to 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. 6). 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 13,923 days in 2016 (Fig. 5). 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. 5). Skipjack is dominant species for this fishery but the proportion of skipjack tends to decrease, from 80-78% in the 1980-1986 to 60-75% in the 2010-2016.

Fishing grounds of the pole-and-line are widely spreads ranging from 45˚N and 10˚S, from 120˚E to 170˚W. The fishing grounds were separated by around 25˚N but more continuous than the purse seine fishing grounds (Figs. 4 and 6).

3. RECENT TRENDS FOR MAJOR SPECIES

3.1. Pacific bluefin tuna (Table 2-A)

Preliminary total catch of Pacific bluefin tuna (PBF) in 2016 was 8,302 t, which corresponded to 30% increase of the catch in 2015 (6,357 t). This was as much as the average level of past 5 years (2011-2015: 8,291 t). Since January 2015, Japan has implemented strict catch limit especially for small fish (smaller than 30 kg) in accordance with the WCPFC conservation and management measure. Catch of small fish is also affected by the recruitment level, therefore, Japanese catch tends to fluctuate largely (Table 2-A). For example, lower recruitment was estimated in 2012 and 2014 fishing year by current stock assessment, while small pelagic purse seine (small PS) targeting age 0-1 fish showed 1st and

2nd smallest catch (763 t and 886 t) in the past 10 years in 2013 and 2015 calendar year, respectively. In contrast, their catch in 2014 was relatively high (3,206 t) reflecting the recruitment condition. Longline fishery tends to target the larger fish compared to the other fisheries, and their length frequency around 200 cm FL shifted a little toward large size from 2015 to 2016 (Fig. 7).

3.2. Albacore (Table 2-B)

Preliminary total catch of albacore in 2016 was 35,582 t, which was slightly decreased from the catch in 2015 (43,988 t) and was smaller than the average of past 5 years (2011-2015: 52,217 t). Albacore catch by the pole-and-line fluctuated largely, but catch by longline was comparatively stable. Fishing effort mainly targeted on albacore by middle class (20-199 GRT) and large (> 200 GRT) pole-and-line vessels fluctuated in recent years. Catch by longline in 2016 (16,541 t) was smaller than the catch in 2015 (21,058 t). The length frequency for longline distributed from 60 cm to 130 cm FL, whereas much smaller fish were caught by pole and line, which distributed from 60 to 90 cm (Fig. 8).

3.3. Swordfish (Table 2-C)

Preliminary total catch of swordfish in 2016 was 4,885 t which corresponds to 84% of the catch in 2015 (5,790 t) and was smaller than the average of past five years (2011-2015: 4,989 t). Swordfish has been caught mainly by offshore and distant-water longline, which catch in 2016 was 2,604 t. The catch by coastal longline showed a drastic decrease from 2,014 t in 2007 to 973 t in 2011, which is primarily due to the reduction of the number of longline boats especially in the Tohoku area, where part of boats operates night-shallow sets targeting swordfish, by the Great East Japan Earthquake in 2011. The length frequency for longline distributed from 90-210 cm eye-fork length in 2015 and 2016 (Fig 9).

3.4. Striped marlin (Table 2-D)

Preliminary total catch of striped marlin in 2016 was 1,320 t which corresponds to 77% of the catch in 2015 (1,708 t) and was smaller than the average of past five years (2011-2015: 1,759 t). Total catch of striped marlin shows continuous decreasing trend 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 220 t in 2016). In recent years, Japanese pelagic fisheries catch striped marlin as bycatch except for coastal driftnet and part of another longline which is seasonal targets striped marlin. The mode of length in 2015 about 150cm (Fig. 10). There are two mode length frequency data in 2016 (Fig. 10). The sample size of the length frequency data in 2016 is considerably smaller than 2015 (Fig. 10).

3.5 Blue shark (Table 2-E)

A total catch of blue shark by Japanese fisheries was estimated 13,190 t in 2015. Those had reached at 24,632 t in 2010, and then had decreased since 2010 due to suffering of coastal and offshore longliners, who seasonally target blue shark, by the Great East Japan Earthquake. In addition to the update of the catch in 2015, most of the previous catch during 2010-2014 were updated due to the revision of the latest available species specific data and statistics.

3.6. Others (Bigeye, Skipjack and Yellowfin tunas) (Table 2-F, G and H)

Preliminary total catch of bigeye in 2016 was 15,758 t which correspond to 23% decrease of the catch in 2015 (20,405 t) and was lower than the average of past 5 years (2011-2015: 20,663 t). Total catch of bigeye by Japanese fisheries shows no clear trend and longline has been the highest proportion among gears in the North Pacific.

Preliminary total catch of skipjack in 2016 was 152,541 t which correspond to 20 % decrease of the catch in 2015 (189,537 t) and was lower than the average of past 5 years (2011-2015: 183,154 t). Most of skipjack was caught by pole-and-line and purse seine in the North Pacific.

Preliminary total catch of yellowfin tuna in 2016 was 35,302 t which correspond to 12 % decrease of the catch in 2015 (40,218 t) and was lower than the average of past 5 years (2011-2015: 29,853 t). The yellowfin tuna catch by purse seine has been the highest proportion among gears in the North Pacific. Relatively higher total catches in 2015 and 2016 were mainly due to higher purse sein catch in tropical waters 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 has been conducted by research and training vessels as well as commercial vessels. In addition, there are cooperative works with prefectural fisheries experimental stations and universities. Several cooperative studies are also on going 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 2016, research cruises were designed to focus on ecological studies of larval/juvenile PBF by R/Vs Shunyo-Maru, Yoko-Maru, Dai-5 Kaiyo-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 the latter area, more than 3,000 of PBF larvae were captured in the west of the Noto Peninsula, which should help to understand biological and environmental factors on larval survival of PBF.

Juvenile surveys were also conducted nursery areas both in the Pacific Ocean in July and in the Sea of Japan in September, respectively, and samples collected are being examined by a variety of approaches such as genetic identification, aging, stable isotope, microchemistry and stomach contents analyses to understand recruitment process to PBF fisheries around Japan.

4.1.2. Troll survey on age-0 Pacific bluefin tuna

Recruitment abundance index (CPUE of age-0 PBF) for stock assessment is based on the sales slips of Japanese troll fishery in Nagasaki area. In addition to this index, the NRIFSF has reported preliminary recruitment indices based on the information from monitoring troll fishing boats. This survey has conducted for the purpose of monitoring the recruitment in a more timely fashion since 2011. In the 2016 survey, data logger and transmitter are installed on 76 troll fishing boats in six prefectures (Mie, Wakayama, Kochi, Miyazaki, Nagasaki and Shimane) and data from 72 boats are available. Once the fishermen input their catch number of age-0 fish into the data logger 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 NRIFSF has reported the preliminary recruitment indices that obtained through this survey on the website of the Fishery Agency since September 2014.

4.1.3. Tagging for Pacific bluefin tuna

The NRIFSF has conducted a conventional tagging of age-0 PBF (about 20 cm in fork length) from off Kochi Prefecture since 2011. A total of 5,930 fish were released and 959 fish were recaptured (16.2%). In addition, the habitat utilization of 398 individuals in coastal nursery areas was investigated using small archival tags (LAT2910, Lotek Ltd.) implanted in a fish during summer (July-August) from 2012 to 2016. 105 tagged fish were recaptured in total (recovery rate 26.4%). They are expected to estimate the natural mortality (M) and fishing mortality (F) of age-0 period, and to provide valuable information on the design of reliable recruitment monitoring survey and the precise estimation of recruitment abundance levels as well as biology of juvenile periods.

The NRIFSF has also conducted a tagging survey of adult PBF at Sado Island in the Sea of Japan in May and June since 2012 to clarify the spawning behavior and migration ecology. A total of 38 fish about 30-60 kg in weight were attached various electronic data storage tags (archival tags, acceleration data-loggers and pop-up tags). Six tagged fish attached archival tags were recaptured (recovery rate 35.3%) in the Sea of Japan after one week to 45 months.

Twenty out of 21 tags were come up to the surface mostly within 3 months and transported the data, but the other did not work.

4.1.4. Tissue sampling and technical development for close-kin analysis

Tissue sampling for close-kin genetics has started since 2014 and more than 3,000 individuals were sampled in 2016. Large mature adults of PBF (about 120-300 kg in body weight: BW) were sampled from individuals fished by coastal long-line 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 and then released into environments off Kochi Prefecture in August. Young adults as well as nearly-matured juveniles (about 20-60 kg in BW) were also sampled from fish landed at Sakai-minato, western part of the Sea of Japan, and Matsumae, southwest of Hokkaido, fish markets in July and in September to December, respectively. All of muscle tissues sampled were preserved in specific buffer (TNES-Urea 6M buffer) because of higher stability of content DNA.

Furthermore, the NRIFSF has worked to develop practical procedures of close-kin analysis in PBF; screening effective single-nucleotide-polymorphic markers (SNPs), evaluating SNPs quality and quantity to detect parent-offspring-pairs (POPs), developing experimental procedure for SNPs genotyping and algorithms for POPs detection, and statistical modeling based on population genetics and close-kin dynamics. Feasibility to detect half-sib pairs (HSPs) among wild PBF samples as well as POPs was examined by computing statistical simulations.

4.2. Sharks

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

In 2016, size and sex data of blue shark and shortfin mako shark were collected from port sampling project in Kesennuma fishing port between January and December. For blue shark, size data from 63,692 individuals were collected from port sampling and 71% of individuals measured was males. In addition, 68% of males and 62% of females were juveniles. Regarding blue shark, the catch number by four categories of size were recorded in the onboard research program for Kesennuma offshore longline fleet. Total of 315,038 blue shark were recorded and “large (processed weight: ≥15 kg)” consisted 38% of all catch with 23% of “middle (11 kg≦processed weight <15 kg)”, 21% of “small (5 kg≦processed weight <11 kg)” and 18% of “extra small (processed weight: < 5 kg)”.

For shortfin mako, data from 14,760 and 15,290 individuals were collected from port sampling and onboard research by Kesennuma-offshore longline fleet, respectively. Regarding shortfin mako measured in the port sampling, 83.6% of males and 99.9% of females were juveniles. In contrast to blue shark, almost all of female were juvenile in shortfin mako. These data will be combined for the previously collected data to sketch their sex and growth specific seasonal migration patterns.

4.2.2. Research cruise

From research and training vessel cruise, catch data from 5,082 blue shark and 161 shortfin mako were obtained.

In the research cruise by Shunyo-maru conducted between September and October in 2016, popup satellite archival tag (PSAT) was deployed for 17 blue shark and 3 shortfin mako. In addition to the tagging, observation of pregnancy was conducted using echo for the blue shark released with PSAT.

4.2.3. Biological sample collection

For the estimation of life history parameters, vertebrae and/or reproductive organ were collected from 70 blue sharks and 61 shortfin mako through commercial longliner and longline research vessel. For blue shark, blood samples were collected from 12 females in order to investigate the physiological state within the research cruise of Shunyo-maru. For shortfin mako, the vertebrae are going to be used for the estimation of growth for the stock assessment of North Pacific shortfin mako.

4.3. Skipjack

4.3.1. Tagging for skipjack

The NRIFSF has been conducting skipjack tagging mainly to investigate migration pattern to the fishing ground off Japan. One offshore pole-and-line vessel was chartered and tagging was conducted in the south off Japan between February and March in 2016. A total of 3,685 skipjack tuna including 182 fish with archival tag (Lotek LAT2910) were released. To date two fishes were recaptured. In addition, skipjack tagging has been being conducted in cooperation with Ajinomoto Co., Inc. in the coastal area of southwestern Japan since 2009. In 2016, 783 skipjack tuna including 183 fish with archival tag and 82 fish with sonic tag were released at around Yonaguni Island (24˚N, 123˚E) in March – June. So far, 16 fishes including seven with archival tag and one with sonic tag were recaptured.

Besides above studies, four research/training pole-and-line vessels conducted skipjack tagging in May and June 2016 around Japanese water. By one of these vessels, collaborative study of archival tagging with NRIFSF has been being conducted since 2010. In 2016, a total of 40 archival tags were deployed in the south off Japan and around Izu Islands (central part of Japan) in May to June, respectively and three fishes were recaptured. Another collaborative study was conducted with several fisheries experimental stations and a total of 726 skipjack tuna caught by troll were released with 95 archival tag around Hachijo Island

(33˚N, 139˚E) in March - June and Wakayama (33.15˚N, 135.75˚E) in September - November, and five fishes were recaptured.

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Table 1A. Number of Japanese tuna fishing vessels operated in the Pacific Ocean by type of fisheries and vessel size based on Ministry of Agriculture, Forestry and Fishery (1980-2006).

Year	Longline fishery*1						Purse seine fishery			Pole-and-line fishery					
	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

Table 1B. Number of Japanese tuna fishing vessels operated in the North Pacific Ocean by type of fisheries and vessel size based on logbook. Value in 2015 and 2016 is provisional.

Year	Longline fishery					Purse seine fishery				Pole-and-line fishery			
	10-49 GRT	50-99 GRT	100-199 GRT	200- GRT	Total	50-199 GRT*2	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	272	24	25	99	420	33	36	4	73	0	63	28	91
2012	262	21	21	92	396	34	37	4	75	0	60	27	87
2013	257	20	23	87	387	34	37	4	75	0	55	25	80
2014	246	18	21	90	375	33	37	3	73	1	54	25	80
2015	229	18	24	80	351	30	35	5	70	1	51	23	75
2016	195	16	15	81	307	32	33	4	69	1	50	25	76

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

A. Pacific bluefin tuna

Year	Purse Seine*1		Dist. & Off. Longline*2		Coastal Longline*2	Troll	Pole and Line	Set Net	Others*4	Total
	Tuna PS	Small PS	North Pacific	South Pacific						
2011	2,227	6,113	9	11	828	1,820	63	1,651	283	13,004
2012	1,043	1,419	6	8	667	570	113	1,932	343	6,101
2013	2,008	763	7	7	777	904	8	1,415	529	6,418
2014	2,250	3,206	11	4	672	1,023	5	1,907	499	9,577
2015	2,759	886	12	4	607	413	4	1,267	407	6,357
2016*3	3,268	1,828	13	4	641	779	37	1,225	508	8,302

*1: Catch amounts of purse seine fisheries are based on logbook data since 2002.

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

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

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

B. Albacore

Year	Longline		Pole-and-line			Driftnet	Purse seine	Troll	Setnet	Others*6	Total
	Distant Water + Offshore*5	Coastal	Distant Waters	Offshore	Coastal						
2011	4,858	16,098	16,803	8,844	57	12	480	443	50	78	47,723
2012	5,160	17,668	22,710	10,940	92	26	4,193	610	48	129	61,576
2013	4,729	15,110	21,197	12,310	61	14	1,988	302	36	211	55,958
2014	4,269	15,701	17,462	11,890	81	11	2,009	197	24	197	51,841
2015	4,091	16,967	11,498	9,710	86	138	1,072	239	17	170	43,988
2016	(3,226)	(13,315)	(9,000)	(6,000)	(86)	(138)	(3,500)	(200)	(17)	(100)	(35,582)

*5 category distant warter + offshore LL includes training/research vessel

*6 Others include Troll catch for 1952-1994

( ) different data souce or carry over from previous year

C. Swordfish

Year	Longline			Drift net	Bait fishing	Net fishing	Trap net	Others	Total
	Distant Water + Offshore	Coastal	Others						
2011*7	3,046	973	2	193	233	0	2	10	4,460
2012	2,946	1,085	4	371	288	0	8	59	4,760
2013	3,319	921	5	290	291	0	13	163	5,002
2014	3,279	1,089	2	269	291	0	7	-	4,936
2015*8	3,867	1,157	1	277	281	0	3	204	5,790
2016*8	2,604	1,515	1	277	281	0	3	204	4,885

*7 Some data in Tohoku area were not available due to the earthquake in 2011

*8 Catch between 2015 and 2016 are preliminary

Table 2. Continued.

D. Striped Marlin

	Longline								
	Distant Water +				Bait				
Year	Offshore	Coastal	Others	Drift net	fishing	Net fishing	Trap net	Others	Total
2011[*9]	319	932	55	347	26	-	30	32	1,741
2012	326	981	29	597	34	-	52	33	2,052
2013	358	1,099	33	336	34	-	39	19	1,918
2014	265	846	35	173	22	-	35	-	1,376
2015[*10]	292	985	43	287	27	-	37	37	1,708
2016[*10]	220	669	43	287	27	-	37	37	1,320

*9 Some data in Tohoku area were not available due to the earthquake in 2011

*10 Catch between 2015 and 2016 are preliminary

E. Blue shark

	Longline								
	Distant				Large mesh	Bait	Trap		
Year	Water	Offshore	Coastal	Others	driftnet	fishing	net	Others	Total
2010	11,537	10,222	1,072	824	962	1	4	9	24,632
2011	14,235	4,458	64	859	764	3	7	1	20,391
2012	6,220	6,083	829	760	1,076	3	2	3	14,975
2013	6,492	8,965	1,124	622	1,103	2	6	4	18,319
2014	6,391	8,715	538	598	1,060	2	4	0	17,306
2015	6,163	5,369	551	386	697	2	21	0	13,190

F. Bigeye

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2011	18,581	2,318	1,609	1	2	141	138	22,790
2012	15,813	2,097	2,552	2	0	118	146	20,728
2013	12,823	2,446	1,421	1	5	116	111	16,923
2014	16,788	2,836	2,546	0	0	160	138	22,468
2015[*11]	16,509	780	2,855	4	3	140	114	20,405
2016[*11]	13,077	1,112	1,308	4	3	140	114	15,758

*11 Catch between 2015 and 2016 are preliminary

Table 2. Continued.

G. Skipjack

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2011	99	69,998	83,667	111	625	1,780	93	156,373
2012	166	66,243	140,900	95	404	3,487	188	211,483
2013	178	80,833	110,212	112	209	2,514	111	194,169
2014	132	58,621	104,159	119	131	954	93	164,209
2015[*12]	80	70,353	117,548	119	153	1,238	46	189,537
2016[*12]	42	68,820	82,123	119	153	1,238	46	152,541

*12 Catch between 2015 and 2016 are preliminary

H. Yellowfin tuna

Year	Longline	Pole-and-line	Purse seine	Gillnet	Set-net	Troll	Other	Total
2011	8,563	4,336	12,323	6	111	2,497	339	28,175
2012	7,072	3,651	19,317	6	113	2,279	369	32,807
2013	6,877	3,268	9,251	8	103	1,817	491	21,815
2014	6,858	2,810	14,553	8	67	1,523	429	26,248
2015[*13]	9,063	2,971	25,503	12	56	2,014	599	40,218
2016[*13]	7,801	3,423	21,397	12	56	2,014	599	35,302

*13 Catch between 2015 and 2016 are preliminary

Longline fishery

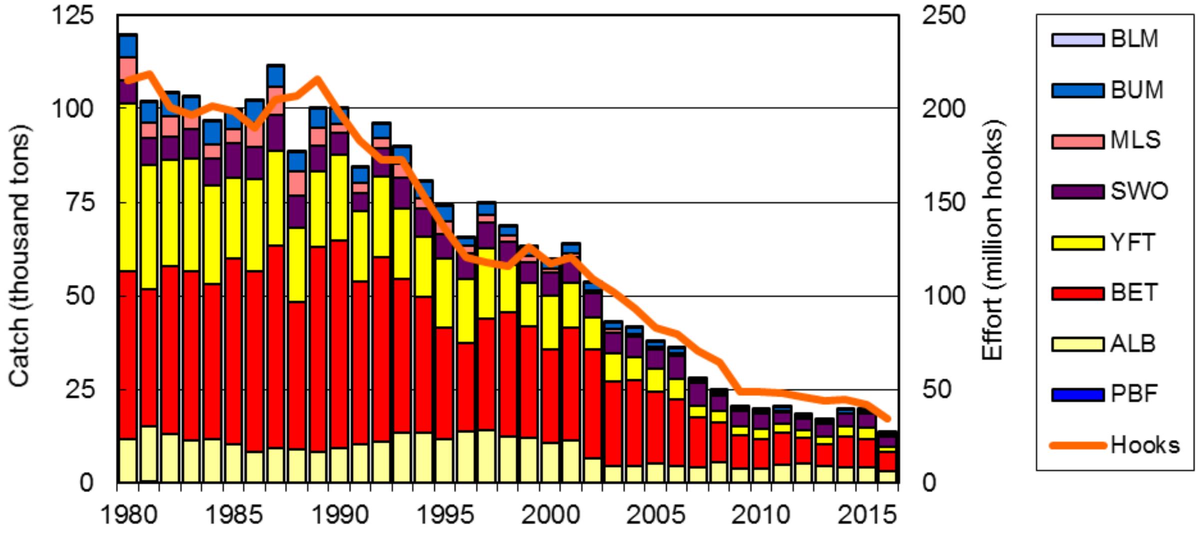

Fig. 1. Historical catches in weight (t) for major species and fishing effort (Number of hooks in million) of the Japanese distant water and offshore longline fisheries (not including small offshore fishery) in the North Pacific Ocean. PBF: Pacific bluefin tuna, ALB: albacore, BET: bigeye, YFT: yellowfin tuna, SWO: sword fish, MLS: striped marlin, BUM: blue marlin. Values in 2015 and 2016 are provisional.

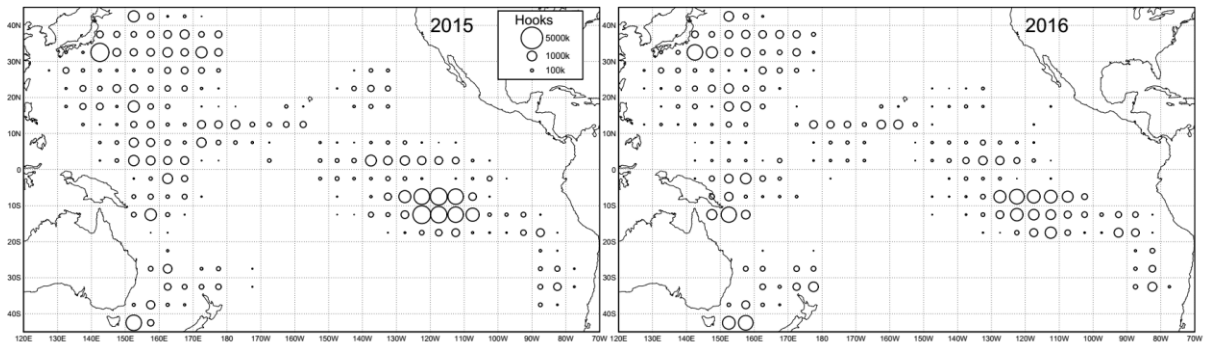

Fig. 2. Distribution of fishing effort (Number of hooks) for the Japanese distant water and offshore longline fisheries in the Pacific Ocean, 2015-2016.

Purse seine fishery

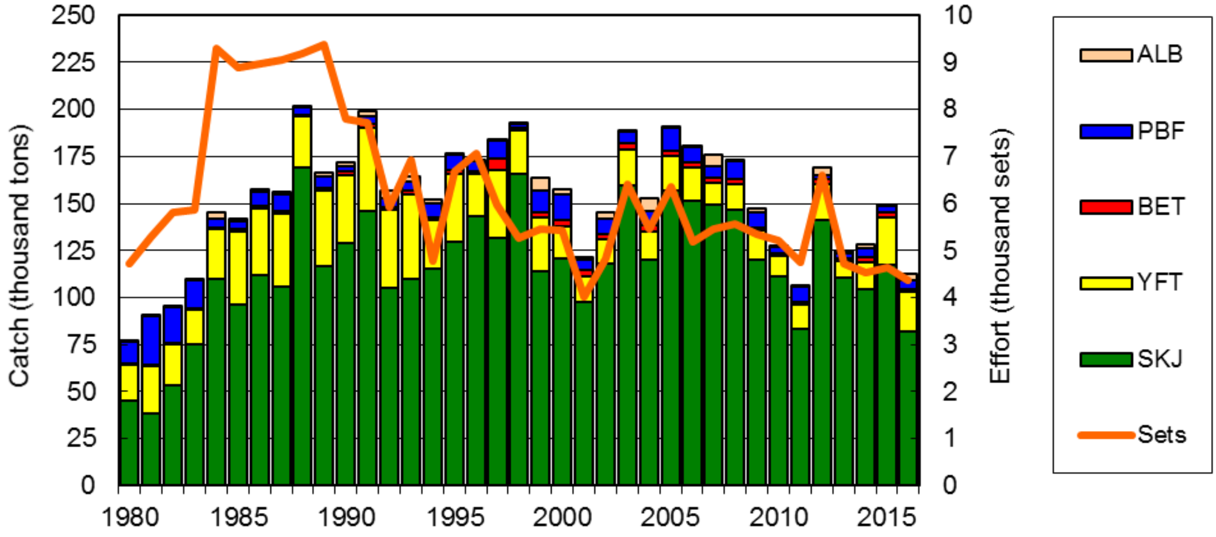

Fig. 3. Historical catches in weight (t) for major species and fishing effort (Number of sets) of the Japanese purse seine fishery in the North Pacific Ocean. SKJ: skipjack, YFT: yellowfin tuna, BET: bigeye, PBF: Pacific bluefin tuna, ALB: albacore. Value in 2016 is provisional.

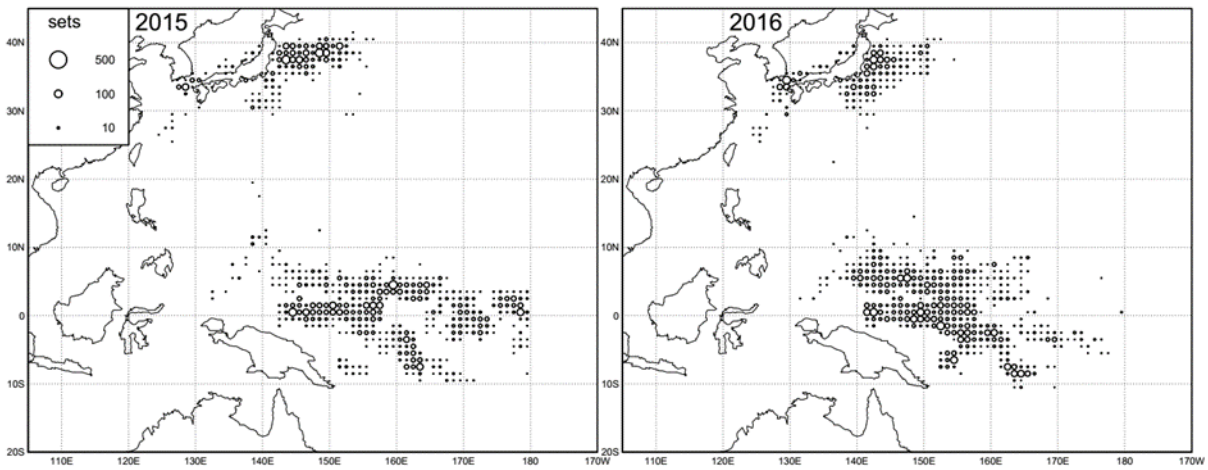

Fig. 4. Distribution of fishing effort (number of sets) for the Japanese purse seine fishery in the Pacific Ocean, 2015-2016.

Pole-and-line fishery

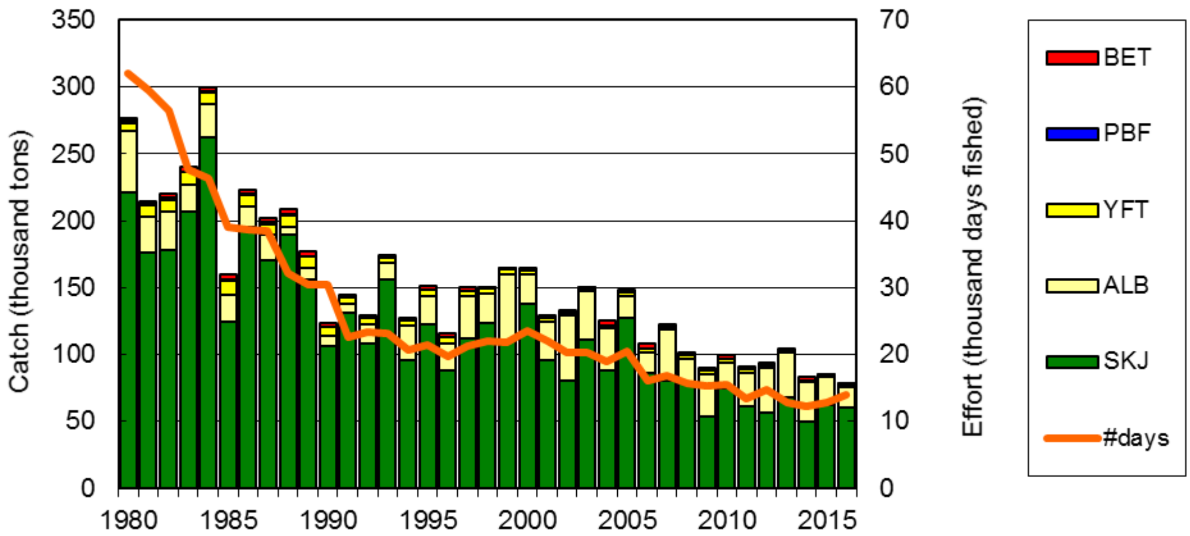

Fig. 5. Historical catch in weight (t) for major species and fishing effort (Number of fishing days) of Japanese distant water and offshore fisheries in the North Pacific. SKJ: skipjack, ALB: albacore, YFT: yellowfin tuna, PBF: Pacific bluefin tuna, BET: bigeye. The catch for PBF includes the catch by coastal pole-and-line (less than 20 GRT vessels) fishery. Value in 2016 is provisional.

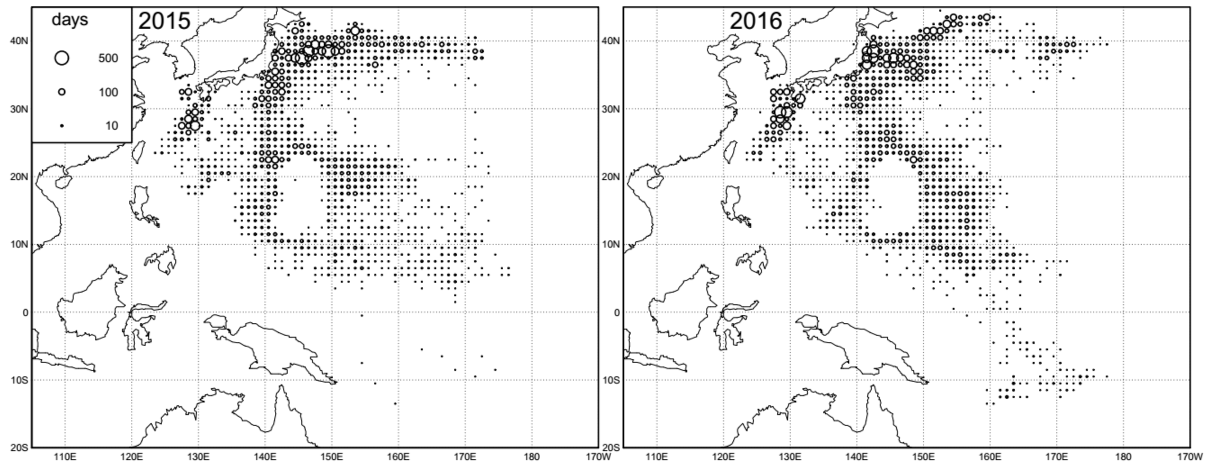

Fig. 6. Distribution of fishing effort (number of days) of the Japanese pole-and-line fishery (larger than 20 GRT vessels) in the Pacific Ocean, 2015-2016.

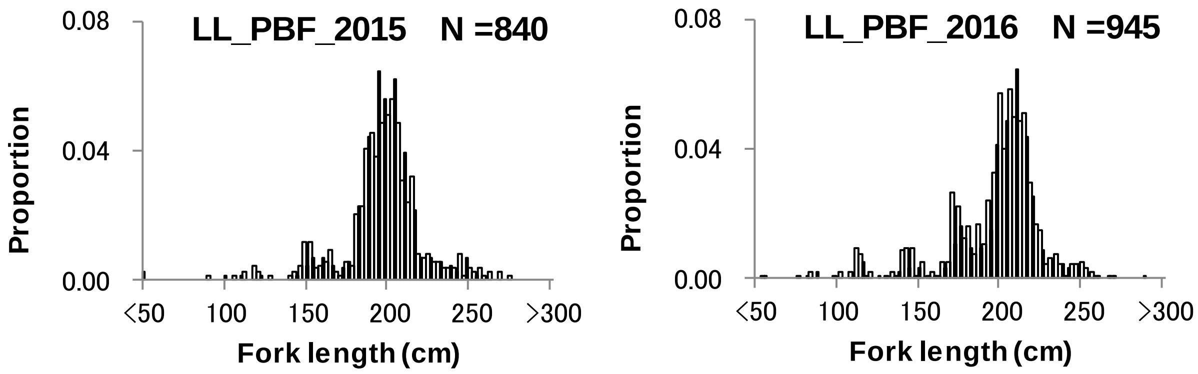

Fig. 7. Annual relative length frequency distribution (simply summing up all measurements) for Pacific bluefin tuna(PBF) caught by longline in 2015 (left) and 2016 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

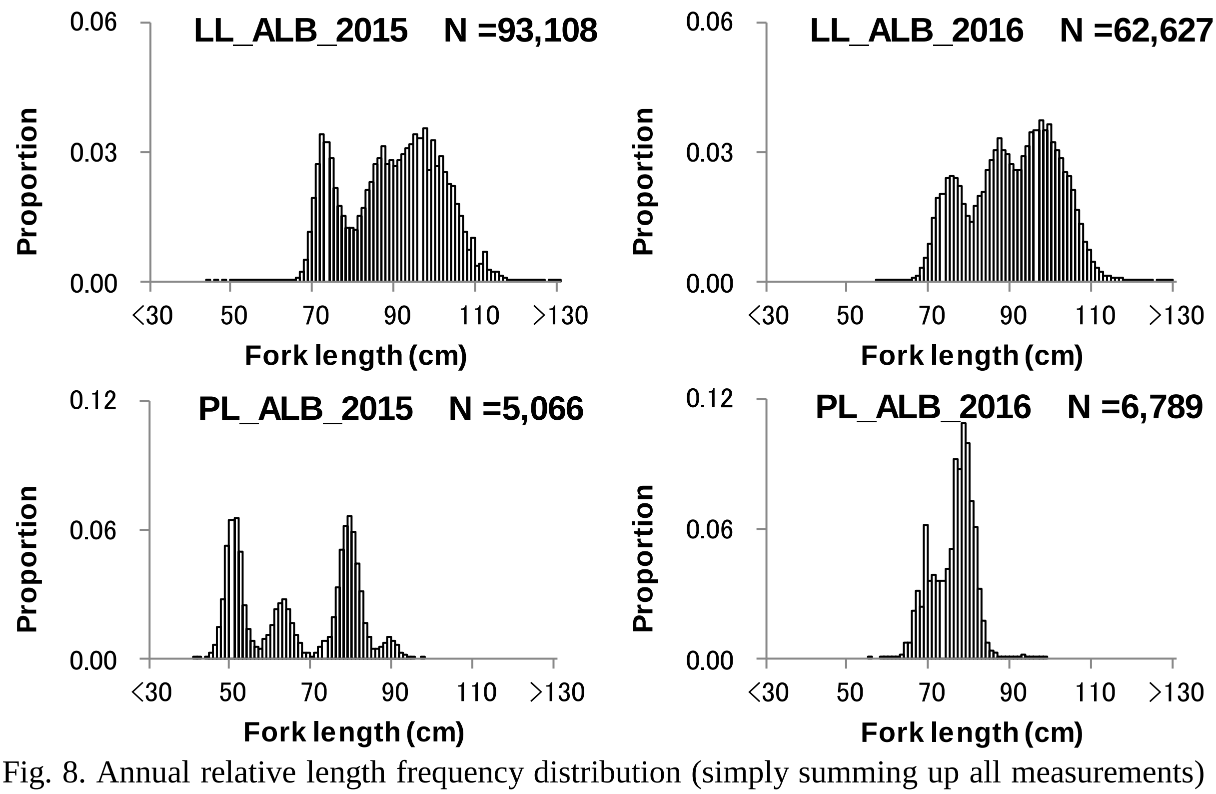

Fig. 8. Annual relative length frequency distribution (simply summing up all measurements) for albacore (ALB) caught by longline (upper two panels) and pole and line (lower tow panels) in 2015 (left) and 2016 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

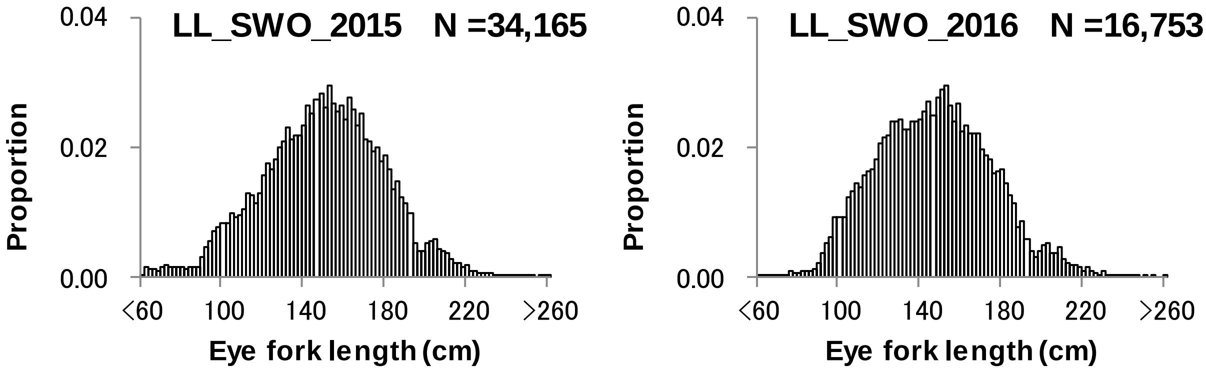

Fig. 9. Annual relative length frequency distribution (simply summing up all measurements) for swordfish (SWO) caught by longline in 2015 (left) and 2016 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.

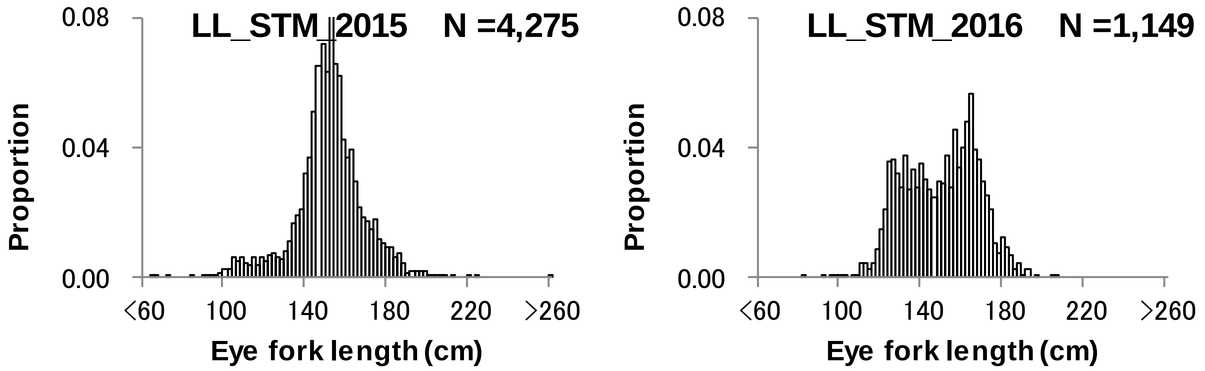

Fig. 10. Annual relative length frequency distribution (simply summing up all measurements) for striped marlin (STM) caught by longline in 2015 (left) and 2016 (right). Texts in each graph indicate gear, species, year, and the number of fish measured.