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National Report of the Republic of Korea¹

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Two Korean fisheries, distant-water tuna longline and purse seine, engage in fishing tuna and tuna-like species in the North Pacific. The number of fishing vessels operated in the Pacific Ocean was 122 longliners and 28 purse seiners in 2007, 126 longliners and 28 purse seiners in 2008, and 113 longliners and 28 purse seiners in 2009, respectively. In the North Pacific in 2009, the total catch of tunas was 62,370 tons, where 6,362 tons by longline and 46,008 tons by purse seine and those of swordfish and billfishes (stripe marlin, blue marlin, black marlin and sailfish) was 2,257 tons exclusively by longline. For longline fishery, the catch ranged from 60 to 34,080 tons from 1972 to 2009, where bigeye tuna, yellowfin tuna (26.5%) and swordfish and billfishes were 66.3%, 18.0% and 11.2% during 2007-2009, respectively. The bigeye tuna catch was shown an increase since 1980s, while the yellowfin tuna a slightly decreasing trend since the mid 1990s and the swordfish and billfishes stayed at a low level with a slightly increasing trend. In purse seine fishery, the catch ranged from 550 to 106,394 tons from 1980 to 2009, where yellowfin tuna and skipjack tuna were 78.1% and 21.9%, respectively, during 2007-2009. The catch of skipjack tuna and yellowfin tuna was in decreasing trend in recent years. Pacific bluefin tuna (PBF) in Korean waters are caught by Korean domestic large purse seine fishery as non-target species, which are targeting mackerels. The PBF catch was 794 tons in 2009, which was half of 2008 catch, and the number of purse seine vessels has gradually decreased from 32 fleets in 2002 to 27 fleets in 2009.

Introduction

Korean tuna fisheries began with small experimental longline fishing for tunas by the mid-1950s in the Indian Ocean. Since then, they have expanded to the major fishing areas of the oceans. The fishing fleet has culminated in the number of about 600 in 1975 and gradually decreased to 129 longliners and 28 purse seiners in recent years. For all having decreased, they are so far of the most importance to Korean distant-water fishery, with an annual yield of more than 250,000mt. Their fishing operations are shifting between the Oceans following the condition of fishing grounds, including the North Pacific where tuna longliners and purse seiners have actually engaged in harvesting the tuna and tuna-like species.

In Korean waters, tuna species were caught in small incidentally by various domestic fisheries such as purse seine targeting small pelagic species and set nets, etc. The total catches

have been an increasing trend, especially in Pacific bluefin tuna by large purse seine fishery.

In 2009, National Fisheries Research & Development Institute (NFRDI) trained 9 international scientific observers and dispatched them 16 times for data collection onboard distant-water fishing vessels. For improvement of catch monitoring, beginning in 2010 the observer coverage to domestic landing sites and distant-water fishing fleets will be increased annually and the data collection strategy will be streamlined for domestic fisheries related to tuna species in Korean waters. NFRDI begun with studies related to the farming for bluefin tuna since 2007 and also started a 5-year research project on the biology of bluefin tuna in Korean waters in 2010.

This report provides the information on the Korean distant-water and domestic fisheries relevant to the 10th plenary meeting of the ISC.

Data source

The data used in this report are sourced the Fishery Production Survey of the Korea Statistical Information Service (KOSIS) and the Statistical Year Book of Overseas Fisheries published by Korea Overseas Fisheries Association (KOFA), and the database (OFIRIS) of NFRDI. The former two statistics are tabulating the catches of tuna and tuna-like species from the Pacific, while those of the OFIRIS are compiled from the detailed fishing report submitted by the captain to NFRDI. The OFIRIS statistics, with coverage of about 70% for longliner and 90% for purse seiner of the total catch and fishing effort report, give the fishing position so that the fishing rate of the North Pacific to the Pacific can be obtained. In this way, catch estimation was made by multiplying the ratio of the North Pacific obtained from the OFIRIS to the total catch from the total Pacific. Finally, conversion factors described in the report of 14th meeting of SCTB were referred to estimate the whole weight from the processed weight in tunas and tuna like species. In case of fishing effort, it should be cautioned that the data be used only for referring to the trend of the effort.

The catch statistics of Pacific bluefin tuna in Korean waters incidentally caught by Korean domestic large purse seiners were referred to 3 sources likewise in the previous reports to the ISC; the catch levels for the years of 1982-1999 were the estimation from the Japanese import records, for 2000-2004 and 2006 derived from the monthly sales slips of the Korean domestic purse seine fisheries cooperatives, and for 2005 and 2007 on were those of OFIRIS.

Catch of distant-water tuna longliners in the North Pacific

The number of fishing vessels operated in the Pacific Ocean was 122 longliners in 2007, 126 longliners in 2008, and 113 longliners in 2009, respectively. The fishing effort of longline vessels in the north Pacific is about 70% of the actual effort because the catch and effort report from the captain of the vessels is about 70% and consequently this data should be used to refer to the trend of fishing effort. The effort was increased until 2003 with a peak at 42.4 million

hooks and then henceforth decreased to 11 million hooks in 2009 (Table 1).

In the north Pacific in 2009, the total catch of tunas was 62,370 tons, where 6,362 tons by longline fishery and those of swordfish and billfishes (stripe marlin, blue marlin, black marlin and sailfish) was 2,257 tons exclusively by longline. Total catch of tuna and tuna-like species by the longline fishery in the north Pacific were characterized as a slightly increasing trend with a large year fluctuation. There were a great fluctuation in the catches from 23 to 32,138 tons in 1970-80s, while they have maintained an increasing trend with a fluctuation less than 1,000 tons since 1990s (Table 1).

The dominant species caught by longliners were bigeye and yellowfin tunas, which accounted in average for 66.3% and 18.0% in 2007-2009, respectively. The catch of swordfish and billfishes was 11.2% in 2007-2009. The annual catches of bigeye tuna have shown for sure an increase since 1980s, while those of yellowfin tuna have been showing a slightly decreasing trend after the mid 1990s. The annual catch of albacore showed large yearly changes from the mid 1970s to the mid 1980s but dropped to a low level from the mid 1980 on. Billfishes were comprised of blue marlin, striped marlin, swordfish, black marlin and sailfish, the annual catches of which have been maintained at a low level with a slightly increasing trend. The mean catch of billfishes during the last 10 years was 1,737 tons.

Korean distant-water longline fishery is operating in the tropical area of the whole Pacific, between 20°N and 20°S and shifting freely from one place to another within their traditional fishing grounds for the sake of efficient operation and catch (Fig. 1). However, its fishing effort has been made more in the western Pacific because of the soaring of fuel price in recent years.

Catch of distant-water tuna purse seiners in the North Pacific

The number of fishing vessels operated in the Pacific Ocean was 28 purse seiners during 2007-2009. The fishing effort of purse seine vessels in the north Pacific is about 90% of the actual effort because the catch and effort report from the captain of the vessels is about 90% and consequently this data should be used to refer to the trend of fishing effort. The effort was sharply increased until 1991 with a peak at 6,070 hauls and then henceforth decreased to 492 hauls, where it was 1,247 hauls in 2009 (Table 2).

The total catch of tunas in the north Pacific by purse seine fishery was 46,008 tons in 2009 (Table 2). It ranged from 550 to 106,394 tons with an average of 50,566 tons from 1980 to 2009. The dominant species were skipjack and yellowfin tunas, the composition of which accounted for 78.1% and 21.9 %, respectively, during 2007-2009. The annual catch of skipjack tuna has steadily increased to reach the peak at 88,654 tons in 2003 but sharply decreased with a large fluctuation in recent years. The yellowfin tuna catches have also been showing an increase until 1993 but thereafter a decreasing trend.

Korean tuna purse seine vessels are operating in the tropical area of the Western and Central Pacific between 140°E-180°E. And they seldom extend to the east over 160°W, according to the oceanographic conditions such as the El-Nino events. So was the case in 2009

(Fig. 2).

Catches of tuna species and Pacific bluefin tuna in Korean waters

Tuna species are tabulated as a group without species classification in the domestic capture fisheries statistics of the Fishery Production Survey of the KOSIS. Although tuna species were not classified by species because of having been taken as minor in the capture fisheries in Korean waters, the proportion of the species were generally known to those concerned. It has been generally known that the majority of tuna species were bullet tuna (*Auxis rochei*) and the rests were not clear except bluefin tuna that was worthy of good market price. The total catch of tuna species ranged from 233 ton to 4,134 ton from 1990 to 2009, where it had fluctuated around 1,000 ton until 1995, with the highest at 2,712 ton in 1985 and the lowest at 233 in 1981 and thereafter it tended to have increased over 3,000 ton with a large fluctuation between 2002 and 2005. The fisheries there involved were 28 types of fisheries, of which large purse seiners (>50 G/T), set nets, small purse seiners (8-30 G/T) and 25 other fisheries were 74.9%, 16.0%, 5.2% and 4.4%, respectively (Table 3). The large purse seine fishery is the principal to the catch of tuna species in Korean waters. It is the largest one among Korean domestic fisheries and for fishing mackerels, the annual catch in average of which amounts up to more than 200,000 tons. In the perspective of large purse fishery in Korean waters, these catches of tunas are defined as bycatch.

It was since early 2000s that the catch of Pacific bluefin tuna in Korean waters has become a matter of significance (Table 3). It could be just because the amount soared to more than 2,000 tons. As there was no statistics before, it should have necessarily resorted on both Japanese import records and the monthly sales slips of the Korean domestic purse seine fisheries cooperatives until 2004. To be improved, NFRDI ended in setting up the species code for Pacific bluefin tuna and some others in its database system (OFIRIS) and also a data collecting strategy at the domestic landing site in 2003.

Given the catch statistics of bluefin tuna in Korean waters relied on the sources mentioned above, it was characterized as an increase, where it was not noticeable before 1995 but thereafter increased to a level of about 1000 tons with an excess of 2000 tons in 2003 (Table 4). On the contrary, the fleet number of large purse seiners as the major fishery has been gradually decreasing by virtue of the fishing capacity control by the government and resulted in reduction almost by half, that is, 27 fleets in 2009 from 48 fleets before. Of them, gear types during 1982-1999 were known of as purse seine.

As for distribution of the catch of bluefin tuna by Korean large purse seiners, it was shown that they were distributed along the fishing ground of purse seiners and mainly occurred in southern waters and centered on around Jeju Island (Fig. 3). In terms of seasonality, it was observed that they were distributed around Jeju Island and the southern waters throughout the year and concentrated in Jeju Island in spring and summer and appeared in the Yellow Sea during August-December, but also observed in the east-southern coast as far as the fleet went

there regardless of the season. It needs to take into account that, as the fishing ground of the fleets is laid largely over the southern waters and Yellow Sea and seldom on the eastern coast of the Korean waters, the spatio-temporal distribution of incidental catch are entirely related to the behavior of purse seine fishery.

As reported to the previous meetings, almost all individuals of PBF incidentally caught by the large purse seiners in Korean waters were juvenile (<150 cm) and likely to increase in size of length as time passed. The fork length of all those individuals ranged from 20 cm to 156 cm from 2000 to 2009 (Fig. 4). There appeared a single narrow mode at 27 cm in 2000 and 40 cm in 2001, and two modes at 40cm and 50cm in 2002. In 2003, there were several modes ranged 25 to 65 cm. On the other hand, the distribution of fork length of 2002 and 2004-2009 showed a similar distribution with the center of mode at 50cm to which some larger individuals, though it was a few, were added year after year. This increase in larger individuals was also reflected in an increase of mean fork length which was moving from 33.6cm in 2000 to 57.8 cm in 2009.

The monthly composition of fork length was examined with the data from 2008 and 2009. It was likely to show that the mean fork length of individuals caught in late winter and spring was slightly larger than that of other seasons (Fig. 5). It was not sure whether larger individuals were more than smaller ones in the fishing grounds in late winter and spring or it was related to fishing behavior of purse seiners by season. There needs further research on this.

Ranching by industry for Pacific bluefin tuna in Korea

There were some fattening operations for juvenile bluefin tuna by the side of industries, actually two fishery companies in Korea since 2007. The juveniles used in fattening by one company were 1,170 individuals (2-50 kg/ind.) taken from set nets in 2007-2009 and 2,200 (2-20kg/ind.) by the other company during 2008-2009.

Research activities

NFRDI begun with studies related to the farming operations for bluefin tuna since 2007. 80 individuals (2kg/ind.) taken in 2008 has been fattening in the cage at sea by the Southwest Sea Fisheries Research Institute of NFRDI. The Subtropical Fisheries Research Center of NFRDI also has been conducting an experiment with 370 individuals (2 kg/ind.) taken by trolling since 2009.

In the mean time, NFRDI started a 5-year research project on the biology and ecology of bluefin tuna in Korean waters in 2010. In 2009, NFRDI monitored 16 fishing trips with 9 international onboard observers to monitor catch of target and by-catch species in the Korean distant-water fishing vessels. For improvement of catch monitoring, beginning in 2010 the annual observer coverage onboard distant-water fishing fleets and to landing sites will be increased. The data collection strategy will be streamlined for landing port and cannery, and for domestic fisheries related to tuna species in Korean waters.

Table 1. Fishing effort (1,000 hooks) and catch (ton) by species for the Korean distant-water longline fishery in the North Pacific.

Fishing effort is form the OFIRIS which represents about 70% of the actual one. Data during 2006-2009 is provisional

(unit : tons)

YEAR	Hooks	Albacore	Yellowfin tuna	Bigeye tuna	Bluefin tuna	Skipjack	Blue Marlin	Striped Marlin	Sword fish	Black Marlin	Sailfish	Others	Total
1972	3	0	153	91	0	6	0	0	0	0	0	0	250
1973	59	5	3	3	0	5	0	0	0	0	0	8	23
1974	465	91	4,040	3,914	0	242	0	0	0	0	0	683	8,970
1975	2,246	7,051	5,749	9,323	4	2,966	0	0	0	0	0	7,045	32,138
1976	5,882	2,213	5,936	6,494	6	90	0	0	0	0	0	3,145	17,883
1977	7,292	501	6,266	9,634	0	1,394	0	0	0	0	0	2,711	20,506
1978	5,073	670	4,990	3,126	3	2,047	0	0	0	0	0	2,387	13,222
1979	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1980	15,945	592	4,609	3,158	0	54	155	74	135	34	633	242	9,685
1981	31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1982	17,292	4,874	4,046	5,411	0	138	351	102	167	192	1,378	344	17,002
1983	1,450	366	1,862	2,143	0	13	83	49	48	92	1,226	76	5,958
1984	6,816	1,925	3,305	3,417	2	25	155	40	28	51	842	563	10,353
1985	9,237	2,789	1,534	1,935	0	3	46	13	12	12	540	393	7,278
1986	7,146	3,833	3,173	4,594	0	1	86	15	19	32	523	3,022	15,299
1987	20,989	1,624	5,484	8,283	13	15	89	15	50	23	99	1,760	17,457
1988	13,917	800	3,139	3,772	0	5	133	17	28	13	0	1,171	9,078
1989	19,086	562	3,149	4,413	0	8	8	33	8	20	1	741	8,943
1990	24,997	30	3,764	8,528	0	4	45	1	46	30	2	1,851	14,301
1991	20,093	5	3,225	5,958	0	5	75	7	37	5	0	874	10,192
1992	22,731	2	4,426	8,437	0	2	60	54	32	242	398	1,924	15,576
1993	19,714	3	3,155	5,187	0	3	36	569	27	514	586	2,629	12,709
1994	19,659	3	3,811	7,247	0	0	2	557	4	225	1,198	1,567	14,614
1995	32,875	14	7,107	9,951	0	0	1	307	10	251	221	2,926	20,786
1996	18,483	158	5,358	4,296	0	1	10	429	15	126	244	1,639	12,276
1997	17,927	404	5,475	7,353	0	0	145	1,017	100	78	1,292	4,472	20,338
1998	30,143	226	3,871	15,425	0	0	335	635	153	146	382	6,796	27,970
1999	27,697	99	4,307	8,490	0	0	165	433	132	408	198	2,499	16,731
2000	16,627	15	4,460	6,851	0	2	96	537	202	186	127	4,016	16,492
2001	32,061	64	5,747	10,071	0	2	166	254	438	895	28	5,203	22,868
2002	33,507	112	3,137	10,786	0	0	152	188	439	479	123	1,400	16,816
2003	42,485	146	4,741	9,739	0	6	159	206	381	819	129	931	17,256
2004	38,240	78	5,145	12,468	0	101	227	75	410	919	1	404	19,827
2005	28,687	420	2,958	9,257	0	35	304	136	404	997	0	820	15,330
*2006	37,741	135	5,096	11,494	0	0	217	56	465	1,063	0	941	19,468
*2007	26,809	93	2,182	9,605	0	0	122	47	453	883	0	185	13,571
*2008	30,612	395	2,565	10,877	0	0	212	29	793	706	0	576	16,152
*2009	11,993	90	4,112	12,160	0	0	325	17	1,132	783	0	896	19,514

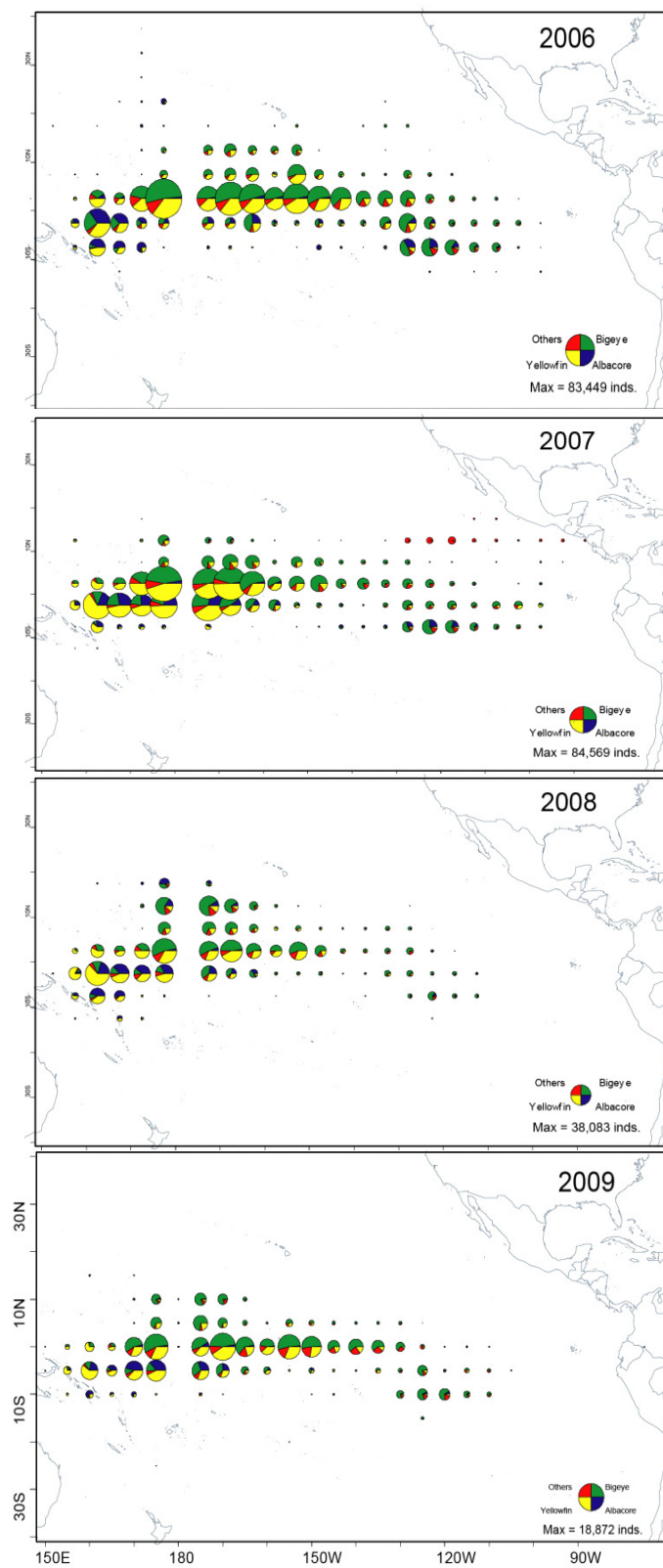


Fig. 1. Distribution of Korean distant-water tuna longline fishing area in the Pacific Ocean.

Table 2. Fishing effort (hauls) and catch (ton) by species for the Korean distant-water purse seine fishery in the North Pacific. Fishing effort is from the OFIRIS which represents about 90% of the actual one. Data during 2006-2009 is provisional

(unit : tons)

YEAR	Hauls	Skipjack tuna	Bigeye tuna	Yellowfin tuna	Others	Total
1980	30	476	0	74	0	550
1981	127	1,462	0	635	0	2,097
1982	400	8,838	0	1,854	0	10,692
1983	375	10,314	0	519	0	10,833
1984	626	10,893	0	285	0	11,179
1985	604	8,590	0	0	0	8,590
1986	805	21,334	0	2,264	0	23,597
1987	1,220	23,119	190	11,818	0	35,127
1988	1,403	46,139	0	11,265	0	57,404
1989	1,772	27,372	139	10,184	0	37,695
1990	2,596	35,609	33	8,037	0	43,679
1991	6,070	53,585	3	18,344	0	71,932
1992	4,502	29,057	3	18,569	0	47,628
1993	4,508	34,594	0	28,570	0	63,164
1994	4,746	50,603	0	15,887	5	66,494
1995	4,461	65,069	0	17,503	0	82,572
1996	4,986	62,361	0	4,263	0	66,624
1997	3,395	38,696	0	11,370	0	50,066
1998	2,699	72,433	106	23,193	0	95,732
1999	1,687	83,292	0	23,102	0	106,394
2000	750	51,603	0	10,773	0	62,376
2001	3,259	82,889	0	17,719	0	100,608
2002	2,537	64,897	0	16,389	0	81,286
2003	2,876	88,654	319	11,715	0	100,687
*2004	1,633	43,797	48	7,426	0	51,271
*2005	1,035	49,724	0	11,027	0	60,751
*2006	510	67,564	13	15,394	0	82,970
*2007	544	18,270	0	3,585	0	21,855
*2008	492	9,269	4	7,842	0	17,114
*2009	1,247	38,789	15	7,204	0	46,008

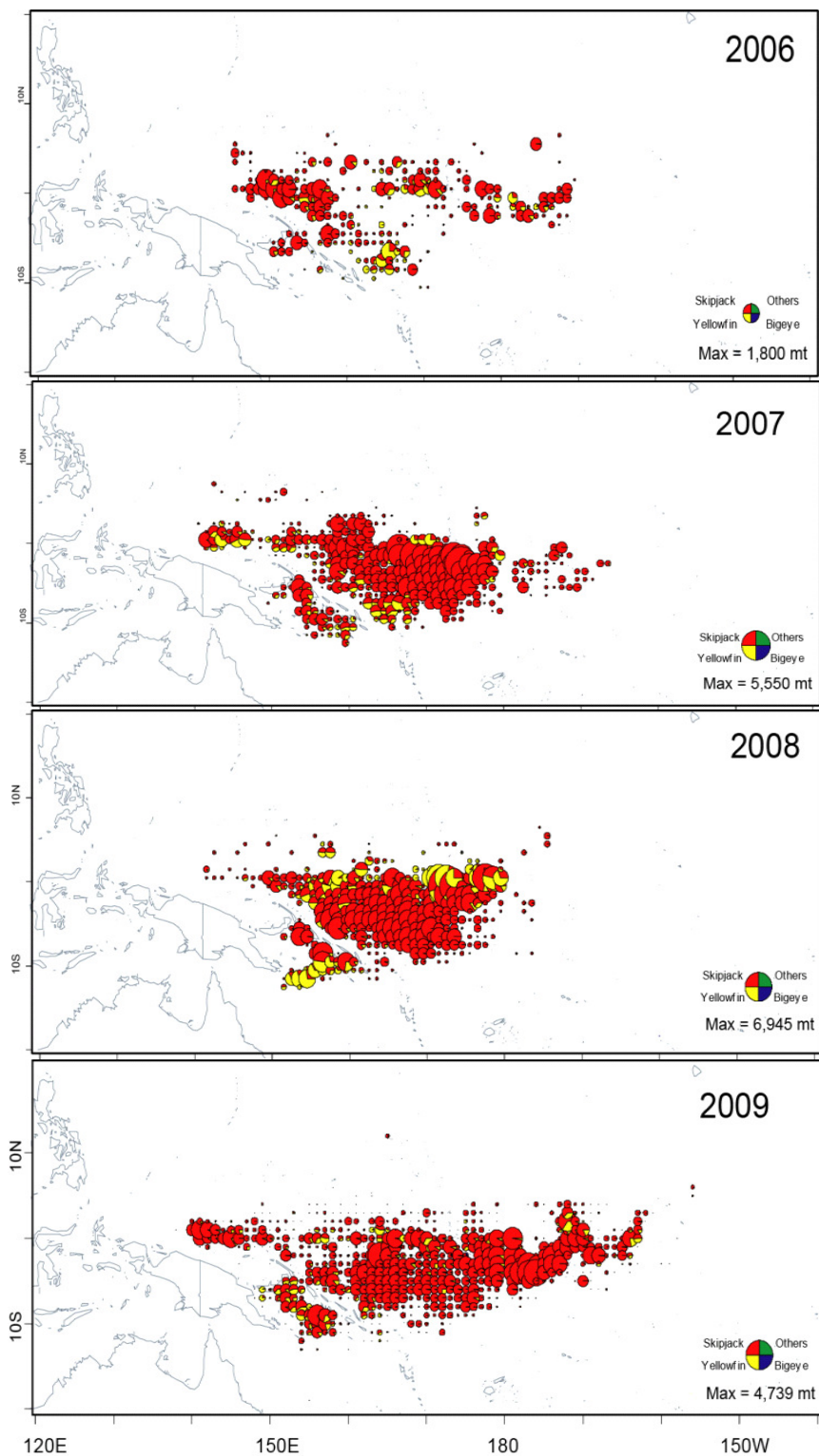


Fig. 2. Distribution of Korean distant-water tuna purse seine fishing area in the Pacific Ocean.

Table 3. Annual catch of tuna species incidentally caught by domestic fishing gear

Year	Total catch (ton)	Catch proportion (%) by fishing gear type			
		Large purse seine	Set nets	Small purse seiner	Others (25 fishing gears)
1990	758		67.2	21.1	11.7
1991	1807	71.0	9.6	3.0	16.4
1992	897		83.1	11.5	5.5
1993	459		67.3	28.1	4.6
1994	848		77.4	19.3	4.2
1995	1816	75.8	14.3	9.3	1.0
1996	2792	64.7	25.4	3.9	6.3
1997	3115	85.3	2.6	9.5	2.9
1998	3371	75.6	15.9	5.6	2.9
1999	2861	74.8	16.7	6.0	2.4
2000	3245	70.1	23.7	4.8	1.4
2001	3295	45.4	40.3	6.6	7.7
2002	2344	90.3	4.9	3.2	1.6
2003	3739	85.3	8.2	4.0	2.4
2004	1755	78.1	9.5	7.1	5.3
2005	3324	86.6	2.8	3.0	7.6
2006	2715	92.5	1.7	3.5	2.4
2007	4134	89.0	7.4	1.3	2.4
2008	3702	85.0	11.3	1.4	2.4
2009	3307	96.1	0.6	1.2	2.1

Table 4. Total annual catch of tunas by various domestic fisheries and bluefin tuna by large purse seiners (LPS) in Korean waters. Gear type during 1982-1999 is known as purse seine.

Year	Tunas (ton)	Tunas by LPS (ton)	PBF by LPS (ton)	Number of fleets permitted
1982	454		31	48
1983	1,855		13	48
1984	890		4	48
1985	2,712		1	48
1986	628		344	48
1987	469		89	48
1988	1,607		32	48
1989	1,711		71	48
1990	758		132	48
1991	1,807	1283	265	48
1992	897	0	288	48
1993	459	0	40	48
1994	848	0	50	48
1995	1,816	1376	821	36
1996	2,792	1807	102	36
1997	3,115	2658	1,054	36
1998	3,371	2549	188	36
1999	2,861	2141	256	36
2000	3,245	2275	1,976	32
2001	3,295	1495	968	32
2002	2,344	2117	767	32
2003	3,739	3191	2,141	29
2004	1,755	1370	636	29
2005	3,324	2880	1,085	29
2006	2,715	2512	949	29
2007	4,134	3678	1,054	29
2008	3,702	3146	1,536	29
2009	3,307	3177	794	27

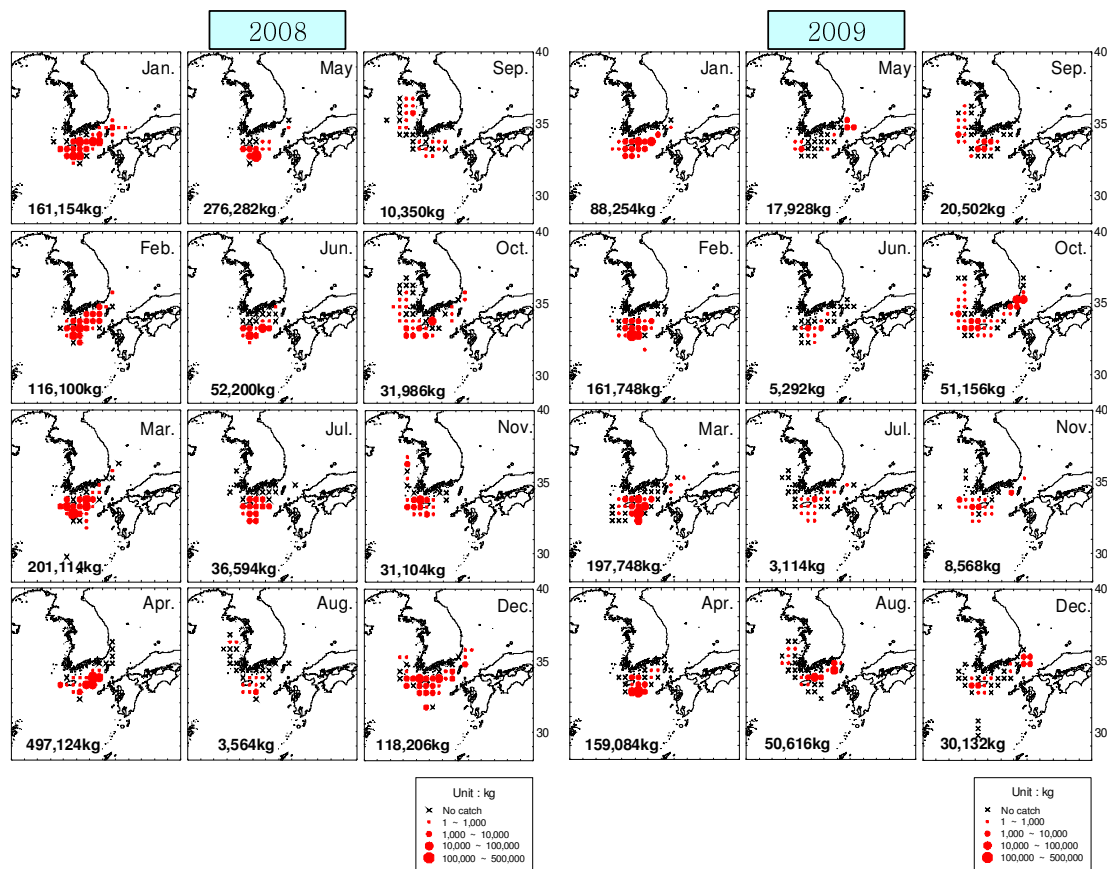


Fig. 3. Monthly horizontal distributions of Pacific bluefin tuna (PBF) caught by offshore purse seiners in Korean waters, 2008-2009.

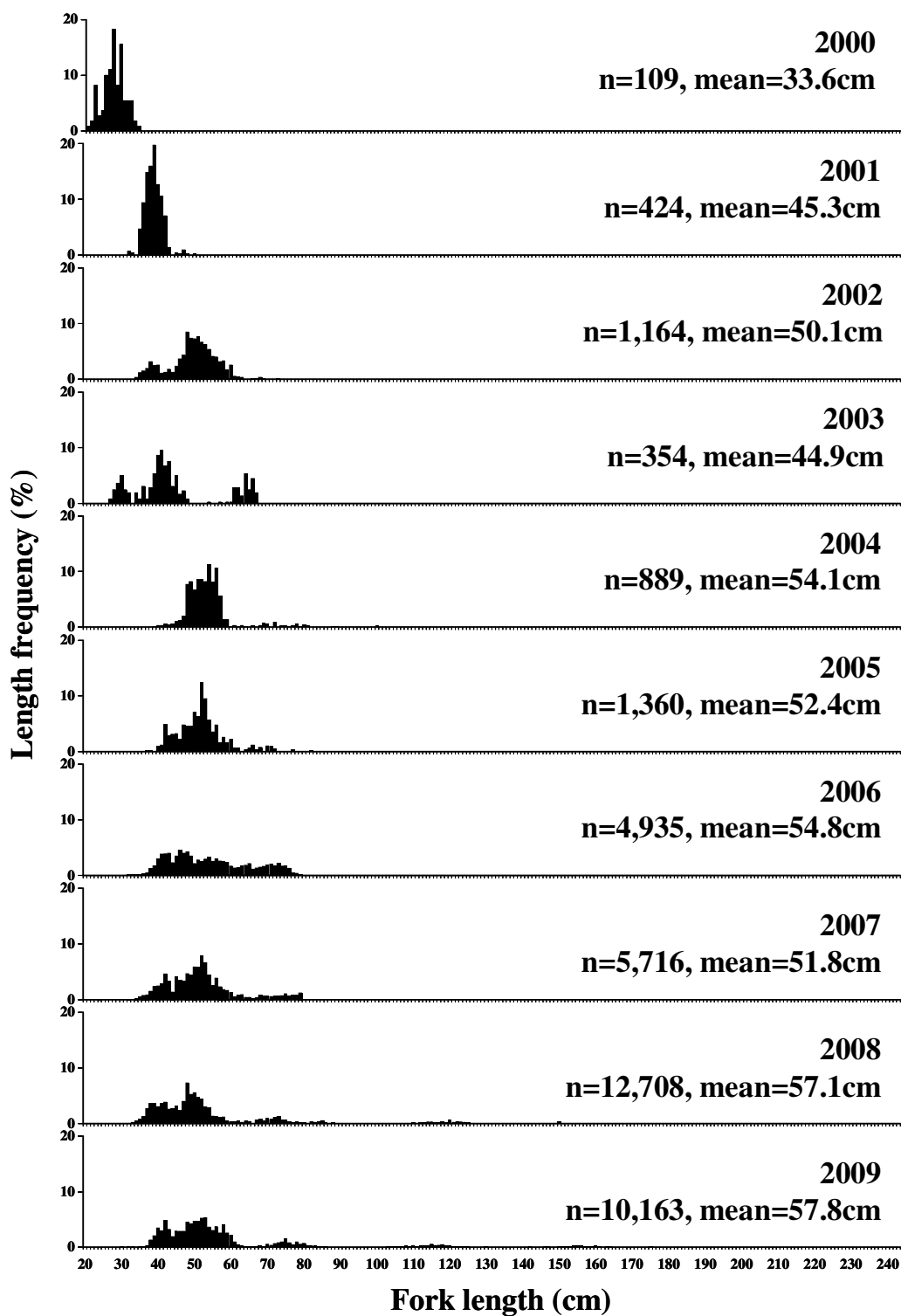


Fig. 4. Length-frequency distributions of PBF landed by the Korean domestic purse seine fishery, 2000-2009.

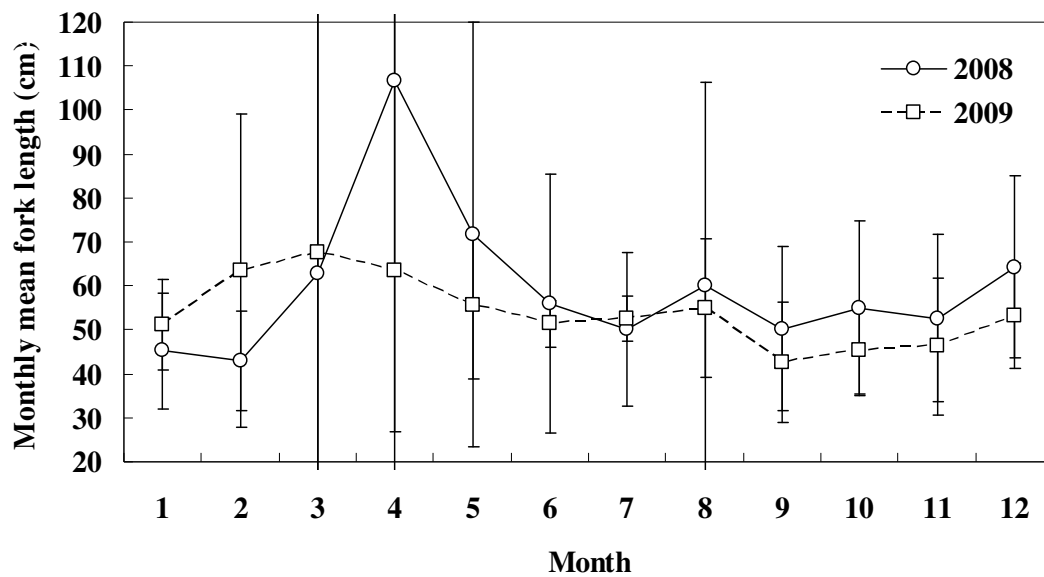


Fig. 5. Monthly mean fork length (cm) of PBF caught by offshore purse seiners in Korean waters, 2008-2009.