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Catch data updates of tuna species in Korea

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Abstract

National Fisheries Research and Development Institute (NFRDI) has collected the Pacific bluefin tuna (PBF) data from the domestic and distant-water fisheries in Republic of Korea. Additionally, biological sampling has been regularly carried out on the boats of overseas fisheries and at designated domestic landing sites.

Annual catches of fishes captured in the North Pacific Ocean by the Korean distant-water longline ranged from 60 to 34,080 mt (averaged 13,865 mt) from 1972 to 2007 (Table 3). In 2007, the annual catch was 14,477 mt. Major species caught by the longline in the North Pacific Ocean from 1971 to 2007 were bigeye tuna (49%), yellowfin tuna (30%) and albacore (6%). In 2007, the annual catches of the three species were 12,822 mt (10,208 mt of bigeye tuna, 2,523 mt of yellowfin tuna and 91 mt of albacore).

Annual catches of distant-water purse seine fishery from 1980 to 2007 ranged from 550 to 110,933 mt (averaged 51,665 mt). Annual catch tended to increase with year and reached 22,004 mt in 2007. Major species caught by the purse seine in the North Pacific Ocean were skipjack tuna (79%) and yellowfin tuna (21%) for the 1980-2007 period. In 2007, the annual catch of skipjack and yellowfin tuna was 18,368 mt and 3,636 mt.

Contrastingly, most Pacific bluefin tuna produced in Korean sea waters were caught by the domestic purse seines targeting mackerels. They were incidentally caught as by-catch and are mostly small individuals of 20-167 cm in fork length. The 30-80 cm FL size class dominated in 2007. The annual catch of PBF by 29-48 purse seiners and 4 trawlers ranged from 1 to 2,141 mt during the 1982-2007 period. PBF catch was not annually consistent in catch due to non-target species.

NFRDI initiated the observer program for distant-water fisheries since 2002 and for domestic fisheries since 1998. In 2007, six observers were deployed 12 times on Korean distant-water fishing vessels. To reduce by-catch of seabird and sea turtle by tuna longline fishery, guidebooks and posters summarizing information of these species were distributed to fishing boats including the tuna longliners.

Introduction

Catches in weight (mt) by fishery for tunas from 1995 to 2006 were reported in the previous 7th International Scientific Committee on Tuna and Tuna-like Species in the North Pacific Ocean (ISC) meeting in 2007 (Hwang *et al.* 2007). This paper provides the updated and latest catch data of tunas in Korea and summarizes recent catch trends of the Korean tuna fisheries in the North Pacific.

The Korean government initiated the fisheries observer programs for both domestic and international distant-water fisheries in 1998 and 2002. In 2007, six observers were dispatched 12 times for distant-water fisheries, and the number will be increased. National Fisheries Research and Development Institute (NFRDI) has collected the catch data from the domestic and distant-water fisheries based on reports of observers and logbooks of fisheries vessels to construct a database.

Accepting the decision to expand the relevant area of International Scientific Committee on Tuna and Tuna-like Species in the North Pacific Ocean (ISC) to the equator during the previous 7th ISC meeting in 2007, catch statistics should be revised and updated based on catch data in the ISC area. Also, the criteria of data source were revised by referring formal publications and recorded documents.

Status of distant-water tuna fishery in the North Pacific Ocean (longline and purse seine)

Data source

The formal catch statistics is compiled and reported in “Fishery Production Survey” by the Ministry for Food, Agriculture, Forestry & Fisheries (MFAFF), which covers the entire Pacific Ocean. National Fisheries Research & Development Institute (NFRDI) has the database system “OFIRIS”, which compiles the logbook data collected from the vessels operating in both the north and south Pacific. Data for 1979 and 1981 are unavailable. The coverage of NFRDI database is about 45% of formal catch statistics of MFAFF. For ISC, the catch levels for the north Pacific were derived from the catch levels for the entire Pacific (catch statistics of MFAFF) by multiplying the ratio of catch for north Pacific estimated from the logbook data of NFRDI (OFIRIS). The unit of catch is metric tons and the whole weight of a tuna was derived from the whole weight of processed parts of the tuna conversion factors are explained in the report of 14th meeting of SCTB and listed in Table 1.

Table 1. Species processed to whole weight formula (Whole weight = Processed weight * σ)

Species	Processed weight	Parameter σ
Albacore	Gilled and gutted	N/A
Bigeye	Gilled and gutted	1.1018
Yellowfin	Gilled and gutted	1.0896
*Black marlin	Headed, Tailed and gutted	1.2005
Blue marlin	Headed, Tailed and gutted	1.2605
Striped marlin	Headed, Tailed and gutted	1.2314
Swordfish	Headed, Tailed and gutted	1.2551
Swordfish	Filletted	1.5269

The unit of fishing effort is the official number of boats in the Pacific permitted by the Korea overseas fisheries association.

Catch and effort data are aggregated for a 5 x 5 degree area.

Monthly catch and effort (number of hooks) data are available from the logbook data in NFRDI.

Catch data of albacore by the gillnet fishery in the distant-waters were obtained by personal communication with Dr. Gong (ISC7, 2007). The fishery had closed since 1992 due to UN resolution implemented for gillnet fishery in the high seas.

Size frequency data for the distant-water longline catch are obtained from samples collected aboard by fisherman.

Catch of distant-water tuna longline in the North Pacific Ocean

Annual catches of tunas captured in the North Pacific Ocean by the Korean distant-water

longline ranged from 60 to 34,080 mt (averaged 13,865 mt) for the 1972 to 2007 period (Table 2). In 2007, the annual catch was 14,477 mt.

Major species caught by the longline in the North Pacific Ocean were bigeye tuna (49%), yellowfin tuna (30%) and and albacore (6%) from 1971 to 2007. In 2007, the annual catch was 10,208 mt for bigeye tuna, 2,523 mt for yellowfin tuna and 91 mt for albacore.

Although annual catch of albacore decreased, catch of bigeye tuna and billfishes trended to increase. Catch data of yellowfin tuna were rather stable (Fig. 1).

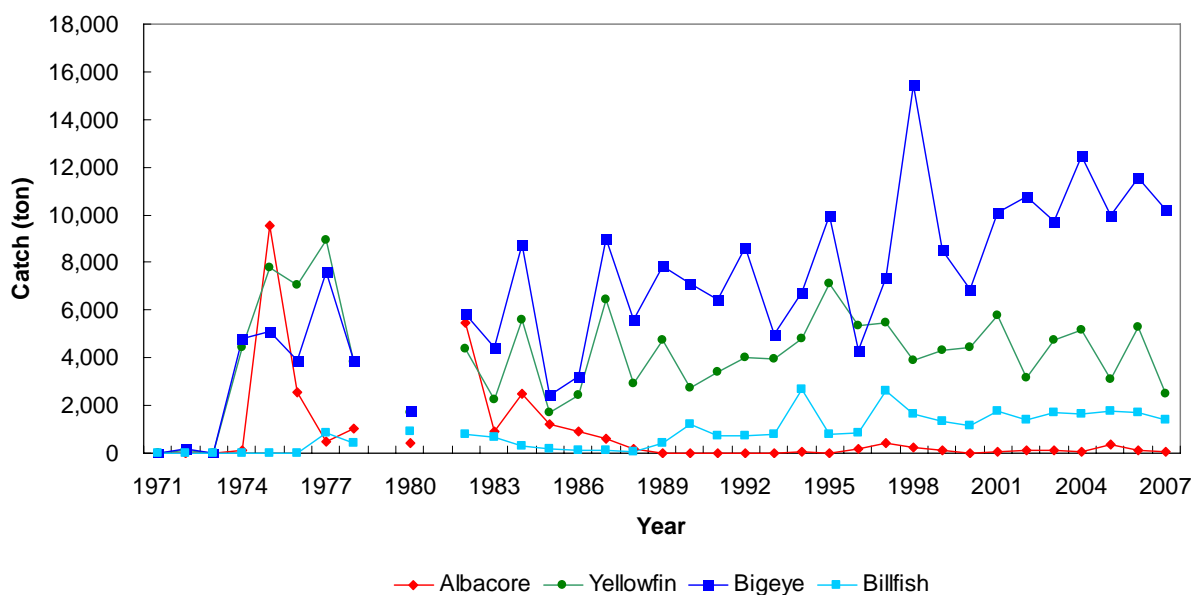


Fig. 1. Annual catches of tuna species caught by Korean distant-water tuna longline fisheries in the North Pacific Ocean.

Table 2. Estimated annual catch of tuna species by Korean distant-water longline fishery in the Northern Pacific Ocean.
(unit: ton)

YEAR	Albacore	Yellowfin tuna	Bigeye tuna	Bluefin tuna	Skipjack	Blue Marlin	Striped Marlin	Sword fish	Black Marlin	Sailfish	Sharks	Others	Total
1972	0	134	181	0	58	0	0	0	0	0	0	0	374
1973	3	4	7	0	22	0	0	0	0	0	0	23	60
1974	114	4,435	4,786	0	1,297	0	0	0	0	0	10	1,100	11,742
1975	9,575	7,804	5,091	6	4,531	0	0	0	0	0	100	6,972	34,080
1976	2,576	7,048	3,905	14	82	0	0	0	0	0	96	1,614	15,334
1977	459	8,961	7,623	0	85	282	43	219	38	245	91	329	18,374
1978	1,006	3,827	3,922	0	47	248	28	68	68	26	36	249	9,524
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	N/A
1980	402	1,712	1,748	0	18	66	37	64	41	715	122	85	5,010
1981	N/A	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	5,462	4,355	5,852	0	30	102	39	48	27	565	186	2,313	18,979
1983	911	2,279	4,414	0	1	45	19	11	26	558	160	1,447	9,869
1984	2,490	5,578	8,751	20	9	90	23	48	43	113	118	2,109	19,391
1985	1,188	1,710	2,433	0	3	114	16	24	21	0	55	311	5,875
1986	923	2,439	3,204	0	4	7	61	9	21	3	28	1,427	8,126
1987	607	6,443	9,010	26	4	37	1	44	19	4	39	1,430	17,665
1988	175	2,931	5,607	4	2	42	11	27	3	0	37	967	9,808
1989	27	4,759	7,858	29	2	54	26	40	235	92	70	1,193	14,384
1990	1	2,710	7,093	0	2	44	315	61	554	213	56	1,655	12,702
1991	0	3,419	6,438	0	0	2	141	5	146	445	0	721	11,317
1992	1	4,044	8,634	0	0	1	318	8	185	221	12	1,970	15,394
1993	21	3,954	4,971	0	1	10	388	15	115	246	26	2,823	12,569
1994	54	4,818	6,729	0	0	152	1,045	66	93	1,294	181	1,962	16,394
1995	14	7,107	9,951	0	0	1	307	10	251	221	16	2,926	20,802
1996	158	5,358	4,296	0	1	10	429	15	126	244	86	1,639	12,363
1997	404	5,475	7,353	0	0	145	1,017	100	78	1,292	639	4,472	20,977
1998	226	3,871	15,425	0	0	335	635	153	146	382	1,010	6,796	28,979
1999	99	4,307	8,490	0	0	165	433	132	408	198	774	2,499	17,505
2000	15	4,460	6,851	0	2	96	537	202	186	127	863	4,016	17,355
2001	64	5,747	10,071	0	2	166	254	438	895	28	500	5,203	23,368
2002	112	3,137	10,786	0	0	152	188	439	479	123	185	1,400	17,001
2003	146	4,741	9,739	0	6	159	206	381	819	129	95	931	17,352
2004	78	5,145	12,468	0	101	227	75	410	919	1	8	404	19,834
2005	395	3,126	9,944	0	36	320	141	434	845	0	12	1,133	16,385
*2006	147	5,274	11,554	0	0	224	56	477	925	0	0	989	19,645
*2007	91	2,523	10,208	0	0	158	28	452	755	0	1	262	14,477

* provisional

Catch of distant-water tuna purse seine in the North Pacific Ocean

Annual catches of distant-water purse seine fishery ranged between 550 and 110,933 mt (averaged 51,665 mt) from 1980 to 2007 (Table 3). Annual catch tended to increase with year, peaking in 2003. In 2007, the catch was 22,004 mt. Major species caught by the purse seine in the North Pacific Ocean were skipjack tuna (79%) and yellowfin tuna (21%) for the 1980-2007 period. Although catch of bigeye was rather stable in the long-term, catch of skipjack tuna generally increased (Fig. 2).

Table 3. Estimated catch of tuna species by Korean distant-water purse seine fishery in the Northern Pacific.
(unit: ton)

YEAR	Skipjack	Bigeye tuna	Yellowfin tuna	Others	Total
1980	476	0	74	0	550
1981	1,462	0	635	0	2,097
1982	8,838	0	1,854	0	10,692
1983	10,314	0	519	0	10,833
1984	10,893	0	285	0	11,178
1985	8,590	0	0	0	8,590
1986	21,334	0	2,264	0	23,597
1987	23,119	189	11,818	0	35,127
1988	46,139	0	11,265	0	57,404
1989	27,372	139	10,184	0	37,695
1990	35,609	33	8,037	0	43,678
1991	53,585	3	18,344	0	71,932
1992	29,057	2	18,569	0	47,628
1993	34,594	0	28,570	0	63,164
1994	50,603	0	15,887	5	66,494
1995	65,069	0	17,503	0	82,572
1996	62,361	0	4,262	0	66,624
1997	38,696	0	11,369	0	50,066
1998	72,433	106	23,193	0	95,732
1999	83,292	0	23,102	0	106,394
2000	51,603	0	10,773	0	62,376
2001	79,020	0	17,333	0	96,353
2002	51,360	0	17,398	0	68,757
2003	97,412	581	12,940	0	110,933
2004	42,269	66	6,217	0	48,552
2005	48,059	0	10,562	0	58,621
*2006	70,944	13	16,008	0	86,965
*2007	18,368	0	3,636	0	22,004

* provisional

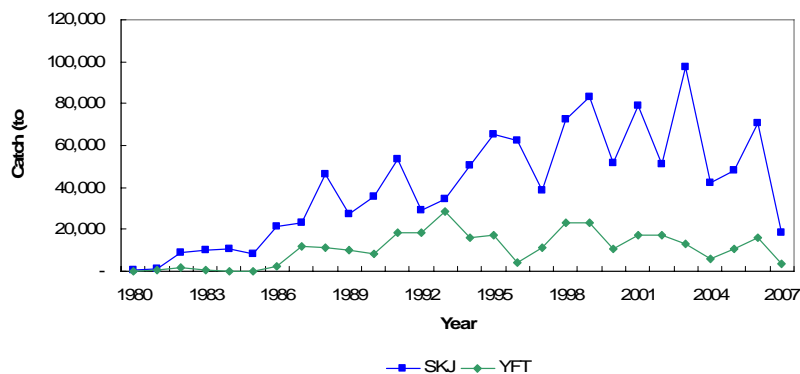


Fig. 2. Annual catch of tuna species by distant-water purse seine in the North Pacific Ocean.

Status of domestic purse seine fishery in the offshore of Korea

Korean catches of Pacific bluefin tuna (PBF), *Thunnus orientalis*, are mainly from the by-catches from Korean domestic offshore purse seine targeting mackerels in Korean sea waters. A typical fleet of Korean offshore purse seine is consisted of one main vessel (128 international gross tonnage, 35-m length) and two light boats (55-88 international gross tonnage, 27-35-m length).

PBF had been ignored among Korean domestic fishermen because its catch was marginal. The PBF caught in Korean waters are mostly smaller than 1 m in fork length and are exported to Japanese market for sashimi.

Data source

Catch levels for the 1982-1999 period were derived from the import data of Japan. Gear types were unknown for this period, but probably the major one was purse seine. Catch levels after year 2000 were derived from the sales slips of the Korean domestic purse seine fisheries cooperatives. The coverage of the vessels operating offshore is about 90%. The unit of catch is metric tons (round weight). Tuna catch data in “OFIRIS” of NFRDI were not classified by species except PBF from 1997 to 2002. The data began to be classified by species in 2003. Only PBF was classified on the sales slips of the Korean domestic purse seine fisheries cooperatives. The unit of fishing effort of the offshore purse seine fishery is the official number of fleets in the offshore waters permitted by the Korean domestic purse seine fisheries cooperatives. Miscellaneous data (e.g. catch by trawl) were excluded because they were collected sporadically (Hwang *et al.*, 2007).

The same system is used for monthly catch of offshore purse seine. The unit of monthly catch is metric tons (round weight). Monthly catches since year 2000 were derived from the sales slips of the Korean domestic purse seine fisheries cooperatives. Because Korean PBF catch is not annually consistent as non-target species, quarterly catch before 2000 can not be extrapolated by using mean catch ratio of 2000-2007 years as suggested by Oshima *et al.*, (2008).

Size frequency data for the offshore purse seine catch were obtained from port sampling conducted by observers. If the catch landed each day exceeded 200, a sample of 200 individuals was measured. In other cases, all individuals were measured.

Catch and effort of domestic purse seine

Most Pacific bluefin tunas were caught by the domestic purse seines as by-catch in Korean coastal waters. Annual PBF catches by the Korean trawlers were also recorded from 2001 to 2002, but the amount was marginal (Hwang *et al.*, 2007).

The annual catch of PBF by 29-48 purse seiners ranged from 1 to 2,141 mt during the 1982-2007 period (Table. 4). PBF catch statistics is not annually consistent because it could include non-target species.

Table 4. Annual catch of Pacific bluefin tuna by offshore purse seine in Korea
(unit: ton)

Year	Gear type	Catch	Permitted number of fleets
1982	(ps)*	31	48
1983	(ps)	13	48
1984	(ps)	4	48
1985	(ps)	1	48
1986	(ps)	344	48
1987	(ps)	89	48
1988	(ps)	32	48
1989	(ps)	71	48
1990	(ps)	132	48
1991	(ps)	265	48
1992	(ps)	288	48
1993	(ps)	40	48
1994	(ps)	50	48
1995	(ps)	821	36
1996	(ps)	102	36
1997	(ps)	1,054	36
1998	(ps)	188	36
1999	(ps)	256	36
2000	ps	1,976	32
2001	ps	968	32
2002	ps	767	32
2003	ps	2,141	29
2004	ps	636	29
2005	ps	594	29
2006	ps	949	29
2007	ps	946	29

* Gears were unknown during this period, but it is probably purse seiner.

Monthly catch of PBF by purse seine

PBF was caught by the purse seine fishery that targets mackerel in Korean coastal waters during all seasons (Table 5).

Table 5. Monthly catch of Pacific bluefin tuna by the purse seine in Korean sea waters from 2000 to 2007

Year	Quarter	Month	Permitted number of fleets	Catch (ton)
2000	1	1	32	100
2000	1	2	32	128
2000	1	3	32	386
2000	2	4	32	555
2000	2	5	32	100
2000	2	6	32	660
2000	3	7	32	23
2000	3	8	32	2
2000	3	9	32	0
2000	4	10	32	11
2000	4	11	32	7
2000	4	12	32	4
2001	1	1	32	29
2001	1	2	32	279
2001	1	3	32	482
2001	2	4	32	85
2001	2	5	32	54
2001	2	6	32	5
2001	3	7	32	3
2001	3	8	32	0
2001	3	9	32	2
2001	4	10	32	10
2001	4	11	32	5
2001	4	12	32	13
2002	1	1	32	8
2002	1	2	32	40
2002	1	3	32	83
2002	2	4	32	91
2002	2	5	32	28
2002	2	6	32	26
2002	3	7	32	375
2002	3	8	32	22
2002	3	9	32	23
2002	4	10	32	71
2002	4	11	32	1
2002	4	12	32	1
2003	1	1	29	31
2003	1	2	29	90
2003	1	3	29	75
2003	2	4	29	210
2003	2	5	29	62
2003	2	6	29	52
2003	3	7	29	21
2003	3	8	29	20
2003	3	9	29	31
2003	4	10	29	1,472
2003	4	11	29	74
2003	4	12	29	2
2004	1	1	29	15
2004	1	2	29	5
2004	1	3	29	23
2004	2	4	29	16
2004	2	5	29	135
2004	2	6	29	306
2004	3	7	29	23

2004	3	8	29	12
2004	3	9	29	13
2004	4	10	29	42
2004	4	11	29	1
2004	4	12	29	44
2005	1	1	29	11
2005	1	2	29	0
2005	1	3	29	20
2005	2	4	29	186
2005	2	5	29	69
2005	2	6	29	24
2005	3	7	29	27
2005	3	8	29	124
2005	3	9	29	64
2005	4	10	29	41
2005	4	11	29	12
2005	4	12	29	17
2006	1	1	29	84
2006	1	2	29	17
2006	1	3	29	97
2006	2	4	29	248
2006	2	5	29	11
2006	2	6	29	21
2006	3	7	29	3
2006	3	8	29	370
2006	3	9	29	0
2006	4	10	29	90
2006	4	11	29	0
2006	4	12	29	6
2007	1	1	29	93
2007	1	2	29	195
2007	1	3	29	162
2007	2	4	29	2
2007	2	5	29	1
2007	2	6	29	5
2007	3	7	29	77
2007	3	8	29	38
2007	3	9	29	N/A
2007	4	10	29	N/A
2007	4	11	29	9
2007	4	12	29	364

The quarterly catch ratios from 2000 to 2007 were estimated based on the monthly catch data from purse seiners (Oshima *et al.*, 2008). The quarterly catch ratios for a year greatly differed for the 2000-2007 period (Fig. 3), probably because the Korean fisheries did not target PBF. However, level of the Korean PBF catch continued to increase after 1999 (Fig. 4). Although the Korean PBF catches are incorporated into the same fleet as the Japanese small purse, the major fishing season seems to differ between the Korean and Japanese fisheries (Oshima *et al.*, 2008).

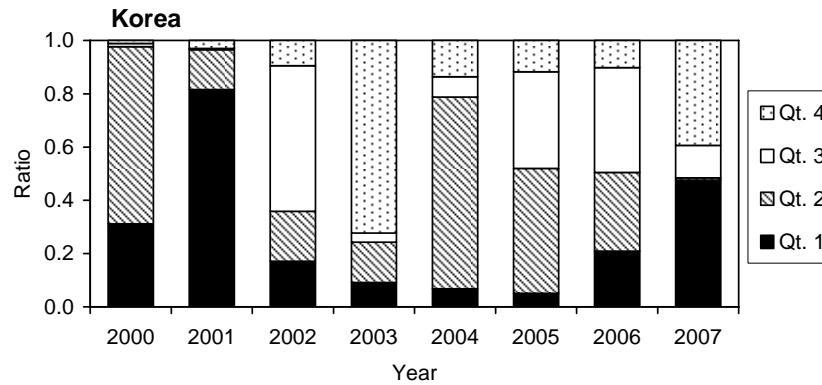


Fig. 3. Annual variation of quarterly catch ratios of PBF in Korea (from Oshima *et al.*, 2008).

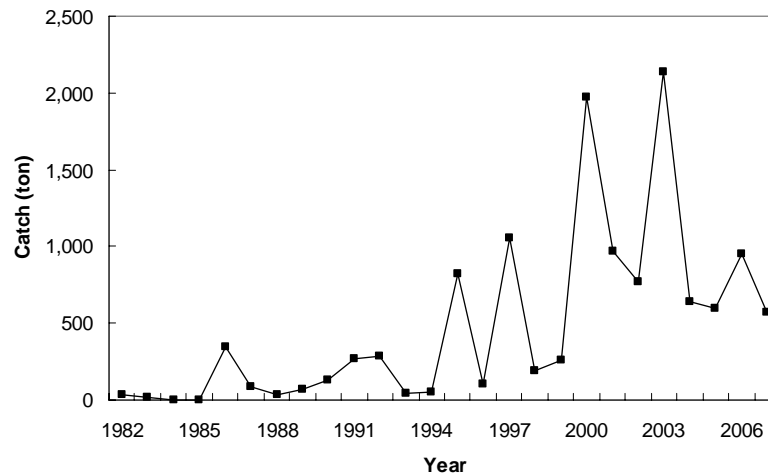


Fig. 4. Annua

Size composition of PBF

The sizes (fork length) of PBF ranged from 20 cm to 167cm from 2000 to 2008 (Fig. 5). In year 2000, the size ranged from 26-40 cm and the mean size was 33.6cm, indicating the size was measured only in June (Fig. 6-1). The mean size (45.3cm) in 2001 was greater than that of 2000. The size was measured for the almost entire year of 2002 (Fig. 6-3), and the size ranged from 34-73cm with two modes. In 2003, it ranged from 27-67 cm, showing three modes. From 2004 to 2007, mean sizes were similar, ranging from 51-55. In 2007, size was measured for all months except April (Fig. 6-8). In January-June 2008, it ranged from 31-167 cm (mean 58.1cm). The catch of individuals > 100 cm in 2008 is notable (Fig. 6-9), and the PBF of ca. 160 cm was caught in April 2008.

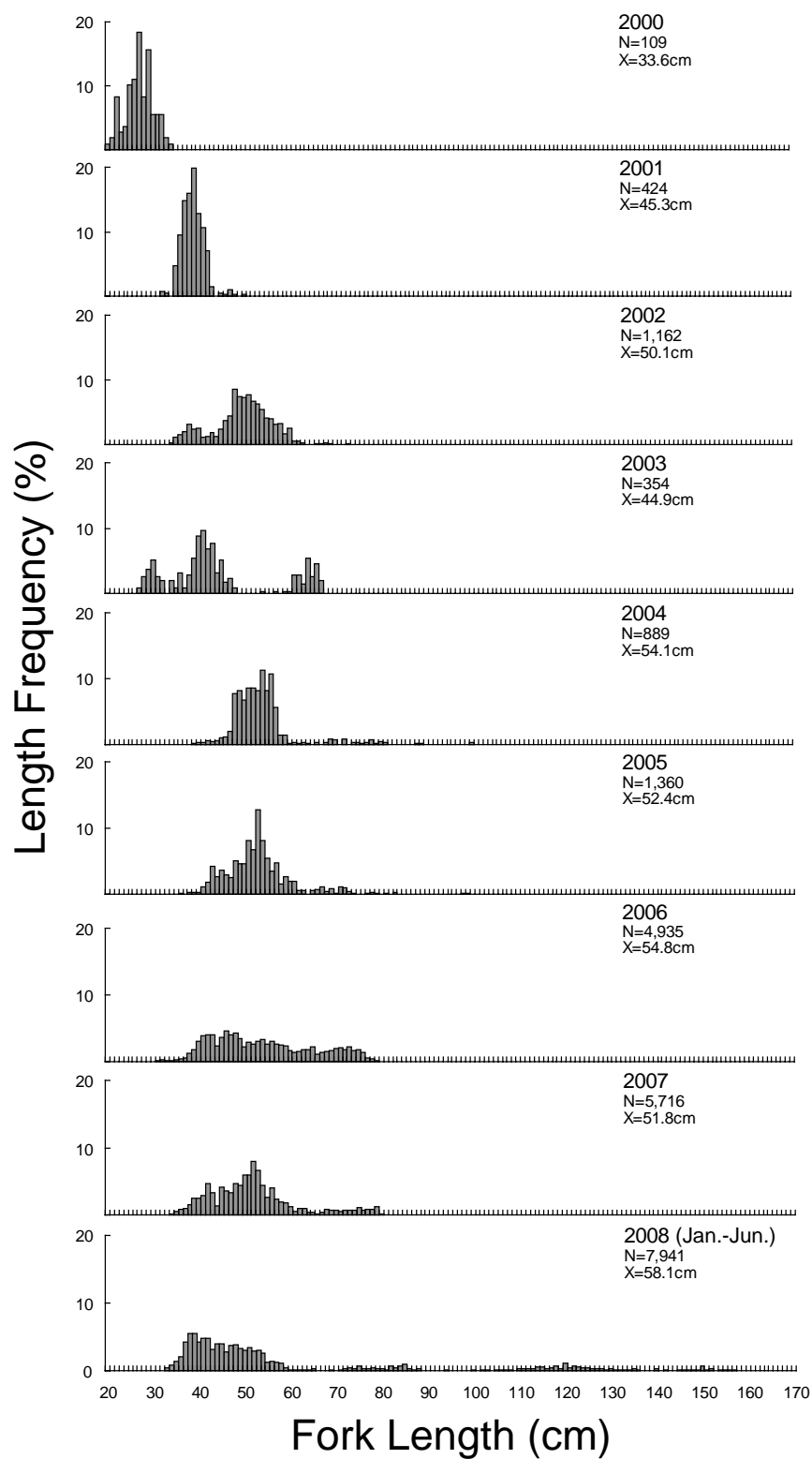


Fig. 5. Annual length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery from 2000 to June 2008.

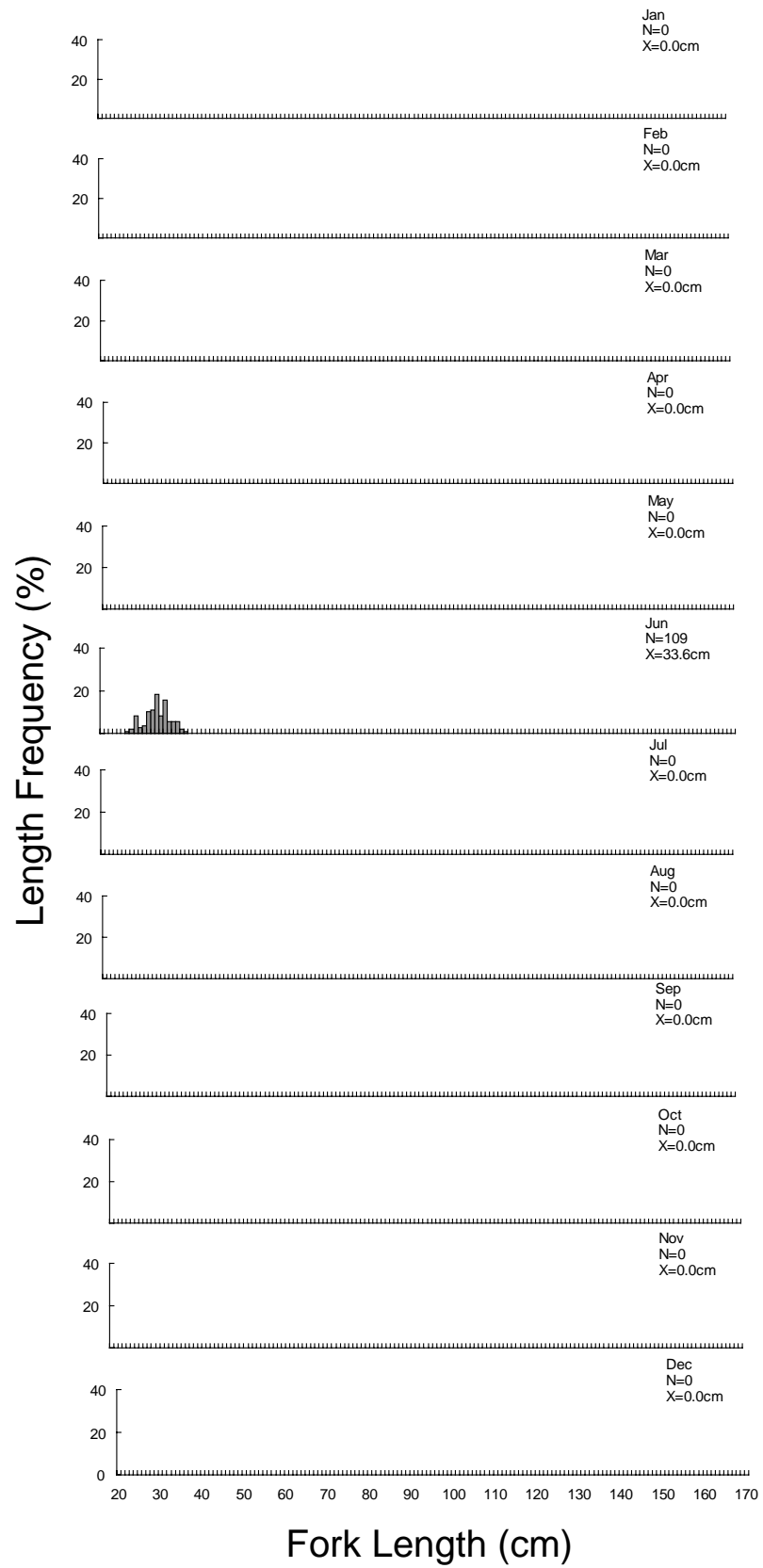


Fig. 6-1. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in 2000.

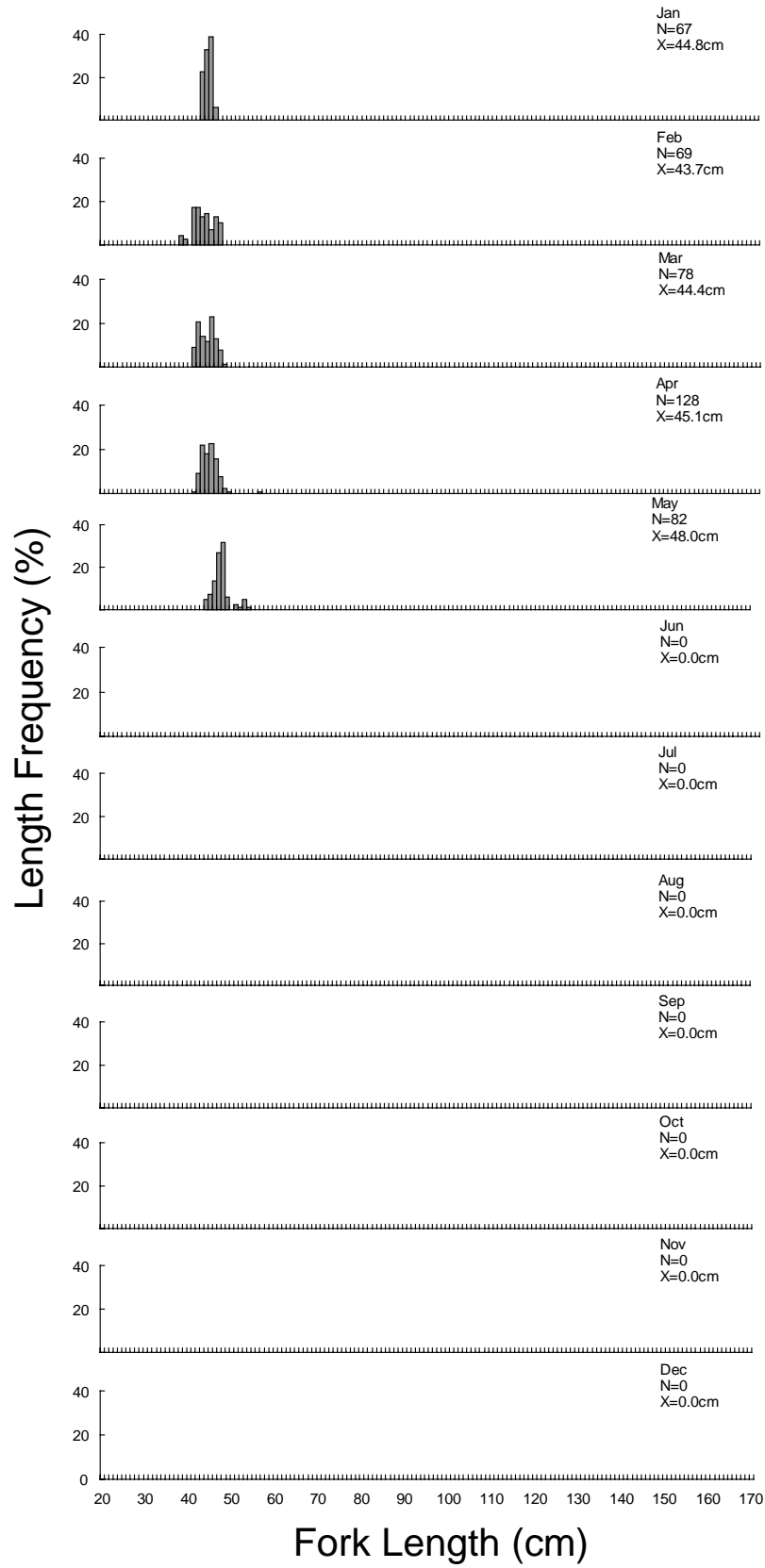


Fig. 6-2. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in 2001.

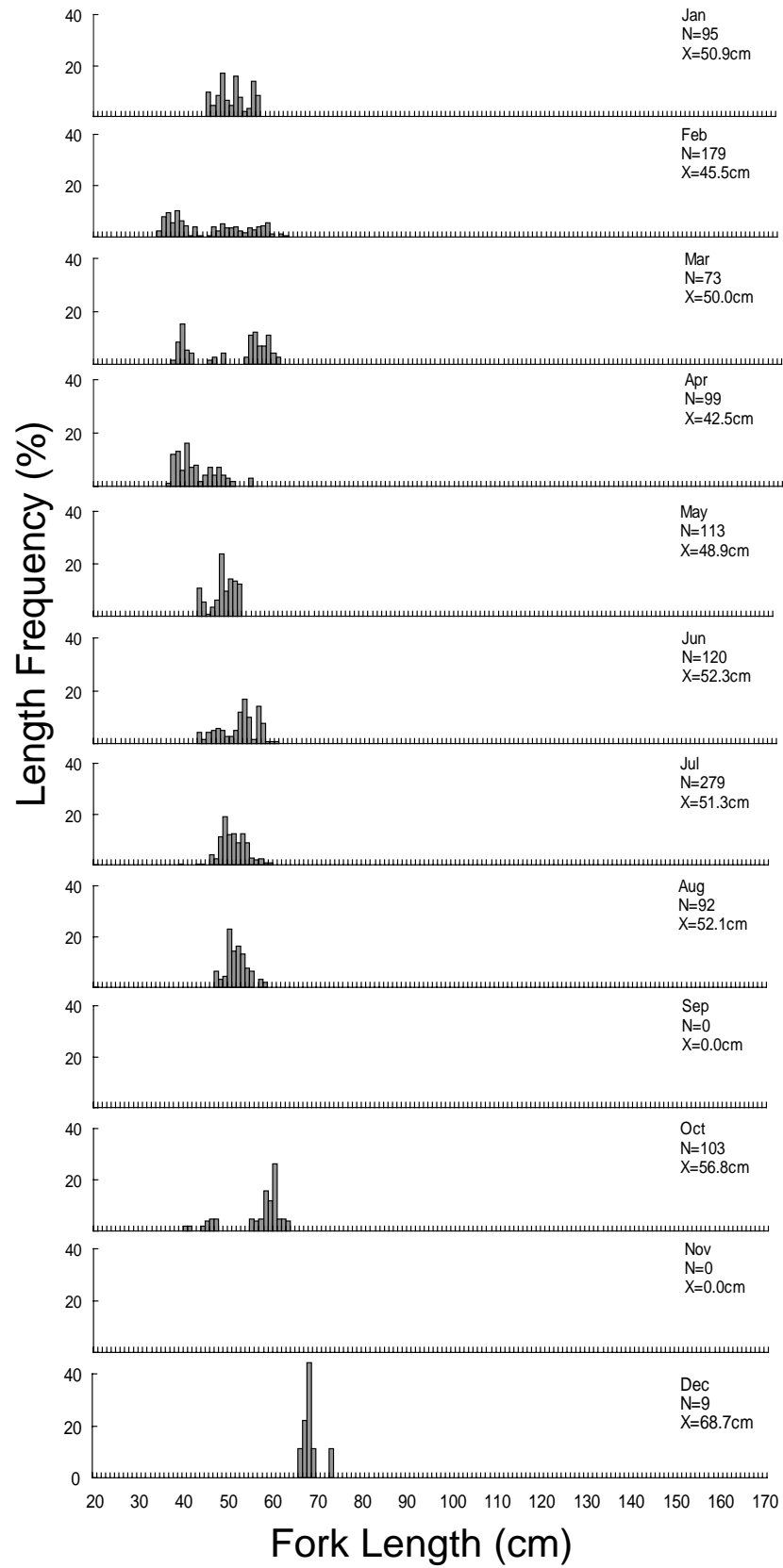


Fig. 6-3. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in 2002.

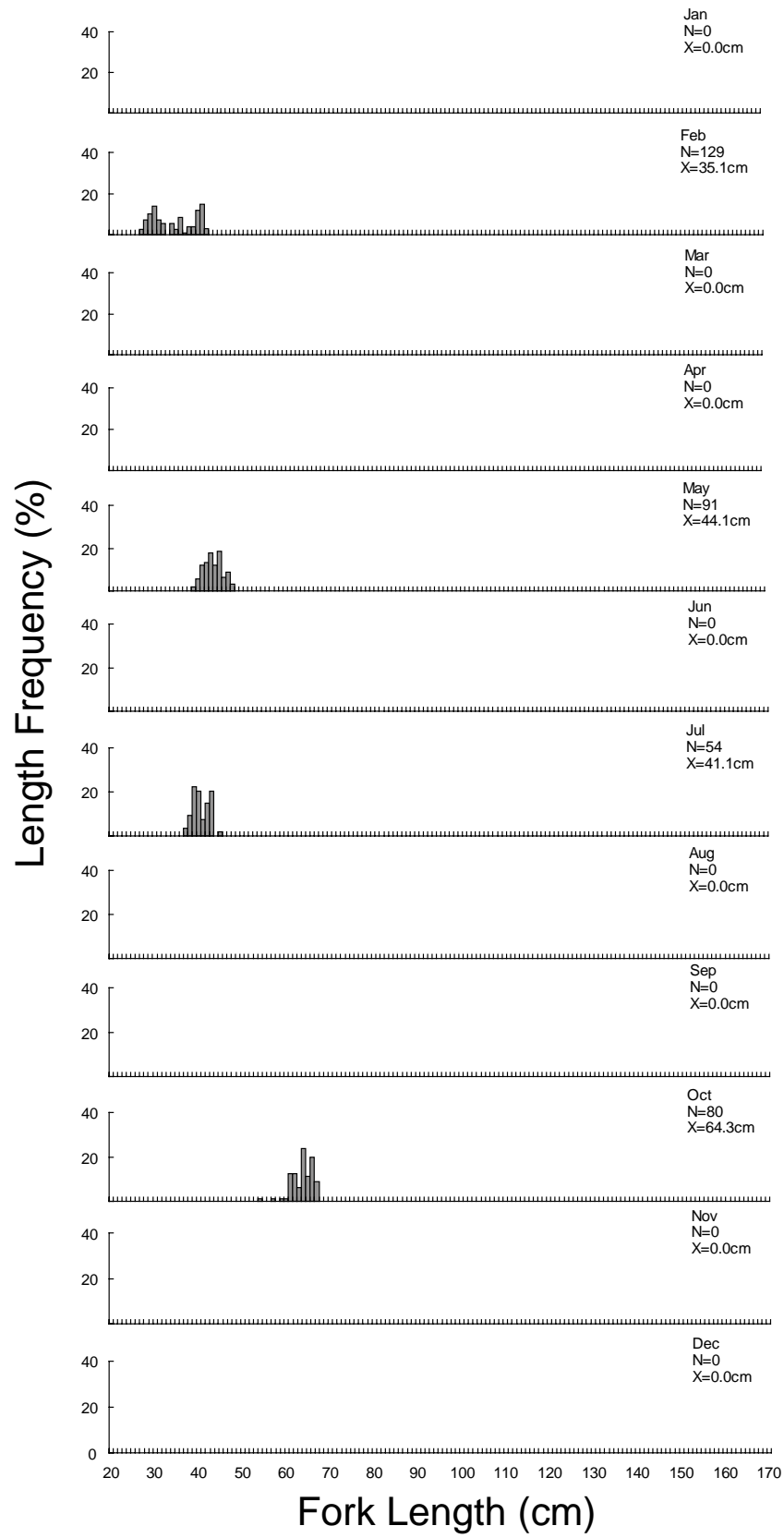


Fig. 6-4. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in 2003.

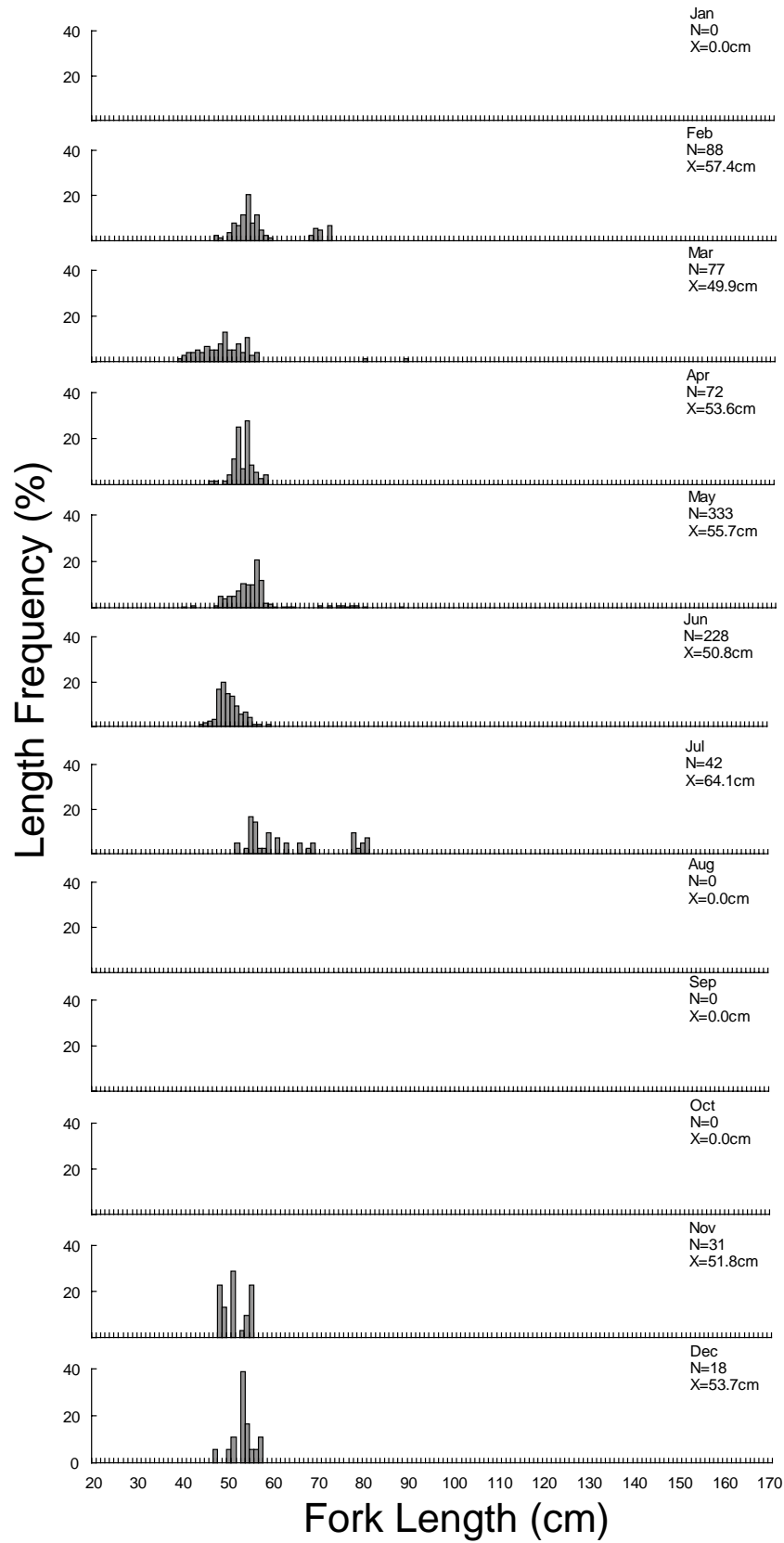


Fig. 6-5. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in 2004.

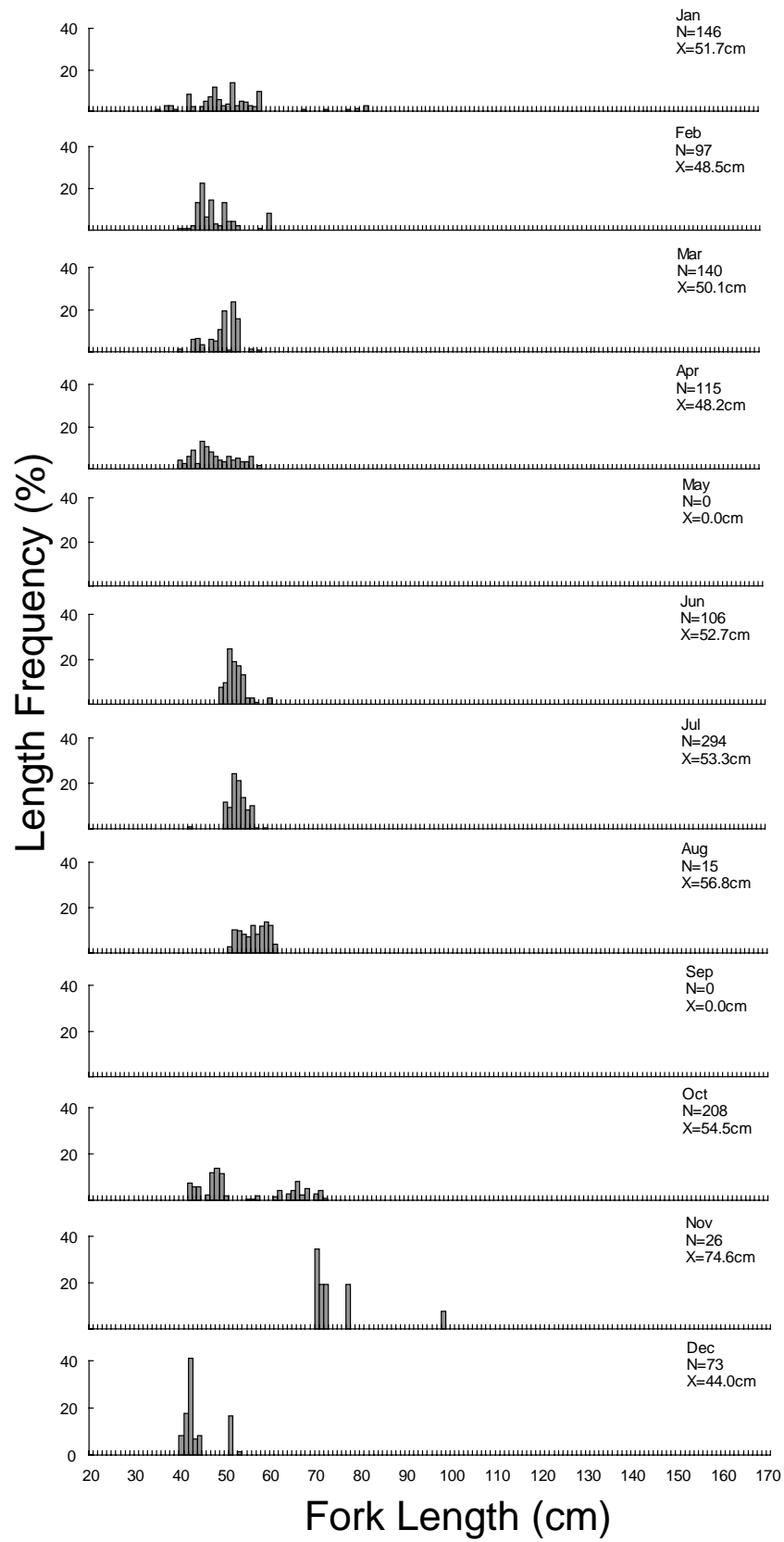


Fig. 6-6. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in 2005.

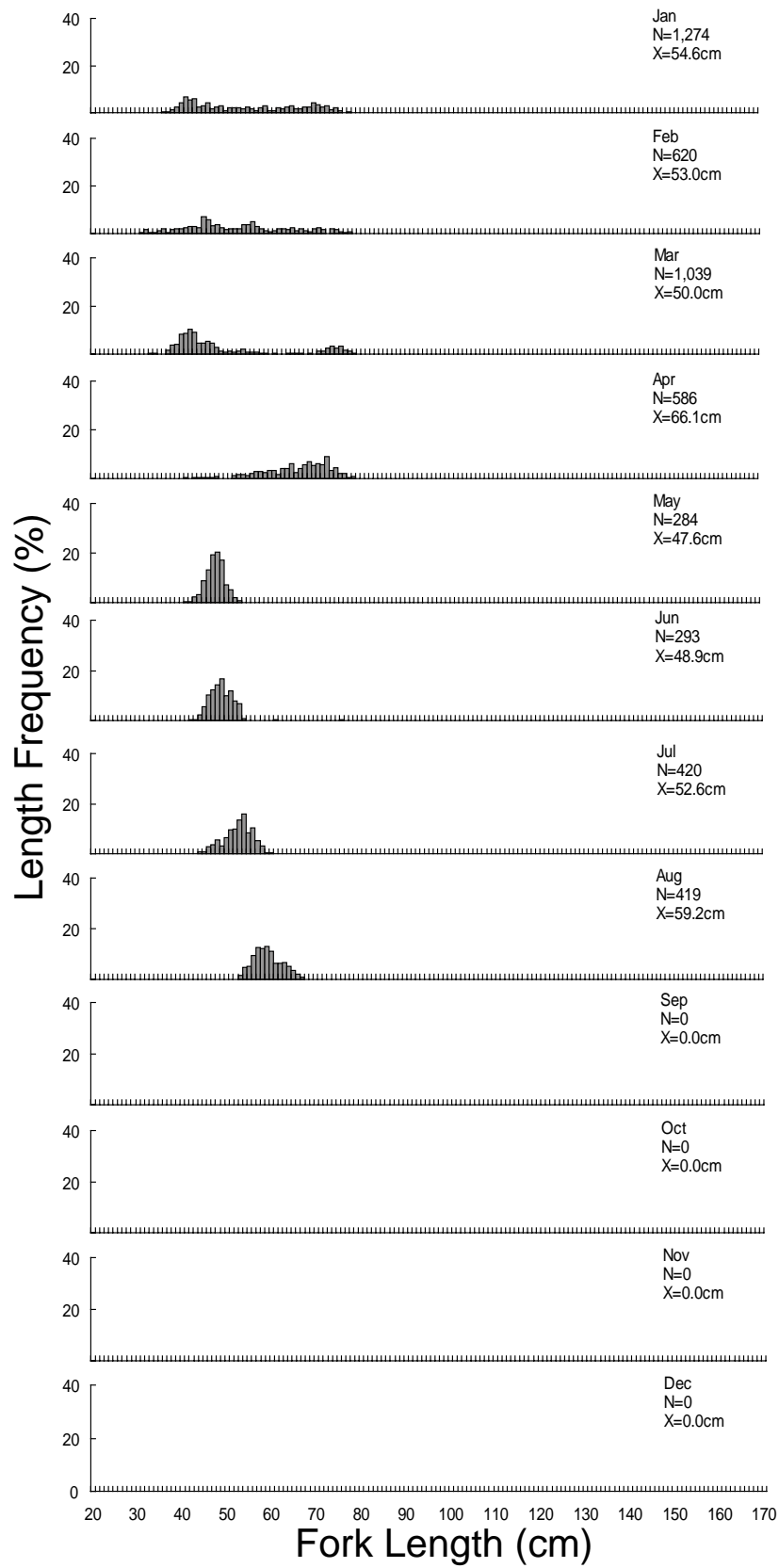


Fig. 6-7. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in 2006.

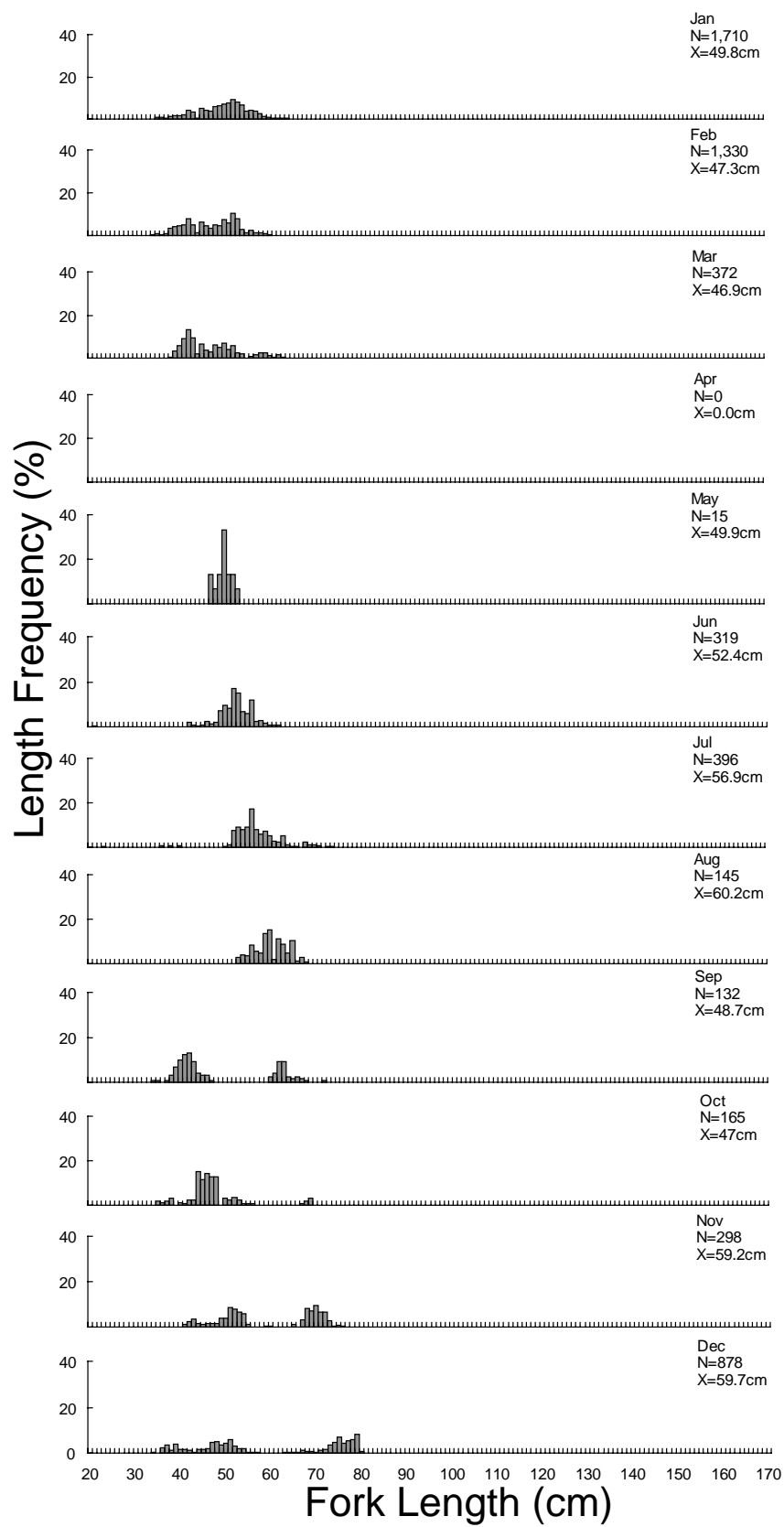


Fig. 6-8. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in 2007.

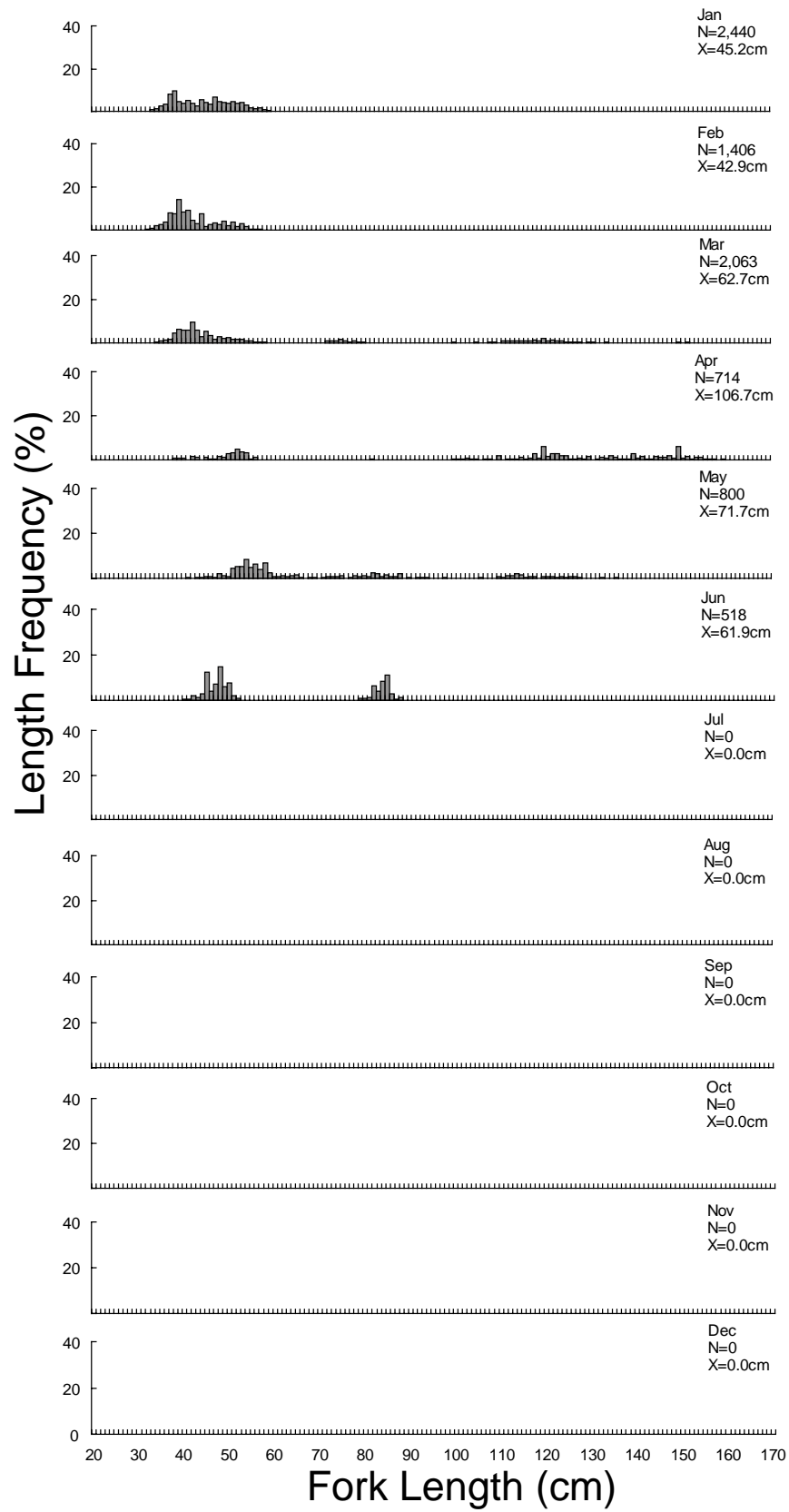


Fig. 6-9. Monthly length-frequency of Pacific bluefin tuna landed by the Korean domestic purse seine fishery in January-June 2008.

Spatial distribution of PBF catch

PBF catches were high around the Jeju and Tsushima Island in the southern waters of Korea which are the main fishing ground of the Korean domestic purse seine fishery (Fig. 7). Occasional catch was taken in the Yellow Sea.

Spatial distributions of monthly PBF catch were shown on Figure 8. Recently, areas and amount of catch tended to expand and increase.

We speculate that distribution of Pacific bluefin tuna catch is related with the distribution of target species of the fishery fleet, the degree of association among bluefin tuna and oceanographic condition and the strength of year class. The cause of recently increasing and expanding trend of the Korean PBF could be examined in the future through international cooperation.

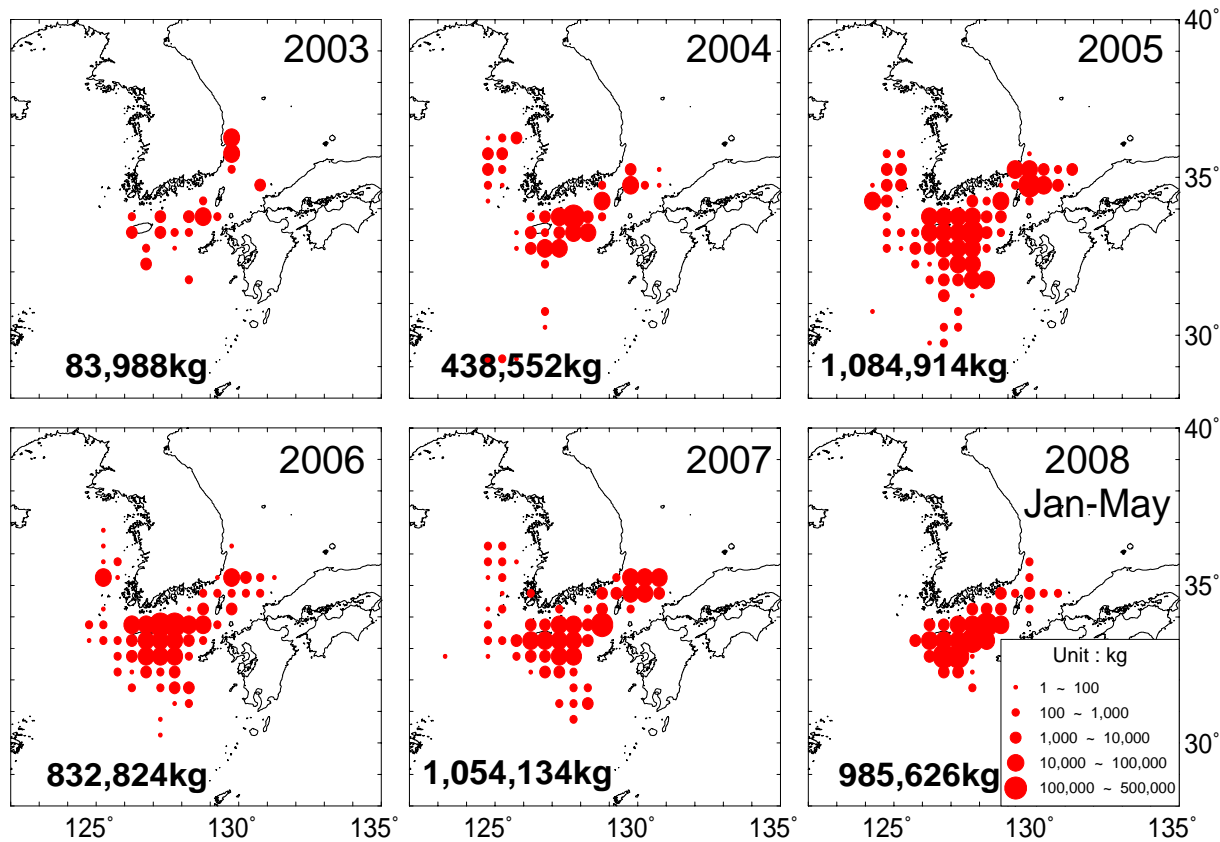


Fig. 7. Catch distribution of Pacific bluefin tuna by the Korean domestic purse seine fishery from 2003 and January-May 2008. Circles denote the amount of catch and x denotes no catch though fishing was operated.

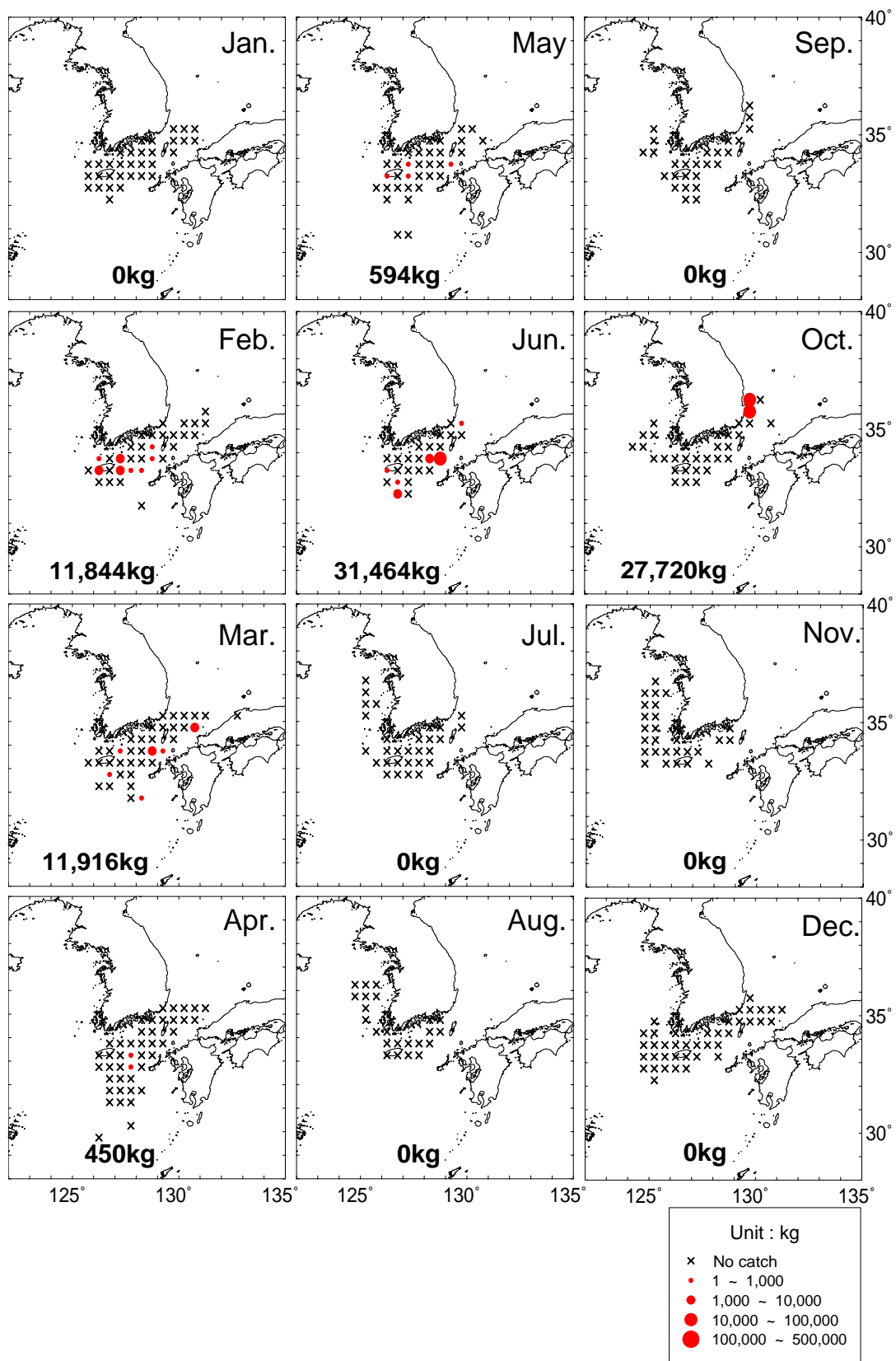


Fig. 8-1. Monthly catch distribution of Pacific bluefin tuna by the purse seine fishery in 2003.

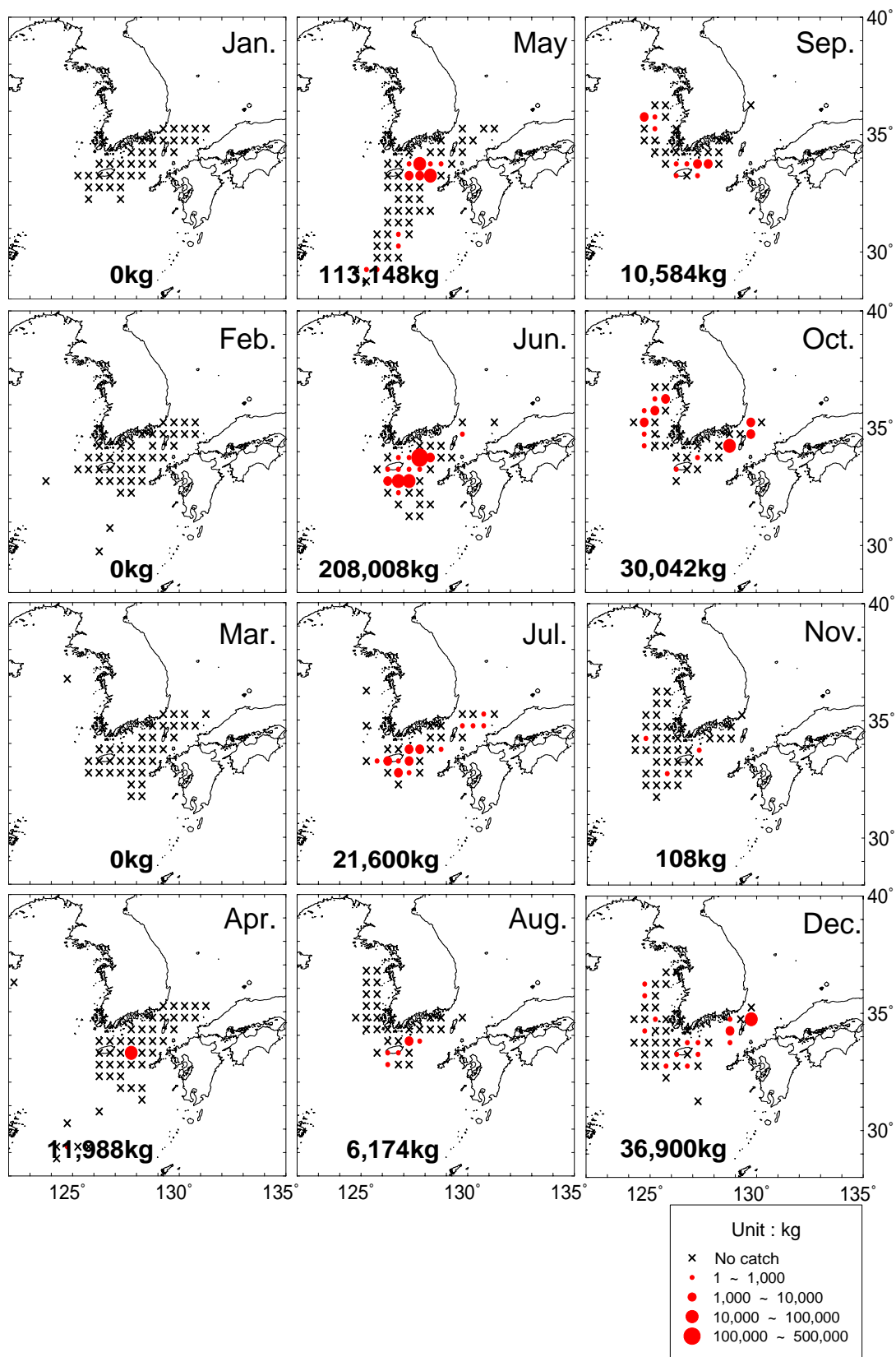


Fig. 8-2. Monthly catch distribution of Pacific bluefin tuna by the purse seine fishery in 2004.

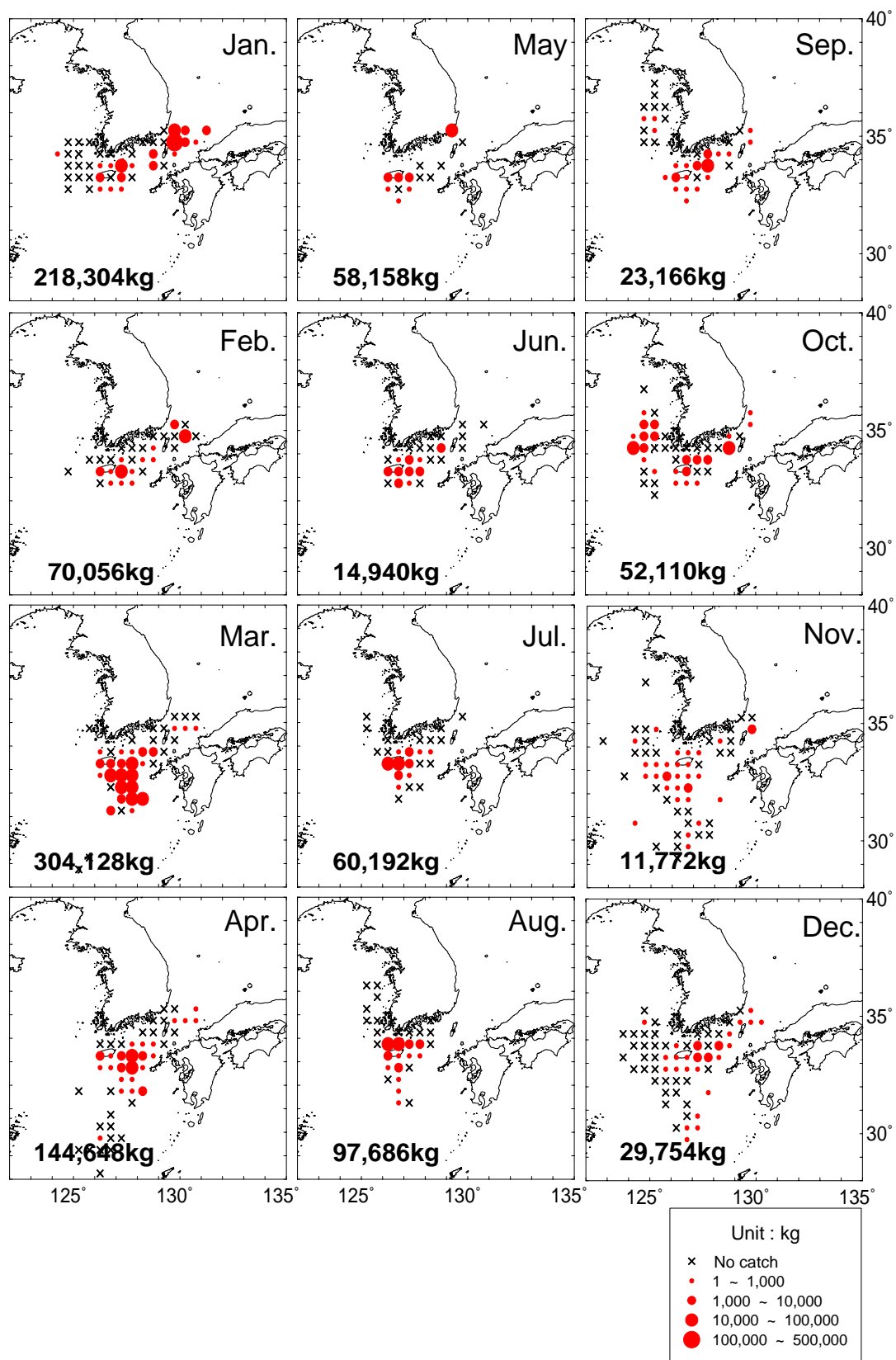


Fig. 8-3. Monthly catch distribution of Pacific bluefin tuna by the purse seine fishery in 2005.

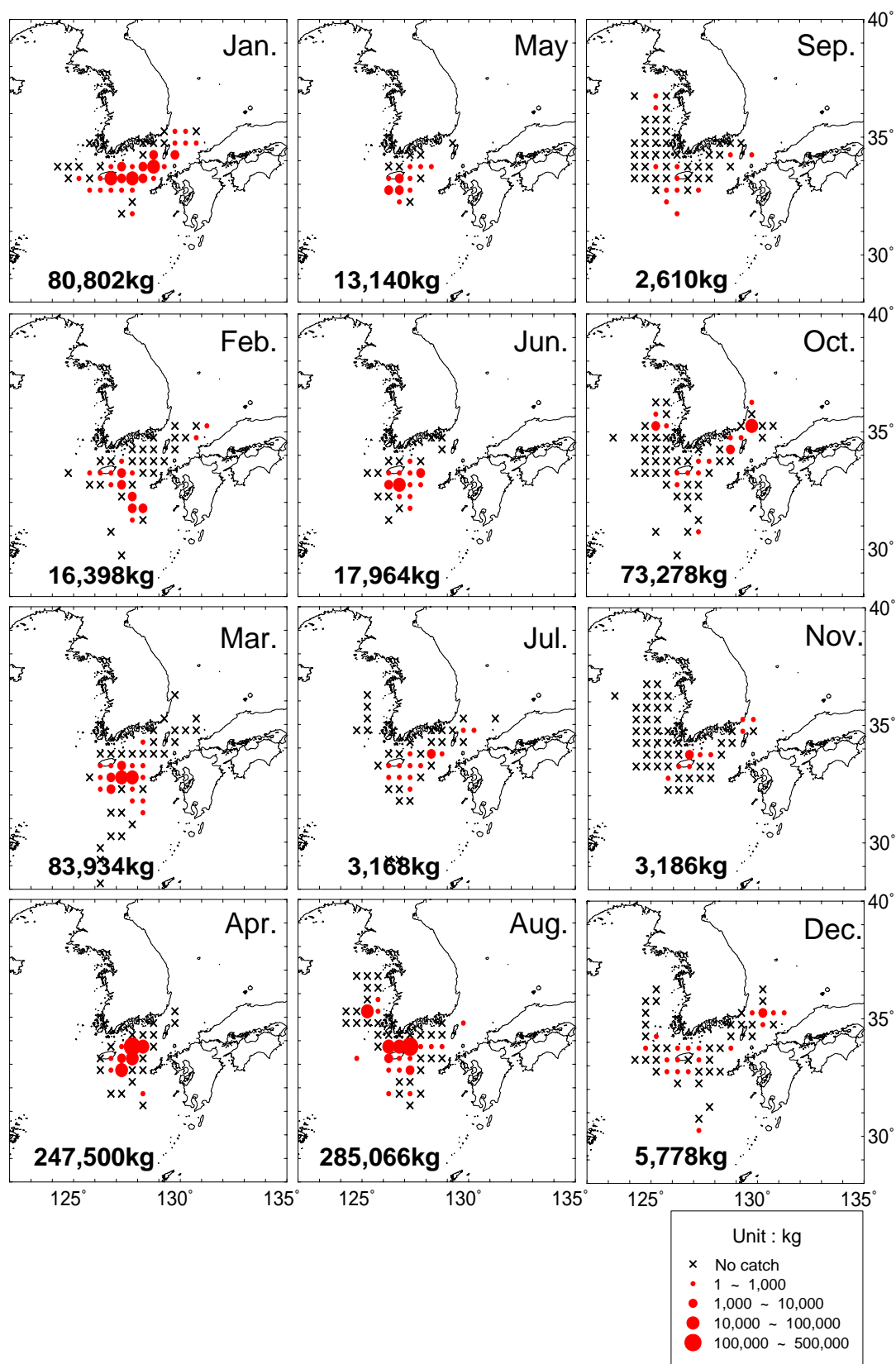


Fig. 8-4. Monthly catch distribution of Pacific bluefin tuna by the purse seine fishery in 2006.

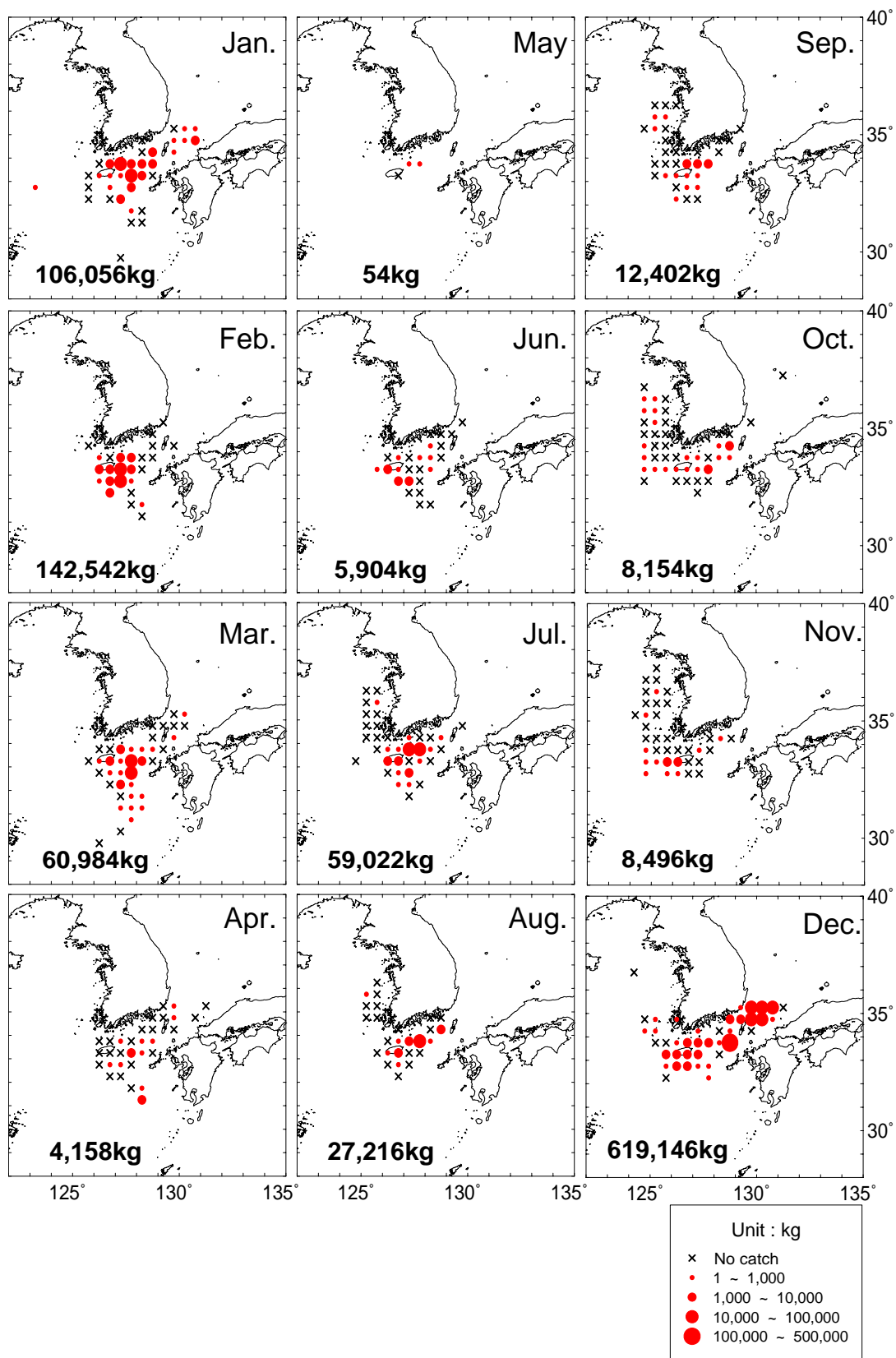


Fig. 8-5. Monthly catch distribution of Pacific bluefin tuna by the purse seine fishery in 2007.

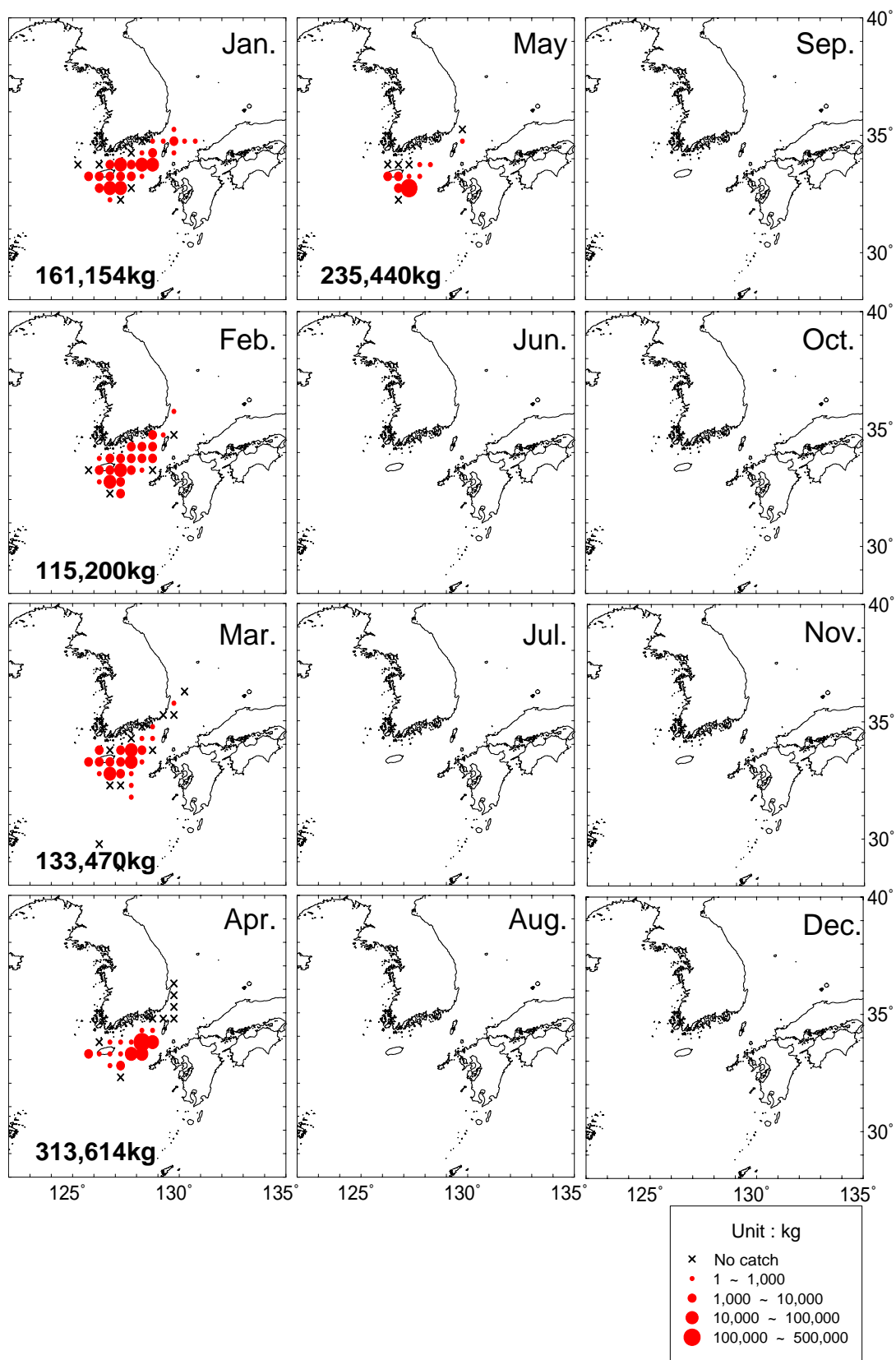


Fig. 8-6. Monthly catch distribution of Pacific bluefin tuna by the purse seine fishery in January-May 2008.

Research activities

The fisheries statistics data have been collected and compiled by MIFAFF and NFRDI. Additionally, biological sampling has been regularly made on the boats and at domestic landing sites.

NFRDI constructs the related database system for easy access and analysis of fisheries data. Old data files will be verified and corrected. NFRDI initiated the international fisheries observer program for distant-water fisheries including tuna fisheries in 2002 and for domestic fisheries in 1998. In 2007, six observers were deployed 12 times on Korean fishing vessels to monitor catch of target and by-catch species. To reduce mortality of seabird and sea turtle caused by tuna longline vessels, guidebooks and posters providing the basic information on these species were distributed to fishing boats including the tuna longliners.

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