ISC/12-3/PBFWG/09

Catch characteristics and resources management of Pacific bluefin tuna caught by offshore large purse seine in Korean waters

Sang Chul YOON, Zang Geun KIM, Sung Il LEE, Mi Kyung LEE and Dong Woo LEE

National Fisheries Research and Development Institute (NFRDI)
216 Gijanghaean-ro, Gijang-eup, Gijang-gun, Busan 619-705, Republic of Korea

Nov. 2012

Working document submitted to the ISC Pacific bluefin tuna Working Group, International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC), 10th November-17th November 2012, Honolulu, Hawaii, USA.

Abstract

The number of permitted fleets of offshore large purse seiner (OLPS) has gradually decreased from 48 in 1994 to 25 in 2011. Total catch of OLPS declined from about 459,000 mt in 1986, when had the highest, to about 192,000 mt in 1991, since then it showed the increasing trend till 1996. But it sharply dropped at 185,000 mt in 1997, and then showed the stable trend with a level of 200,000 mt having fluctuations to recent years. The most dominant species of OLPS was common mackerel which accounted for 59.2% of total catch, and its main fishing season was likely to be October to December. The PBF catch of OLPS was below 500 mt until early 1990s, and tended to increase with a large fluctuation since 1994. The catch peaked at 2,601 mt in 2003, but decreased to 670 mt in 2011. The main fishing season for PBF by OLPS was likely to be March to April. Korea established the Ministerial Directive on Conservation and Management of PBF, and statistic system for PBF catches to enhance the quality and timeliness of data and data reporting.

Introduction

Pacific bluefin tuna, *Thunnus orientalis* (PBF) is an important commercial fish species caught by troll, longline, purse seine, set net, and so on in the North Pacific Ocean. In Korean waters, PBF has been almost caught by domestic offshore large purse seiner (OLPS).

The number of permitted fleets of OLPS has gradually decreased since 1994. The gross tonnage of fishing vessels ranged from 56-129, and their length and width ranged from 28 to 42 m and from 6 to 8 m, respectively. OLPS fleet consists of 1 main vessel, 2-3 light boats, and 2-3 fish carriers. Korean OLPS mainly targets Common mackerel (*Scomber japonicas*), horse mackerel (*Trachurus japonicas*), spotted mackerel (*S. australasicus*) and common squid (*Todarodes pacificus*). Number of hauling is 2 or 3 times per a day. Required cast time and hauling time are 5-10 minutes and about 1 hour, respectively. It mainly operates at 80-120m in depth, and the main fishing ground is off Jeju Island, however it expands to the Yellow Sea, coastal of Busan and the East Sea depending on PBF migration patterns by the season (NFRDI, 2002).

In this study, we would like to provide information on PBF caught by Korean domestic OLPS and Korean management strategy for conservation of PBF.

Data and methods

Changes in catch of Korean OLPS were analyzed using catch production statistics (KOSTAT, 1990-2011). Since 2000 annual PBF catch was revised by calculating actual weight of PBF per box (applying 22.3 kg to fish box containing individuals below 90 cm) times a number of box (Yoo *et al*., 2011; Yoo *et al*., 2012).

Distributions of fishing grounds of OLPS were analyzed using data of Fisheries Cooperatives Radio Station from 2003 to 2011. Length frequency distributions of PBF were analyzed from data which were measured by observers in Busan Fisheries Cooperative Fish Market from 2000 to 2011.

Results and Discussion

Catch characteristics of Korean offshore large purse seiner (OLPS)

The number of permitted fleets of OLPS has gradually decreased from 48 in 1994 to 25 in 2011 (Table 1). Annual catch of OLPS is shown in Table 1. Average catch of OLPS was about 261,000 mt in Korean waters during 1980-2011. Total catch had declined from about 459,000 mt in 1986, when had the highest, to about 192,000 mt in 1991, and since then it showed the increasing trend till 1996. But it sharply dropped at 185,000 mt in 1997, and then showed the stable trend with a level of 200,000 mt having fluctuations to recent years (Fig. 1).

Fig. 2 shows the species composition of catch by OLPS from 1990 to 2011. The most dominant species was common mackerel which accounted for 59.2% of total catch proportion of OLPS. In order of species catch proportion, spotted mackerel was 7.9%, horse mackerel, 6.7%, Pacific sardine, 6.2%, common squid, 4.3%, and PBF accounted for less than 1% of total catch proportion (Fig. 2).

Decadal species composition of catch by OLPS is shown in Fig. 3. In 1990s, the most dominant species were common mackerel (66.2%), Pacific sardine (8.1%), horse mackerel (6.7%), common squid (4.6%), and PBF accounted for 0.2% of total catch. In 2000s, the most dominant species were common mackerel (67.7%), spotted mackerel (11.2%), horse mackerel (7.3%), common squid (5.4%), hairtail (4.9%), and PBF accounted for 0.7% of total catch. In 2011, the most dominant species were common mackerel (57.6%), horse mackerel (17.0%), spotted (5.4%), common squid (4.5%), and PBF accounted for 0.3% of total catch.

As shown in Figs. 2 and 3, they suggested that OLPS has mainly targeted common mackerel, horse mackerel, common squid, and PBF had even less than 1% of catch by

OLPS in Korean waters.

Monthly average catch of recent 5 years (2007-2011) showed the lowest in May and the highest in December. Especially, the catch from October to December accounted for 52 % of total catch (Fig. 4).

Therefore, it was considered that the main fishing season of OLPS is autumn to winter, targeting common mackerel, horse mackerel and common squid as their seasonal migrations.

Fig. 5 shows the catch distributions of OLPS in Korean waters. The fishing ground of OLPS was mainly formed around Jeju Island, and widely expanded to the East China Sea and the East Sea.

Catch characteristics of PBF

The PBF catch of OLPS was below 500 mt until early 1990s, and tended to increase with a large fluctuation since 1994. It showed a peak with 2,601 mt in 2003, but decreased to 670 mt in 2011 (Fig. 6). The catch per unit effort (CPUE) of PBF caught by OLPS peaked at 353 kg/haul in 2003, and decreased to 110 kg/haul in 2004. And it had increased until 2008, then decreased to 117 kg/haul in 2011 (Fig. 7).

As shown in Fig. 8, the seasonal catch had high level with 160-190 mt in March and April, low level of less than 30 mt from July to November, and the other seasons showed about 80-90 mt. Therefore, the main fishing season of PBF by OLPS was likely to be March to April.

The catch distributions of PBF are shown in Figs. 9 and 10. The fishing ground of OLPS for PBF was mainly formed around Jeju Island, and widely expanded to the East China Sea and the East Sea. The catch density in the Yellow Sea was lower than other seas.

Length frequency distributions of PBF

The length frequency distributions of PBF from 2000 to 2011 are presented in Fig. 11. There were one mode below 40 cm in 2000 and 2001, and then the mode was larger than 40 cm except 2003. In 2003, there were 3 modes with the classes of 30 cm, 40 cm, and 60 cm. Since 2008, individuals of over 80 cm occurred frequently, and especially there was strong mode with the class of 110 cm in 2010.

Establishment of the Ministerial Directive on Conservation and Management of PBF

The Republic of Korea established “The Ministerial Directive on Conservation and

Management of PBF (Administrative Directive No. 2011-51 of the Ministry for Food, Agriculture, Forestry and Fisheries (MIFAFF))" which entered into force on May 26th, 2011. With this Directive in place, the Korean government is making various efforts to manage the PBF resources in its waters. For example, those who have caught PBF are required to report to the National Fisheries Research and Development Institute (NFRDI) of Korea the date/time, location, quantity, estimated date/location of commissioned sale within 24 hours by electronic means including telephone, facsimile or e-mail. Also, all PBF caught under the Directive are required to be sold on commission only in a market designated by a Fisheries Cooperative.

The NFRDI is conducting sample research on the PBF sold in designated markets and carrying out analytic research to identify the stock and catch status for the sustainable conservation and utilization of the PBF resources. Not only offshore large purse seiners but also small-scale trolls, which are catching the PBF as fry for aquaculture under the authorization provided by the Directive, are subject to the close monitoring of the NFRDI. According to the scientific advice that has been drawn from this research so far, the PBF are being caught by Korea's large-scale domestic purse seiners fishing for mackerels as bycatch or incidental catch.

Improvement of catch statistics system for Pacific bluefin tuna

To enhance the quality and timeliness of data and data reporting, Korea's fisheries authorities are taking the following measures. The government established a statistics system for PBF catches to maintain the records of the number and weight of catches. This system is operated jointly by the government (MIFAFF) and the Offshore Large Purse Seine Fisheries Cooperative in an efficient and transparent manner. Also, the data and statistics put into the system are cross-checked by the NFRDI to ensure the accuracy and reliability of the data. Since 2010, the NFRDI has been undertaking a 'Five-year Scientific Research Plan on PBF", which is scheduled to be concluded until 2014. Under the plan, the NFRDI is collecting and analyzing the biological data (e.g length, weight, other biological aspects); and updating and correcting historical and current data. To maximize the effectiveness of these measures, one of the scientific staff at the NFRDI is carrying out monitoring and research operations in the Busan Co-op Fisheries Market, main landing port of PBF caught by Korean vessels.

References

KOSTAT, 1990-2011. Fisheries Production Statistics.

NFRDI, 2002. Fishing gear of Korea. Hangeul Graphics Publ. Co. 579pp.

Yoo, J. T., Kim, Z. G., Choi, K., Kang, S., Lee, J. B., Lee, S. I., Kim, D. N., Seok, K. J., Moon, D. Y. and Lee, D. W. 2011. Update of Pacific bluefin tuna catch in Korean waters. ISC/11-1/PBFWG/15.

Yoo, J. T., Kim, Z. G., Lee, S. I., Yean, I. J., Yoon, S. C. and Lee, D. W. 2012. Recent update of Pacific bluefin tuna catch in Korean waters. ISC/12-1/PBFWG/19.

Table 1. The number of permitted offshore large purse seiner (OLPS), total catch of OLPS and catch of Pacific bluefin tuna (PBF) from 1982 to 2011

Year	Permitted number of OLPS fleets	Catch of OLPS (mt)	Catch of PBF* (mt)	Proportion (%)
1982	48	257,931	31	0.0
1983	48	328,028	13	0.0
1984	48	349,325	4	0.0
1985	48	314,154	1	0.0
1986	48	458,785	344	0.1
1987	48	355,817	89	0.0
1988	48	409,708	32	0.0
1989	48	415,603	71	0.0
1990	48	358,993	132	0.0
1991	48	191,815	265	0.1
1992	48	212,475	288	0.1
1993	48	283,577	40	0.0
1994	48	310,967	50	0.0
1995	36	227,995	821	0.4
1996	36	453,337	102	0.0
1997	36	184,789	1,054	0.6
1998	36	205,037	188	0.1
1999	36	229,927	256	0.1
2000[1]	32	179,988	2,401	1.3
2001	32	231,821	1,176	0.5
2002	32	181,849	932	0.5
2003	29	158,662	2,601	1.6
2004	29	220,004	773	0.4
2005	29	173,795	1,318	0.8
2006	29	146,839	1,012	0.7
2007	29	194,093	1,281	0.7
2008	29	234,525	1,866	0.8
2009	27	241,052	936	0.4
2010	25	160,409	1,196	0.7
2011	25	219,109	670	0.3

* PBF catch is derived from PBF import data of Japan for 1982-1999, PBF export data to Japan for 2000-2004, and sale slips at Busan Cooperative Fish Market for 2005-2011.

[1] PBF catch from 2000 to 2011 is converted from actual weight of PBF per box (22.3 kg).

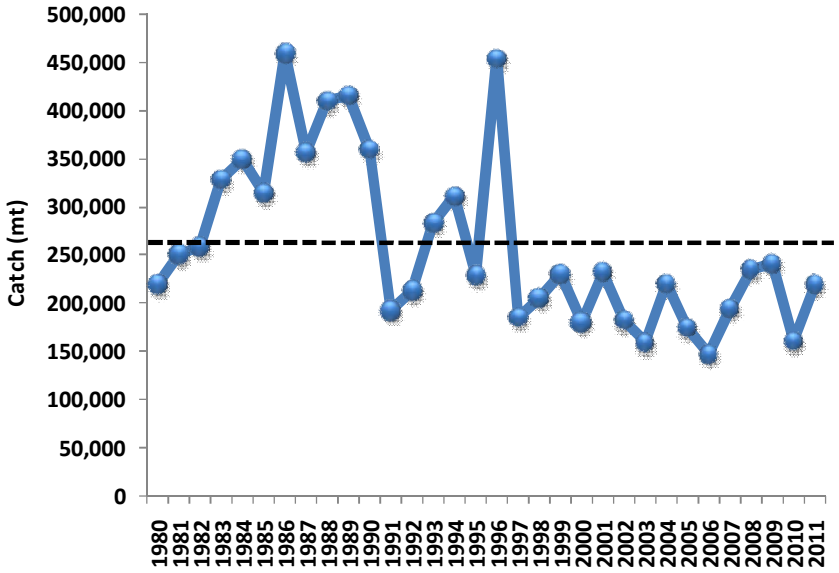

Fig. 1. Variations in annual catch of OLPS in Korean waters. Dotted line indicates average catch during 1980-2011.

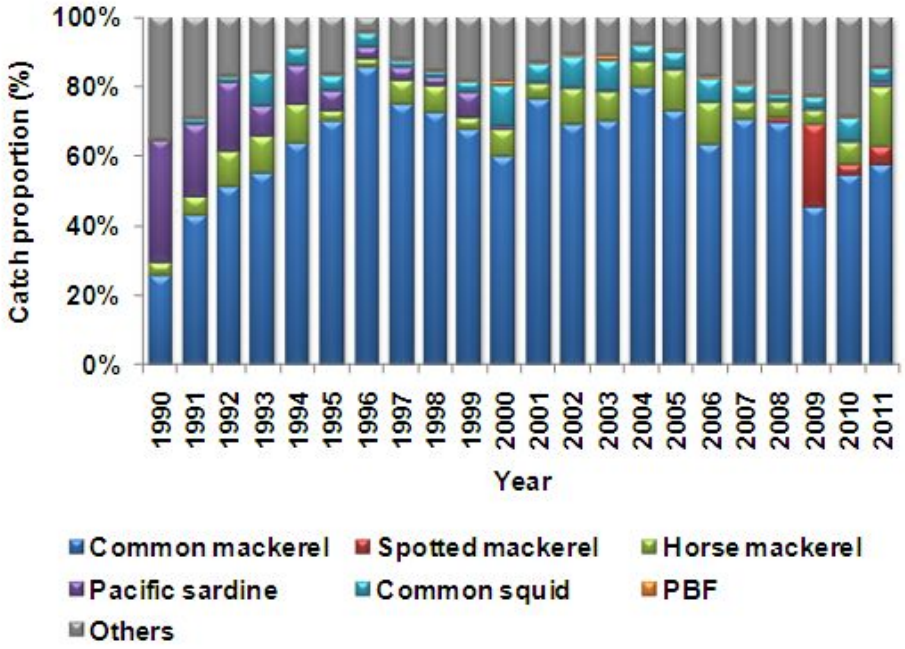

Fig. 2. Annual species composition caught by OLPS in Korean waters from 1990 to 2011.

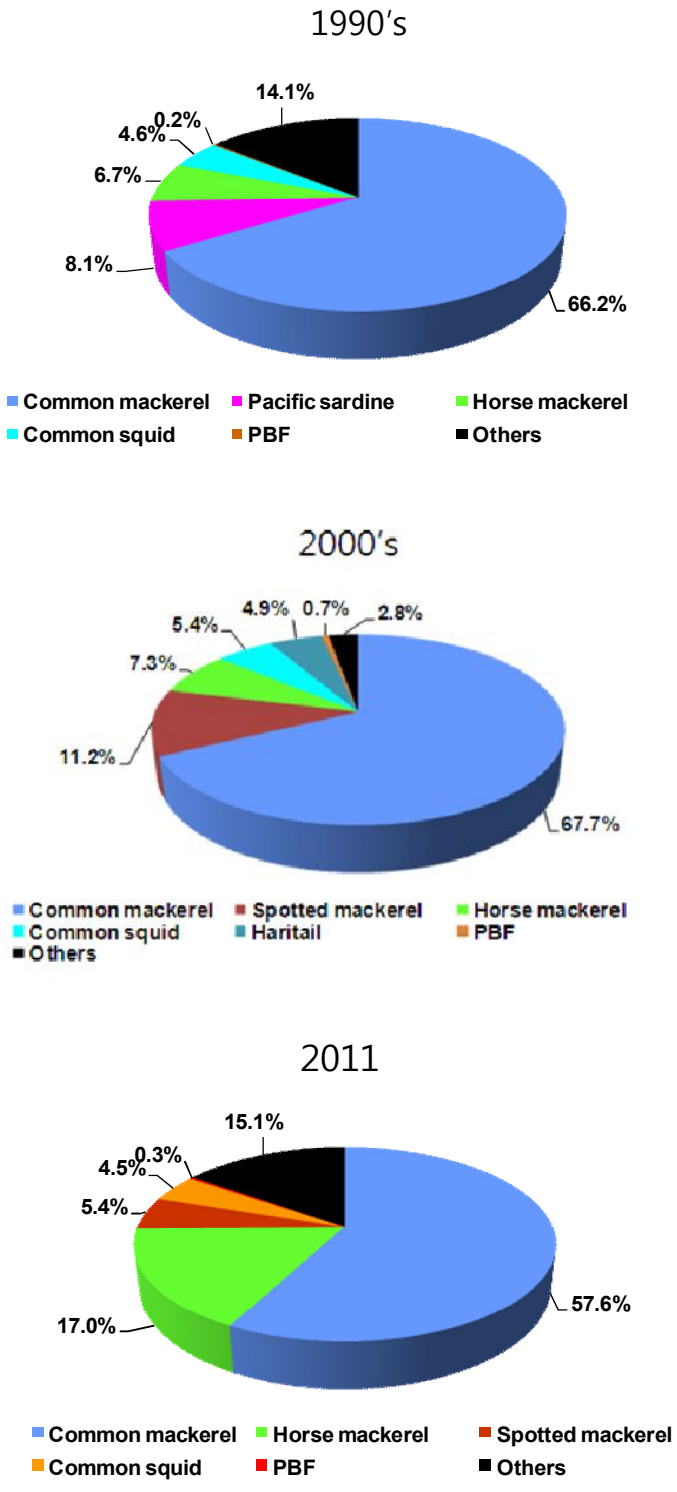

Fig. 3. Decadal species composition caught by OLPS in Korean waters from 1990 to 2011.

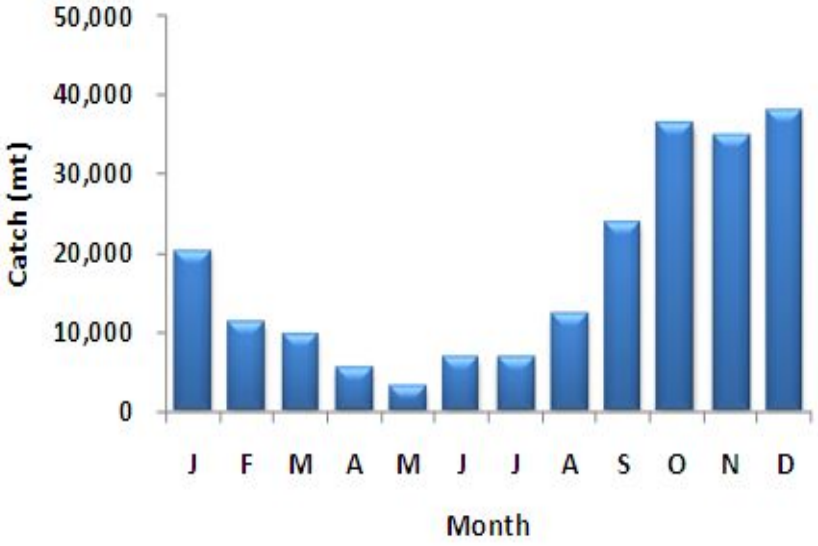

Fig. 4. Variations in monthly average catch of OLPS in Korean waters during recent 5 years (2007-2011).

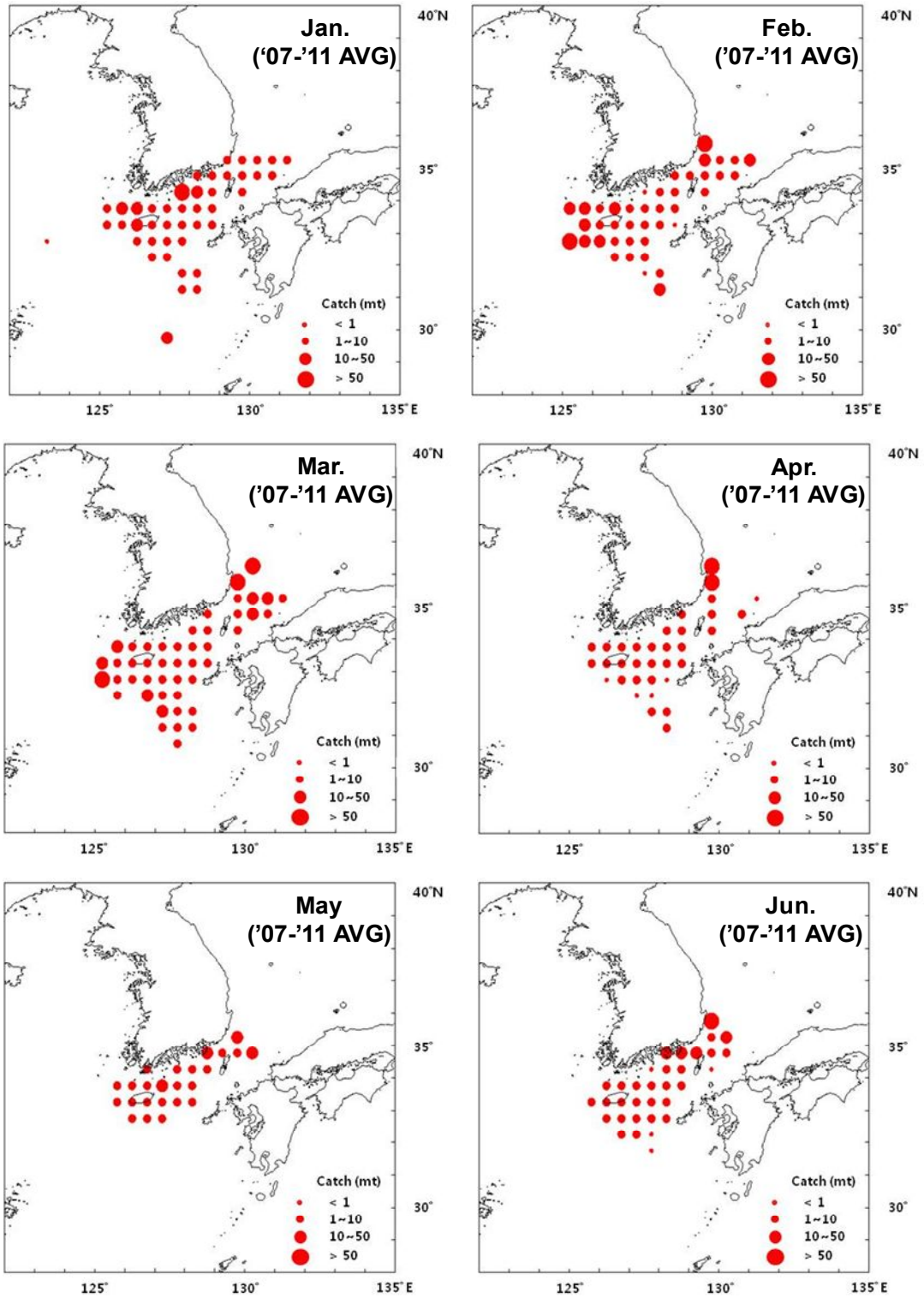

Fig. 5. Month catch distributions of OLPS in Korean waters during recent 5 years (2007-2011).

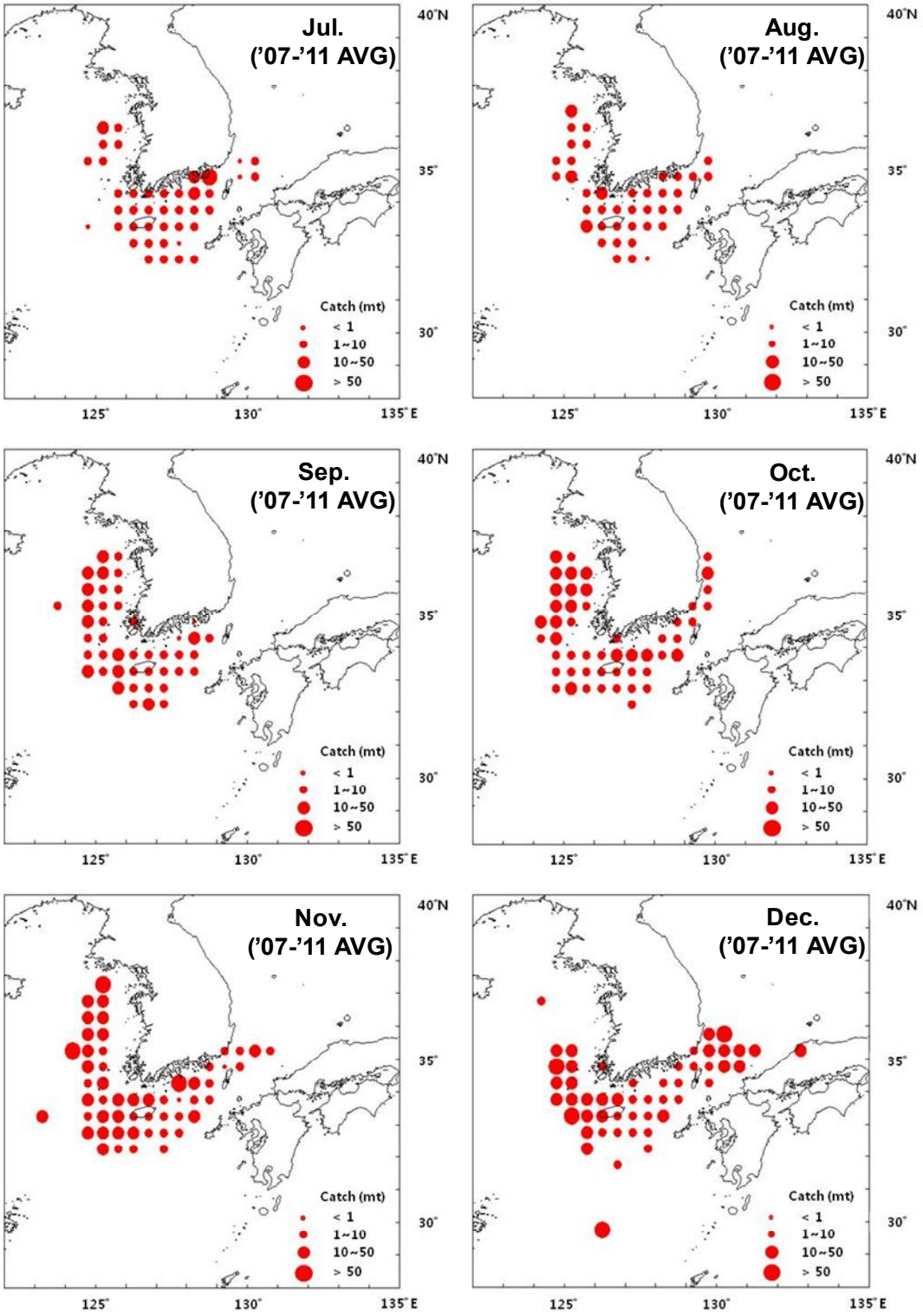

Fig. 5. Continued.

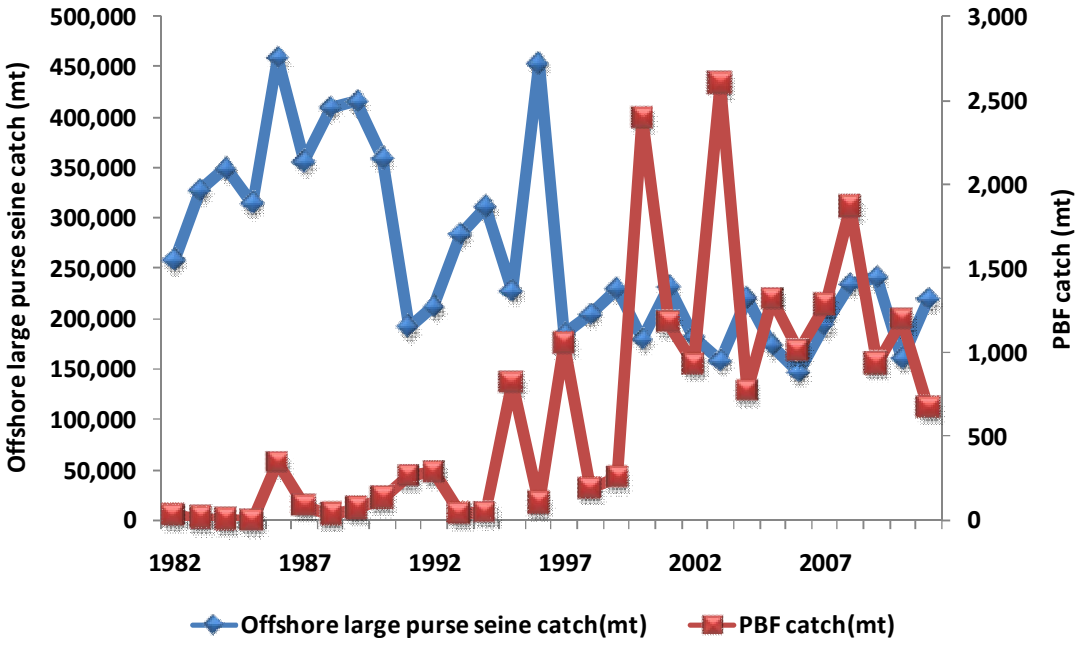

Fig. 6. Annual variations in total catch and PBF catch of OLPS in Korean waters from 1982 to 2011.

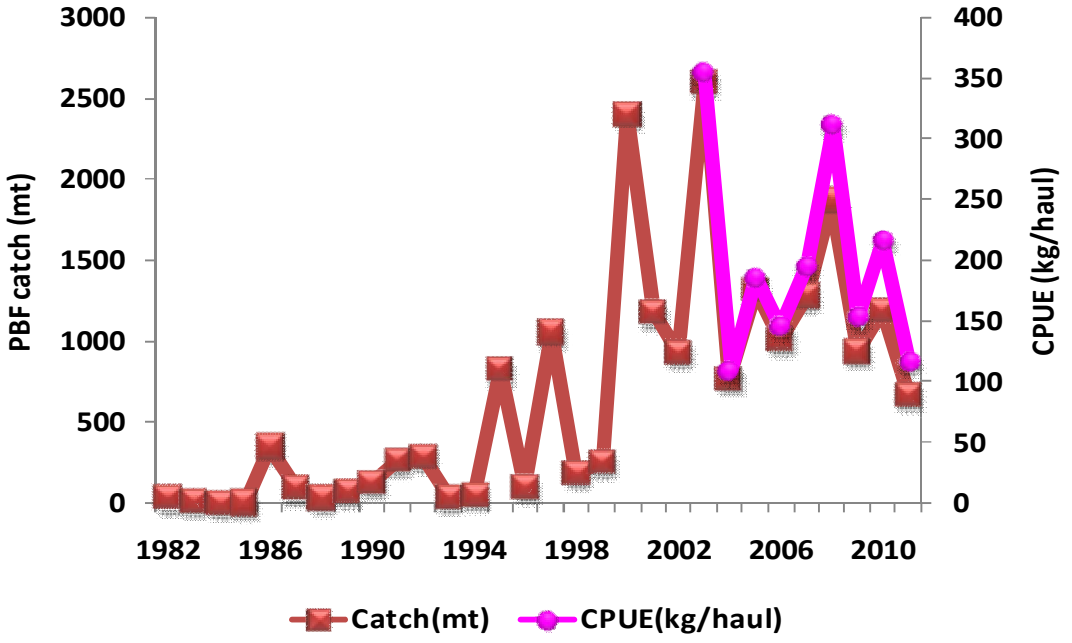

Fig. 7. Variations in PBF catch and CPUE (kg/haul) of OLPS in Korean waters from 1982 to 2011.

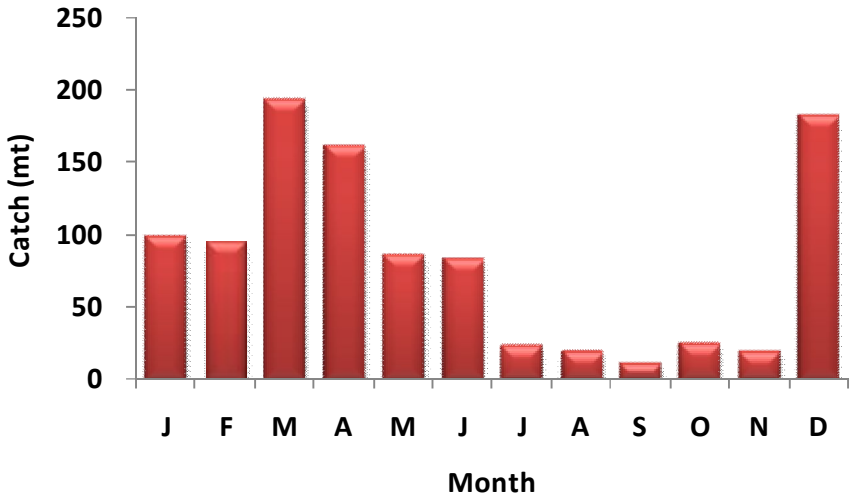

Fig. 8. Variations in monthly average catch of PBF by OLPS in Korean waters during recent 5 years (2007-2011).

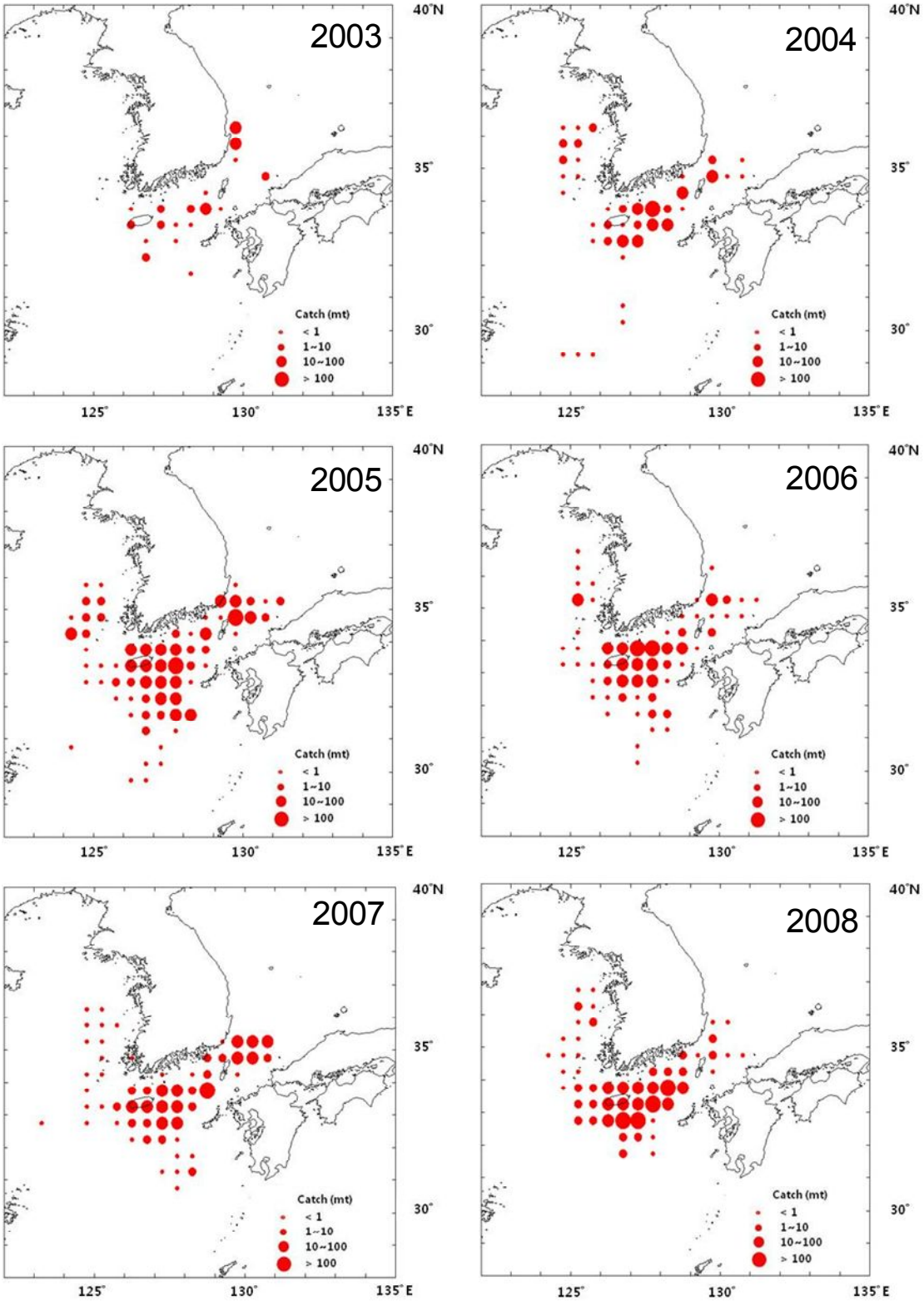

Fig. 9. Annual catch distributions of PBF by OLPS in Korean waters from 2003 to 2011.

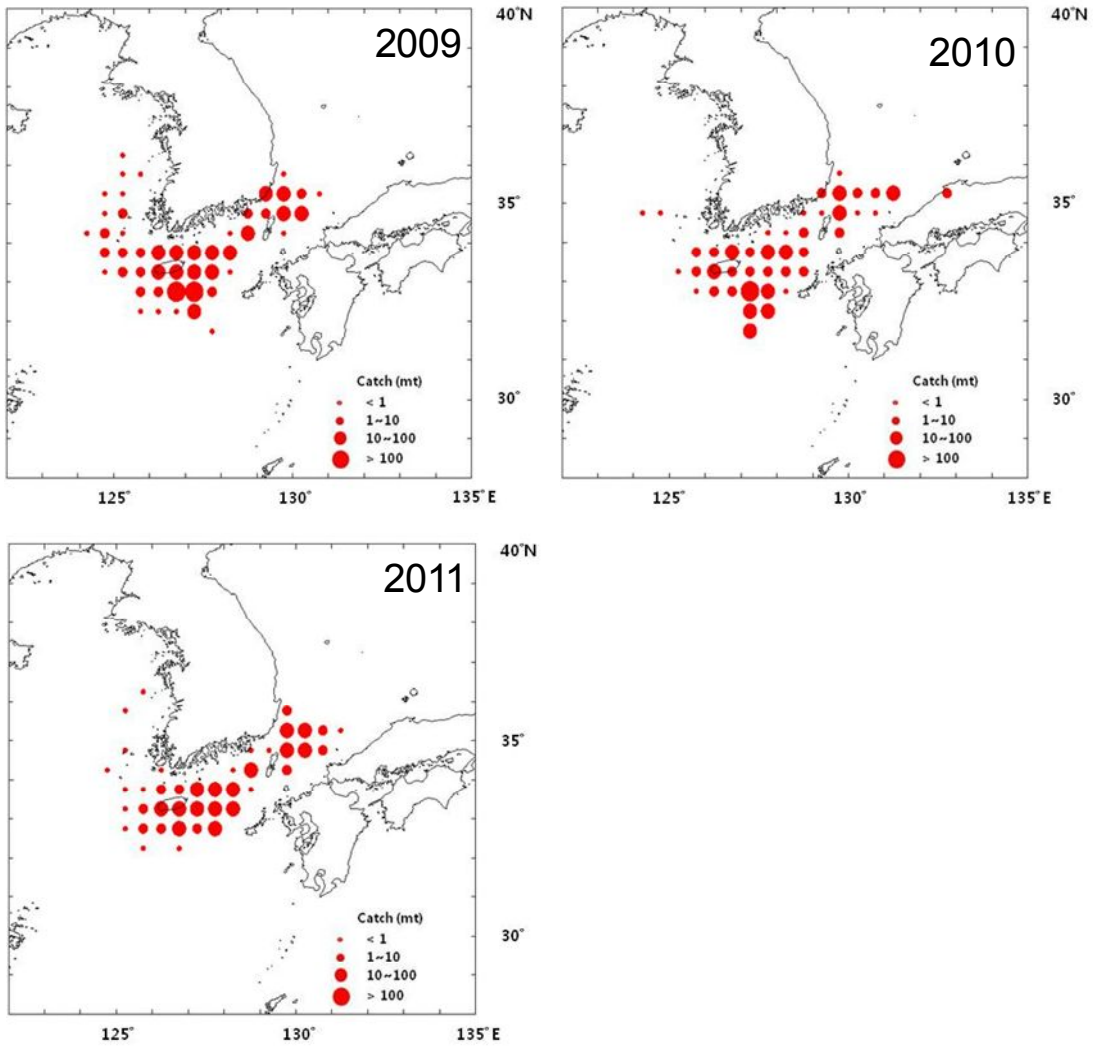

Fig. 9. Continued.

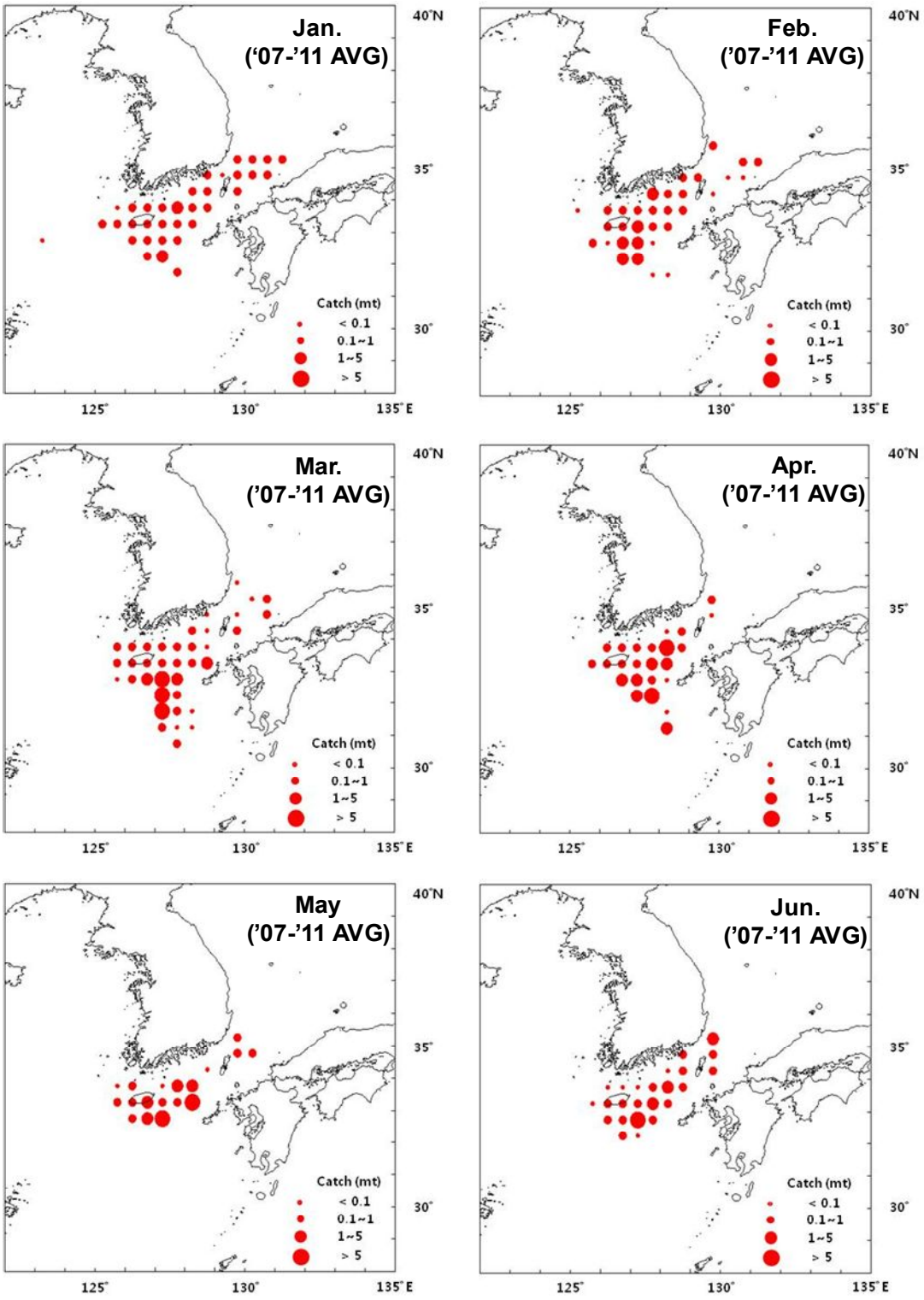

Fig. 10. Month catch distributions of PBF by OLPS in Korean waters during recent 5 years (2007-2011).

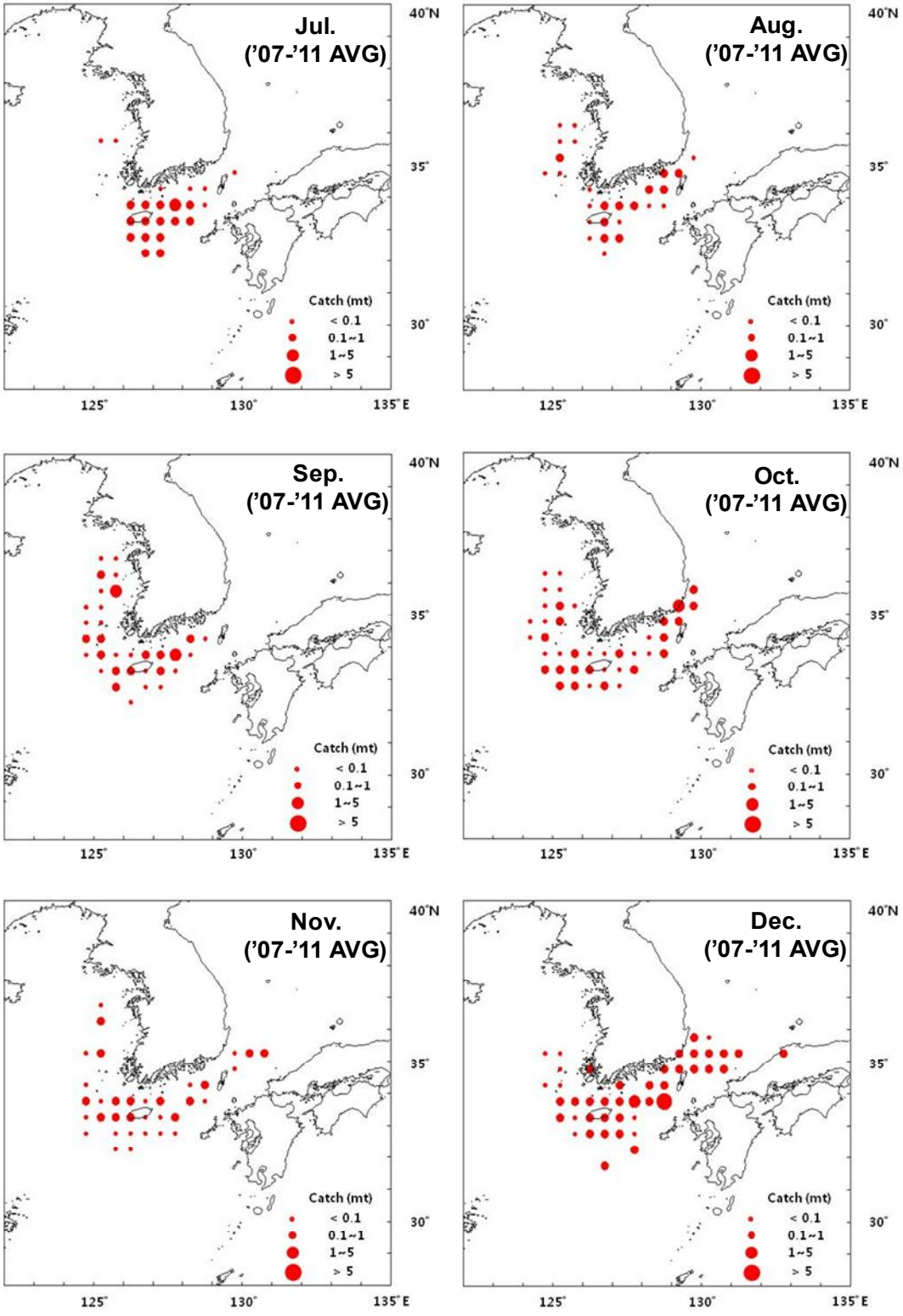

Fig. 10. Continued.

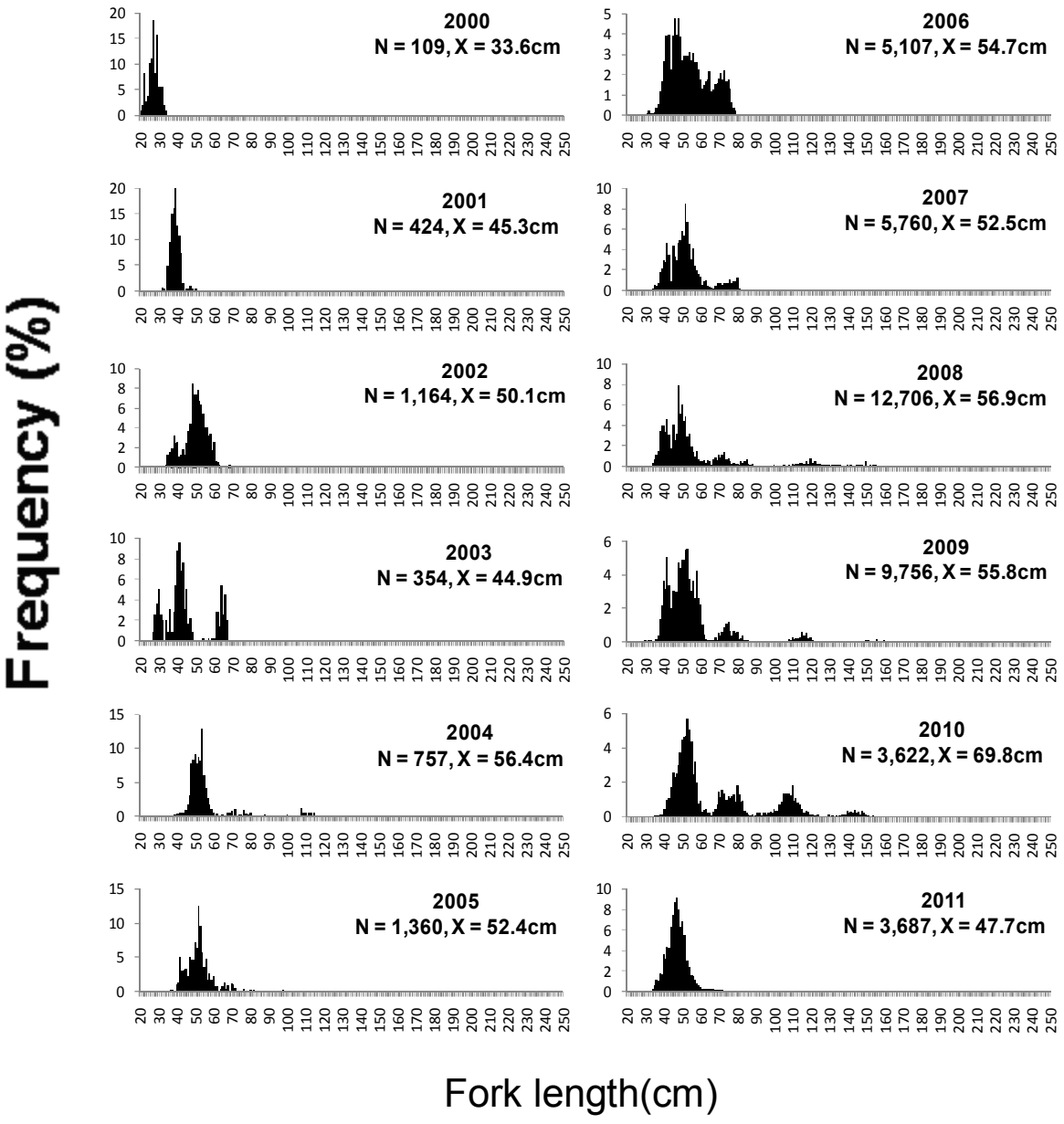

Fig. 11. Length frequency distributions of PBF caught by OLPS in Korean waters from 2000 to 2011.