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Recent update of Pacific bluefin tuna catch in Korean waters

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Abstract

Most of Pacific bluefin tuna (PBF) in Korean waters are caught by Korean domestic purse seiners, but PBF is not main target species in the purse seiners. The weight of catch per wooden box used in catch auctions at Busan Cooperative Fish Market was fixed at 18.0 kg, while the actual weight of PBF (< about 90 cm in fork length) per box in 2011 was 22.7 kg. The catch based on 18.0 kg/box from 2009 to 2011 were revised to the catch based on actual weight of catch/box and the catch from 2000 to 2008 were revised basing on 22.3 kg. The annual catch of PBF tended to increase until 2010, but the catch in 2011 remarkably decreased. The size of the offshore purse seine fleet has gradually decreased since 1994. Although annual mean FL (fork length) of PBF during 2000-2010 tended to increase, the mean FL of PBF in 2011 rapidly declined. The fishing ground of PBF is mainly formed around Jeju Island and the main fishing season was spring in 2010 and 2011.

Introduction

Pacific bluefin tuna (PBF), *Thunnus orientalis*, in Korean waters has been almost caught by Korean domestic offshore purse seiners. Most of PBF caught by the purse seines have been auctioned at Busan Cooperative Fish Market in Korea and exported to Japanese markets. In the auction a rectangle wooden box (length: 55×35 cm, weight: about 2 kg) has been used at least after 1999 when common mackerel, a main target fish of the purse seiners, was obligatorily sold in common fish markets due to a domestic TAC (Total Allowable Catch) system.

The PBF at the fish market was greatly classified in two groups using the wooden box: PBF larger and smaller than about 40 cm in fork length (FL) (Yoo *et al*., 2011). The large PBF (> about 40 cm FL and < about 90 cm FL) is almost exported to Japan, and the small one is domestically consumed. In the large PBF, the number per box is two, six, eight and ten individuals by size. The small PBF (< about 40 cm FL) is fully put into the box (hereafter “small PBF”). The weight of catch/box at the fish market was fixed at 18.0 kg. However, as a result by our study, actual weight of catch/box at the fish

market during 2009-2010 was 22.3 kg (Yoo *et al*., 2011). Namely, the catch of PBF based on 18.0/box has been underestimated. Therefore, the catch of PBF in Korea since 2005 has been revised in the meeting of PBF working group in the last year (Yoo *et al*., 2011).

On the other hand, the big PBF (> about 90 cm FL) at the fish market is directly weighed by wholesalers, and then after cut of guts and caudal fin the PBF is exported to Japan (Yoo *et al*., 2011).

In 2011 the catch of PBF by offshore purse seiners in Korean waters auctioned at the fish market is also revised in the paper. In addition, this paper describes annual length-frequency distributions and spatial variations in the catch of PBF.

Materials and methods

The catch of PBF in Korean waters during 1982-1999 were estimated from Japanese import records of Korean bluefin tuna, and those of 2000-2004 were estimated from export data of PBF to Japan obtained from the Korean domestic purse seine fisheries cooperatives. Since 2005, the catch data of PBF based on the monthly sale slips of the purse seiners have been obtained from Busan Cooperative Fish Market and compiled into the database system (named OFIRIS) of National Fisheries Research & Development Institute (NFRDI) of Korea. In addition, we look at daily sale slips at Busan Cooperative Fish Market in order to collect number data for a wooden box used in the auction of PBF. The number data of the box can obtain from 2009 to 2011.

The annual catch of PBF from 2009 to 2011 were revised using the follow equation (Yoo *et al*., 2011).

$$\text{The annual catch of PBF revised from 2009 to 2011} = \sum_{i=1}^{5}\left\{\left(\frac{x_i}{\text{Total number of box}} \times \overline{\text{Catch}}_{\text{year}}\right) \times \frac{y_i}{18}\right\} + \text{Catch of big PBF}(>\text{about 90 cm FL}) \quad (1)$$

where x is number of box (1~5 for subscript i indicate 2, 6, 8, 10 and small PBFs/box

groups, respectively). $\overline{\text{Catch}}$ denotes that except for catch of big PBF (> about 90 cm FL). *y* is actual weight of catch/box. The catch of big PBF in 2009, 2010 and 2011 were 84.7 tons (11.9% of total catch), 81.9 tons (8.7% of total catch) and 0.33 tons (0.06% of total catch), respectively.

The annual catch of PBF from 2005 to 2008 was estimated basing on 22.3 kg/box instead of 18.0 kg/box using the follow equation (Yoo *et al*., 2011).

$$\text{The annual catch of PBF converted from 2005 to 2008} = \left\{ \left(\frac{\text{Catch}_{\text{year}} - (\text{Catch}_{\text{year}} \times 0.1)}{18} \right) \times 22.3 + (\text{Catch}_{\text{year}} \times 0.1) \right\} \quad (2)$$

Further, because the catch of PBF before 2005 had clearly underestimated, the catch of PBF since 2000, which began the domestic TAC system, were also revised in the paper. However, there is no information on catch and auction of PBF at the fish market before 2005 except for the following information.

- The big PBF (> about 90 cm FL) in Korean waters had been scarce before 2005.
- Most of the PBF larger than about 40 cm FL auctioned at the fish market had been exported to Japan.

We assumed that the proportion of catch of the big PBF to total catch of PBF before 2005 may be less than 10%. The annual catch of PBF exported to Japan from 2000 to 2004 was revised using the equation (2). However, the catch before 2005 could be still underestimated due to omission of the catch of small PBF (< about 40 cm FL).

Results and Discussion

Proportion of fish species caught by offshore purse seiners

Figure 1 shows the proportion of fish species caught by offshore purse seiners in Korean waters. Most of fishes caught by the purse seiners were *Scomber* sp. Of them, tunas are less than 2 percent both in catch (M/T) and value (₩, Korean won). Namely, PBF is not main target species in the purse seiners.

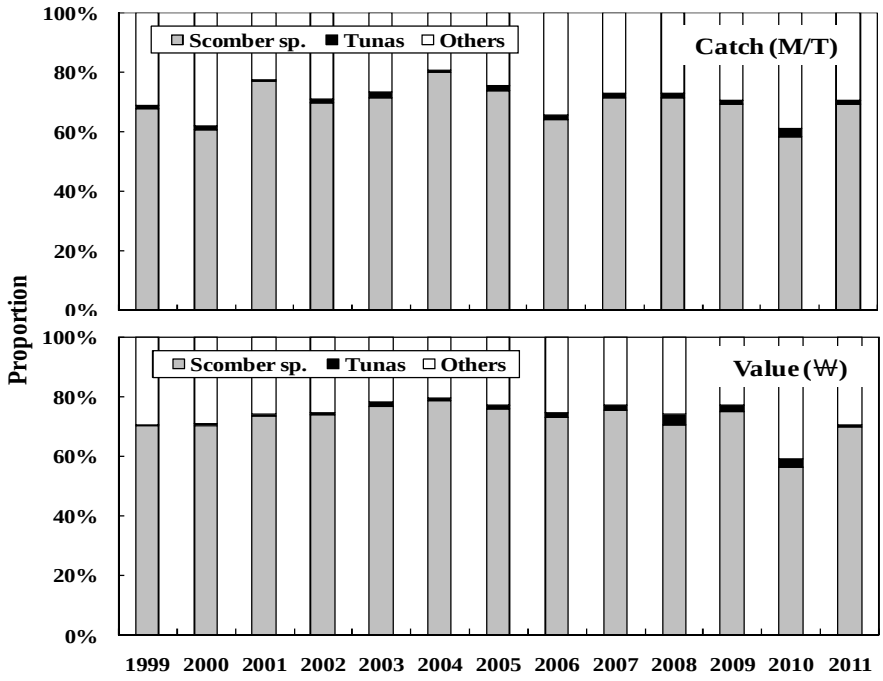

Fig. 1. Proportion of catch (M/T) and value (\ ) of fish species caught by offshore purse seiners in Korean waters.

The revised catch of PBF

Actual weight of PBF/box has been continually examined by our study since 2010. The entire mean of actual weight of catch/box in 2011 was 22.7 kg (Table 1). Each actual weight of two, six, eight, ten and small PBFs/box groups in 2011 is shown in Table 1.

Table 1. Mean of the actual weight (kg) of two, six, eight, ten and small PBFs/box groups in 2011.

	2 ind.	6 ind.	8 ind.	10 ind.	Small PBF	Entire mean
Mean	18.9	25.5	22.1	21.0	25.7	22.7

Table 2 shows the number of box for the groups by size (2, 6, 8, 10 and small PBFs/box) from 2009 to 2011.

Table 2. The number of box in 2, 6, 8, 10 and small PBFs/box groups from 2009 to 2010.

	Year	2 ind.	6 ind.	8 ind.	10 ind.	Small PBF	Total
Number of box	2009	8,146	4,524	7,501	2,225	3,731	26,127
	2010	13,825	4,579	11,030	2,139	4,402	35,975
	2011	22	403	11,012	5,840	6,131	23,408

The annual catch of PBF revised by equations mentioned above from 2000 to 2011 is shown in Table 3. The number of fleets of the offshore purse seiners has been gradually decreased since 1994 (Table 3). The number of fleets in 2011 was 25 (Table 3). Gear types during 1982- 1999 were unknown, but the major gear was probably purse seine. The annual catch of PBF after 1994 tended to increase with large annual fluctuation. The catch peaked at 2,601 tons in 2003 (Table 3).

Table 3. Annual catch of PBF by offshore purse seiners in Korea (unit : tons).

Year	Gear type	Permitted number of fleets	Existing catch	The revised catch	Data source
1982	(ps)*	48	31		Import data of Japan
1983	(ps)	48	13		
1984	(ps)	48	4		
1985	(ps)	48	1		
1986	(ps)	48	344		
1987	(ps)	48	89		
1988	(ps)	48	32		
1989	(ps)	48	71		
1990	(ps)	48	132		
1991	(ps)	48	265		
1992	(ps)	48	288		
1993	(ps)	48	40		
1994	(ps)	48	50		
1995	(ps)	36	821		
1996	(ps)	36	102		
1997	(ps)	36	1,054		
1998	(ps)	36	188		
1999	(ps)	36	256		

2000	ps	32	1,976	2,401	Export data to Japan
2001	ps	32	968	1,176	
2002	ps	32	767	932	
2003	ps	29	2,141	2,601	
2004	ps	29	636	773	
2005	ps	29	1,085	1,318	Sale slips at Busan Cooperative Fish Market
2006	ps	29	833	1,012	
2007	ps	29	1,054	1,281	
2008	ps	29	1,536	1,866	
2009	ps	27	794	936	
2010	ps	25	1,021	1,196	
2011	ps	25	529	670	

※ Gears were unknown during 1982-1999, but probably purse seine.

※ Export data of PBF to Japan obtained from the Korean domestic purse seine fisheries cooperatives.

Annual length-frequency distributions of the catch of PBF

Annual mean FL of PBF caught by the offshore purse seiners in Korean waters during 2000-2010 tended to increase, reaching a peak at 66.8 cm in 2010 (Fig. 2). However, the mean FL of PBF in 2011 remarkably declined to 48.3 cm (Fig. 2).

A strong mode at 27 cm in 2000 progressed to about 50 cm by 2002 (Fig. 2). Length-frequency distribution in 2003 had dominant modes at 30 cm, 40 cm and 64 cm, and then had several modes between about 30 to 80 cm in FL (Fig. 2). Further, after 2008, some weak modes in larger length classes appeared in the length-frequency distribution (Fig. 2). In 2011, length-frequency distribution had dominant modes at about 50 cm in FL (Fig. 2).

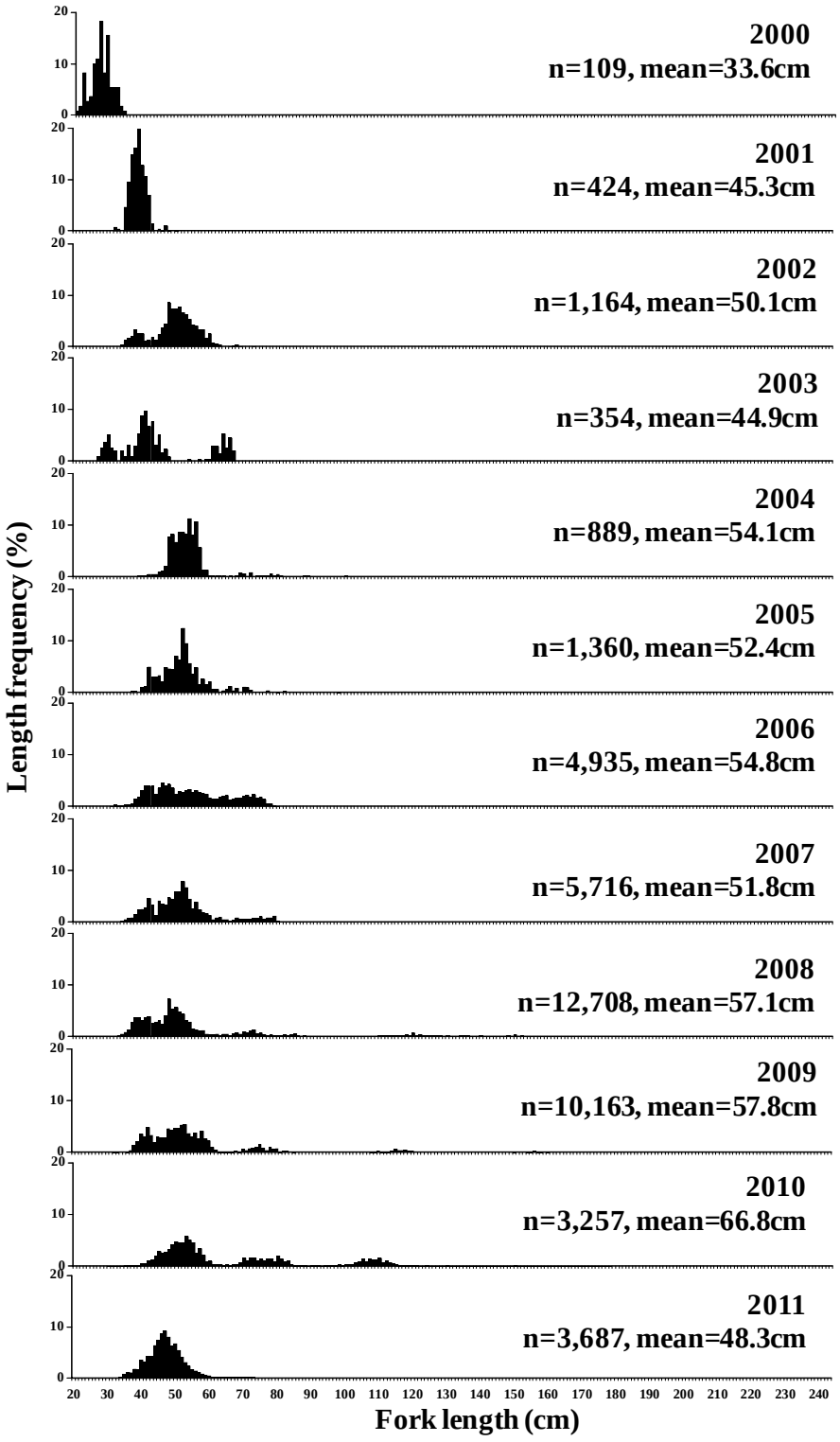

Fig. 2. Annual size distribution of PBF caught by offshore purse seiners in Korean waters from 2000 to 2011.

Fishing ground of PBF in Korea waters

The fishing ground of PBF in 2010 and 2011 was mainly formed around Jeju Island in spring (Fig. 3). While an additional fishing ground tended to form around Tsushima Island, monthly changes of the fishing ground was large (Fig. 3).

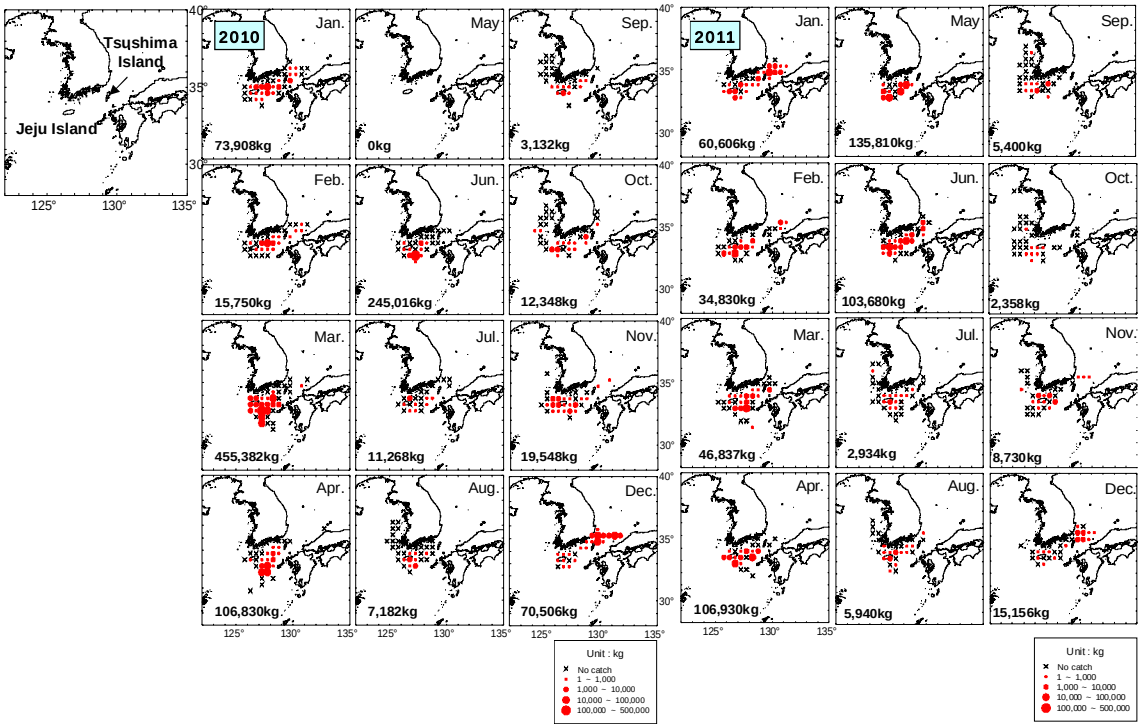

Fig. 3. Monthly horizontal distributions of PBF caught by offshore purse seiners in Korean waters from 2010 to 2011.

References

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