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Update of Pacific bluefin tuna catch in Korea waters

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Jae Bong Lee, Sung IL Lee, Doo-Nam Kim , Kyu-Jin Seok,
Dae-Yeon Moon and Dong-Woo Lee

National Fisheries Research and Development Institute (NFRDI)
152-1 Haean-ro, Gijang-up, Gijang-gun, Busan 619-705, Republic of Korea

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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 was 22.3 kg. The catch based on 18.0 kg/box was revised to the catch based on actual weight of catch/box or 22.3 kg for the period of 2005-2010. The annual catch of PBF tended to increase after 1994, although the size of the offshore purse seine fleet has decreased since 1994. The quarterly catch ratios of PBF from 2000 to 2010 were highly variable from year-to-year. The fishing ground of PBF is mainly formed around Jeju Island and the main fishing season was spring in 2009 and 2010. As a result of our examination on composition of fishes caught by coastal set nets in 2010, PBF was not observed in the fishes caught by set nets. This indicates that the catch level of PBF by set net is quite low.

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 recent years, the information on the catch of PBF in Korean waters was requested by the ISC. Further, a statistics error in the catch data of PBF by the purse seiners in

Korea was noted in the NC meeting of WCPFC in 2010 (WCPFC, 2010). Cause of the error is examined by our study and explained in this paper. In addition, this paper describes more recent temporal and spatial variations in the catch of PBF by offshore purse seiners in Korean waters.

Materials

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 2010.

We also monitored composition of fishes caught by set nets in the coast of Korea peninsula in order to examine catch of PBF by set net in 2010 (Fig. 1). The catch data of the set nets obtained from daily sale slips.

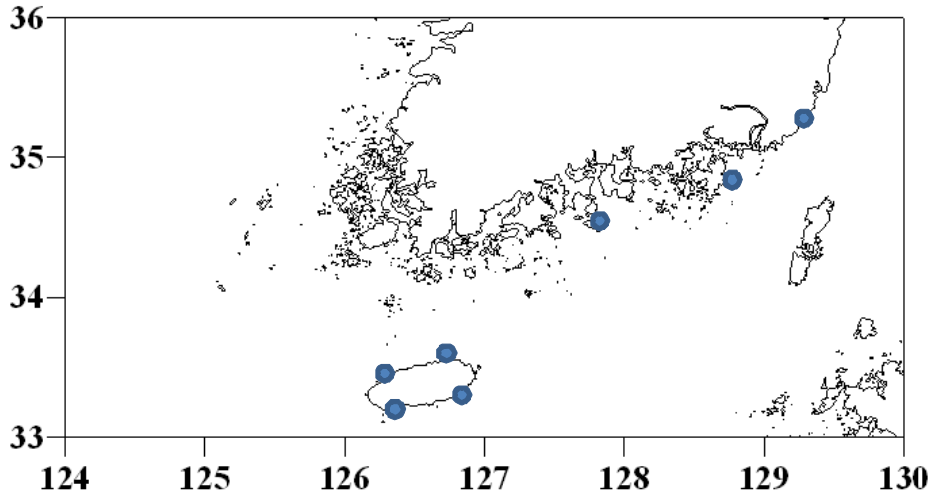

Fig. 1. Location (○) of set nets examined in the present study.

Results and Discussion

Proportion of fish species caught by offshore purse seiners

Figure 2 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.

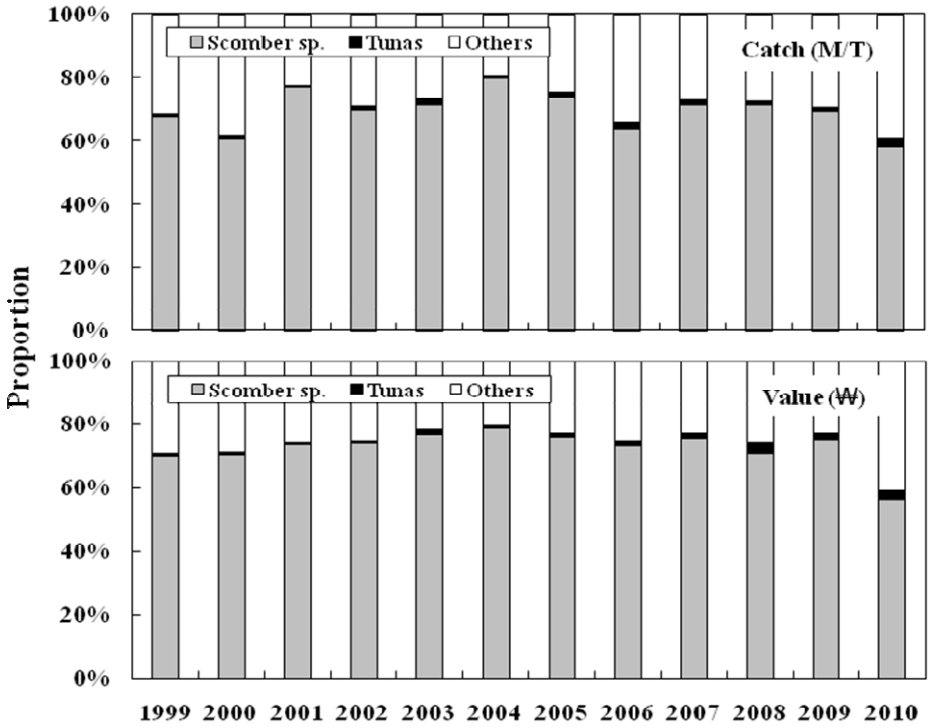

Fig. 2. Proportion of catch (M/T) and value (₩) of fish species caught by offshore purse seiners in Korean waters.

Conditions for the auction of Pacific bluefin tuna

A rectangle wooden box (length: 55×35 cm, weight: about 2 kg) has been used in the auction of catch by the offshore purse seiners at Busan Cooperative Fish Market in Korea at least since 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 weight of catch per one wooden box at the fish market was fixed at 18.0 kg. 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). 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 (Fig. 3) (hereafter “small PBF per box”).

Fig. 3. PBF arranged on the ground at Busan Cooperative Fish Market. A and B are PBF smaller and larger than about 40 cm FL, respectively.

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 (Fig. 4).

Fig. 4. The big PBF arranged on the ground at Busan Cooperative Fish Market shortly before export to Japan.

Conversion of the catch of PBF by offshore purse seiners

We examined actual weight of PBF/box in 2010 and the number of box reported to daily sale slips from 2009 to 2010 by size at the fish market in order to obtain better information on catch of PBF by the purse seiners. As a result, the entire mean of actual weight of catch/box is 22.3 kg (Table 1). Namely, the different between the actual and fixed weight was 4.4 kg. Each actual weight of two, six, eight, ten and small PBFs/box groups is shown in Table 1.

Table 1. The actual weight of two, six, eight, ten and small PBFs/box groups.

	2 ind.	6 ind.	8 ind.	10 ind.	Small PBF	Entire mean
Mean±SE	19.4±2.0 (n=6)	22.2±2.3 (n=8)	22.1±0.7 (n=71)	21.1±1.0 (n=73)	24.8±0.5 (n=50)	22.3±0.5 (n=208)

* SE : standard error of mean

Table 2 shows the number of box for the groups by size (2, 6, 8, 10 and small PBFs/box) in 2009 and 2010.

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

We converted the annual catch estimated basing on 18.0 kg/box into the annual catch based on actual weight of catch/box in the groups by size in 2009 and 2010 using the following equation;

$$\text{The annual catch of PBF converted in 2009 and 2010} = \sum_{i=1}^{5}\left\{\left(\frac{x_i}{\text{Total number of box}} \times \overline{\text{Catch}}_{\text{year}}\right) \times \frac{y_i}{18}\right\} + \text{Catch of big PBF}(>\text{about 90 cm FL}) \quad (1)$$

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 and 2010 were 84.7 kg (11.9% of total catch) and 81.9 kg (8.7% of total catch), respectively.

Further, because there is no information on number of box before 2009, 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 equation mentioned below. We assumed that the proportion of catch of the big PBF to total catch of PBF from 2005 to 2008 is 10% because the catch of big PBF from 2009 to 2010 captured 10% of the total catch.

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

The annual and quarterly catch of PBF converted by equations mentioned above from 2005 to 2010 is shown in Table 3 and 4, respectively. The number of fleets of the offshore purse seiners has been gradually decreased since 1994 (Table 3). The number of fleets in 2010 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 2,141 tons in 2003 (Table 3).

However, the annual catch of PBF at least from 1999 to 2004 based on export data of Korea is underestimated due to omission of the catch of small PBF (< about 40 cm FL). Therefore, to development some method for estimation of accurate catch of PBF before 2005 is an important future task.

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		Export data to Japan
2001	ps	32	968		
2002	ps	32	767		
2003	ps	29	2,141		
2004	ps	29	636		
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	

※ 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.

Table 4. Quarterly catch of PBF by offshore purse seiners in Korea.

Year	Quarter	Permitted number of fleets	Catch (ton)
2000	1	32	100
2000	2	32	128
2000	3	32	386
2000	4	32	555
2001	1	32	29
2001	2	32	279
2001	3	32	482
2001	4	32	85
2002	1	32	8
2002	2	32	40
2002	3	32	83

2002	4	32	91
2003	1	29	31
2003	2	29	90
2003	3	29	75
2003	4	29	210
2004	1	29	15
2004	2	29	5
2004	3	29	23
2004	4	29	16
2005	1	29	720
2005	2	29	264
2005	3	29	220
2005	4	29	114
2006	1	29	220
2006	2	29	339
2006	3	29	353
2006	4	29	100
2007	1	29	376
2007	2	29	12
2007	3	29	120
2007	4	29	773
2008	1	29	581
2008	2	29	1,003
2008	3	29	62
2008	4	29	220
2009	1	27	518
2009	2	27	213
2009	3	27	96
2009	4	27	109
2010	1	25	616
2010	2	25	424
2010	3	25	26
2010	4	25	130

※ The quarterly catch of PBF after 2005 was converted by the equations used in this study.

The quarterly catch ratios from 2000 to 2010 were estimated from the monthly catch data of purse seiners (Fig. 5). They greatly differed year by year. Due to such much difference of the quarterly catch ratios by year, extrapolation of the quarterly catch before 2000 by using quarterly mean catch ratios since then as suggested by Oshima *et al.*(2008) is not applicable to the case of Korea.

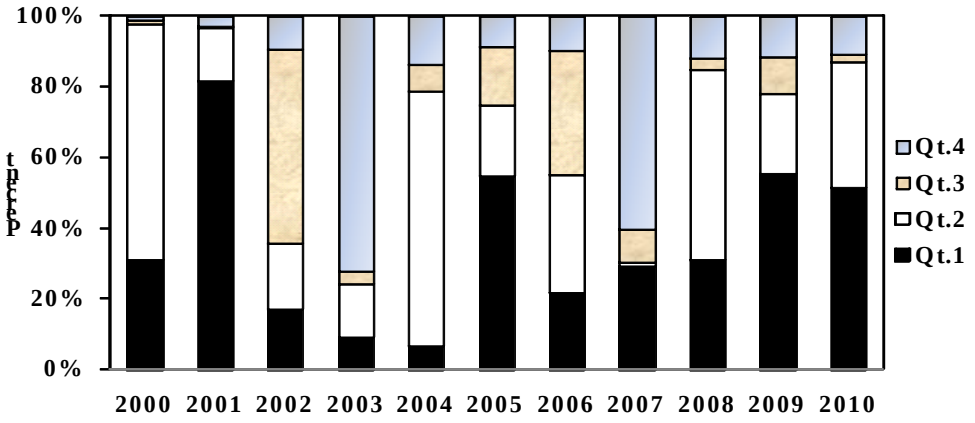

Fig. 5. Annual changes of quarterly catch ratios of PBF in Korea.

Fishing ground of PBF in Korea waters

The fishing ground of PBF in 2009 and 2010 was mainly formed around Jeju Island in spring (Fig. 6). While an additional fishing ground tended to form around Tsushima Island, monthly changes of the fishing ground was large (Fig. 6).

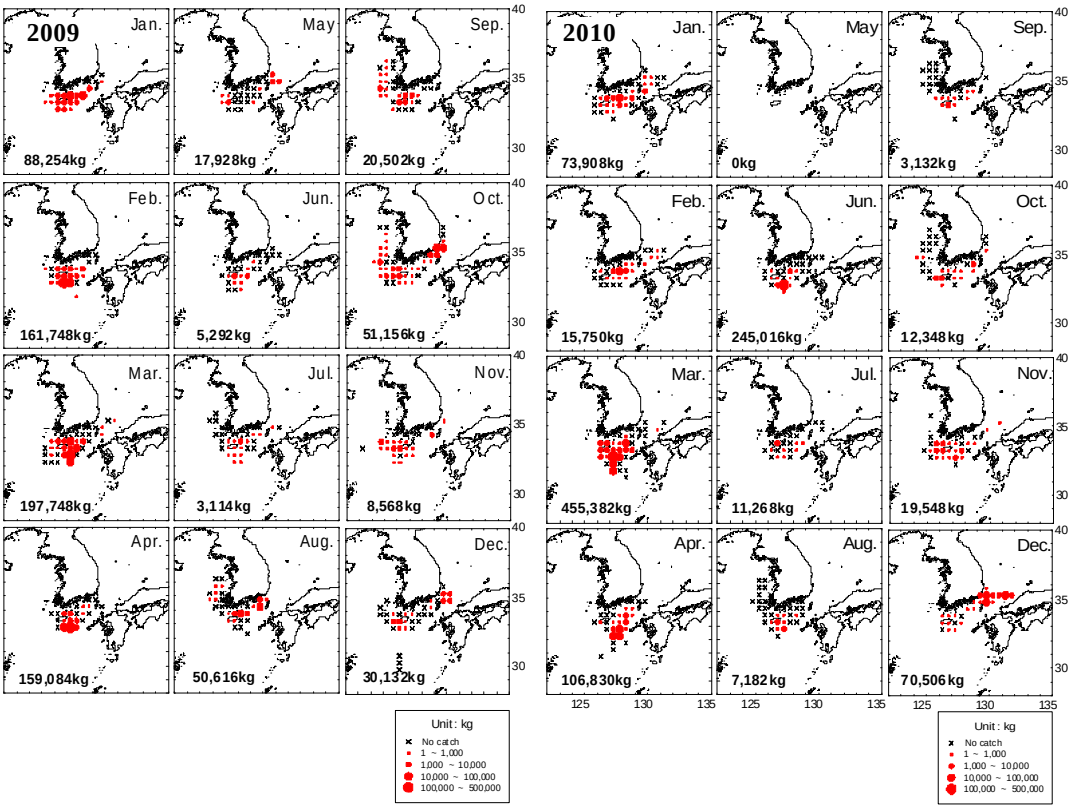

Fig. 6. Monthly horizontal distributions of PBF caught by offshore purse seiners in Korean waters from 2009 to 2010.

Monitoring of catch of PBF by set net in the coast of Korea peninsula

We examined composition of fishes caught by set nets in the coast of Korea peninsula in 2010. As a result, PBF was not observed in the fishes caught by set nets. This indicates that the catch level of PBF by set net is quite low

References

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