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The Korean Annual Report

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Annual Report of Korea to the 5th Scientific Committee Meeting of the South Pacific Regional Fisheries Management Organization (SPRFMO)

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1. Description of the fishery

Jack mackerel fishery

Korean commercial trawl fisheries targeting on Chilean jack mackerel have been operating in the SPRFMO convention area since Korean research trawl vessel *Tamgu No.1* commenced in 2003. The number of active Korean fishing vessels is described in Table 1. The number of operating vessels was stable within the range of 1-3, but their size became larger than those at the beginning of fisheries.

Table 1. Number and size of vessels for Korean jack mackerel fisheries in the SPRFMO area.

Years	Number of vessels	Gross registered Tonnage			
		2,000-2,999	3,000-3,999	4,000-4,999	5000<
2004	3	1	1	1	-
2005	2	1	1	-	-
2006	3	1	1	1	-
2007	3	1	1	1	-
2008	3	1	1	1	-
2009	2	-	1	1	-
2010	2	-	1	-	1
2011	2	-	1	-	1
2012	2	-	1	-	1
2013	1	-	1	-	-
2014	1	-	1	-	-
2015	2	-	1	-	1
2016	2	-	1	-	1
2017	2	-	1	-	1

2. Catch, effort and CPUE summaries

Catches by species for jack mackerel fishery

Annual catches of jack mackerel, chub mackerel, and others are summarized in Table 2. The highest catch in the convention area was approximately 15 thousand tons in 2009, and the lowest catch was in 2014. In 2015, catches of jack and chub mackerel by two trawlers were 5,749 ton and 82 ton, respectively. Catches of other species were reported and added in Table 2. Pomfret catch took the largest proportion in by-catch and jumbo flying squid catch followed next.

The largest CPUE (ton/hour) of jack mackerel was shown when the catch was the largest in 2009 (Figure 1). Since 2012, the CPUE has remained relatively stable around 6 ton per hour. In 2016, catch was relatively increased but their CPUE was decreased around 4 ton per hour.

Table 1. Jack and chub mackerel catch and by-catch species catch from Korean trawlers

Years	Number of fishing days	Total Catches (ton)	Catches (ton)		
			Trachurus murphyi	*Scomber japonicus*	Others
2004	205	8,146	7,438	708	-
2005	170	9,507	9,126	381	-
2006	232	11,934	10,474	1,460	-
2007	237	12,180	10,940	1,240	-
2008	249	13,568	12,600	968	-
2009	182	14,534	13,759	716	59
2010	136	8,267	8,183	84	-
2011	205	9,377	9,253	24	100
2012	117	5,492	5,492	-	-
2013	140	5,378	5,267	111	-
2014	86	4,099	4,078	21	-
2015	104	5,834	5,749	82	3
2016	182	6,931	6,430	486	16

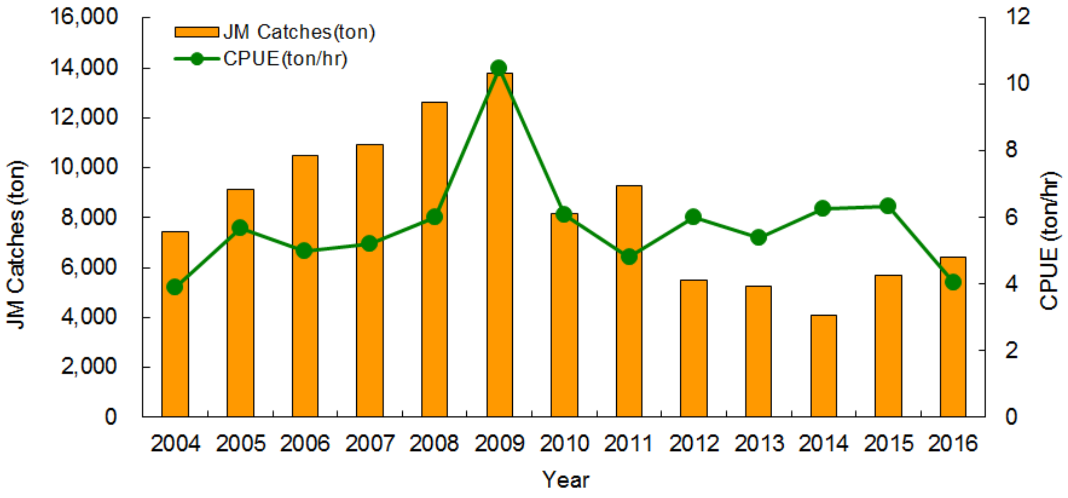

Figure 1. Catch and CPUE (Catch per unit effort, ton/hr) of jack mackerel from 2004 to 2016.

Geographical distribution of the CPUE

Geographical distributions of the CPUE of jack mackerel from 2009 to 2015 are shown in Figure 2. In 2009, when the catch was the largest, the distribution of CPUE was the widest. In 2010-2012, the distribution of CPUE was revealed in the area of 35°-45°S and 80°-95°W. The CPUE distribution formed closely to the continent in the last 4 years. The fishing ground showed in two latitudinal separated areas; 1) 25°-30°S and 2) 35-45°S.

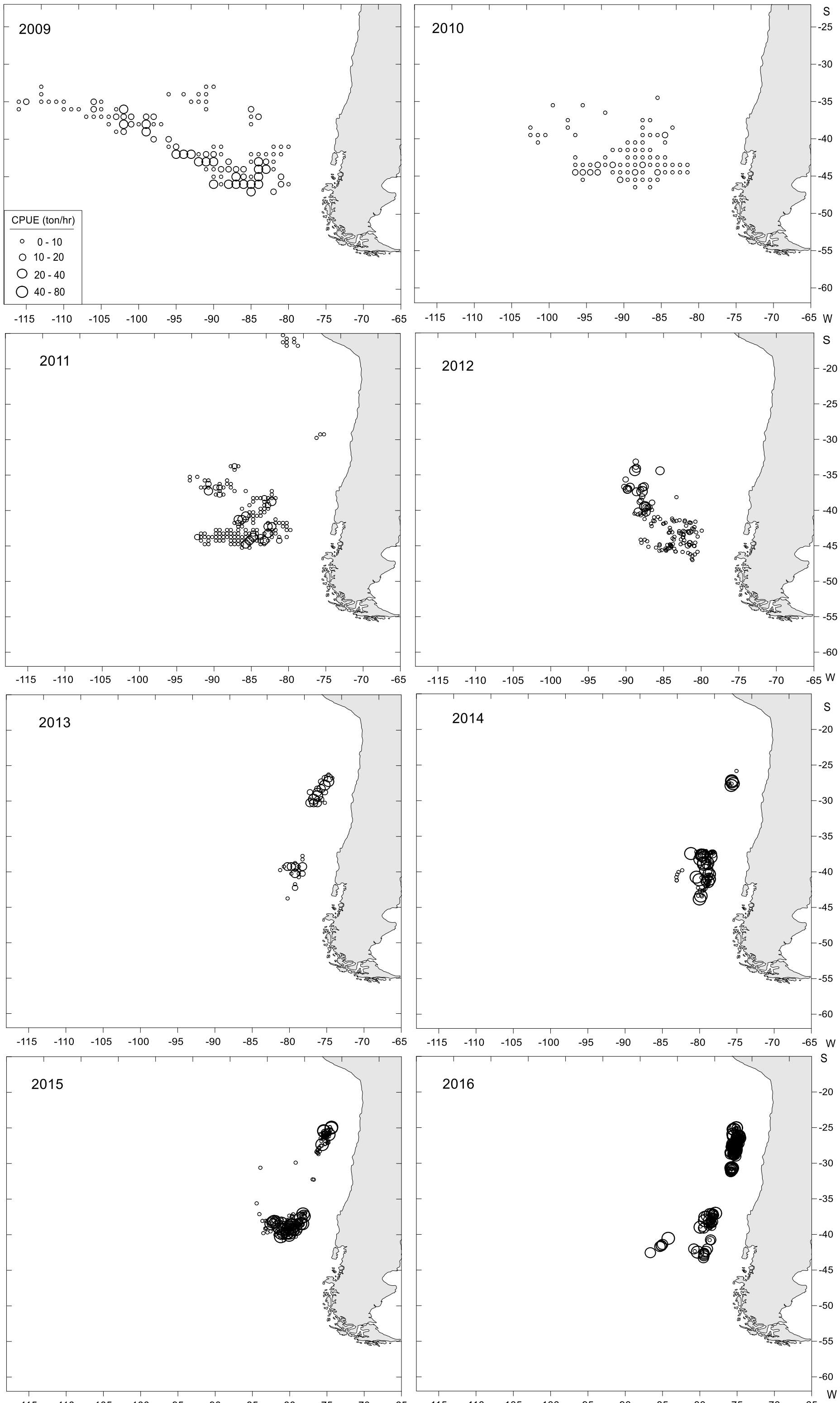

Figure 2. Distribution of CPUE (ton/hr) of jack mackerel of Korean fishing vessels in the SPRFMO area in 2009-2016.

Catches by species for bottom fishery

Table 3 represents total annual catches and fishing efforts (number of fishing days) for the Korean bottom trawl fishery during 2001-2007 in the SPRFMO area. The catch including orange roughy increased from 101 tons to 266 tons over 2001-2003, and it decreased down to 49 tons over 2004-2007 showing the lowest value in 2007 (Figure 3). Since 2007, bottom fishery was not operated in the convention area.

Table 2. Annual catches for Korean bottom fisheries in the SPRFMO area

Years	Number of fishing days	Catches (ton)	Orange roughy (ton)	Others
2001	?	101.4	93.3	8.1
2002	?	225.0	207.8	17.2
2003	?	266.5	243.3	23.2
2004	51	143.8	137.9	5.9
2005	-	-	-	-
2006	32	83.1	77.2	5.9
2007	29	48.8	44.2	4.4

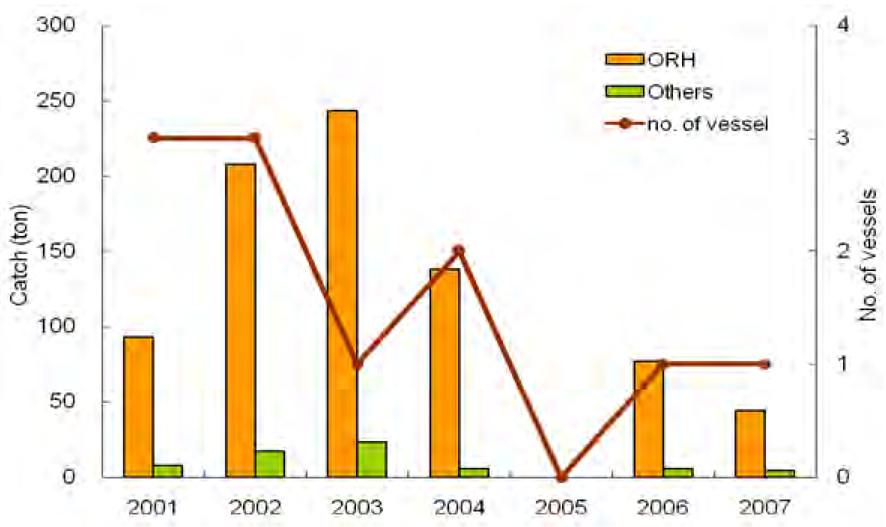

Figure 3. Trends of annual catch of orange roughy and number of fishing vessels by Korean bottom trawl fisheries in the SPRFMO area in 2001-2007.

Catches by species for jigging fishery

Korean jigging fisheries have been operating for jumbo flying squid (*Dosidicus gigas*) in the SPRFMO convention area since 1990. Annual catches of jumbo flying squid and their effort were summarized in Table 4. The highest catch of jumbo flying squid was about 69 thousand tons in 1994, and the lowest catch was about 2 thousand tons in 2006. The catch trend showed a continuous decrease from 1995 to 2007. After 2008, the catch trend is relatively constant compared to the prior fishing seasons. Ranges of CPUE were from 14 to 28 ton/day in 2012-2016 (Figure 4).

Table 4. Annual catches for Korean jigging fisheries in the SPRFMO area

Year	No. of fishing days	Catch (ton)	Year	No. of fishing days	Catch (ton)
1990	?	3,465	2004	?	10,787
1991	?	24,015	2005	?	2,519
1992	?	43,022	2006	?	2,485
1993	?	62,887	2007	?	-
1994	?	69,664	2008	?	6,775
1995	?	35,719	2009	?	7,221
1996	?	12,896	2010	?	14,506
1997	?	3,359	2011	?	7,410
1998	?	-	2012	580	7,991
1999	?	19,728	2013	365	6,034
2000	?	20,822	2014	397	7,261
2001	?	5,797	2015	151	4,263
2002	?	21,759	2016	409	4,367
2003	?	4,722			

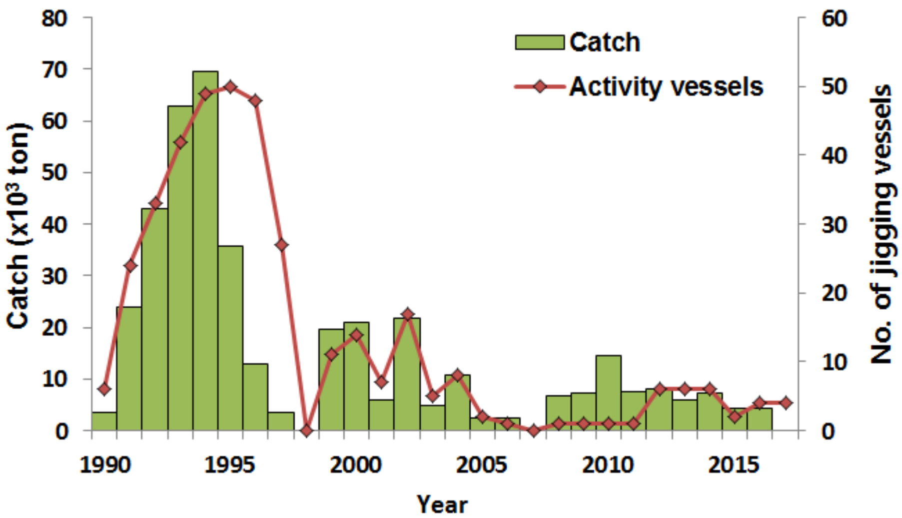

Figure 4. Trends of annual catch and number of fishing vessels of jumbo flying squid (*D. gigas*) by Korean jigging fisheries in the SPRFMO area in 1990-2017.

3. Fisheries data collection

Official catches by distant-water fishery was obtained by two organizations. Korea Overseas Association (KOFA) collects total catches by gear type from Korean distant-water fishery industries, which are used as Korean official total catch. National Institute of Fisheries Science (NIFS) collects logbook data from fishing vessels.

The logbook contains daily catch and effort data on a tow-by-tow basis. Electronic report system (ERS) was developed on the basis of VMS, and catch data from vessel of distant-water fisheries has been reported through ERS to Korea Fishery Monitoring Center (KFMC) since September 2015.

Data collection from the vessel

Each commercial vessel of distant-water fisheries submits the electronic "Catch Report and Biological Report (e-logbook)" which are recorded on fishing vessels according to the domestic regulation on a tow-by-tow basis. The logbook and catch data have been submitted to the SPRFMO Secretariat in accordance with the data standards of SPRFMO.

4. Biological sampling and length composition of Chilean jack mackerel

Yearly length frequencies and length-weight relationship of Chilean jack mackerel is shown in figures 5 and 6. In October 2008, a total of 344 jack mackerel was measured. The range of fork length (FL) was 32 cm to 49 cm with the average length 37.6 cm. There was only one group with one mode at 38 cm (Fig. 4). The relationship equation between body weight (g) and fork length (cm) was $BW=0.073FL^{2.460}$ (R^2=0.876).

In August and September 2011, a total of 2,450 jack mackerel was measured. The range of fork length was 28 cm to 69 cm, and the average was 45.2 cm. There were two separate groups with two modes at the 33 cm and 45 cm, respectively. The small group in the smaller length may indicate a new recruitment. The relationship equation between body weight and fork length was $BW=0.02FL^{2.760}$ (R^2=0.949).

In April to July 2012, a total of 9,789 jack mackerel was measured. The range of fork length was 31 cm to 60 cm, and the average FL was 48.1 cm. There was only one group with one mode at 48 cm. The relationship equation between body weight and fork length was $BW=0.016FL^{2.820}$ (R^2=0.925).

In June to August 2013, a total of 3,085 jack mackerel was measured. The range of fork length was from 20 cm to 54 cm, and the average FL was 29.2 cm. Length class with 30 cm was the highest frequency, but modes were not clearly separated. The relationship equation between body weight and fork length was $BW=0.035FL^{2.732}$ (R^2=0.925).

In June to August 2014, a total of 1,108 jack mackerel was measured. The range of fork length was from 27 cm to 53 cm, and the average FL was 38.2 cm. Length class with 36 cm was the highest frequency, but modes were not clearly separated. The relationship equation between body weight and fork length was $BW=0.011FL^{3.008}$ (R^2=0.974).

In 2015, 2,550 jack mackerels were measured by two observers on two trawlers. The range of fork length was from 19 cm to 56 cm, and the average FL was 32.5 cm. More than two modes appeared in the length range, and the highest mode formed between 25-31 cm. The highest frequency appeared within 28-29 cm. The relationship equation between body weight and fork length was $BW=0.0048FL^{3.202}$ (R^2=0.978).

In 2016, 8,170 jack mackerels were measured by two observers on two trawlers. The range of fork length was from 17 cm to 54 cm, and the average FL was 28.4 cm. More than two modes appeared in the length range, and the highest mode formed between 25-30 cm. The highest frequency appeared within 26-27 cm. The relationship equation between body weight and fork length was $BW=0.005FL^{3.211}$ (R^2=0.937).

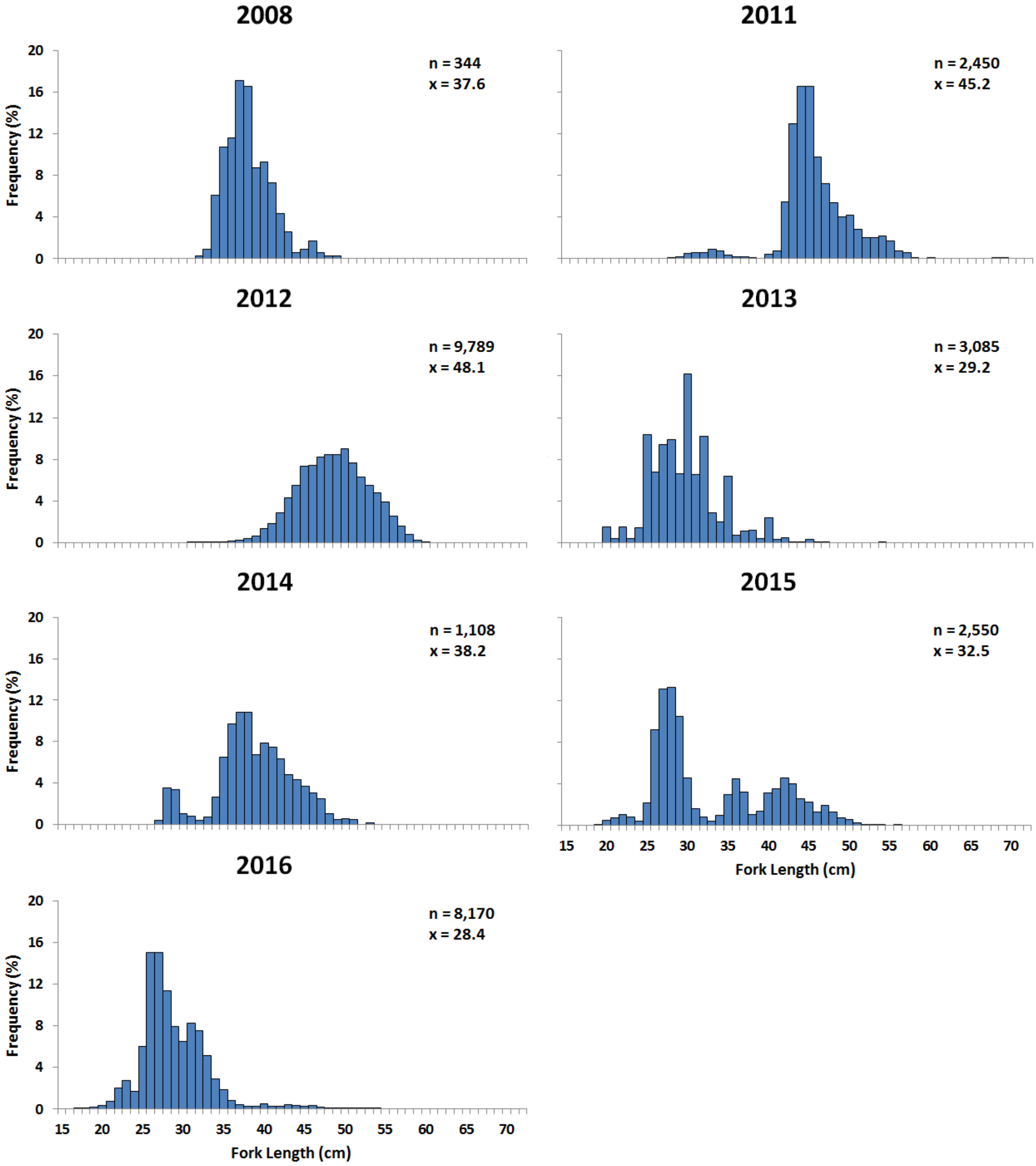

Figure 5. Fork length frequency of jack mackerel by Korean fishing vessels in 2008-2016.

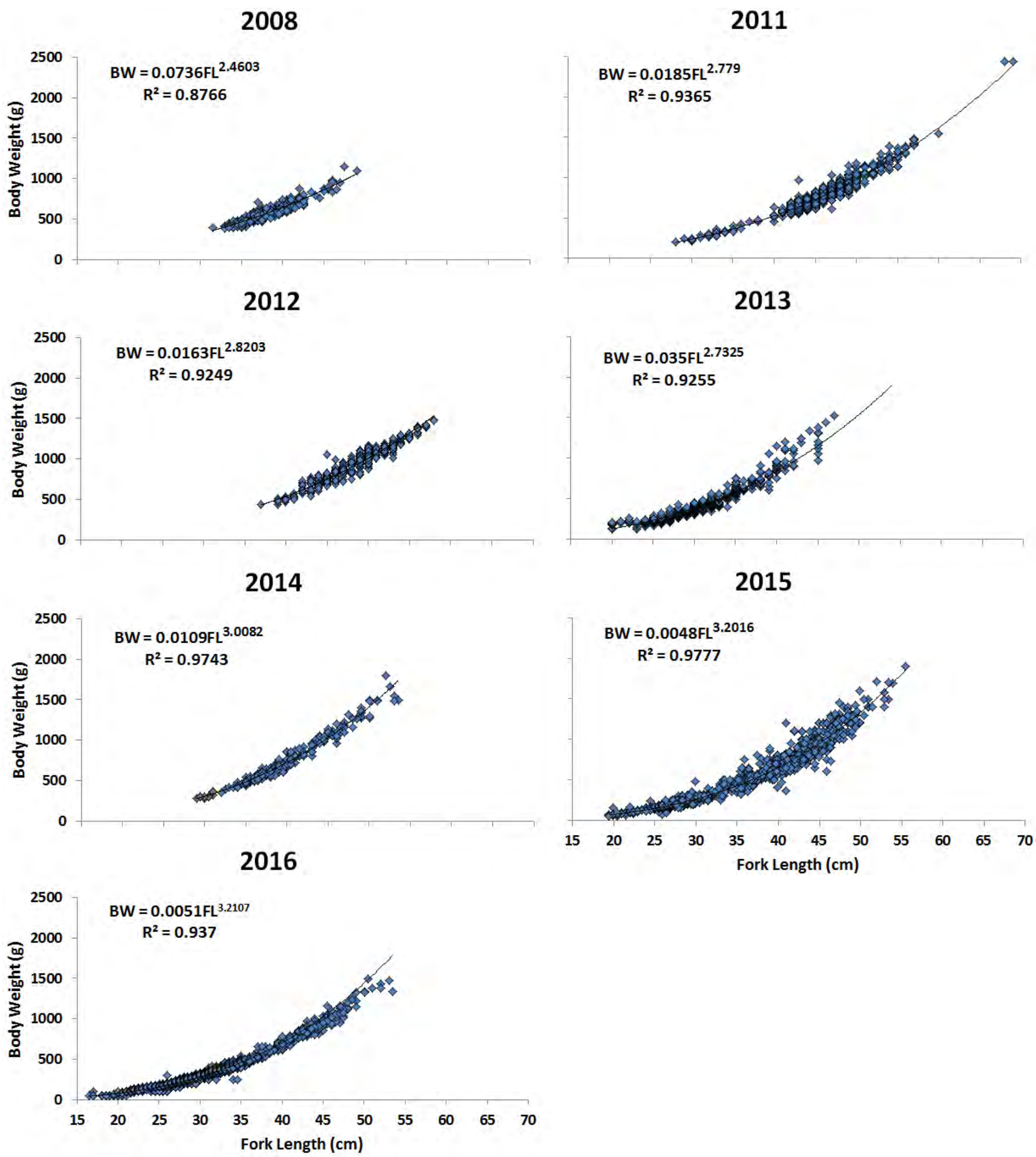

Figure 6. Relationship between body weight (BW) and fork length (FL) of jack mackerel in 2008-2016.

5. Ecosystem Approach consideration

Korean trawl vessels equip mitigation devices, such as streamer line, baffler during operating. Their utilization rates were 40 – 70 % varying with sea and weather conditions. During deploying the gear, scientific observers regularly watched the warp strike more than one time a day.

Figure 7. Photos of setting up the streamer line (left) and baffler (right) on vessels.

During operating and steaming, 6-11 species of seabirds were observed on trawl vessels in 2013-2016 (Table 5). There was no injured, struck or died seabirds that have been observed and reported so far. Seabird abundance was commonly more than 100 individuals at the end of vessel in deploying time. Cape petrel and black browed albatross were observed more than other seabird species.

Table 5. Lists of observed seabird in SPRFMO convention area

Code	English name	Scientific name
DAC	Cape petrel	*Daption capense*
DCR	Yellow-nosed Albatross	*Thalassarche chlororhynchos*
DIB	Buller's albatross	*Thalassarche bulleri*
DIC	Grey-headed albatross	*Diomedeidae*
DIM	Black browed albatross	*Diomedea melanophris*
DIU	Shy albatross	*Thalassarche cauta*
DIX	Wandering albatross	*Diomedea exulans*

DMP	Black browed albatross	*Diomedea melanophris*
DSQ	Masked Booby	*Sula dactylatra*
FGZ	Storm petrels	*Fregetta* spp
MAI	Southern giant petrel	*Macronectes giganteus*
OCO	Wilson's storm petrel	*Oceanites oceanicus*
PHE	Light-mantled albatross	*Phoebetria palpebrata*
PHE	Light-mantled Sooty Albatross	*Phoebetria palpebrata*
PRO	White chinned petrel	*Procellaria aequinoctialis*
-	Juan Fernandez petrel	*Pteroderma externa*
-	Masked Booby	*Sula dactylatra*
-	Tropicbird	*Phaethon* spp

6. Observer Implementation Report

Observer training

Korean scientific observer program for distant water fisheries started in 2002. National Institute of Fisheries Science (NIFS) is responsible for implementing and developing the observer program. The qualification for a person to be an observer is: a person who is a college graduate whose major field is nature science, or else, a fisheries high school graduate who accompanies at least 2-year experience on board having a certificate of qualification to deck officer. Candidates for observer who have passed the paper review (including medical check-up) and oral interview have to take training programs for 3 weeks. Observer training programs include basic safety training for seafaring, operations of navigation devices, biological information training for target and non-target species and data collection method for fishing activities. During the training program they have two types of test. One is the test on a technical term of fisheries and biology, and the other is the test on species identification. The person who scored above 70 in both tests and attended 100 % of the course timetable can be qualified and deployed on board as a scientific observer. NIFS trains observers again before dispatching them to each RFMO area. The training includes the conservation and management measure of each RFMO, how to collect the data and sample, specific task needs to be done and more.

Data collection by observer at the sea

For the analysis of the biological characteristics for jack mackerel, observers measure fork length, body weight, sex and reproduction indices from the commercial vessels.

In 2008, two Korean vessels operated in the SPRFMO area and one observer was deployed on two vessels for 9 days. The observer coverage rate was 4 %. Korean vessels operated in 2010, but no observer was on these trips. In 2011, one observer embarked on one vessel from August 15 to September 5, and the coverage rate of observation was 6.8 %. In 2012, one observer operated on one vessel from April 22 to July 28, and the coverage rate of observation was 58.1 %. Since 2013, observer coverage rates are 100 % in the convention area.

Table 5. Scientific observers on Korean fishing vessels

Date	Vessel name	observed days	Coverage rate (%, tows)
2008. 10	*Insungho*	3	4
	Kwangjaho	6	
2011. 8-9	*Kwangjaho*	14	6.8
2012. 4-7	*Kwangjaho*	68	58.1
2013. 6-12	*Kwangjaho*	140	100
2014. 5-8	*Kwangjaho*	86	100
2015. 6-9	*Kwangjaho*	120	100
	Sejongho	10	100
2016. 6-12	*Kwangjaho*	179	100
	Sejongho	28	100