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Korea's Annual Report

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Annual Report of Korea to the 6th 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 fishery targeting on *Trachurus murphyi* (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 trawl fishery 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
2018	2	-	1	-	1

2. Catch, effort and CPUE summaries

Catches by species for jack mackerel fishery

Annual catches of *T. murphyi*, *Scomber japonicus* (Pacific chub mackerel), and other species 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 2017. Catches of other species were reported and added in Table 2. Catch of *Brama japonica* (Pacific pomfret) took the largest proportion in bycatch and *Dosidicus gigas* (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. In 2017, the fleet fishing for jack mackerel stayed in the fishing ground for 107 days. However, the number of days actually spent for fishing was only 40 days as the fleet spent most of its time on fish detection; accordingly, a low amount of catch, 1,235 tons, was taken. However, the CPUE was 5.5 ton/hr, which is an increased level compared to the previous year.

Table 2. Catch and effort of target and bycatch species by Korean trawlers

Year	Number of fishing days	Total Catch (ton)	Catches (ton)		
			Trachurus murphyi	*Scomber japonicus*	Other species
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
2017	40	1,429	1,235	191	3

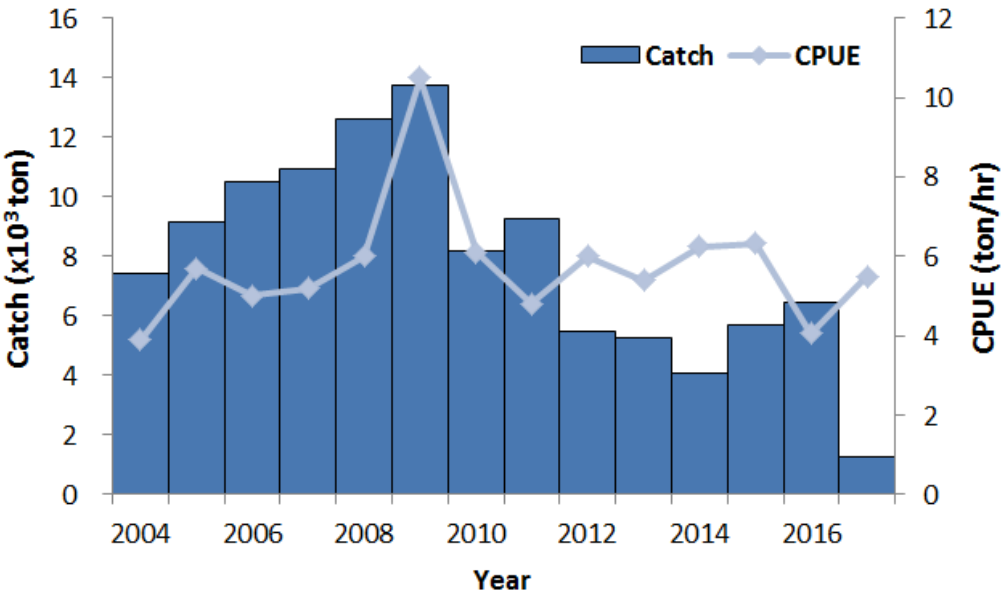

Figure 1. Catch and CPUE of *T. murphyi* from 2004 to 2017.

Geographical distribution of the CPUE of jack mackerel fishery

Geographical distributions of the CPUE of jack mackerel from 2009 to 2017 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 5 years. The fishing ground showed in two latitudinal separated areas; 1) 25°-30°S and 2) 35-45°S.

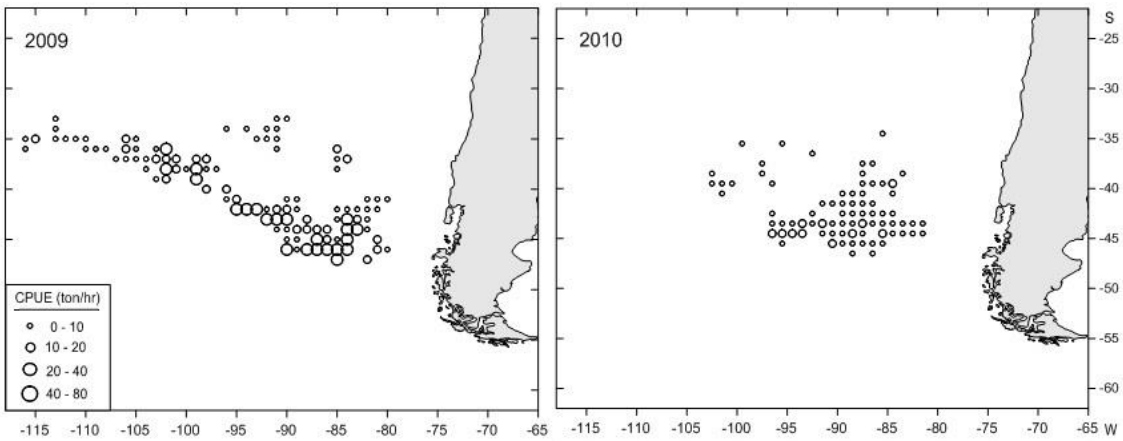

Figure 2. Distribution of CPUE (ton/hr) of *T. murphyi* in the SPRFMO area in 2009-2017.

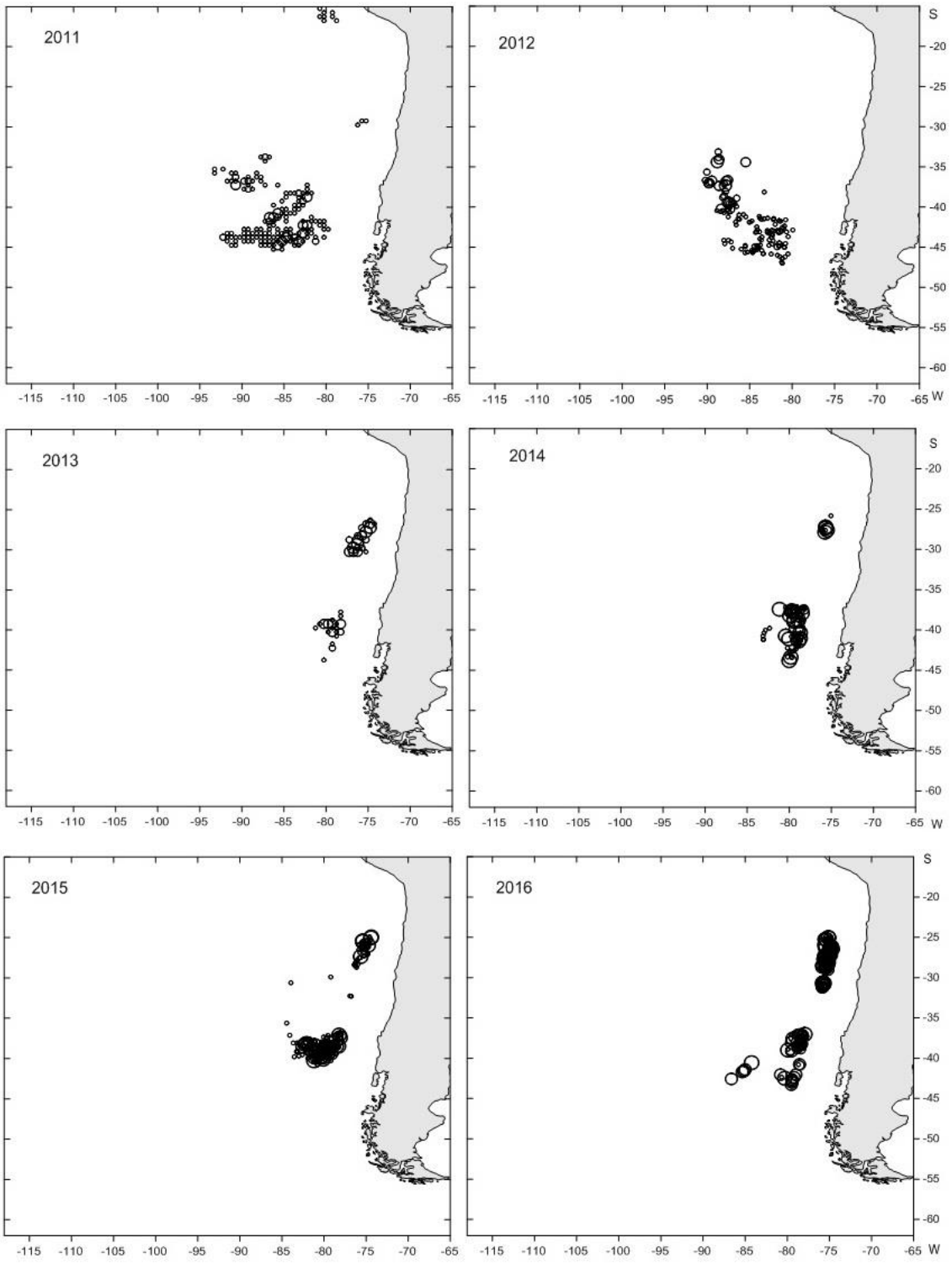

Figure 2. Continued.

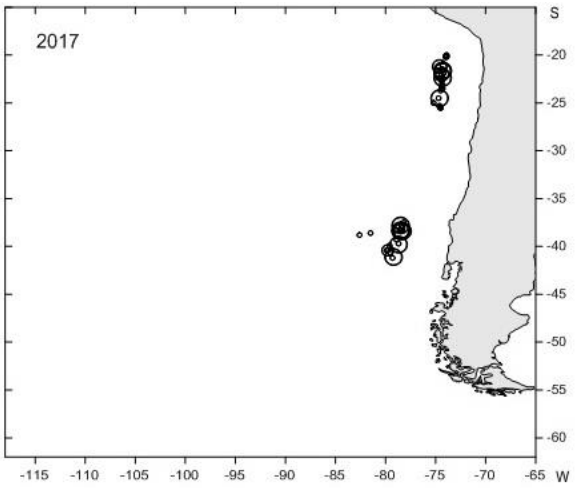

Figure 2. Continued.

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 *Hoplostethus atlanticus* (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 3. Annual catch of Korean bottom trawl fishery in the SPRFMO area

Year	Number of fishing days	Total Catch (ton)	Catch (ton)	
			Hoplostethus atlanticus	**Other species**
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

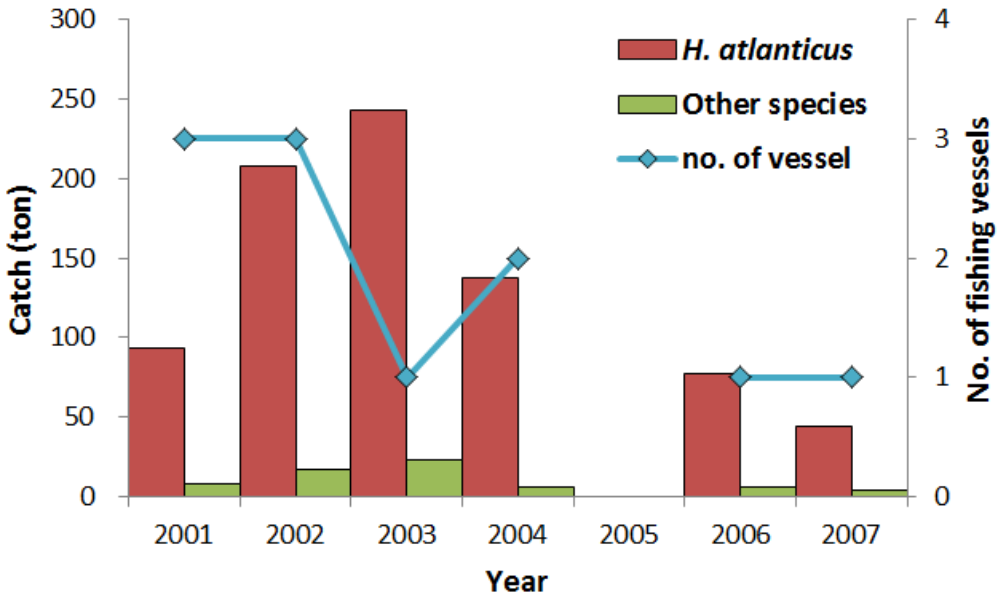

Figure 3. Annual catch and number of fishing vessels by bottom trawler in the SPRFMO area.

Catches by species for jigging fishery

Korean jigging fisheries have been operating for *D. gigas* in the SPRFMO convention area since 1990. Annual catches of *D. gigas* and their effort were summarized in Table 4. The highest catch of *D. gigas* 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 8 to 28 ton/day in 2012-2017 (Figure 4).

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

Year	No. of fishing days	No. of fishing vessels	Catch (ton)
1990	?	6	3,465
1991	?	24	24,015
1992	?	33	43,022
1993	?	42	62,887
1994	?	49	69,664
1995	?	50	35,719
1996	?	48	12,896
1997	?	27	3,359
1998	-	-	-
1999	?	11	19,728

2000	?	14	20,822
2001	?	7	5,797
2002	?	17	21,759
2003	?	5	4,722
2004	?	8	10,787
2005	?	2	2,519
2006	?	1	2,485
2007	-	-	-
2008	?	1	6,775
2009	?	1	7,221
2010	?	1	14,506
2011	?	1	7,410
2012	580	6	7,991
2013	365	6	6,034
2014	397	6	7,261
2015	151	2	4,263
2016	409	4	4,388
2017	456	8	3,460

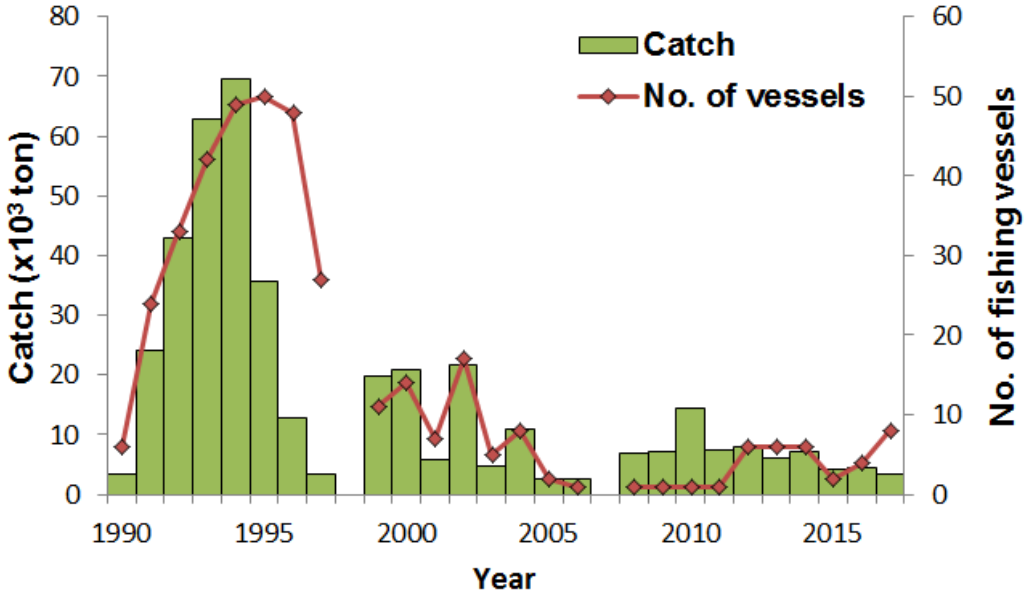

Figure 4. Annual catch and number of fishing vessels by Korean jigging fishery in the SPRFMO area in 1990-2017.

3. Fisheries data collection and research activities

Fisheries data collection and verification

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.

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.

Research activities

Korea reported on the biological information of *D. gigas* and bycatch status based on the information collected by an observer dispatched on board a jigging vessel in 2015 (SC5-SQ09).

Korea, considering its expansion of jigging fishery in the Convention Area of SPRFMO, has determined to investigate a fishing ground on *D. gigas*. In 2018, a total of 17 squid-jigging vessels are expected to be participating in the fishery, and the plan established is to dispatch two scientific observers for studies including biological research. The expected time of the research is from October to December, and the primary objective of the survey is to collect information on the distribution of fishing grounds and biological information of *D. gigas*, while it is also to obtain biological samples, basic information for stock assessments of *D. gigas*, etc.

4. Biological sampling

Length composition of T. murphyi, Chilean jack mackerel

Yearly length frequencies and length-weight relationship of *T. murphyi*, 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 $BW=0.005FL^{3.211}$ ($R^2=0.937$).

In 2017, 1,567 jack mackerels were measured by one observers on a trawler. The range of fork length was from 19 cm to 46 cm, and the average FL was 29.5 cm. More than two modes appeared in the length range, and the highest mode formed between 26-36 cm. The highest frequency appeared within 26-27 cm. The relationship equation between body weight and fork length was $BW=0.001FL^{3.614}$ ($R^2=0.947$).

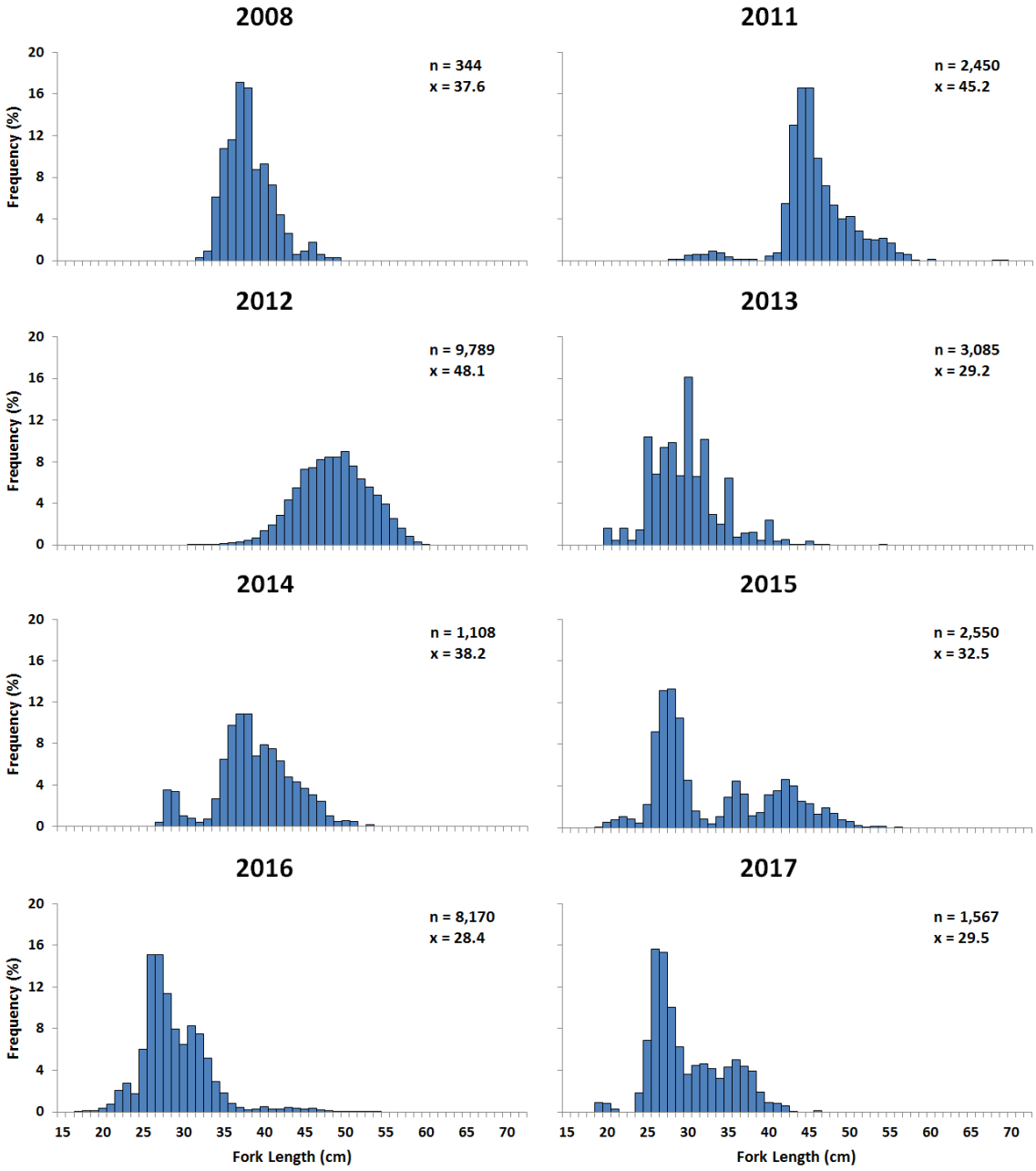

Figure 5. Fork length frequency of jack mackerel by Korean fishing vessels in 2008-2017.

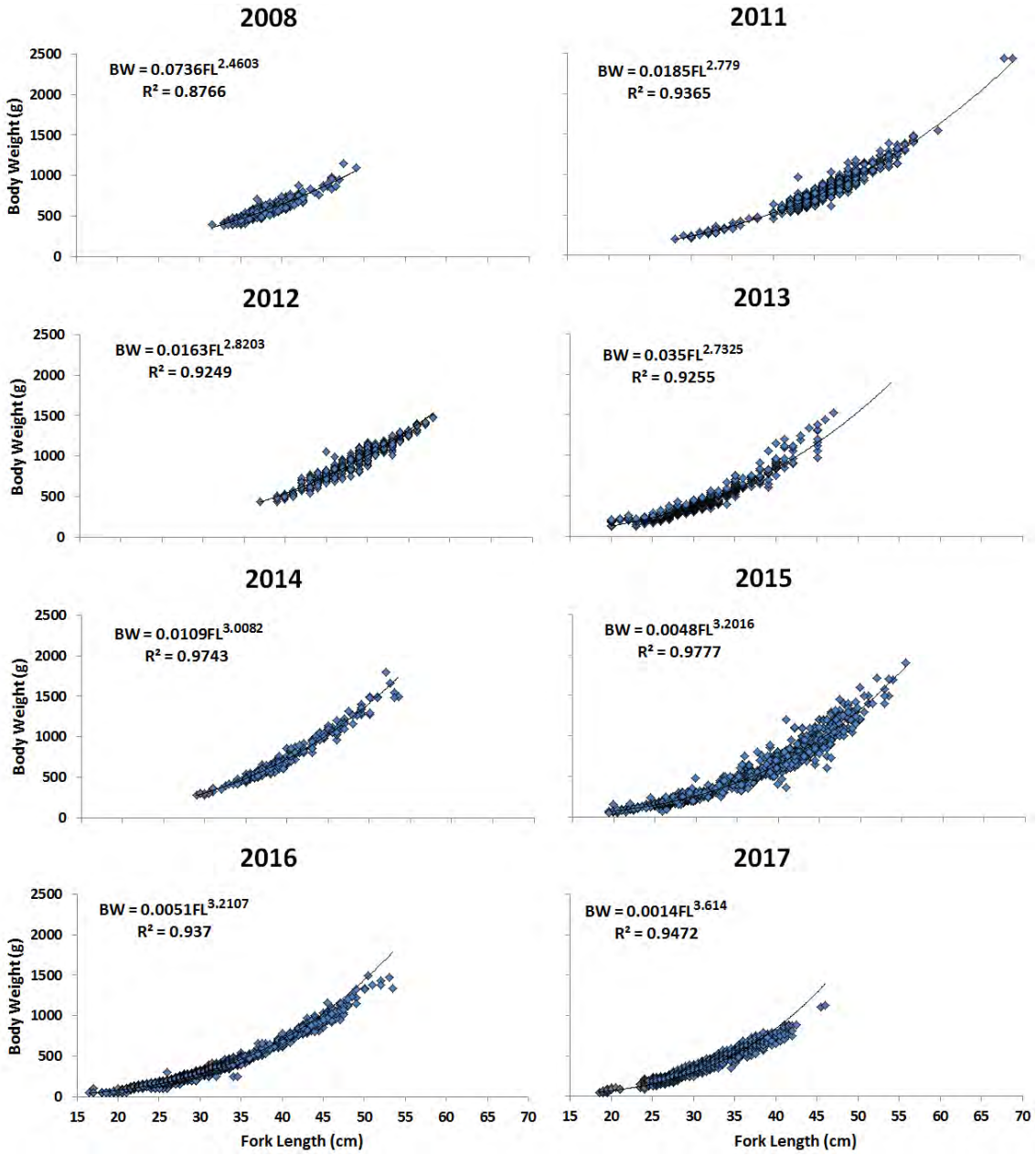

Figure 6. Length (FL) – weight (BW) relationship of jack mackerel in 2008-2017.

5. Summary of observer program

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 1-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 (%)
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
2017. 6-10	*Kwangjaho*	88	100

Bycatch mitigation policy

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. And they are prohibiting discharge of offals and discards during shooting and hauling in order to reduce seabirds' bycatch. During deploying the gear, scientific observers regularly watched the warp strike more than one time a day.

In 2017, the trawl vessel consistently used the streamer lines during its operation except for the 7 hauls which were conducted during the night time. The biological waste that can be used as bait for seabirds was not released in any form (e.g., whole and minced fish, liquid, etc.) during the prohibiting time.

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

Report on bycatch of seabirds, marine mammals, reptiles and other species of concerns

During operating and steaming, 6-11 species of seabirds were observed on trawl vessels in 2013-2017 (Table 6). 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. *Daption capense* (cape petrel) and *Diomedea melanophris* (black browed albatross) were observed more than other seabird species. In 2017, 23 over the total 58

hauls were observed for seabirds, mammals, reptiles and other species of concern. And over 50 individuals consisting of 1-4 species of seabirds were observed in each 19 hauls, while no seabird was observed during the other 4 hauls.

Table 6. 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
FUG	Southern fulmar	*Fulmarus glacialoides*
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

The number of Korea's reporting on the other species of concern in the Convention Area of SPRFMO was had known to be two times, and had reported individuals were all *Lamna nasus* (porbeagle sharks) (SC5-Doc31). In 2017, *L. nasus* was reported twice from the trawl in operation. There were no bycatch of marine mammals, reptiles or other species of concern.