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China's Annual Report to the 2017 SPRFMO Scientific Committee Part I: The Jack Mackerel Fishery

Gang Li & Xiaorong Zou
National Data Center for Distant-water Fisheries,
Shanghai Ocean University

1 *Description of Chinese Pelagic Trawl Fishery*

The Chinese pelagic trawlers have harvested jack mackerel (*Trachurus murphyi*) in the high seas outside the Exclusive Economic Zone (EEZ) of Chile since 2000. The first Chinese pelagic trawler KAIXIN arrived at the Southeast Pacific in June 2000 and worked for two months. During the early years the Chinese fleet fish for jack mackerel all year round, however, it only worked for 8 to 10 months that covered the main fishing season (March to October) after 2006.

The number of active Chinese vessels increased to 11 in 2008, and then continued to decrease. Although it recovered to six in 2015, three of them only worked for 2 or 3 months. In 2016 and 2017, two pelagic trawlers operated in the Southeast Pacific for jack mackerel. The number of vessels during recent years is showed in table 1.

Annual catch fluctuated from 2,318 to 160,000 tons during 2000 to 2017 and peaked in 2006. Staring from 2007, jack mackerel catch declined continuously and reached the lowest level in 2013. In recent years, catches increase with the jack mackerel biomass recovered.

Table 1 Number of vessels from 2012 to 2017

Year	Number of fishing vessels	Registered tonnage, GRT		Gear type
		<4,000	≥4,000	
2012	3	0	3	Pelagic trawl
2013	2	0	2	Pelagic trawl
2014	3	0	3	Pelagic trawl
2015	6	0	6	Pelagic trawl
2016	2	0	2	Pelagic trawl
2017	2	0	2	Pelagic trawl

2 Catch, Effort and CPUE Summaries

The Chinese trawl fishery targets jack mackerel with some by-catch being mainly chub mackerel (*Scomber japonicus*). Chub mackerel usually makes up a small fraction of the total catch. In 2016, 1,616 tons chub mackerel was caught which accounted for 7.41% of the total catches (21,824 tons).

Table 2 presents the summary of annual catch, fishing days, trawling hours and catch per fishing effort of the Chinese trawl fishery during the last 5 years. Catch, fishing days, as well as catch per fishing effort of the Chinese vessels increased in the previous five years. These increases are related to the increased biomass of jack mackerel.

Annual catch in 2016 was about 20 thousand tons and decreased obviously when compared catch in 2015, which might be due to the strong El Niño occurred in 2016. Up to the 31th day of July 2017 the two Chinese pelagic trawlers had caught about 12.9 thousand tons jack mackerel in 2017.

Fishing day or trawling hours based effort and the corresponding CPUEs presented similar trend with catch from 2011 to 2016 (Table 3). Effort and CPUE have continued to grow since 2013 and peaked in 2015, however, they both dropped in 2016. Contrary to 2015, fishing days and trawling hours declined by 23.5% and 14.6% respectively, and the two kinds of CPUEs dropped by more than 10 per cent.

Table 2 Catch, effort and catch per fishing effort of the Chinese fishing fleets over the period of 2012-2017

Year	Catch in tons	Fishing days	Catch per day in tons	Trawling time in hours	Catch per hour in tons
2012	13,012	260	50	3208.4	4.1
2013	8,329	177	47	1893.2	4.4
2014	21,155	298	71	3655.2	5.8
2015	29,180	362	81	3704.4	7.9
2016	20,208	277	73	3162.5	6.4
2017*	1,2882	126	102	1144.2	11.3

Note: The total catch of jack mackerel was 12,882 tons through July 2017.

Monthly catches of jack mackerel in the last five years is shown in Figure 1. The second and third quarter was the main fishing seasons during 2014-2016 and there was no fishing activity either in the first or the last two months. Jack mackerel catches in 2016 increased from the beginning of the fishing season and reached the highest value in May and then decreased sharply, however the highest catches were taken in June 2015 and in July 2014 respectively. Overall, catches in the second and third quarter of 2016 were less than that of 2015. Although catches in the fourth quarter of 2016 increased relative to 2015, the Chinese trawlers stopped fishing in September 2015 because the cumulative catches reached the quota.

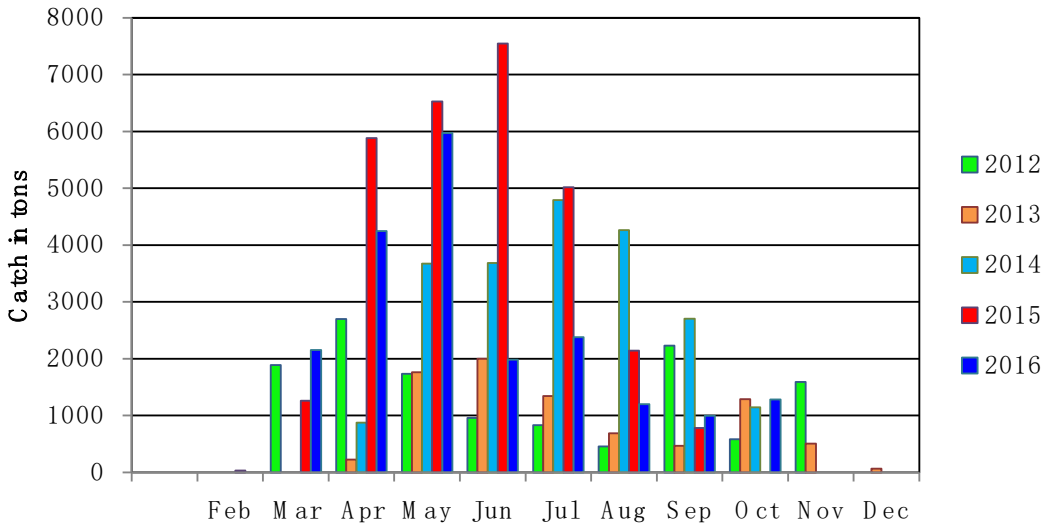


Figure 1. Monthly catches of jack mackerel by the Chinese trawling vessels during 2012-2016.

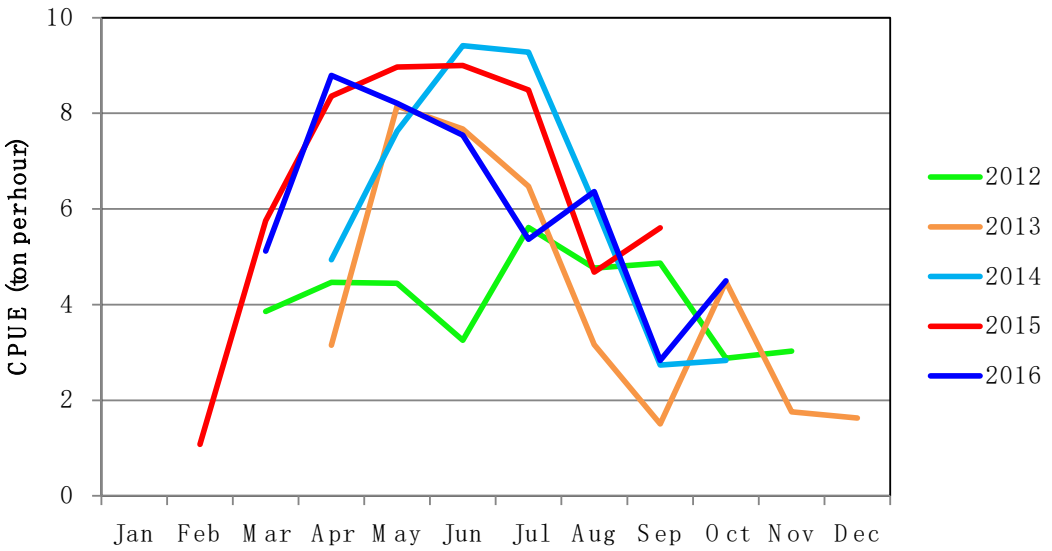
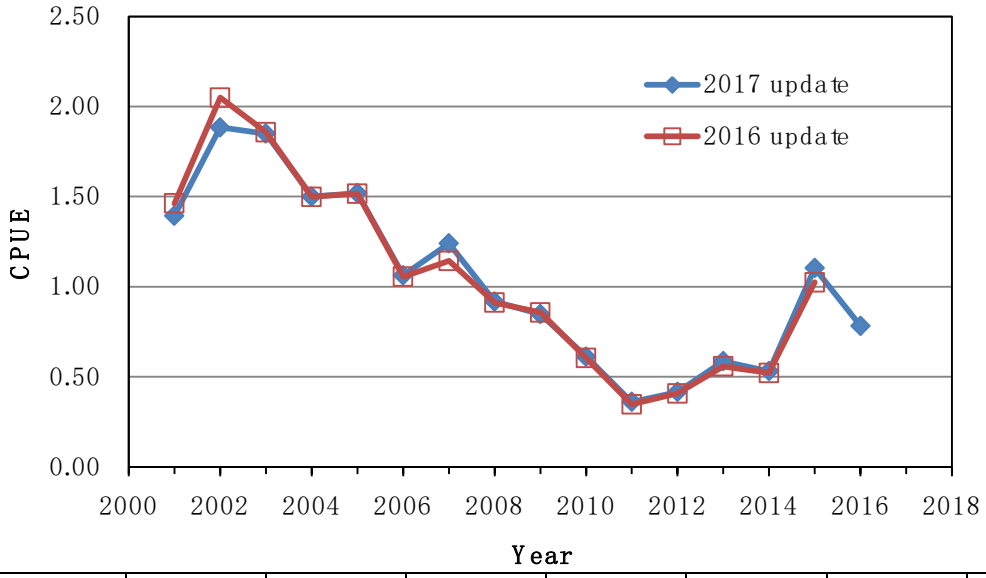


Figure 2. Monthly CPUE of the Chinese trawl fishery during 2012-2016.

Monthly CPUE fluctuated between to 1.1 (February 2015) to 9.4 ton per hour (Jun 2014). The trend in 2012 was different obviously with the CPUE trends of the next four years, in which higher CPUEs appeared from March to July and then dropped rapidly.

Nominal CPUE were standardized by generalized additive model (GAM) and the estimated Year Effect (exponential transformed) was used as abundance index for jack mackerel (Li, 2012). Catch data in 2016 were input to the database to update the CPUE standardization, but an environmental factor, sea surface height (SSH), was removed from the GAM because SSH data are not available in 2016. There were some small difference between the new standardized CPUE series (2017 update) and the old one (2016 update). The latest update standardized CPUE indicate that CPUE in 2016 was lower than in 2015 (Figure 3).



Year	2001	2002	2003	2004	2005	2006	2007	2008
CPUE	1.394	1.884	1.849	1.500	1.519	1.063	1.240	0.918
Year	2009	2010	2011	2012	2013	2014	2015	2016
CPUE	0.847	0.612	0.360	0.415	0.586	0.531	1.103	0.782

Figure 3. Standardized CPUE of Jack mackerel during 2001-2016.

Monthly catch distribution in 2016 derived from the tow-by-tow information was presented in Figure 4. Catch geographical distributions of 2015 were also showed for comparison in Figure 5. The catches in 2016 as well as 2014 were distributed along west of Chilean EEZ in most months except March, but further east than 2015. Over time the Chinese fishing vessels moved from south-central Chile to northern Chile, however, the catch and effort in the south area in 2016 decreased compared to 2015, whereas they increased significantly in the north in 2016. These trawlers had moved to north in August 2016, a month earlier than 2015, and worked till the end of 2016 fishing season.

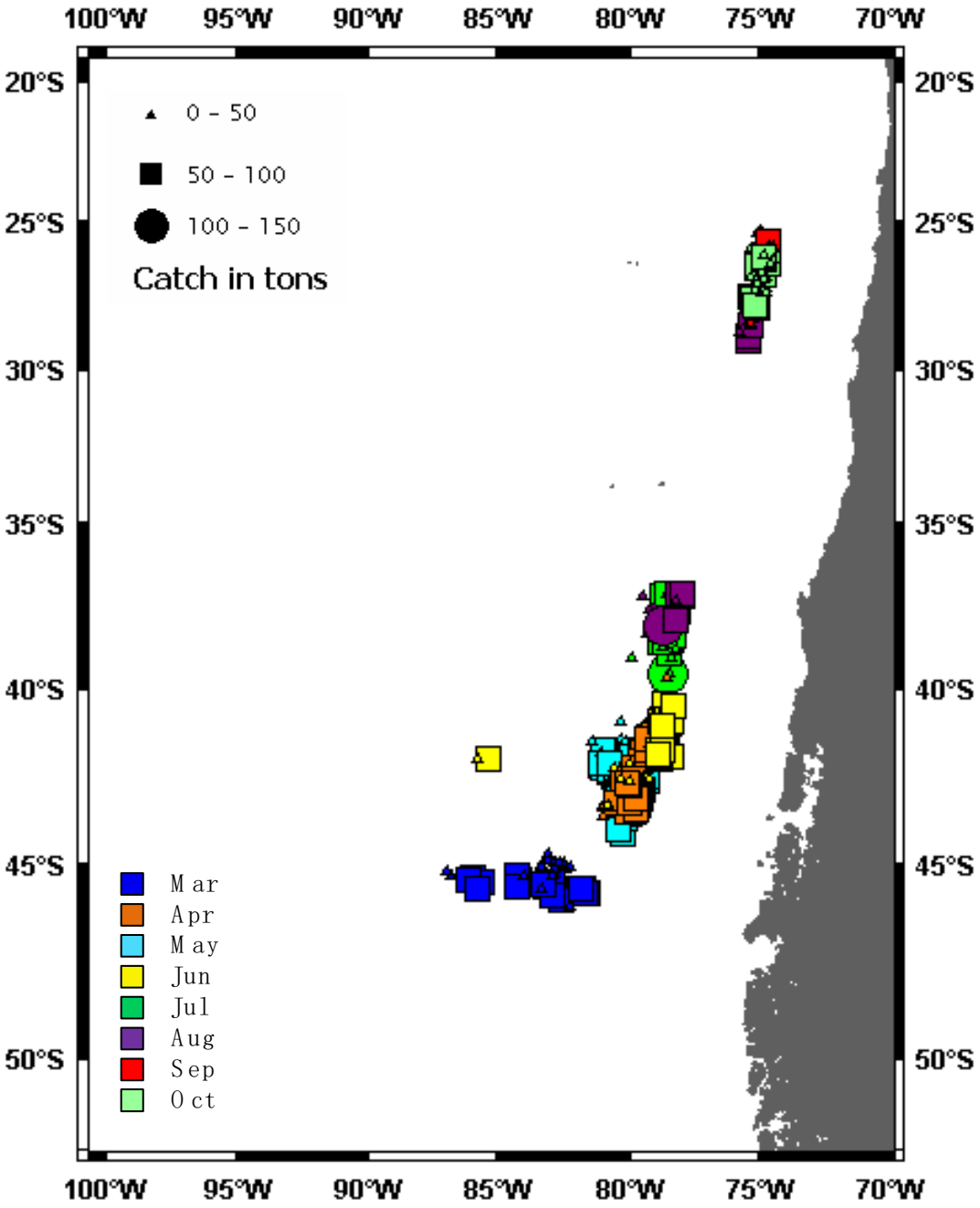


Figure 4. Monthly catch distributions by the Chinese fleets in SPRFMO area in 2016.

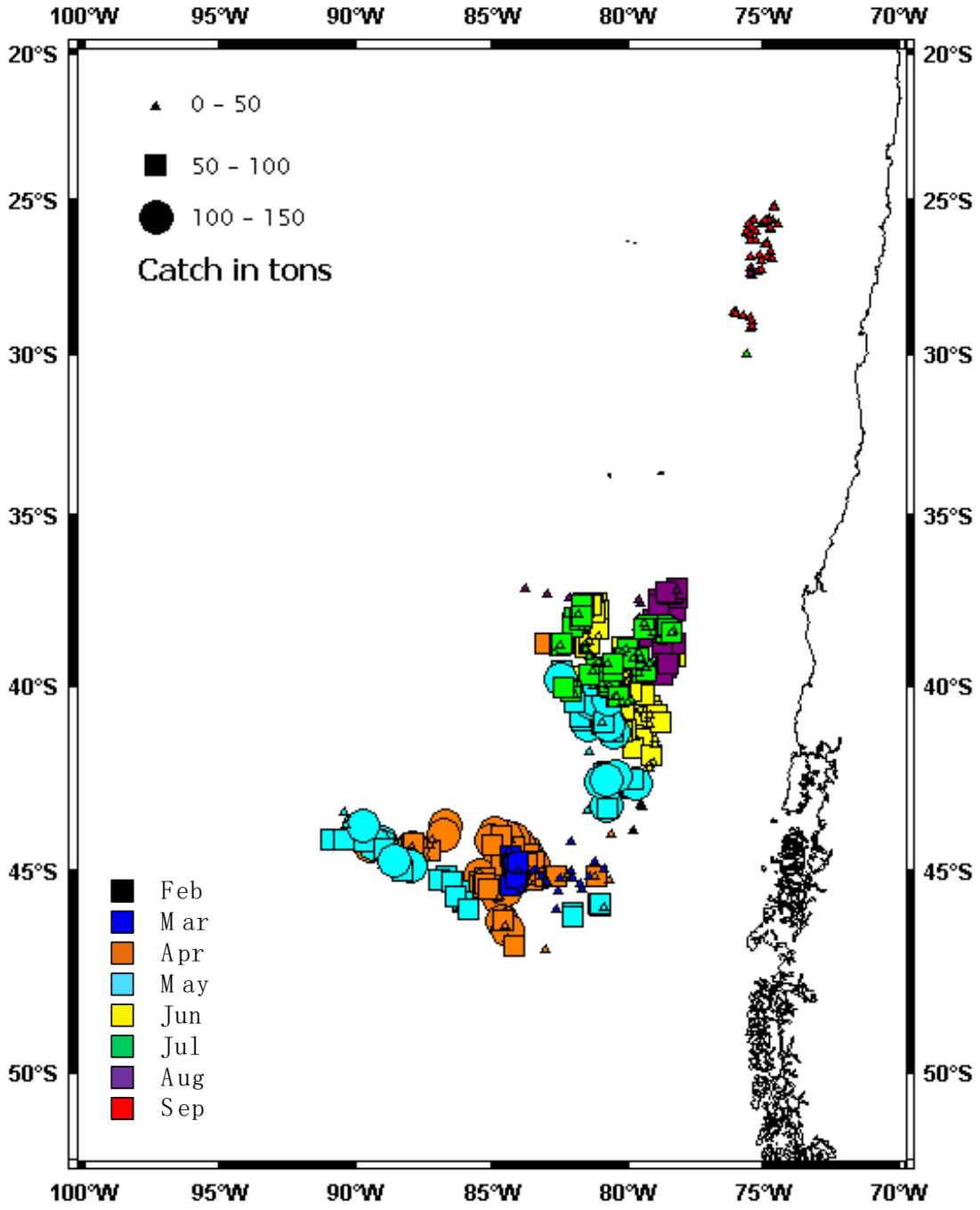


Figure 5. Monthly catch distributions by the Chinese fleets in SPRFMO area in 2015.

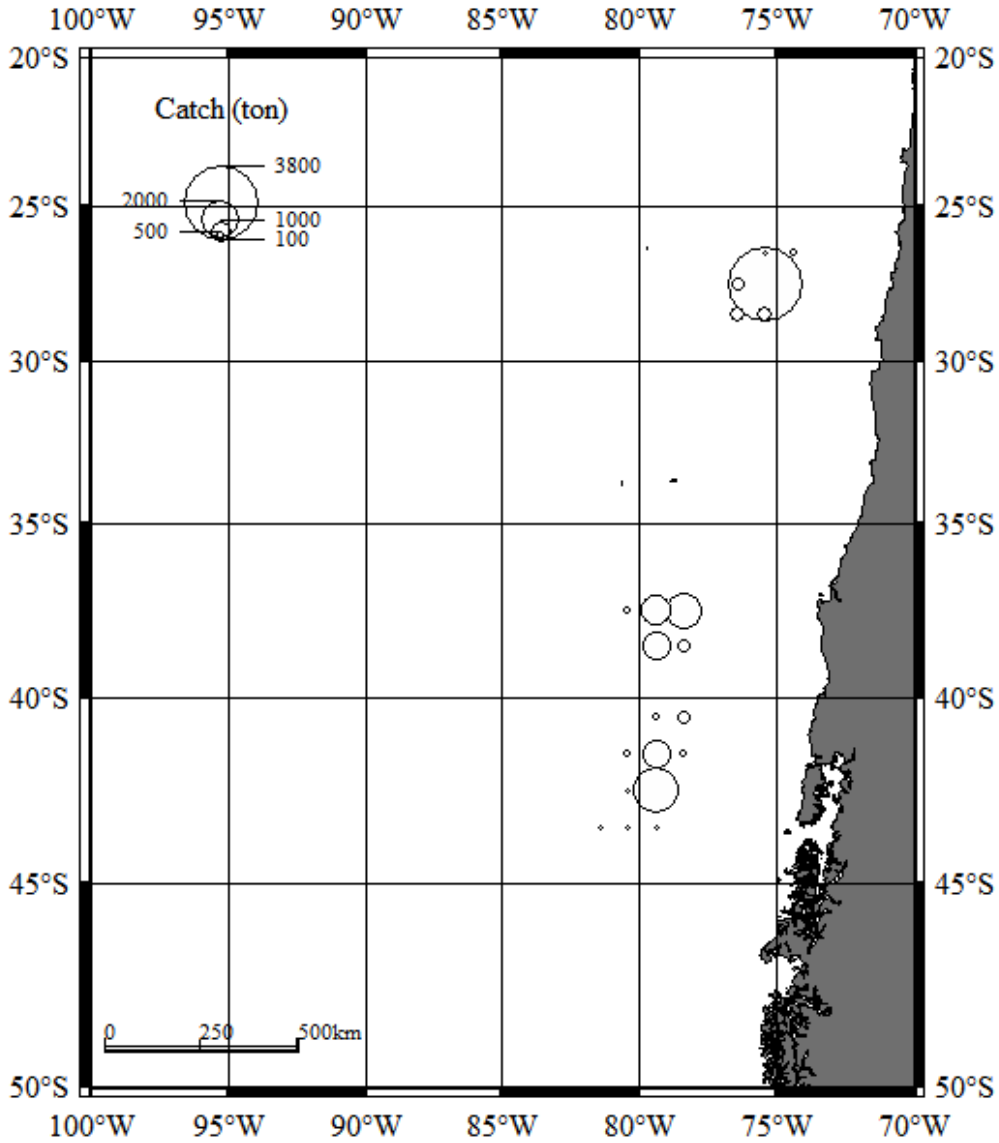


Figure 6. Catch distribution (1°×1°) by the Chinese fleets in SPRFMO area in 2014

3 *Fisheries Data Collection and Research Activities*

Two types of fisheries data are collected for jack mackerel, the logbook data and scientific onboard observed data. Catch data collection were carried out in 2000, in which the Chinese trawlers began to fish jack mackerel in the South East Pacific. The Chinese trawlers were requested to supply the fishing log books and report the monthly catch statistics. Fisheries data from the log books include names of trawlers, start and end locations and time (date and UTC time) of each tow, catch of jack mackerel and other by-catch species etc. In 2016, a total of 500 recorders of tow-by-tow information were collected.

Observer data collected are usual biological information such as fork length, weight, sex, maturity stage, stomach fullness etc. Because only one observer was available and deployed in 2016, observer data collection was limited. The observer boarded KAI FU HAO on March 5 and stared his work until October 29. A total of 112 fishing days and 134 tows were observed, which account for 22.4% of the total fishing days.

4 *Biological Sampling and Length Composition of Catches*

The observer measured 665 jack mackerel for fork length and determined the sex by examining the gonads. Information about sampling location and time were also recorded.

Fork length ranged from 20 to 44 cm in 2016, and the dominant size was 30-34 cm, followed by 26-28 cm (Figure 7). Compared with the historic length composion, it can be seen that the ratio of the small fish with fork length less than 27 cm was higher in 2016 while the percentage of big fish with fork length more than 40cm was lower. The number of jack mackerel measured in 2016 was less than that in 2015, but the sampling area and time covered the whole fishing area and season, especially for the northern area, which explained why the percentage of younger age jack mackerel was higher in 2016 (Table 4).

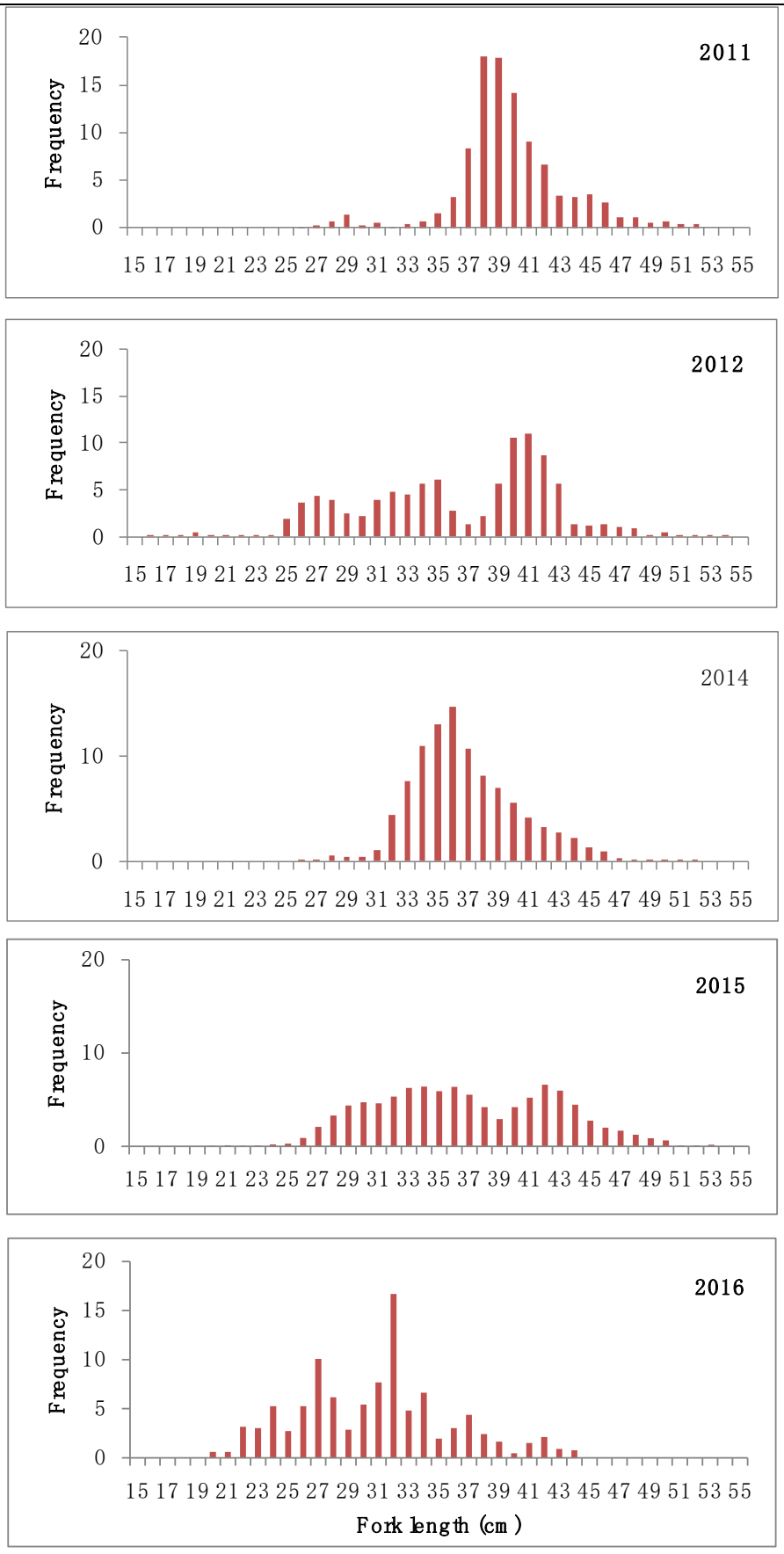


Figure 8 Fork length frequencies of jack mackerel sampled in 2011-2016

5 *Ecosystem Approach Considerations*

The observer inspected whether the trawlers installed the bird scaring lines when operating. In 2016, all the Chinese vessels are equipped bird scaring lines (Figure 9a and b). No birds were found in the net and no collisions were observed.

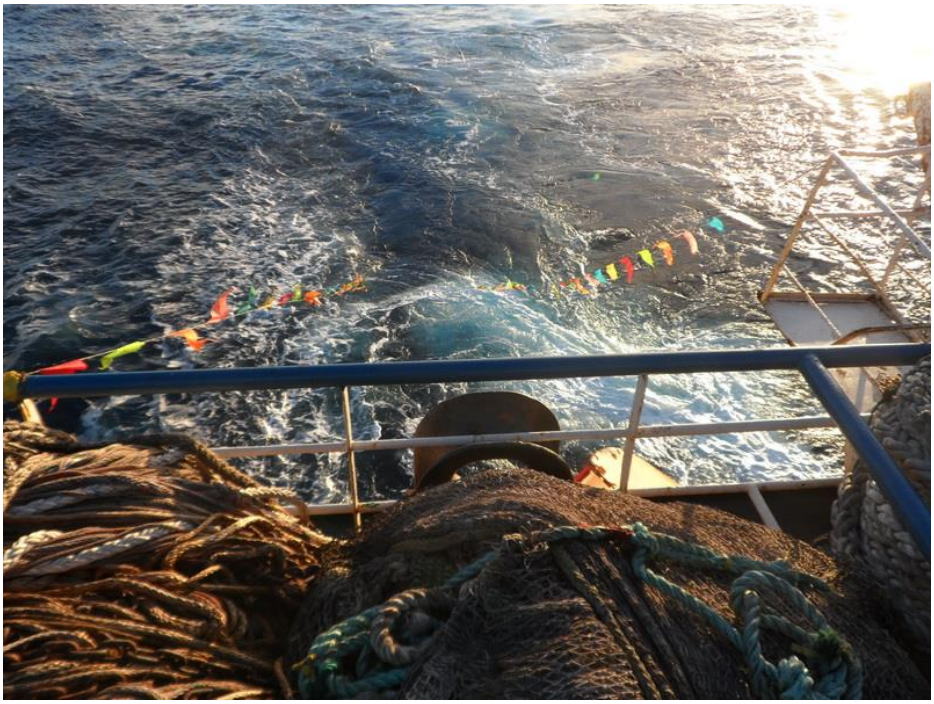


Figure 9a. Bird scaring lines attached to the stern of KAI FU HAO

Figure 9b Bird scaring lines attached to the starboard side of KAI FU HAO

6 *Observer Implementation Reports*

In 2015, National Data Center for Distant-water Fisheries, located at Shanghai Ocean University, was formed to take the full responsibility for fishery data collection and national observer programme, China Distant-water Fishing Observer Programme. This programme is financed by the government, and organized by Shanghai Ocean University's College of Marine Science structurally. The programme concentrates on placing observers on pelagic trawlers and concerned about collecting data for science.

Trainers of China Distant-water Fishing Observer Programme are from the highly qualified personal teaching at the College of Marine Science at the Shanghai Ocean University. All have been observers in the past and also have other qualifications of expertise.

Observers require at least high school pass as a minimum to be eligible. Actually the employed observers are generally graduate students from College of Marine Science. The training courses include four parts mainly as follow:

a) Fisheries management and CMMs of SPRFMO;

b) Techniques of data collection, sampling, measuring;

c) Knowledge of navigation and communication devices operation;

d) Safety on the sea.

The safety course consists including First Aid, Fire drill, Pollution Prevention, Lifeboat training, and other sea safety issues. All crew and observers per Chinese regulations must have this certificate to board a vessel going to sea. Sea Safety training course takes approximately two weeks. The Certificate received by the observers on their successful completion of all training course is issued by the Government.

There were two Chinese trawlers operated in the Convention Area in 2016. According to the plan, an observer was placed on KAIFU HAO and worked for the whole fishing season to ensuring representative coverage and sampling data.

Based on the CMM4.02 about data standards and observer data template, information about KAIFU HAO and observers, fishing activity data, and biological data for jack mackerel were collected. Furthermore, the observer also collected photos of bird scaring lines equipped on the trawler. The biological data included fork length, sex, and maturity, but otoliths and stomach were not sampled. No seabirds, mammals, reptiles and other species of concern were caught and observed during the fishing operation.

Only one observer was employed and placed on the Chinese trawler in the last two years, which lead to some difficulties in data collection, especially for biological sampling and measurement. In addition, recruiting undergraduate and graduate students major in fisheries sciences as observers has become increasingly difficult. In view of this situation, China Distant Water Fishing Observer Programme has taken steps to expand the sauce of observers, for example cooperating with other colleges and vocational schools. Two observers from Qingdao Marine Technology College have been placed on a Chinese trawler this year.

Table 4 Quarterly fork length frequency data of Jack Mackerel in 2016

Quarter	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	Total
1	0	0	0	0	0	0	0	0	0	0	2	4	8	3	8	3	6	3	6	7	0	3	11	6	5	0	75
2	0	0	0	0	4	6	13	21	10	6	15	25	62	24	26	7	12	22	8	3	1	3	2	0	0	0	270
3	1	2	13	15	22	8	16	26	13	3	16	19	28	3	6	3	2	4	2	1	2	4	1	0	0	0	210
4	3	2	8	5	9	4	6	20	18	10	3	3	13	2	4	0	0	0	0	0	0	0	0	0	0	0	110
Total	4	4	21	20	35	18	35	67	41	19	36	51	111	32	44	13	20	29	16	11	3	10	14	6	5	0	665

7 *Summaries*

In 2016, two pelagic trawlers operated in the South East Pacific. Catch of target species, jack mackerel was 20,208 tons with 1,616 tons chub mackerel. Fishing days, as well as trawling hours were decreased compared to 2015 due to the decreasing number of vessels. The nominal and standardized CPUE showed a small decrease in 2016, but still higher than that in 2010-2014. The trawlers shifted to the north area a month earlier than 2015. Catch and effort in the south area in 2016 decreased compared to 2015, whereas they increased in the high seas off northern Chile. The observer boarded on March 5 and stared his work until October 29. A total of 112 fishing days and 134 tows were observed.

References

Li G., Zou X. R., and Zhou Y. Q., 2010. Standardization of catch per unit effort for Chilean Jack Mackerel (*Trachurus murphyi*) from Chinese trawl fleet on the high Seas in the Southeast Pacific Ocean (2001-2010). Tenth SWG meeting of SPRFMO, Port Vila, Vanuatu, 19 - 23 September 2011, Doc. SWG-10-JM-06.