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China's Annual Report Part I: Jack Mackerel Fishery

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National Report of China to the 2016 SPRFMO Science Committee Part I: the Jack Mackerel Fishery

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1 *Description of Chinese Pelagic trawl Fishery*

The Chinese large pelagic trawlers have harvested the Jack Mackerel (*Trachurus murphyi*) in the SPRFMO AREA since 2000. The Chinese trawl vessels only operated in the high seas outside Chile EEZ. The number of Chinese vessels varied between 11 and 13 during 2004-2009, however, it continued to decrease from 2010 to 2013 and dropped to 2 vessels in 2013. In 2014, 3 pelagic trawlers operated in the high seas of the South Pacific Ocean, and the number of trawlers increased to 6 in 2015 (Table 1).

Table 1 Number of vessels from 2010 to 2016

Year	Number of fishing vessels	Registered tonnage, GRT		Gear type
		<4,000	≥4,000	
2011	6	0	6	Pelagic trawl
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

Note: the number of vessels was February through July 2016.

Annual catch fluctuated from 2318 to 160,000 tons during 2000 to 2015. During the 2001-2006 time period, annual catch increased steadily and peaked in 2006. Staring from 2007, Jack Mackerel catch declined continuously and reached the lowest level in 2013. Table 2 presents the summary of annual

catch, fishing days and nominal catch per fishing day of the Chinese trawl fishery during the last 5 years. Catch, fishing days, as well as catch per fishing day of the Chinese vessels all decreased during 2010-2013, but showed obvious increases in 2014 and 2015. Annual catch reached 21,155 tons in 2014, and increased to 29,180 tons in 2015. Up to the 31th day of July 2016, the two Chinese pelagic trawlers had caught 16,541 tons Jack Mackerel in 2016.

Table 2 Catch, fishing days and catch per day of Jack Mackerel by the Chinese fishing fleets over the period of 2011-2016

Year	Catch in tons	Fishing days	Catch per day in tons
2011	32,862	591	56
2012	13,012	260	50
2013	8,329	177	47
2014	21,155	298	71
2015	29,180	362	81
2016*	16,541	198	84

Note: The total catch of Jack Mackerel was 16,541 tons through July 2016.

2 Catch, Effort and CPUE Summaries

The Chinese trawl fishery targets Jack Mackerel with some bycatch being mainly Chub Mackerel (*Scomber japonicus*). Catch of Chub Mackerel usually makes up a small fraction of the total catch and the percentage of bycatch is less than 4%.

Annual total effort and CPUE presented the same trend with catch from 2011 to 2016 (Table 3). Effort and CPUE have continued to grow since 2013, and reached to 29,180 tons and 7.9 tons per hour, respectively, the highest level during the past 4 years.

Monthly catches of Jack Mackerel in the last five years is shown in Figure 1.

Catch distribution among months changed from year to year. Catches in March, April and May declined sharply from 2010 to 2014, catches in May to October increased steadily during 2012-2014. In 2015, monthly catch showed the trend similar to in 2014, i.e., Jack Mackerel catch increased in the first several months and then decreased continuously over the remaining months. The fishing season was shortening and there was no fishing activity in the first-three-month in 2013 and 2014. However, the Chinese fleet began operations in February 2015, and stop fishing in September because they had completed the catch quota.

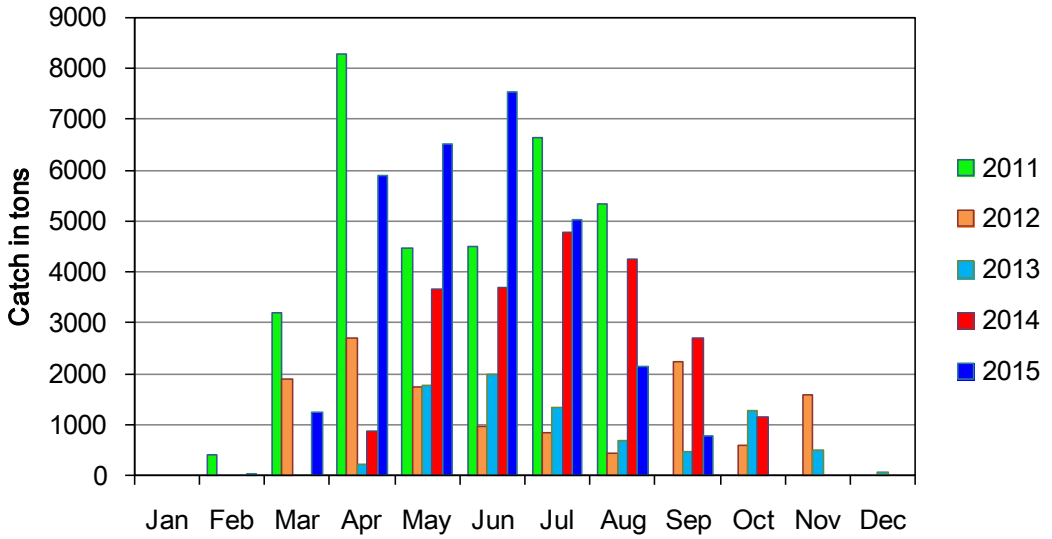

Figure 1. Monthly catch of Jack Mackerel by the Chinese trawling vessels during 2010-2014.

Monthly nominal CPUEs are presented in Figure 2. Monthly CPUE fluctuated between to 1.1 (February 2015) to 9.4 ton per hour (Jun 2014). The CPUEs of the last three years show the similar trend and were consistent with the monthly catch. Monthly CPUE trend of 2011 and 2012 were different obviously with it of 2013, 2014 and 2015.

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). The standardized Jack Mackerel CPUE

declined steadily up to 2011, but showed a slow increasing trend from 2011 to 2014 and rose significantly in 2015 (Figure 3).

Table 3 Catch, effort (trawling hours) and CPUE of Jack Mackerel by the Chinese fishing fleets over the period of 2011-2015.

Year	Catch in tons	Trawling time in hours	CPUE (ton/hour)
2011	32,862	7022.3	4.7
2012	13,012	3208.4	4.1
2013	8,329	1893.2	4.4
2014	21,155	3655.2	5.8
2015	29,180	3704.4	7.9
2016*	16,541	2343.2	7.1

Note: The total catch of Jack Mackerel was 16,541 tons through July 2016.

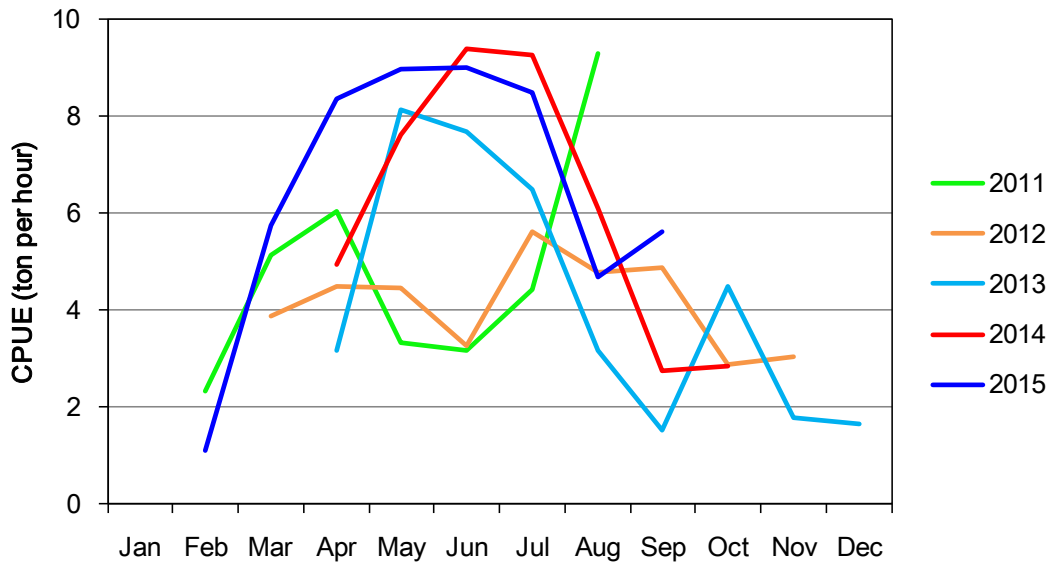

Figure 2. Monthly CPUE of the Chinese trawl fishery during 2010-2015.

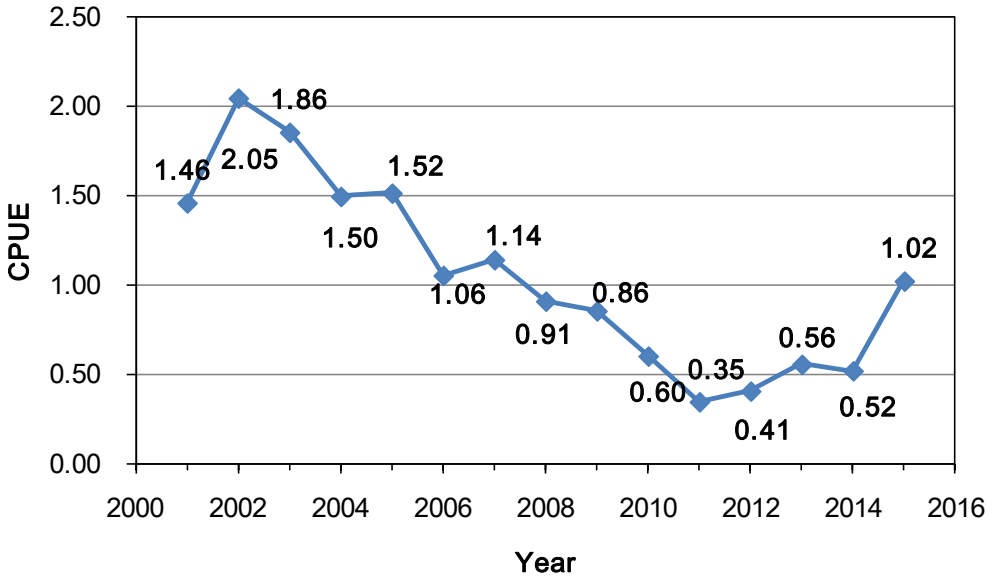

Figure 3. Standardized CPUE of Jack Mackerel during 2001-2015.

Monthly catch distribution in 2015 derived from the tow-by-tow information was presented in Figure 4. In the first season of 2015, the Chinese fishing vessels operated in the southern area between 43°- 45°S, and moved westward gradually. In the next two months, the vessels continued to shift westward and reached the most west around 93°W. Catch distribution in latitude of 2015 was similar to that of 2011 and 2012 (Figure 5), but the fishery was just distributed along west of Chilean EEZ in 2013 and 2014 (Figure 5 and 6). In May, the vessels also moved to north and distributed as far north as 25°S in September. Consequently, the Chinese vessels have appeared in the northern area for 4 years since 2012, however, catch in northern Chile in 2015 decreased obviously compared with 2014.

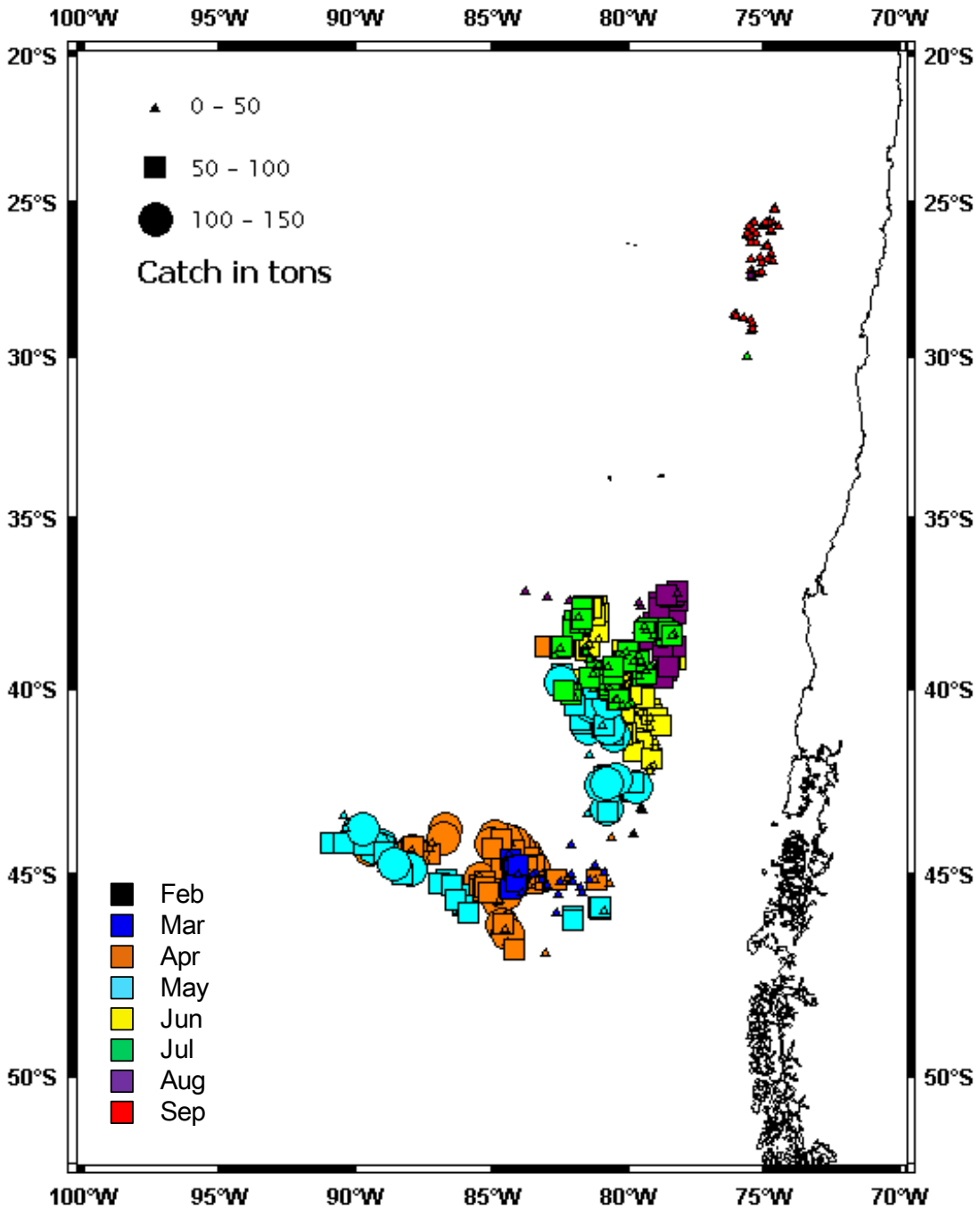

Figure 4 Monthly catch distribution by the Chinese fleets in SPRFMO area in 2015.

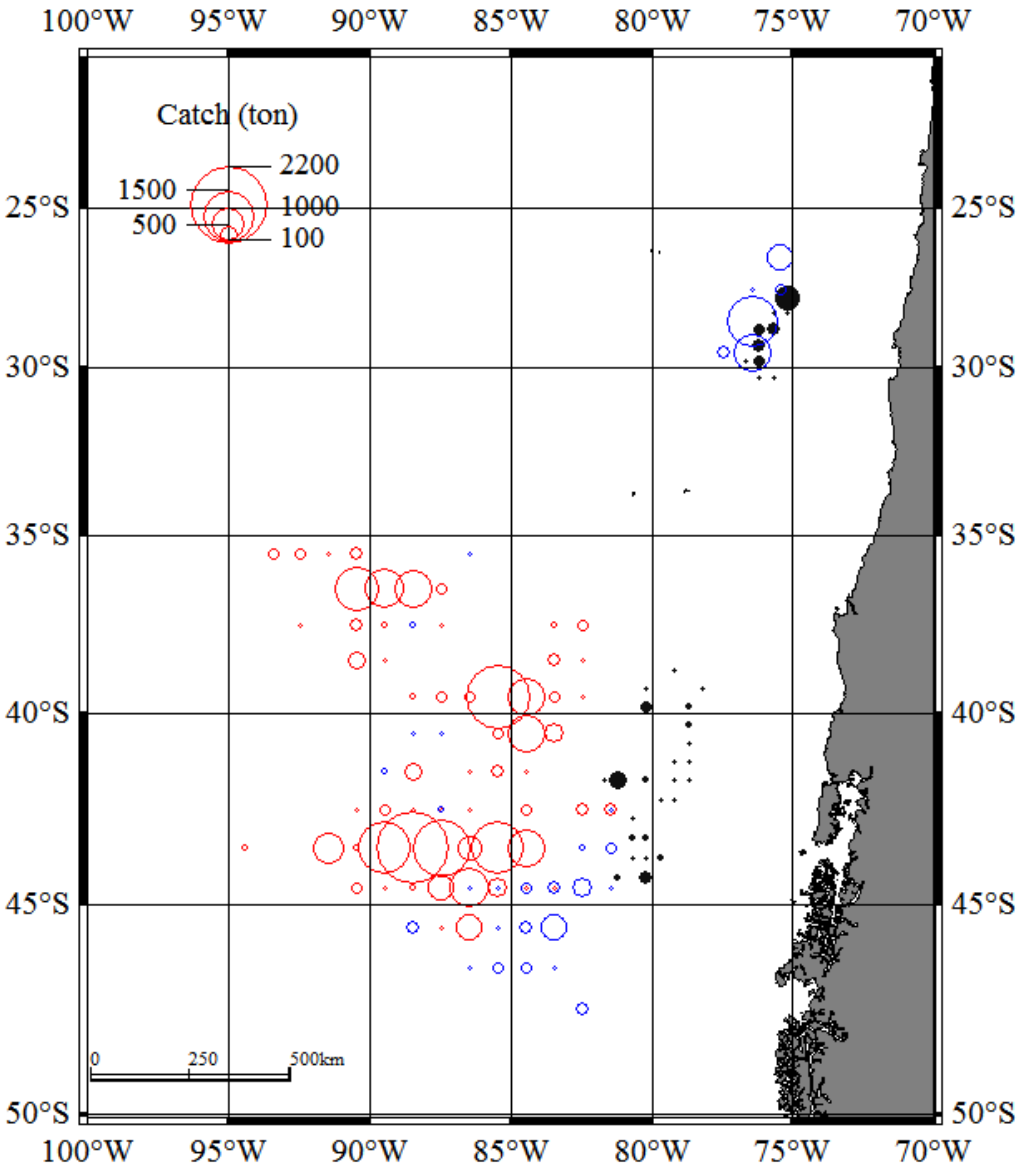

Figure 5 Catch distribution (1°×1°) by the Chinese fleets in SPRFMO area in 2011 (red circle), 2012 (blue circle) and 2013 (solid black circle)

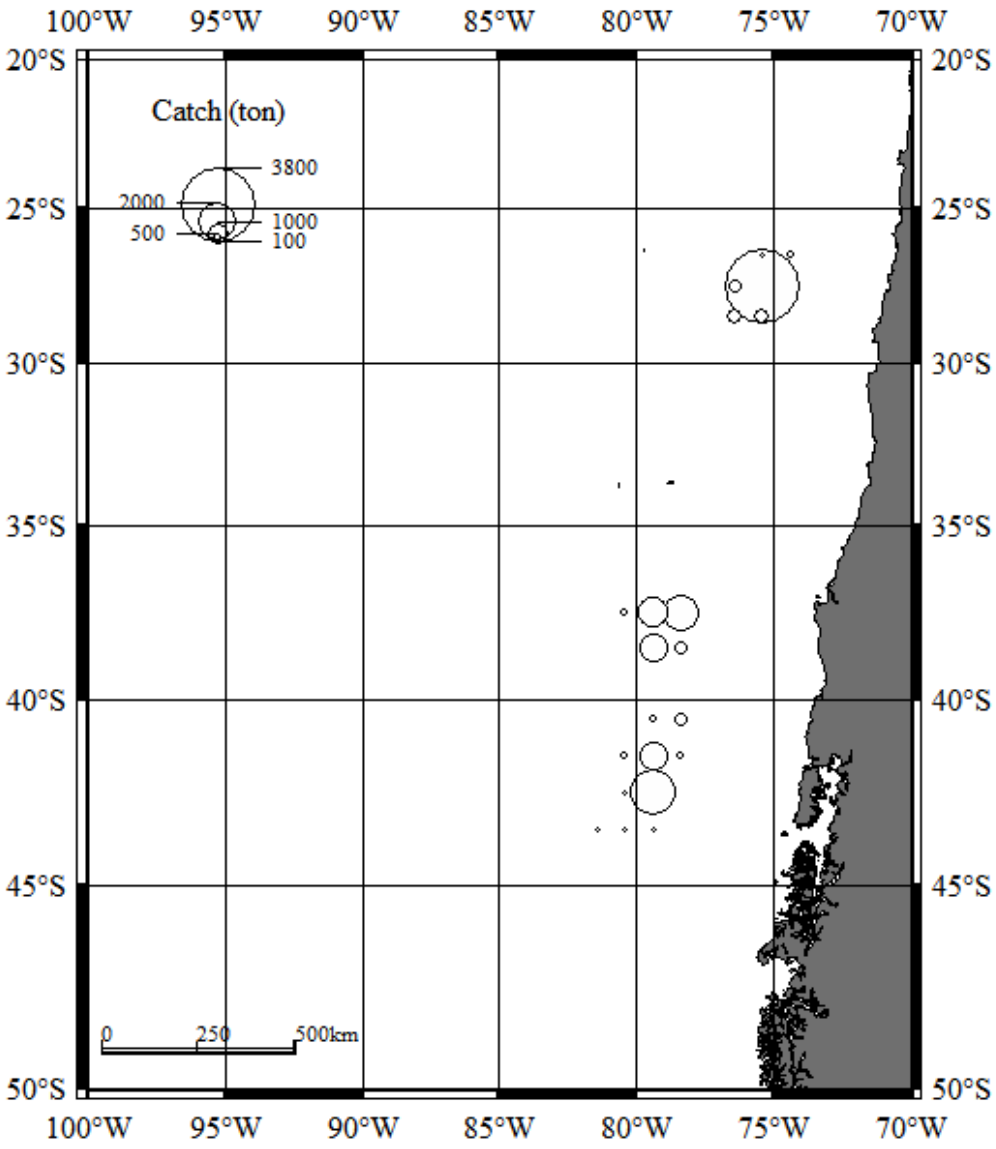

Figure 6. Catch distribution (1°×1°) by the Chinese fleets in SPRFMO area in 2014

3 Fisheries Data Collection

Two types of fisheries data are collected for Jack Mackerel , the logbook catch 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 bycatch species etc. In 2015, a total of 614 recorders of tow-by-tow data were collected, 158 more

than last year.

Scientific data from the scientific onboard observer program was mainly the biological information such as fork length, weight, maturity stage, degree of stomach fullness. Otolith, gonads, muscle and other organs were also sampled on board. Furthermore, Jack Mackerel were sampled randomly and frozen, and then transported back to the laboratory for further biological test and analysis. The scientific observers also measured environmental data such as water temperature and salinity using CTD.

In March 2015, the observer boarded the pelagic trawler, KAI FU HAO. Observation started from 15th April and ended at 9th July, and a total of 70 fishing days and 129 tows were observed.

The observer also inspected whether KAI FU HAO installed the bird scaring lines when operating. In 2015, all the Chinese vessels are equipped bird scaring lines (Figure 7 and 8).

Figure 7 Bird scaring line of the Chinese trawler KAI FU HAO

Figure 8 Bird scaring line of the Chinese trawler LONG TENG

4 Biological Sampling and Length Composition of Catches

A total of 8177 Jack Mackerel were measured to get the length frequency information from 15 April to 9 July 2014 by the scientific observer. Another 690 Jack Mackerel were measured for fork length (FL), weight and determined the sex by examining the gonads. Among of the 690 samples, 600 samples were aged by reading the annual rings of the otolith. Information about sampling location and time were also recorded.

In 2015, fork length of the sampled 8,177 Jack Mackerel ranged from 18 to 55 cm, and four modals might be distinguished. The first modal was fork length at 28-31cm, the second was 33-35 cm, the third was 36-37cm and the fourth was 41-44cm. The percentages of small fish with fork length less than 27 cm and big fish with fork length more than 45 cm were no more than 5%. The percentage of smaller Jack Mackerel with size 26-31 cm in 2015 was higher than that in 2011 and 2014, in which the young Jack Mackerel seemed to disappear from the catch. However, catches in 2010 contained a high percentage of immature Jack Mackerel with fork length smaller than 26 cm.

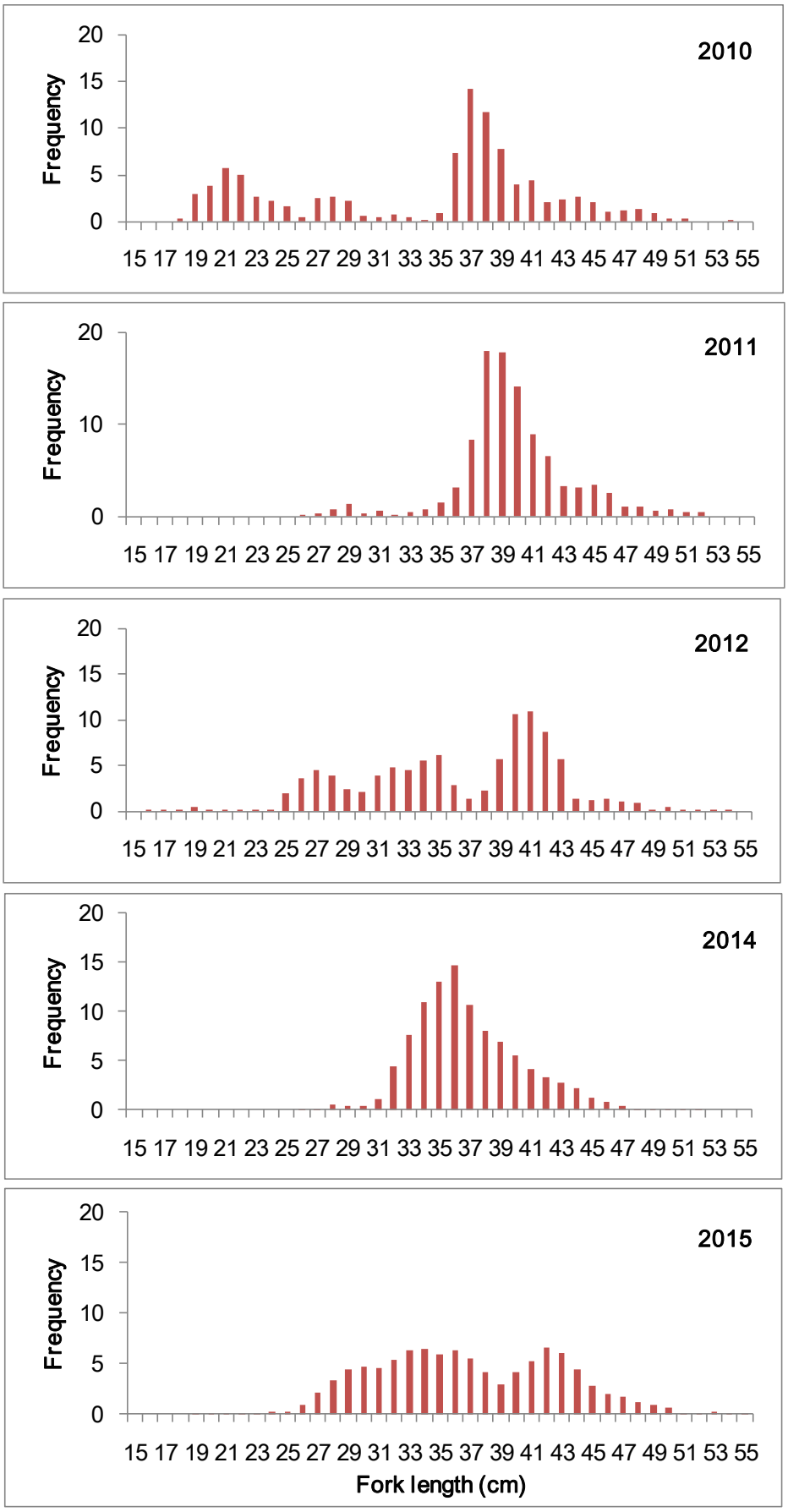

Figure 8 Fork length frequency of Jack Mackerel

Table 4 Fork length frequency data of Jack Mackerel in 2015

Date	18	19	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	46	47	48	49	50	51	52	53	54	Total
4/15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	5	9	13	17	6	5	2	13	24	26	29	33	10	6	6	7	5	0	0	2	2	0	**223**
4/17	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	5	17	15	12	6	9	11	29	26	25	17	2	5	1	2	1	0	1	1	0	0	**190**
4/18	0	1	0	0	0	0	0	0	0	0	0	0	4	14	16	8	22	19	12	15	0	3	16	45	53	24	12	2	5	2	3	1	0	0	1	0	0	**278**
4/19	0	0	0	0	0	0	0	0	0	0	0	1	3	1	2	9	19	20	31	17	3	10	37	35	29	30	7	5	1	8	4	2	0	1	0	0	1	**276**
4/20	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	9	12	20	5	3	21	19	59	42	22	15	2	1	2	7	2	0	0	1	0	0	**246**
4/21	1	0	8	0	2	5	1	2	6	36	39	36	22	26	45	39	21	7	2	5	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**306**
4/23	0	2	2	0	0	0	0	3	5	16	25	29	30	29	26	23	17	19	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**231**
4/27	0	0	0	0	1	0	0	0	6	24	24	22	20	26	22	10	19	2	11	1	2	1	5	16	12	3	0	0	0	0	0	0	0	0	0	0	0	**227**
4/27	0	0	1	0	0	0	0	0	22	28	34	37	19	14	20	37	25	9	6	2	2	19	17	13	12	3	1	0	0	0	0	0	0	0	0	0	0	**321**
4/28	0	0	0	0	0	0	0	0	1	2	0	2	0	3	9	9	13	17	6	5	2	13	24	26	29	33	7	6	6	7	8	3	0	1	2	0	0	**234**
4/28	0	0	0	0	1	0	0	0	6	25	39	22	18	19	22	10	19	2	11	1	2	1	5	15	12	3	0	1	1	0	0	0	0	0	0	0	0	**235**
5/2	0	0	0	2	0	1	0	0	0	2	1	2	3	0	1	6	21	31	16	9	7	28	25	26	16	19	1	7	5	6	1	2	0	0	2	0	0	**240**
5/4	0	0	0	0	0	0	0	0	0	0	2	1	0	3	7	15	22	17	6	4	3	28	28	43	32	17	2	5	6	2	2	3	2	2	1	0	0	**253**
5/8	0	1	0	0	0	0	3	14	25	15	28	14	24	36	23	17	17	2	2	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**225**
5/8	1	0	0	0	1	4	2	5	27	18	25	22	9	33	24	13	2	7	3	5	4	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**208**
5/18	0	0	0	0	0	0	0	0	1	1	8	4	1	8	31	28	29	29	28	10	6	7	3	1	1	1	0	2	0	0	0	0	0	0	0	0	0	**199**
5/21	0	0	0	0	0	0	0	1	1	2	2	10	18	27	20	16	16	18	14	11	11	11	10	6	3	6	2	1	0	0	0	0	0	0	0	0	0	**206**
5/22	0	0	0	1	3	1	3	5	14	14	30	36	30	19	22	14	12	5	5	2	1	3	1	2	4	1	0	0	0	0	0	0	0	0	0	0	0	**228**
5/29	0	0	0	0	0	0	0	1	1	2	1	7	15	20	26	31	21	14	21	10	10	5	7	6	4	0	0	0	1	0	0	0	0	0	0	0	0	**203**
6/5	0	0	0	0	0	2	1	4	0	2	1	3	6	4	21	19	24	25	30	17	12	12	9	5	8	12	7	5	2	1	1	0	0	0	0	0	0	**233**
6/11	0	0	0	0	0	0	0	0	0	1	2	5	17	14	14	6	21	31	16	9	7	28	31	27	24	19	1	7	5	6	1	2	0	0	1	0	0	**295**
6/14	0	0	0	0	0	0	0	13	14	36	24	19	14	24	34	25	4	6	2	3	16	13	24	15	14	2	4	0	0	0	0	0	0	0	0	0	0	**306**
6/18	0	0	0	0	0	0	2	5	12	3	13	13	14	3	14	25	14	24	14	16	25	14	17	28	29	16	17	16	6	8	6	0	0	0	0	0	0	**354**
6/19	0	0	0	0	0	0	5	6	7	4	7	9	15	5	18	0	5	9	17	4	18	7	5	0	3	16	12	7	0	1	0	0	0	0	0	0	0	**180**
6/24	0	0	0	0	0	0	0	0	1	7	15	4	16	17	8	18	4	18	28	18	7	9	28	17	18	16	14	19	8	5	0	0	0	0	0	0	0	**295**
6/26	0	0	0	0	0	0	0	1	2	4	6	15	16	17	14	18	14	25	18	9	5	4	8	4	5	2	3	1	1	0	0	0	0	0	0	0	0	**192**
6/29	0	0	0	0	0	0	0	2	6	4	5	8	17	14	19	18	15	18	19	19	17	14	13	19	17	7	7	4	6	0	1	0	0	0	0	0	0	**269**
6/29	0	0	0	0	0	0	2	3	4	16	16	13	8	18	17	9	17	24	17	27	16	18	15	17	4	8	7	4	7	1	1	0	0	0	0	0	0	**289**
6/30	0	0	0	1	0	0	4	2	6	6	3	7	2	1	7	17	16	18	27	15	15	13	17	18	27	13	16	17	14	5	3	2	0	0	0	0	0	**292**
7/1	0	0	0	0	0	0	0	2	3	4	8	13	16	13	17	9	13	16	14	18	25	28	19	13	14	15	13	15	13	7	13	15	7	4	0	0	0	**347**
7/3	0	0	0	0	0	0	2	3	0	3	6	4	13	7	14	24	18	16	15	18	13	16	14	17	13	12	14	16	14	17	9	12	6	3	3	0	0	**322**
7/6	0	0	0	0	0	0	1	2	3	2	3	13	6	13	16	6	13	16	14	16	18	7	13	15	13	16	7	13	18	9	7	13	0	0	1	0	0	**274**
Total	2	4	11	4	8	13	26	74	173	277	367	371	379	431	532	487	496	506	459	312	262	348	435	545	490	370	219	167	131	94	76	63	15	12	15	2	1	**8177**

The age length key of 600 aged Jack Mackerel in 2015 was presented in table 5. No young fish (age less than 3 years old) were sampled during the 2015 observation duration. The youngest age was 3 years old with mean fork length of 29.6 cm and the oldest age was 9 years with mean fork length of 49.3 cm. The number of Jack Mackerel, age 4 to 6, accounted for 81.3% of the total 600 samples.

Table 5 age-length key of Jack Mackerel sampled from “KAI FU HAO” in 2015

Fork length	**Age**												
(cm)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
25													
26													
27													
28													
29				2	1								
30					3								
31					3	5							
32					17	31							
33					49	44							
34					49	52							
35						85							
36						30	29						
37						11	10						
38						9	6	0					
39							22	7					
40							23	11					
41							7	4					
42							2	9					
43								5					
44								1	2				
45								1	1				
46								1	5				
47													
48									0				
49									0	2			
50									1				
51													
52													
53													
54													
55													

5 Summary of Observer Programme

China Distant Water Fisheries Association (CDWFA) and Shanghai Ocean University (SHOU) share joint responsibility for the fisheries data collection for Jack Mackerel. In 2015, National Data Center for Distant-water Fisheries, located at Shanghai Ocean University, was formed to take the full responsibility for the collection, compilation and bookkeeping of fisheries and relevant environmental data. The observer programme has been continually operated since 2007 and SHOU sent in total of 8 scientific observers on board from 2007 to 2015.

6 Summaries

In 2015, a total of 6 Chinese large pelagic trawlers operated in the South East Pacific and annual catch was 29,180 tons with 3704 trawling hours. The nominal CPUE reached 7.9 tons per hour. Compared with previous years, Catch, effort, CPUE and standardized CPUE in 2015 all increased, which might imply that the Jack Mackerel stock is recovering. In April and May, the fishing grounds shifted to further west than in previous years and further south than in 2014, in which, the Chinese vessels operated along the Chilean EEZ. Fishing season began in February 2015, earlier than 2013 and 2014. The scientific observer started work on 15 April and had worked 85 days on the sea, and a total of 8,776 Jack Mackerel were measured and 600 fish were aged in lab, which yield the size frequency data and age-length key table.

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.