

Review of Taiwan SBT Fishery of 2017/2018

1. Introduction

In the 1970s, the main target species of the Taiwanese conventional tuna longline fishery was albacore. Since 1980s, some operators began to build new vessels and switch to super freezer tuna longline fishing for bigeye tuna and yellowfin tuna, then started fishing SBT seasonally in early 1990s. In the meantime, some tropical tuna fishing vessels shift southward and mainly operate in the central south Indian Ocean (Area 2 and 14) for SBT during April to September, and some operate in the high seas area off South Africa (Area 14 and 9) for SBT during October to February of following year.

The annual catches of SBT were less than 250 tons in early 1980s but from that time, with the increase of fleet size and the expansion of fishing grounds, the catches of SBT fluctuated between about 900 tons to 1,600 tons from 1990 to 2002. Since 2002, Taiwan has become a member of the Extend Commission of CCSBT and its national allocation has been set at 1,140 tons. The annual catches of SBT fluctuated between 500 tons and 1,300 tons from 2002 to 2017. In 2018, 77 fishing vessels were authorized to catch SBT and the SBT catch was 1,220 tons for calendar year and 1,214 tons for quota year.

2. Catch and Effort

Taiwanese SBT longline fishery mainly operates in Area 2, Area 14, Area 8 and Area 9 (here after: major Areas) seasonally. The catch and efforts by calendar year are provided in Table 1 and Figure 1.

The annual catches of SBT ranged from 494 to 1,298 tons between 2002 and 2016 (Table 1) with the highest catch in number and weight in 2004. The catch declined significantly to about 530 tons in 2011 for the shared quota of 2010 and 2011, which had been mostly used in 2010 and less fishing vessels engaging in SBT. The low catch in 2012 was due to better catch rate in tropical area, so most of fishing vessels remained to target bigeye tuna instead of SBT. The annual catches of SBT resumed from 2013 to

2017 because of the return of fishing vessels for SBT.

Figure 1 shows the variation of annual catches in number between 2002 and 2017. Most of the catches were made in Area 2 and 14. The aggregated number of SBT, which were caught in major Areas fluctuated between 28,000 and 41,000 during 2002-2010. After that, the total number declined rapidly in the next two years (2011-2012) and resumed to the level of 26,000-35,000 from 2013 to 2018.

The fishing efforts of 2002 and 2003 shown in Table 1 were aggregated all fishing efforts made by SBT fishing vessels, including the fishing efforts deployed in the tropical areas for bigeye tuna. Since 2004, only the fishing efforts of SBT vessels operated in the area south 20°S were included as fishing efforts for SBT.

The area-specific and monthly catches and fishing efforts of Taiwanese SBT longline fishing vessels in recent 5 years (2014-2018) are provided in Tables 2 and 3. It is observed that most of fishing efforts and catch were made in major Areas, and it should be noted that the fishing efforts made in Area 9 were mainly from the fishing vessels targeting Oilfish or Escolar in the Indian Ocean, and the fishing efforts made in Area 15 were mainly from fishing vessels targeting albacore with by-catch of SBT.

3. Nominal CPUE

The annual nominal CPUE of calendar years is shown in Table 1 and Figure 1. The nominal CPUE aggregated by the data from all areas reached the highest level in 2005, while the nominal CPUE aggregated by the data from major Areas reached the highest level in 2012.

It was noted that catches were mainly made in Areas 2 and 14 (Table 2), but the fishing efforts were mainly deployed in Area 9 except for 2014 (Table 3). The area-specific and monthly nominal CPUE in recent 5 years are provided in Table 4 and Figure 2. It was observed that the nominal CPUEs in Area 2 were generally higher than those in other areas.

4. Size composition

Before 2002 SBT fishing vessels had to report their operation position, weights of SBT catches on weekly basis, they were requested to report the length of individual SBT catch between 2002 to 2009, and the catch documentation scheme (CDS) applied

to Taiwanese SBT fishery and the length data of all SBT were collected through CDS after 2010.

The annual area-specific size compositions are shown in Figure 3 and Figure 4. It was observed that the size composition mainly concentrated at the range of 110 cm to 125 cm among all areas of 2010s. However, the mode at 150 cm was observed in other areas, but the total number is far less than the major Areas (Figure 3).

In recent 5 years (2014-2018), the size composition generally concentrated at the range of 106 cm to 126 cm among all areas (Figure 4), and the modes at 120 cm were observed both in 2017 and 2018.

5. Fleet size and fishing efforts distributions

According to the weekly reports and trading documents, there were more than 100 fishing vessels were engaged in SBT fishery during 1998 to 2001. Since Taiwan became a member of the Extend Commission of CCSBT in 2002, all SBT fishing vessels have to be authorized to access this fishery, and the Fisheries Agency (FA) of Taiwan reviews and renews their authorizations annually.

The numbers of fishing vessels engaged in SBT fishery ranged from 36 to 100 during 2002 to 2017 (Table 5). During 2005 to 2008, the number of fishing vessels decreased significantly because some of fishing vessels shifted to the waters off South Africa for targeting Oilfish or Escolar. In 2009 and 2010, the number of fishing vessels increased because some tropical tuna fishing vessels shifted southward to avoid the threat of Somalian piracy. The number of fishing vessels decreased to 56 in 2011 as national SBT allocation was set at 578 tons, and decreased further to 36 in 2012 because most of fishing vessels remained in tropical area for bigeye tuna. Owing to poor catch of tropical tuna in 2013, the fishing vessels returned to SBT fishing ground and the number of SBT longline fishing vessel increased substantially to 76 with a slight decrease to 71 and 72 in 2014 and 2015. In 2016, some fishing vessels remained in tropical area for targeting yellowfin tuna, so the number of SBT fishing vessels decreased to 60. On the contrary, the number of fishing vessel increased to 75 and 77 in 2017 and 2018, respectively, due to the poor catch of tropical tuna.

Taiwanese SBT fishing vessels seasonally targeting SBT mainly operate in the waters of 20°S - 40°S in the Indian Ocean and the areas adjacent to the Atlantic Ocean.

Since 2017, the authorized seasonal vessels of Taiwanese SBT fishing was allowed to operate fishing ground whole year until finishing individual quota base on new policy measures. The distributions of fishing efforts and SBT catch in number are shown in Figure 5 to Figure 8. There are two major fishing grounds in general with one in the southern central Indian Ocean around 50°E-105°E, 20°S-40°S, and one in the high seas area off South Africa around 20°E-50°E, 25°S-45°S. The mainly fishing season for Taiwanese SBT fishery in the southern central Indian Ocean is from April to September, and the mainly fishing season in the southwest Indian Ocean is from October to February of following year. It was observed that the fishing efforts and SBT catches were mainly made in Areas 2, 14 and 9 in the second and the third quarters. The fishing efforts deployed in Area 9 are mainly from the fishing vessels targeting Oilfish or Escolar, but also targeting SBT in the first and the fourth quarters.

6. Research and monitoring to improve estimates of attributable catch

The assessments of the effectiveness of Electronic Monitoring System (EMS) application had been carried out successively by RFMOs in recent years. Consequently, Taiwan also have some trials of EMS with the cooperation of tuna longliners.

In November 2016, with the supports from the FA and Taiwan Tuna Longline Association, 2 small scale tuna longliners in the Pacific Ocean had installed with Electronic Eye System of the Marine Instruments (MI) of Spain for trailing, and the trails were completed in March and May 2017 respectively. To fully test the effectiveness of MI's Electronic Eye System, we continued cooperating with MI in 2017 and installed improved Electronic Eye System on one each small scale tuna longliner in the Pacific Ocean and the Indian Ocean in July and September respectively; moreover, we also dispatched observers on board to provide assistance. When retrieving the EMS data at the end of the trial, we will conduct analysis according to the data interpreted by the experienced observers to evaluate the effectiveness of MI's Electronic Eye System and the feasibility of improving estimates of attributable catch.

7. Development and implementation of scientific observer programs

Appendix 1 provides the summary report on the implementation of scientific observer program.

8. Other relevant information

The collaboration between Taiwan and Australia on SBT archival tagging program had been conducted during 2004 to 2007. The observers dispatched to Taiwanese SBT fishing vessels carried out the SBT tagging program. There were 37, 48, 25 and 50 archival tags successfully settled during 2004 to 2007. The results were incorporated into the documents of CCSBT-ESC/0709/20 and CCSBT-ESC/0809/23.

Table 1 Annual catches of SBT in weight and in number, fishing efforts and nominal CPUE of Taiwanese SBT longline fishery

Unit : Hooks_N : thousand hooks ;
SBT_W: round weight in ton. ;
CPUE : SBT catch in number /total hooks;

Calendar year	Hooks_N		SBT_N		SBT_W		CPUE	
	All Area	Area 2、 14、8、 9	All Area	Area 2、 14、8、9	All Area	Area 2、 14、8、9	All Area	Area 2、 14、8、9
2002	102,908*	39,188	34,841	34,754	1,137	1,132	0.34	0.89
2003	144,620*	44,570	31,606	28,768	1,129	1,045	0.22	0.65
2004	36,055	34,993	42,151	41,733	1,298	1,279	1.17	1.19
2005	20,471	19,375	33,319	33,266	941	937	1.63	1.72
2006	20,444	18,919	30,667	30,660	846	845	1.50	1.62
2007	26,185	25,532	33,776	33,772	841	841	1.29	1.32
2008	28,724	26,656	35,144	35,082	913	911	1.22	1.32
2009	37,236	32,380	31,801	31,639	921	913	0.85	0.98
2010	40,916	33,897	33,407	33,263	1,208	1,201	0.82	0.98
2011	27,062	20,327	15,156	14,884	533	520	0.56	0.73
2012	18,414	9,702	17,578	17,198	494	472	0.95	1.77
2013	34,817	25,188	33,583	33,186	1,004	980	0.96	1.33
2014	30,823	21,067	26,659	26,300	944	922	0.86	1.27
2015	31,753	22,875	33,004	32,663	1,162	1,143	1.04	1.44
2016	32,071	27,865	30,392	30,204	1,023	1,013	0.95	1.09
2017	40,858	38,197	32,864	32,809	1171	1168	0.8	0.86
2018	36,206	33,251	35,784	35,671	1220	1213	0.99	1.08

* There were including deployed in the tropical areas for bigeye tuna.

Table 2 SBT catch in number by area, by month and by year of Taiwanese SBT longline fishery

Year	Month	Area1	Area2	Area3	Area4	Area5	Area6	Area7	Area8	Area9	Area10	Area11	Area12	Area13	Area14	Area15
2014	Total	-	15872	-	151	-	7	61	453	1041	15	18	0	-	8934	107
	1	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	0	0	0	-	-	0	-
	3	-	-	-	-	-	-	-	0	0	0	0	-	-	0	-
	4	-	0	-	18	-	4	17	74	38	0	0	-	-	0	-
	5	-	521	-	53	-	3	44	361	136	6	-	0	-	48	0
	6	-	2645	-	49	-	-	0	18	61	4	0	-	-	1143	26
	7	-	4275	-	30	-	-	-	-	16	5	11	0	-	1882	36
	8	-	6583	-	1	-	-	-	-	31	-	7	0	-	4030	5
	9	-	1785	-	-	-	-	-	-	0	-	0	-	-	1831	40
	10	-	63	-	-	-	-	-	-	0	-	-	-	-	0	-
	11	-	-	-	-	-	-	-	-	388	-	-	-	-	0	-
	12	-	-	-	-	-	-	-	-	371	-	-	-	-	0	-
2015	Total	0	15049	0	179	1	0	24	7595	895	1	0	18	0	9124	118
	1	-	-	-	-	-	-	-	-	288	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	0	138	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	0	0	-	0	-	-	0	-
	4	-	-	-	18	-	-	2	1332	0	0	0	-	-	10	0
	5	-	379	-	140	0	-	22	4667	38	1	-	0	-	8	32
	6	-	6247	-	21	1	-	-	1596	39	0	0	0	-	1507	23
	7	-	5394	-	0	0	-	-	-	21	0	0	10	-	4830	0
	8	-	1753	-	0	0	-	-	-	44	0	0	2	-	2133	59
	9	-	1276	-	0	-	-	-	-	0	-	-	3	-	636	4
	10	-	-	-	-	-	-	-	-	0	-	-	3	-	0	0
	11	-	-	-	-	-	-	-	-	159	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-	168	-	-	-	-	-	0
2016	Total	0	16026	0	33	0	3	0	2311	659	0	0	2	0	11208	150
	1	-	-	-	-	-	-	-	-	1	0	0	-	-	-	0
	2	-	-	-	-	-	-	-	-	0	-	0	-	-	-	0
	3	-	0	-	-	-	-	-	-	0	-	0	-	-	0	-
	4	-	0	-	0	-	-	0	474	0	-	-	-	-	0	6
	5	-	250	-	24	-	3	-	1153	48	-	-	-	-	3	59
	6	-	4292	-	9	-	-	-	684	104	-	-	0	-	805	74
	7	-	5911	-	0	0	-	-	-	60	-	-	0	-	5112	11
	8	-	4356	-	-	0	-	-	-	88	-	-	2	-	5268	0
	9	-	1217	-	-	-	-	-	-	15	-	0	0	-	20	0
	10	-	-	-	-	-	-	-	-	0	-	0	-	-	0	0
	11	-	-	-	-	-	-	-	-	222	-	-	-	-	0	-
	12	-	-	-	-	-	-	-	-	121	-	0	-	-	0	-
2017	Total	0	20789	0	0	0	0	0	2025	863	0	0	0	0	9132	55
	1	-	-	-	-	-	-	-	-	87	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	0	0	-	-	-	0	-
	3	-	0	-	-	-	-	-	0	0	0	-	-	-	0	0
	4	-	9	-	-	-	-	-	1094	30	-	-	-	-	0	18
	5	-	478	-	-	-	-	-	697	14	-	-	-	-	493	6
	6	-	5375	-	-	-	-	-	234	12	-	-	-	-	2358	1
	7	-	10770	-	-	-	-	-	-	72	-	-	-	-	2934	13
	8	-	4005	-	-	-	-	-	-	151	-	-	-	-	3176	5
	9	-	152	-	-	-	-	-	-	174	-	-	-	-	152	12
	10	-	-	-	-	-	-	-	-	67	-	0	-	-	18	0
	11	-	-	-	-	-	-	-	-	122	-	-	-	-	1	0
	12	-	-	-	-	-	-	-	-	134	-	-	-	-	0	-
2018	Total	0	16781	0	0	0	0	0	2888	521	10	12	0	0	15481	91
	1	-	-	-	-	-	-	-	-	188	-	-	-	-	0	0
	2	-	-	-	-	-	-	-	0	1	0	0	-	-	0	0
	3	-	2	-	-	-	-	-	551	2	0	0	-	-	0	0
	4	-	0	-	-	-	-	-	757	3	0	-	-	-	0	5
	5	-	430	-	-	-	-	-	781	65	10	-	-	-	27	4
	6	-	4600	-	-	-	-	-	799	76	0	0	-	-	3612	4
	7	-	7536	-	-	-	-	-	-	88	0	12	-	-	8496	37
	8	-	4013	-	-	-	-	-	-	26	-	0	-	-	2987	31
	9	-	200	-	-	-	-	-	-	72	-	-	-	-	259	10
	10	-	-	-	-	-	-	-	-	0	-	-	-	-	100	0
	11	-	-	-	-	-	-	-	-	0	-	-	-	-	0	-
	12	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-

Table 3 Number of hooks (thousand hooks) deployed by area, by month and by year of Taiwanese SBT longline fishery

Year	Month	Area1	Area2	Area3	Area4	Area5	Area6	Area7	Area8	Area9	Area10	Area11	Area12	Area13	Area14	Area15
2014	Total	-	6337	-	3212	-	51	756	1753	6318	1030	876	1366	-	6659	2466
	1	-	-	-	-	-	-	-	-	88	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	300	7	97	-	-	12	-
	3	-	-	-	-	-	-	-	54	490	164	70	-	-	22	-
	4	-	9	-	105	-	27	314	755	823	338	39	-	-	17	-
	5	-	554	-	992	-	24	317	930	857	409	-	4	-	499	303
	6	-	1490	-	1238	-	-	125	14	921	104	172	-	-	1402	732
	7	-	1822	-	775	-	-	-	-	486	8	223	631	-	2120	691
	8	-	1950	-	102	-	-	-	-	481	-	185	731	-	1742	473
	9	-	492	-	-	-	-	-	-	507	-	90	-	-	746	267
	10	-	20	-	-	-	-	-	-	581	-	-	-	-	15	-
	11	-	-	-	-	-	-	-	-	437	-	-	-	-	39	-
	12	-	-	-	-	-	-	-	-	347	-	-	-	-	45	-
2015	Total	0	6291	0	2270	341	0	88	3700	7146	708	328	2827	0	5738	2314
	1	-	-	-	-	-	-	-	-	375	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	25	376	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	94	458	-	43	-	-	114	-
	4	-	-	-	141	-	-	27	1164	913	67	11	4	-	43	126
	5	-	163	-	500	56	-	61	1848	851	314	-	169	-	637	375
	6	-	1795	-	296	118	-	-	569	891	173	129	881	-	813	353
	7	-	2058	-	698	159	-	-	-	648	111	134	561	-	2033	365
	8	-	1700	-	600	8	-	-	-	869	43	11	798	-	1726	463
	9	-	575	-	35	-	-	-	-	659	-	-	344	-	327	506
	10	-	-	-	-	-	-	-	-	481	-	-	70	-	45	122
	11	-	-	-	-	-	-	-	-	209	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-	416	-	-	-	-	-	4
2016	Total	0	4958	0	515	73	59	4	2069	15242	2	151	250	0	5595	3149
	1	-	-	-	-	-	-	-	-	813	2	4	-	-	-	4
	2	-	-	-	-	-	-	-	-	626	-	31	-	-	-	3
	3	-	20	-	-	-	-	-	-	1460	-	8	-	-	49	-
	4	-	3	-	12	-	-	4	1061	2038	-	-	-	-	43	70
	5	-	412	-	136	-	59	-	881	2608	-	-	-	-	247	431
	6	-	1430	-	197	-	-	-	127	2092	-	-	3	-	995	690
	7	-	1622	-	170	49	-	-	-	1672	-	-	12	-	1520	796
	8	-	1193	-	-	24	-	-	-	1648	-	-	227	-	1897	601
	9	-	278	-	-	-	-	-	-	836	-	60	8	-	751	431
	10	-	-	-	-	-	-	-	-	617	-	38	-	-	87	123
	11	-	-	-	-	-	-	-	-	536	-	-	-	-	3	-
	12	-	-	-	-	-	-	-	-	296	-	10	-	-	3	-
2017	Total	0	6479	0	0	0	0	0	2877	17980	38	38	0	0	10862	2585
	1	-	-	-	-	-	-	-	-	55	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	313	15	-	-	-	11	-
	3	-	36	-	-	-	-	-	47	1940	23	-	-	-	119	16
	4	-	60	-	-	-	-	-	1496	3195	-	-	-	-	21	172
	5	-	651	-	-	-	-	-	1243	3392	-	-	-	-	722	509
	6	-	1998	-	-	-	-	-	91	1762	-	-	-	-	2537	486
	7	-	2485	-	-	-	-	-	-	1472	-	-	-	-	2907	434
	8	-	1110	-	-	-	-	-	-	1234	-	-	-	-	3342	290
	9	-	139	-	-	-	-	-	-	2041	-	-	-	-	628	381
	10	-	-	-	-	-	-	-	-	1076	-	38	-	-	430	284
	11	-	-	-	-	-	-	-	-	932	-	-	-	-	86	13
	12	-	-	-	-	-	-	-	-	568	-	-	-	-	59	-
2018	Total	0	4593	0	0	0	0	0	3992	11139	750	129	0	0	13527	2075
	1	-	-	-	-	-	-	-	-	181	-	-	-	-	40	8
	2	-	-	-	-	-	-	-	40	197	3	15	-	-	81	49
	3	-	10	-	-	-	-	-	807	1010	207	20	-	-	89	49
	4	-	36	-	-	-	-	-	1506	2361	238	-	-	-	109	146
	5	-	442	-	-	-	-	-	1327	2519	198	-	-	-	766	375
	6	-	1346	-	-	-	-	-	312	1922	93	7	-	-	2254	286
	7	-	1534	-	-	-	-	-	-	1214	11	79	-	-	3852	277
	8	-	985	-	-	-	-	-	-	580	-	8	-	-	3969	521
	9	-	240	-	-	-	-	-	-	567	-	-	-	-	1729	263
	10	-	-	-	-	-	-	-	-	174	-	-	-	-	602	101
	11	-	-	-	-	-	-	-	-	276	-	-	-	-	36	-
	12	-	-	-	-	-	-	-	-	138	-	-	-	-	-	-

CCSBT-ESC/1909/SBT Fisheries-Taiwan

(ESC Agenda Item 4.1)

Table 4 Nominal CPUE by area, by month and by year of Taiwanese SBT longline fishery

Unit: CPUE=Numbers/Thousand hooks

Year	Month	Area1	Area2	Area3	Area4	Area5	Area6	Area7	Area8	Area9	Area10	Area11	Area12	Area13	Area14	Area15
2014	Total	-	2.5	-	0.05	-	0.14	0.08	0.26	0.16	0.01	0.02	0	-	1.34	0.04
	1	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	0	0	0	-	-	0	-
	3	-	-	-	-	-	-	-	0	0	0	0	-	-	0	-
	4	-	0	-	0.17	-	0.15	0.05	0.1	0.05	0	0	-	-	0	-
	5	-	0.94	-	0.05	-	0.12	0.14	0.39	0.16	0.01	-	0	-	0.1	0
	6	-	1.78	-	0.04	-	-	0	1.29	0.07	0.04	0	-	-	0.82	0.04
	7	-	2.35	-	0.04	-	-	-	-	0.03	0.62	0.05	0	-	0.89	0.05
	8	-	3.38	-	0.01	-	-	-	-	0.06	-	0.04	0	-	2.31	0.01
	9	-	3.63	-	-	-	-	-	-	0	-	0	-	-	2.45	0.15
	10	-	3.15	-	-	-	-	-	-	0	-	-	-	-	0	-
	11	-	-	-	-	-	-	-	-	0.89	-	-	-	-	0	-
	12	-	-	-	-	-	-	-	-	1.07	-	-	-	-	0	-
2015	Total	-	2.39	-	0.08	0	-	0.27	2.05	0.13	0	0	0.01	-	1.59	0.05
	1	-	-	-	-	-	-	-	-	0.77	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	0	0.37	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	0	0	-	0	-	-	0	-
	4	-	-	-	0.13	-	-	0.07	1.14	0	0	0	0	-	0.23	0
	5	-	2.33	-	0.28	0	-	0.36	2.53	0.04	0	-	0	-	0.01	0.09
	6	-	3.48	-	0.07	0.01	-	-	2.8	0.04	0	0	0	-	1.85	0.07
	7	-	2.62	-	0	0	-	-	-	0.03	0	0	0.02	-	2.38	0
	8	-	1.03	-	0	0	-	-	-	0.05	0	0	0	-	1.24	0.13
	9	-	2.22	-	0	-	-	-	-	0	-	-	0.01	-	1.94	0.01
	10	-	-	-	-	-	-	-	-	0	-	-	0.04	-	0	0
	11	-	-	-	-	-	-	-	-	0.76	-	-	-	-	-	-
	12	-	-	-	-	-	-	-	-	0.4	-	-	-	-	-	0
2016	Total	-	3.23	-	0.06	0	0.05	0	1.12	0.04	0	0	0.01	-	2	0.05
	1	-	-	-	-	-	-	-	-	0	0	0	-	-	-	0
	2	-	-	-	-	-	-	-	-	0	-	0	-	-	-	0
	3	-	0	-	-	-	-	-	-	0	-	0	-	-	0	-
	4	-	0	-	0	-	-	0	0.45	0	-	-	-	-	0	0.09
	5	-	0.61	-	0.18	-	0.05	-	1.31	0.02	-	-	-	-	0.01	0.14
	6	-	3	-	0.05	-	-	-	5.39	0.05	-	-	0	-	0.81	0.11
	7	-	3.64	-	0	0	-	-	-	0.04	-	-	0	-	3.36	0.01
	8	-	3.65	-	-	0	-	-	-	0.05	-	-	0.01	-	2.78	0
	9	-	4.38	-	-	-	-	-	-	0.02	-	0	0	-	0.03	0
	10	-	-	-	-	-	-	-	-	0	-	0	-	-	0	0
	11	-	-	-	-	-	-	-	-	0.41	-	-	-	-	0	-
	12	-	-	-	-	-	-	-	-	0.41	-	0	-	-	0	-
2017	Total	-	3.21	-	-	-	-	-	0.7	0.05	0	0	-	-	0.84	0.02
	1	-	-	-	-	-	-	-	-	1.58	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	0	0	-	-	-	0	-
	3	-	0	-	-	-	-	-	0	0	0	-	-	-	0	0
	4	-	0.15	-	-	-	-	-	0.73	0.01	-	-	-	-	0	0.1
	5	-	0.73	-	-	-	-	-	0.56	0	-	-	-	-	0.68	0.01
	6	-	2.69	-	-	-	-	-	2.57	0.01	-	-	-	-	0.93	0
	7	-	4.33	-	-	-	-	-	-	0.05	-	-	-	-	1.01	0.03
	8	-	3.61	-	-	-	-	-	-	0.12	-	-	-	-	0.95	0.02
	9	-	1.09	-	-	-	-	-	-	0.09	-	-	-	-	0.24	0.03
	10	-	-	-	-	-	-	-	-	0.06	-	0	-	-	0.04	0
	11	-	-	-	-	-	-	-	-	0.13	-	-	-	-	0.01	0
	12	-	-	-	-	-	-	-	-	0.24	-	-	-	-	0	-
2018	Total	-	3.65	-	-	-	-	-	0.72	0.05	0.01	0.09	-	-	1.14	0.04
	1	-	-	-	-	-	-	-	-	1.04	-	-	-	-	0	0
	2	-	-	-	-	-	-	-	0	0.01	0	0	-	-	0	0
	3	-	0.2	-	-	-	-	-	0.68	0	0	0	-	-	0	0
	4	-	0	-	-	-	-	-	0.5	0	0	-	-	-	0	0.03
	5	-	0.97	-	-	-	-	-	0.59	0.03	0.05	-	-	-	0.04	0.01
	6	-	3.42	-	-	-	-	-	2.56	0.04	0	0	-	-	1.6	0.01
	7	-	4.91	-	-	-	-	-	-	0.07	0	0.15	-	-	2.21	0.13
	8	-	4.07	-	-	-	-	-	-	0.04	-	0	-	-	0.75	0.06
	9	-	0.83	-	-	-	-	-	-	0.13	-	-	-	-	0.15	0.04
	10	-	-	-	-	-	-	-	-	0	-	-	-	-	0.17	0
	11	-	-	-	-	-	-	-	-	0	-	-	-	-	0	-
12		-	-	-	-	-	-	-	-	0	-	-	-	-	-	-

Table 5 Number of fishing vessel engaged in SBT fishery during 2002-2018

Year	No. of seasonal target vessels	No. of by-catch vessels	Total vessels
2002	21	50	71
2003	76	24	100
2004	79	18	97
2005	49	8	57
2006	33	3	36
2007	27	3	30
2008	35	6	41
2009	34	33	67
2010	65	17	82
2011	28	28	56
2012	12	24	36
2013	39	37	76*
2014	37	34	71
2015	45	27	72
2016	34	26	60
2017	43	32	75
2018	46	31	77

* There was one vessel shipwreck.

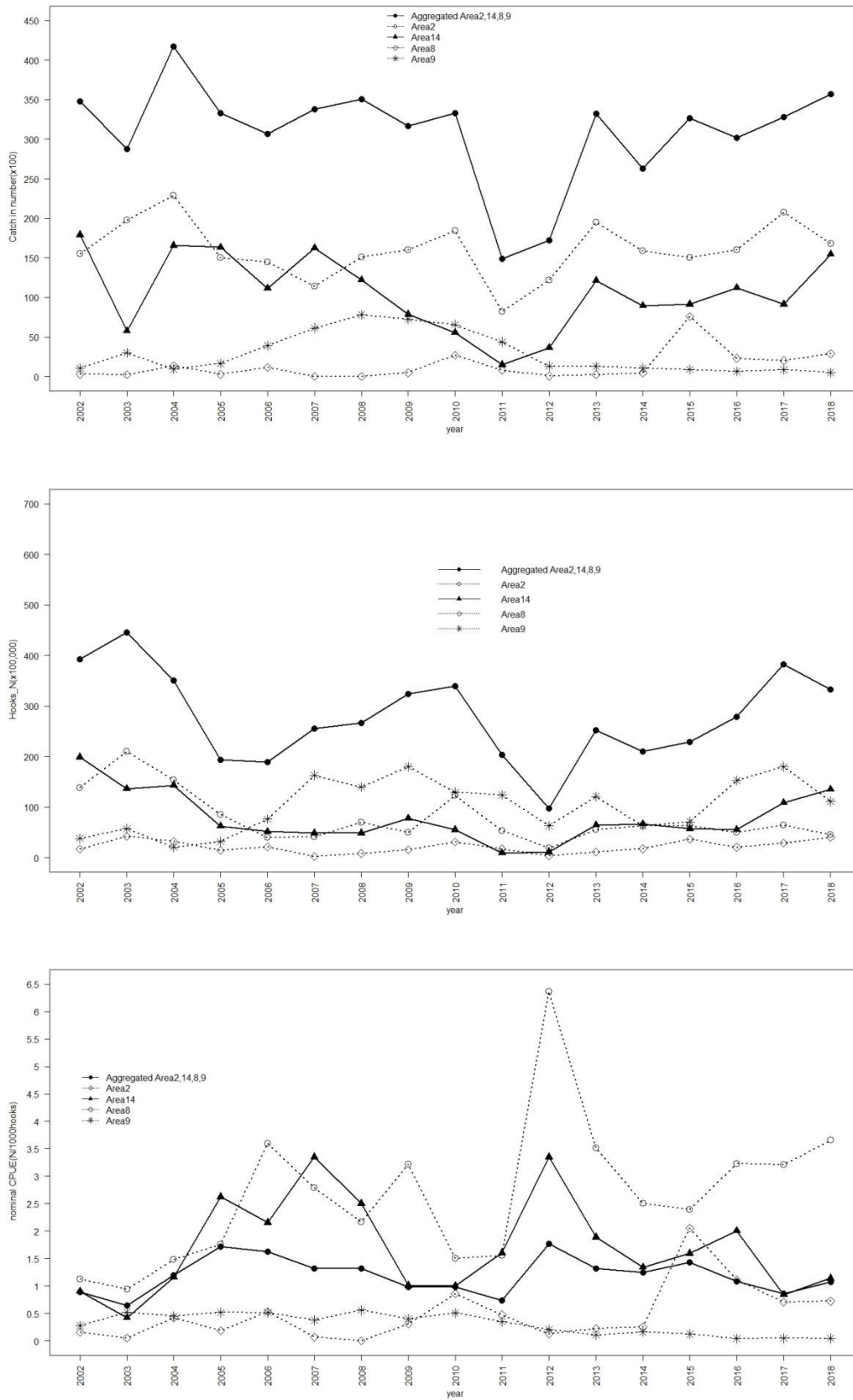


Fig. 1 Annual SBT catches in number, fishing effort and nominal CPUE of Taiwanese SBT longline fishery in main fishing ground

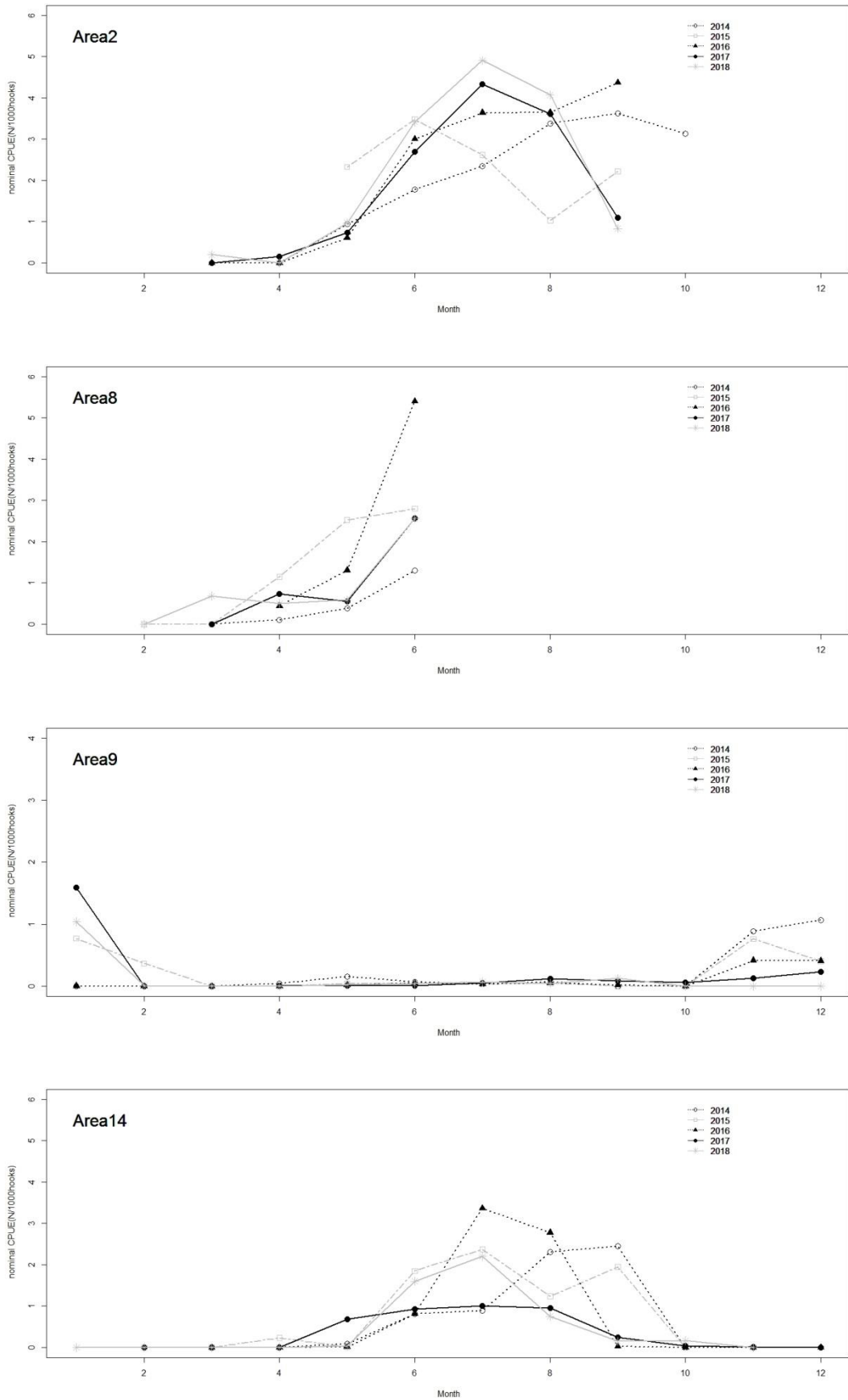


Fig. 2 Annual nominal CPUE by area, by month and by year of Taiwanese SBT longline fishery in main fishing ground

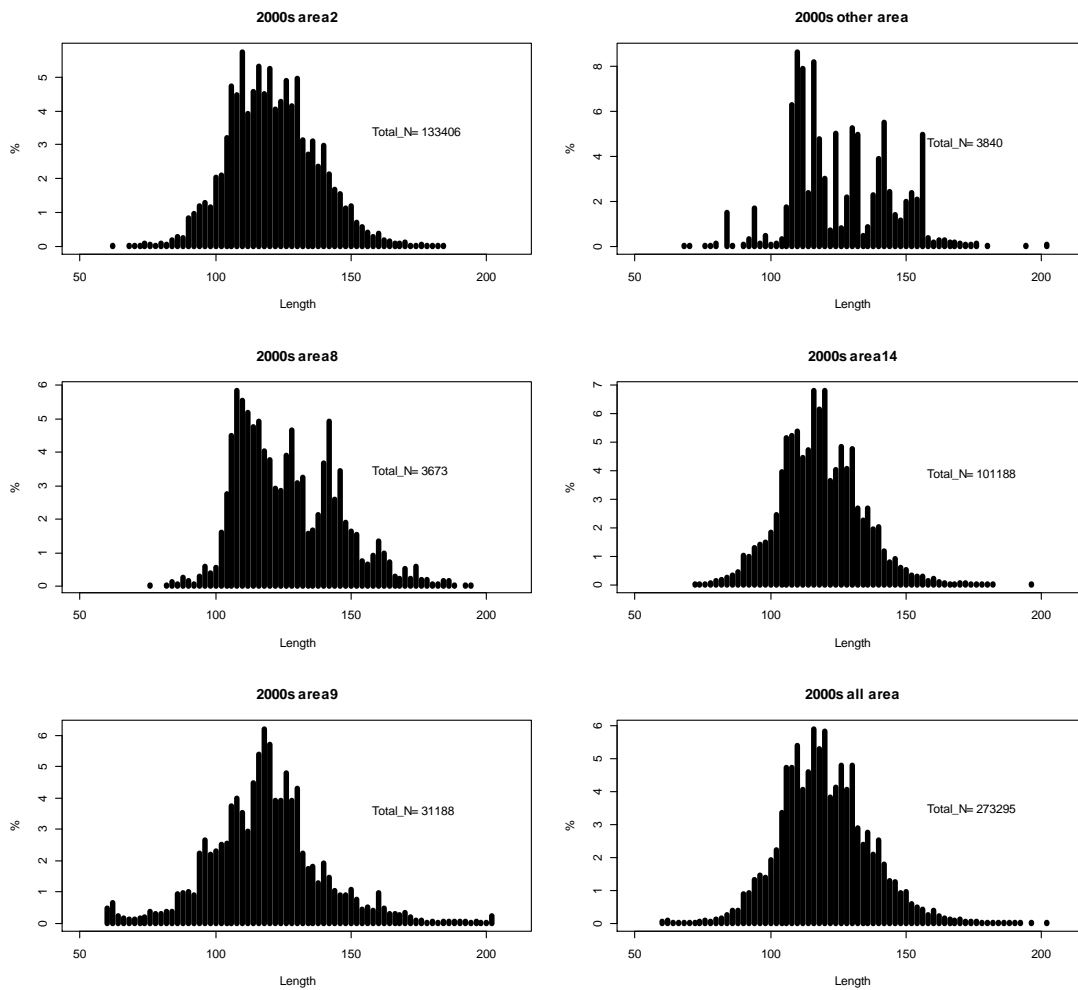


Fig.3 (1) SBT catch length frequency by area of Taiwanese SBT longline fishery in 2000s

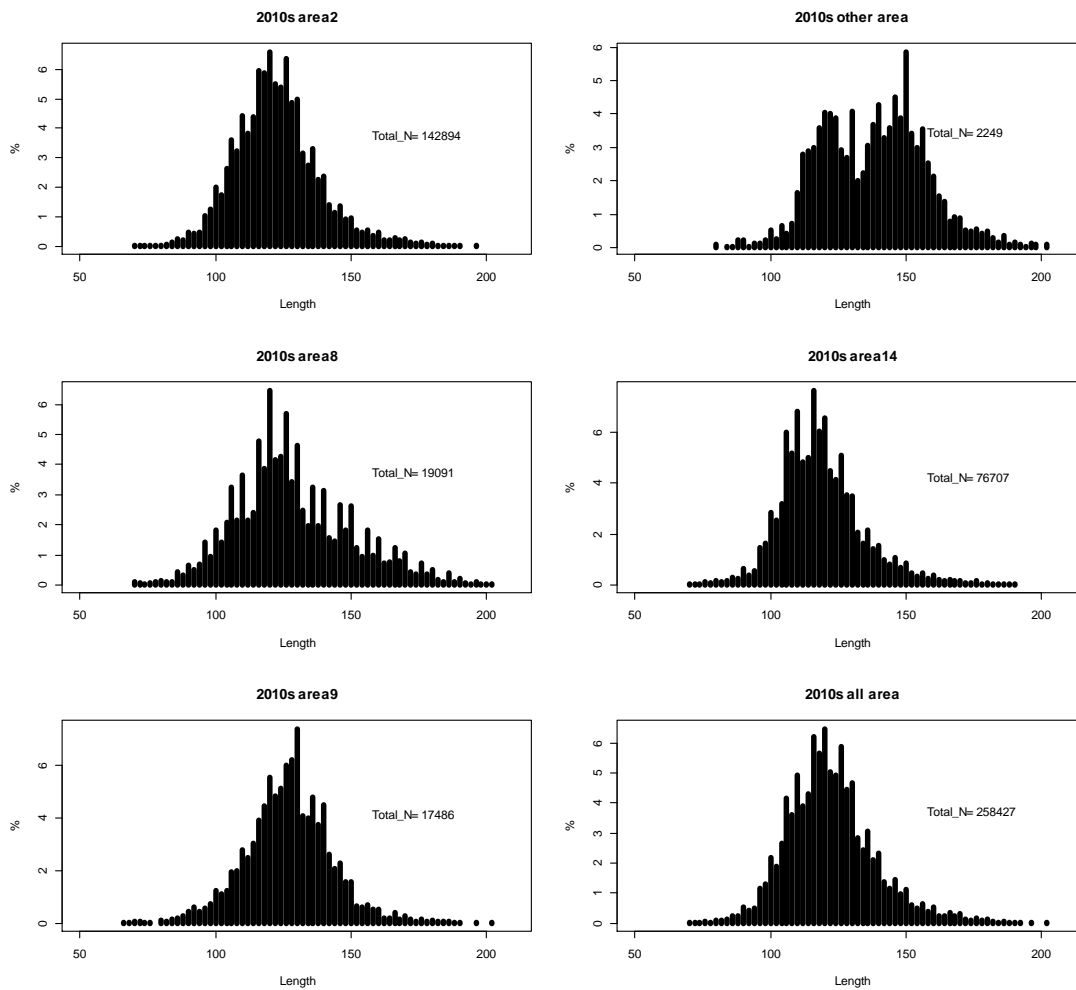


Fig.3 (2) SBT catch length frequency by area of Taiwanese SBT longline fishery during 2010-2018

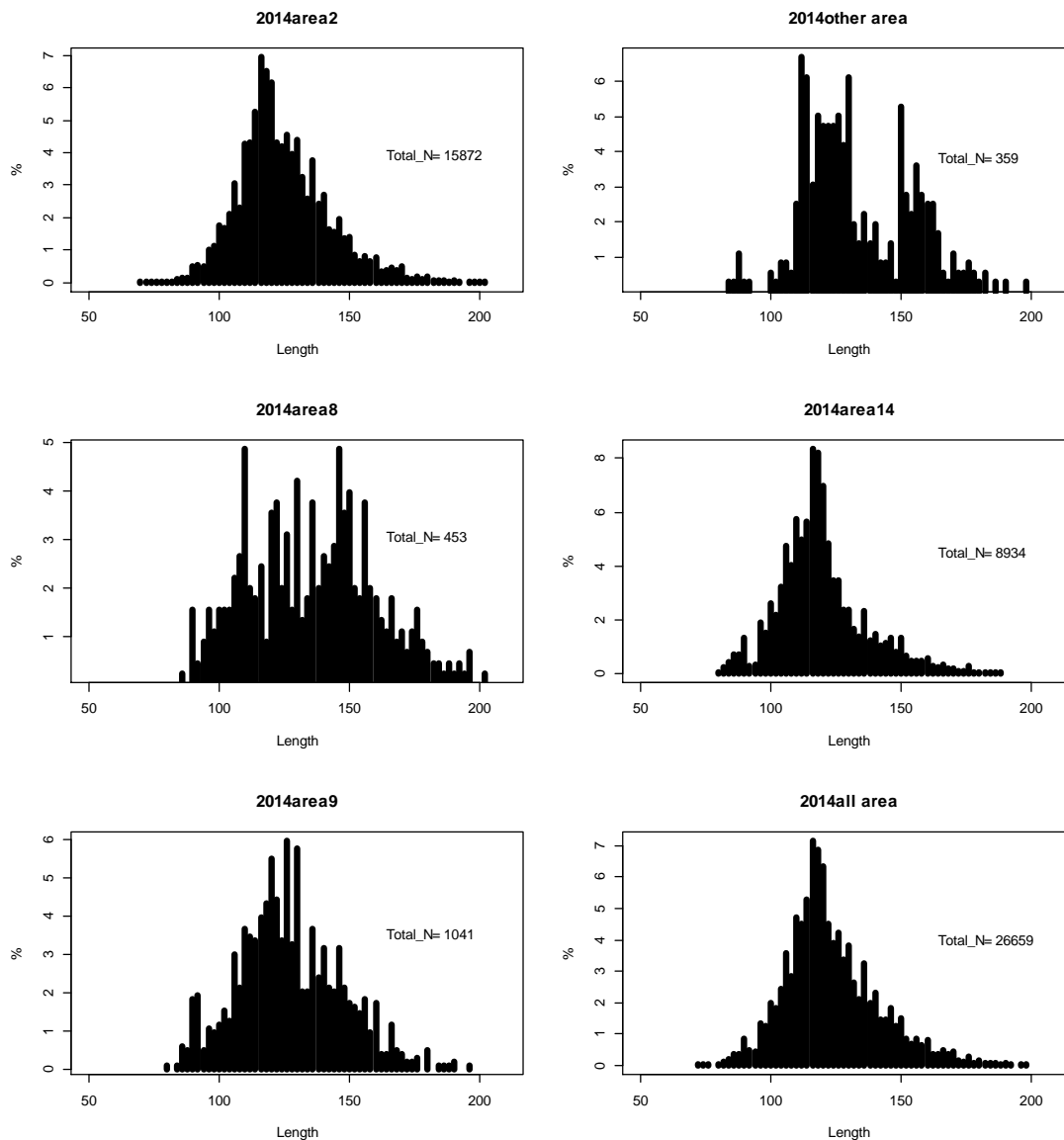


Fig.4 (1) SBT catch length frequency by area of Taiwanese SBT longline fishery in 2014

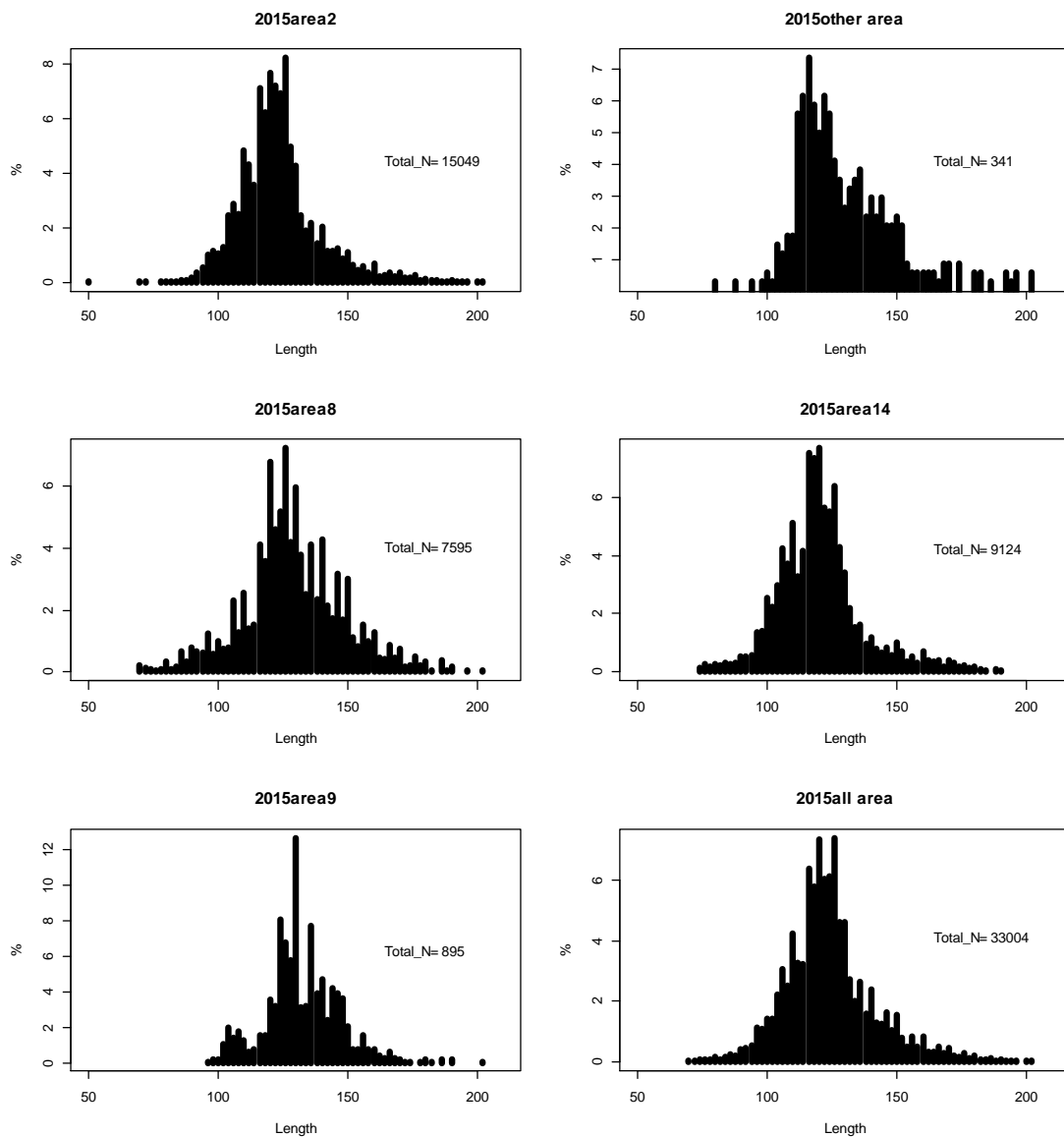


Fig.4 (2) SBT catch length frequency by area of Taiwanese SBT longline fishery in 2015

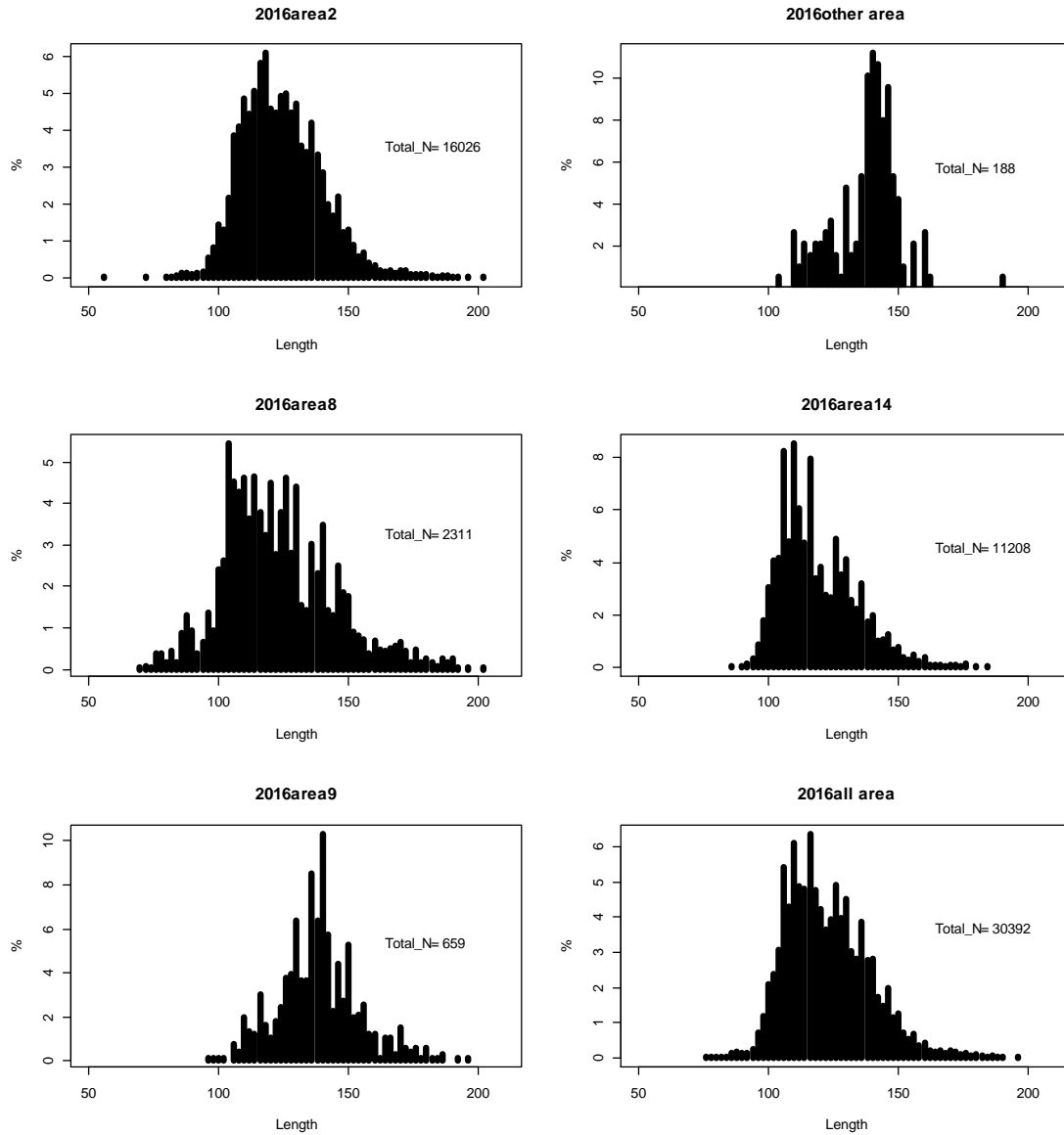


Fig.4 (3) SBT catch length frequency by area of Taiwanese SBT longline fishery in 2016

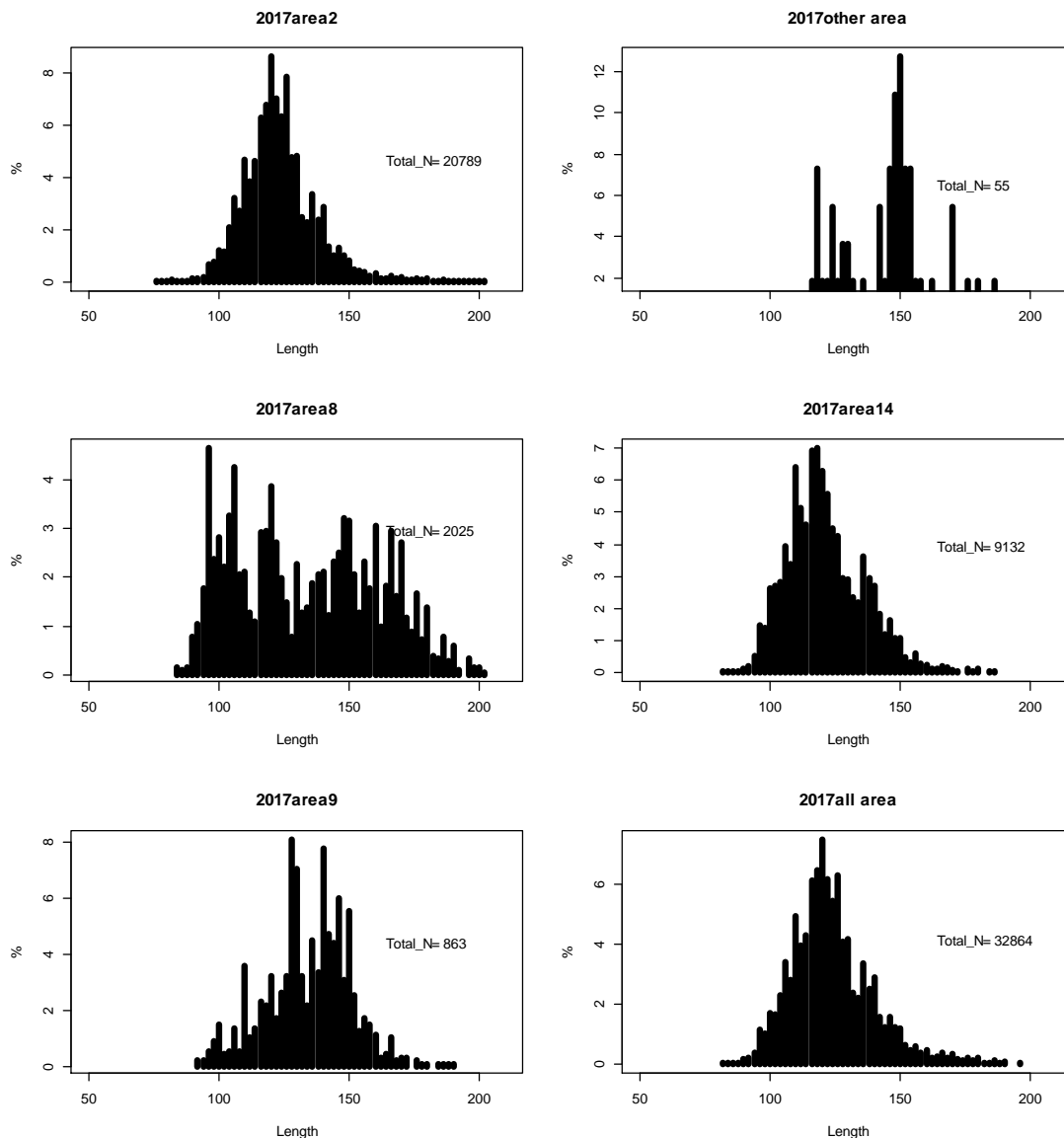


Fig.4 (4) SBT catch length frequency by area of Taiwanese SBT longline fishery in 2017

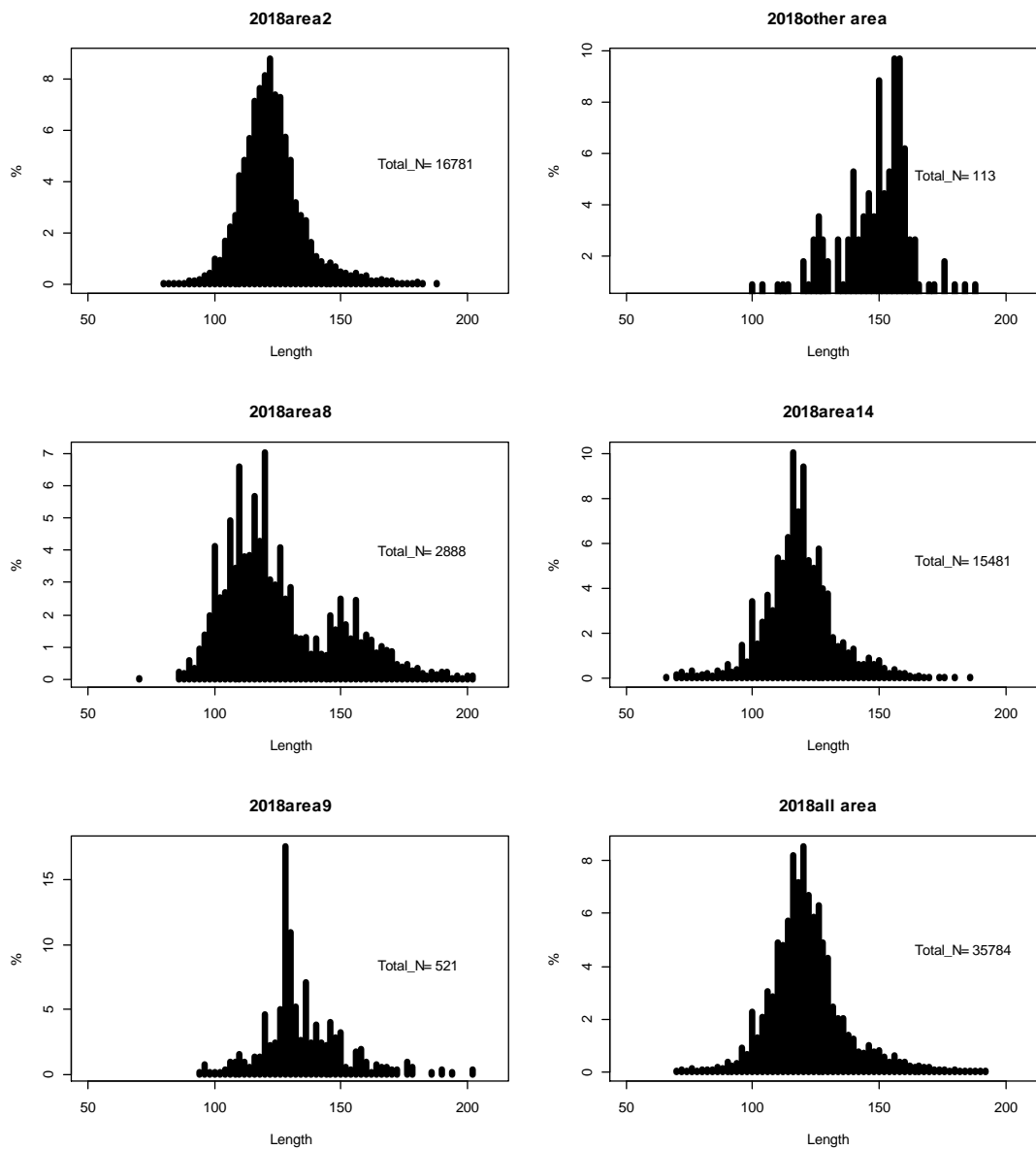


Fig.4 (5) SBT catch length frequency by area of Taiwanese SBT longline fishery in 2018

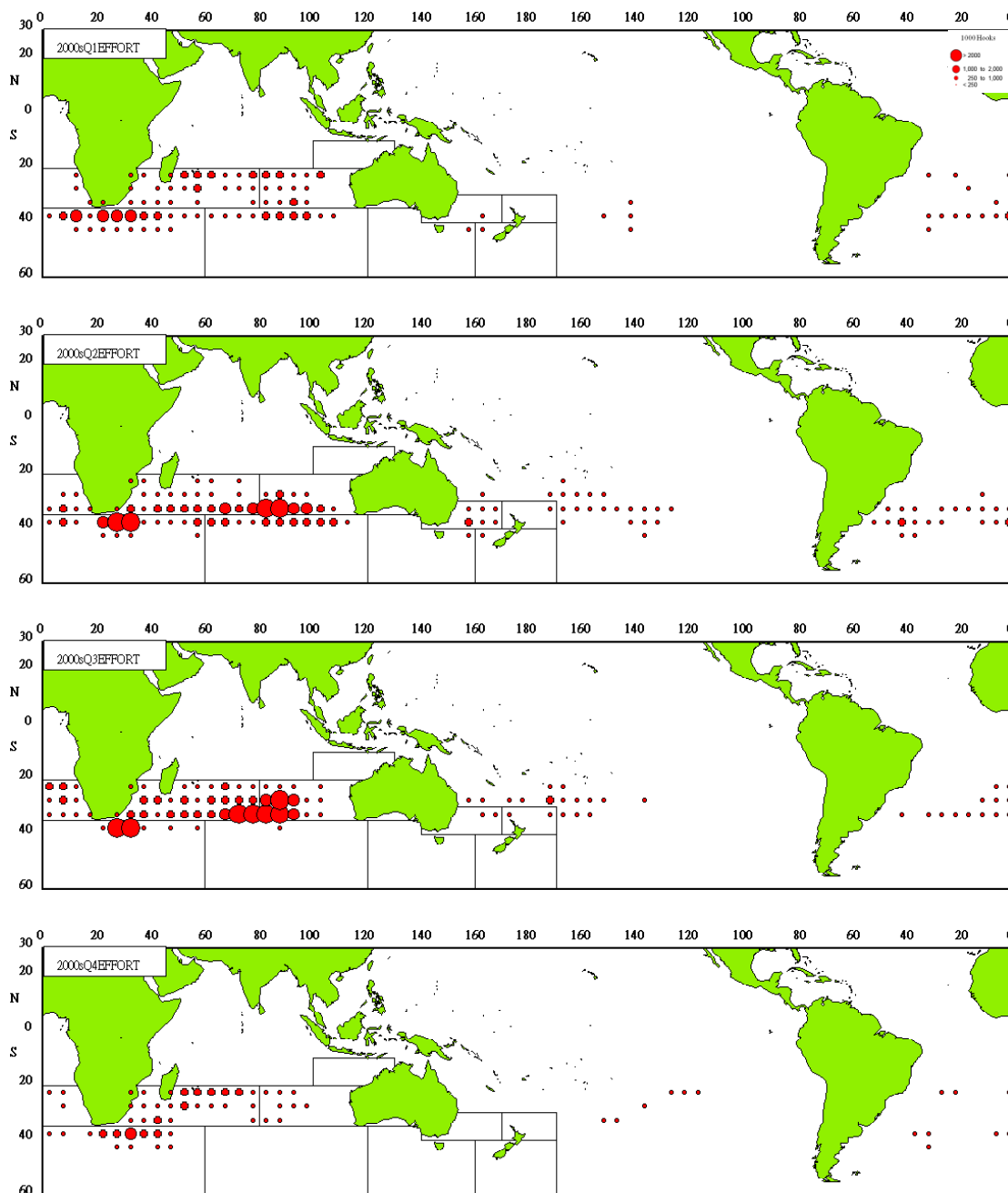


Fig.5 (1) Fishing efforts distributions by quarter of Taiwanese SBT longline fishery in 2000s

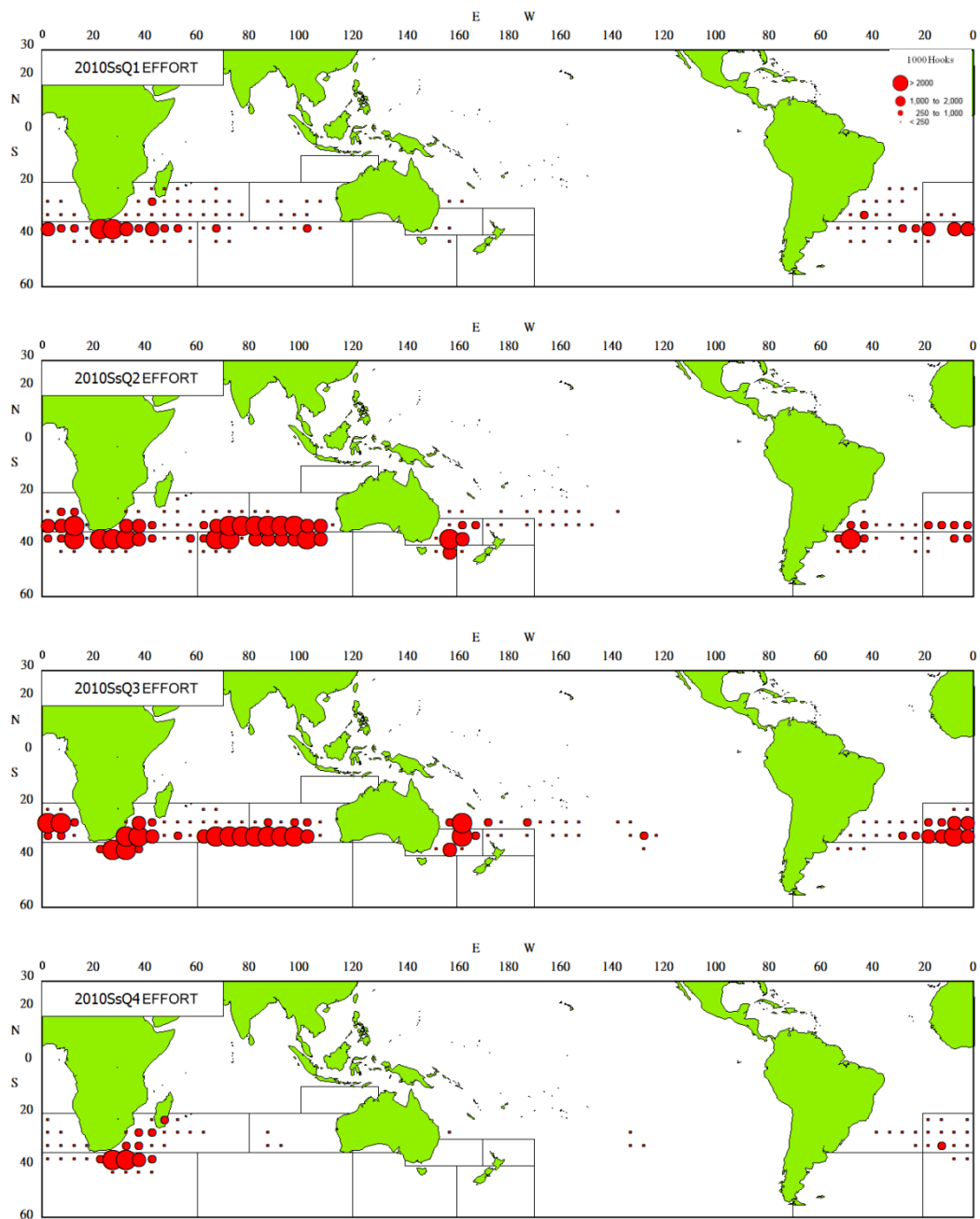


Fig.5 (2) Fishing efforts distributions by quarter of Taiwanese SBT longline fishery during 2010-2018

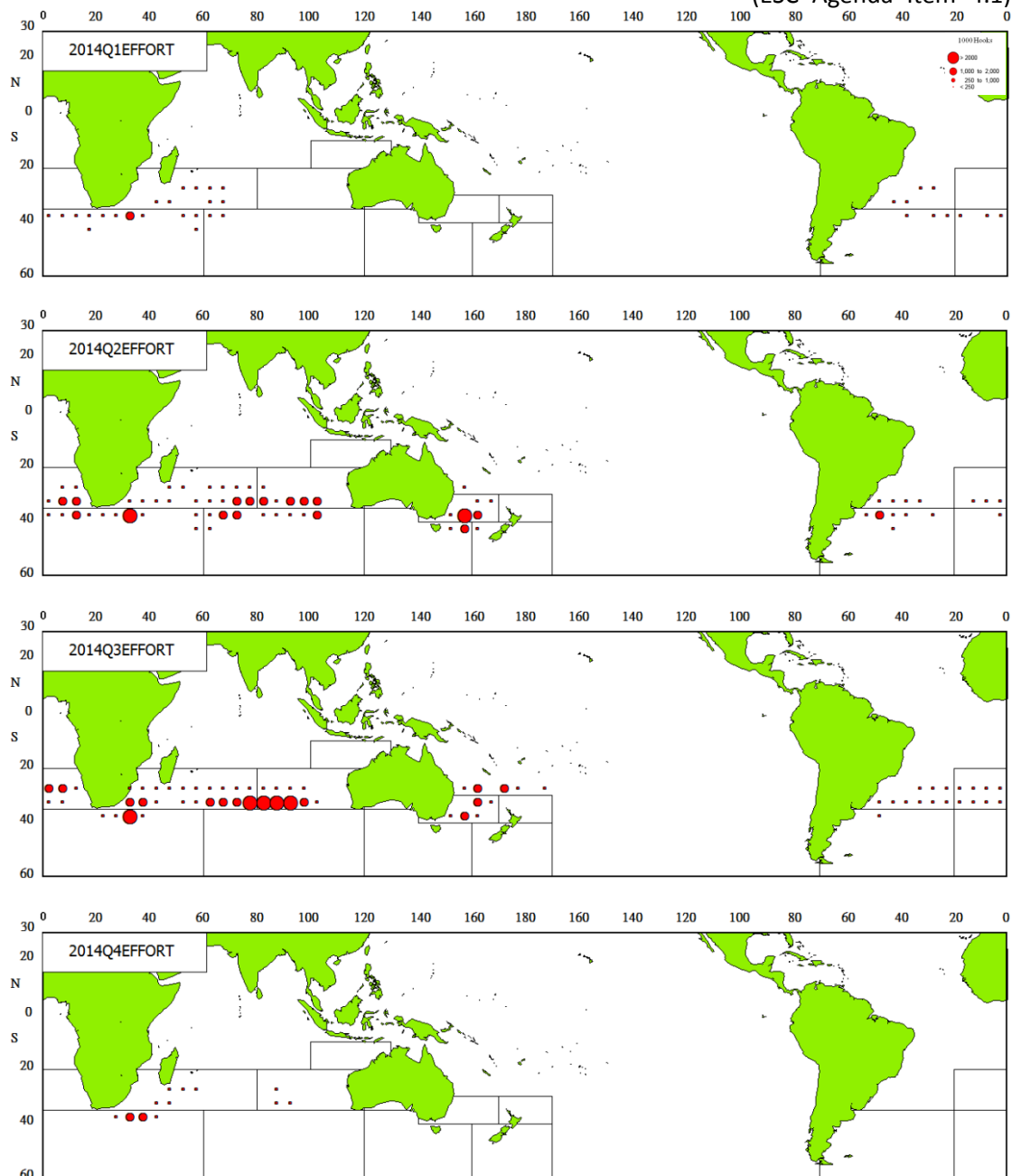


Fig.6 (1) Fishing efforts distributions by quarter of Taiwanese SBT longline fishery in 2014

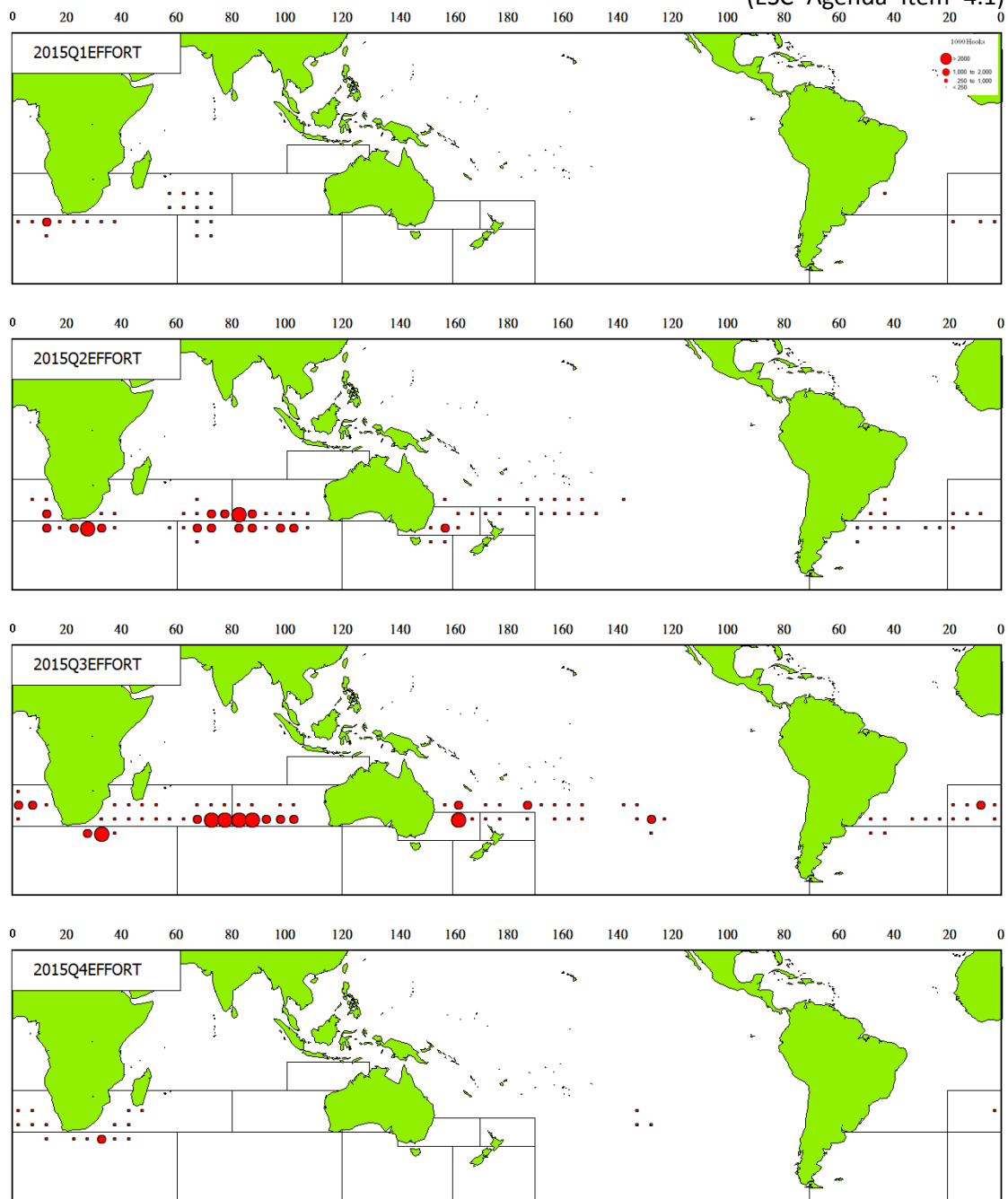


Fig.6 (2) Fishing efforts distributions by quarter of Taiwanese SBT longline fishery in 2015

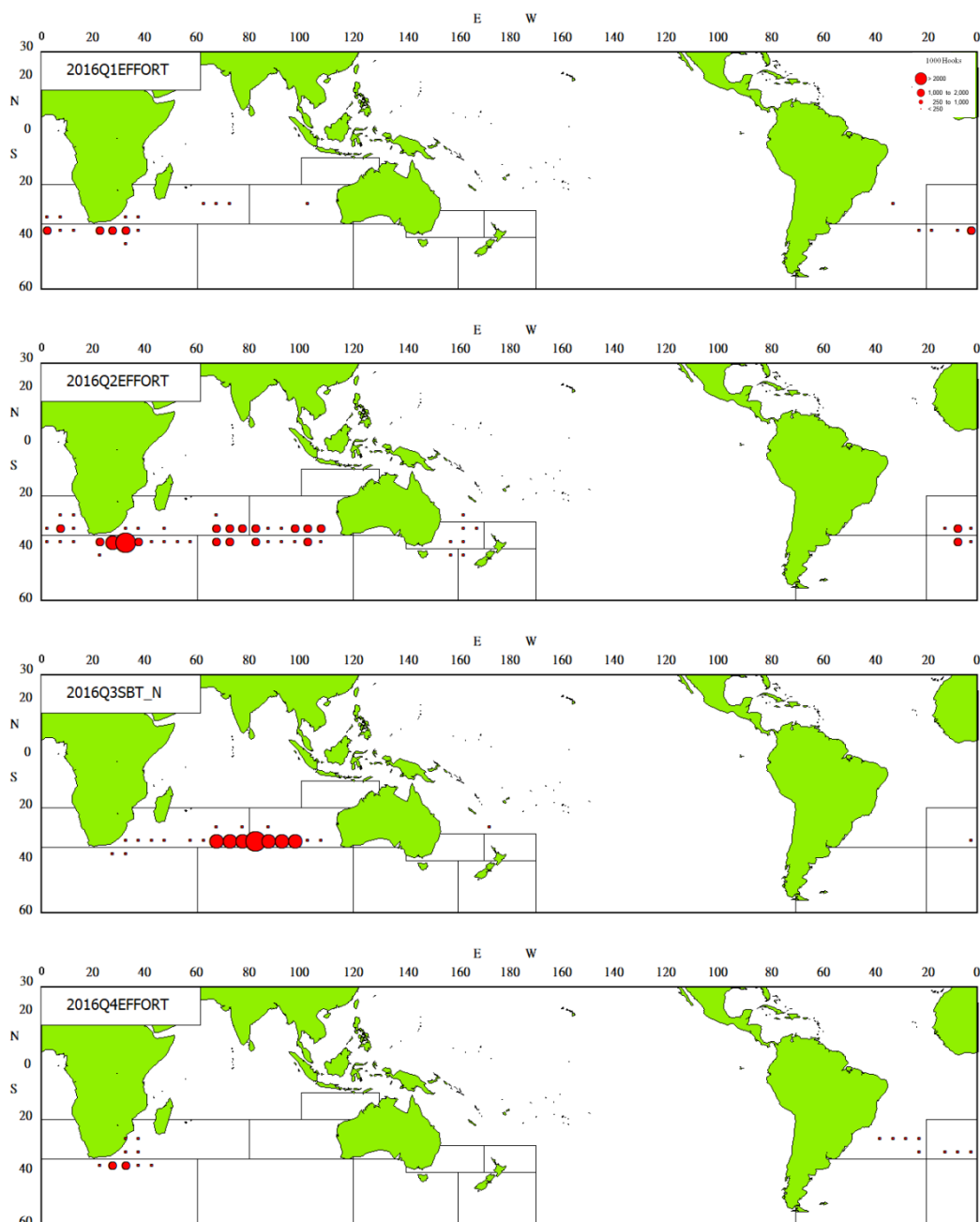


Fig.6 (3) Fishing efforts distributions by quarter of Taiwanese SBT longline fishery in 2016

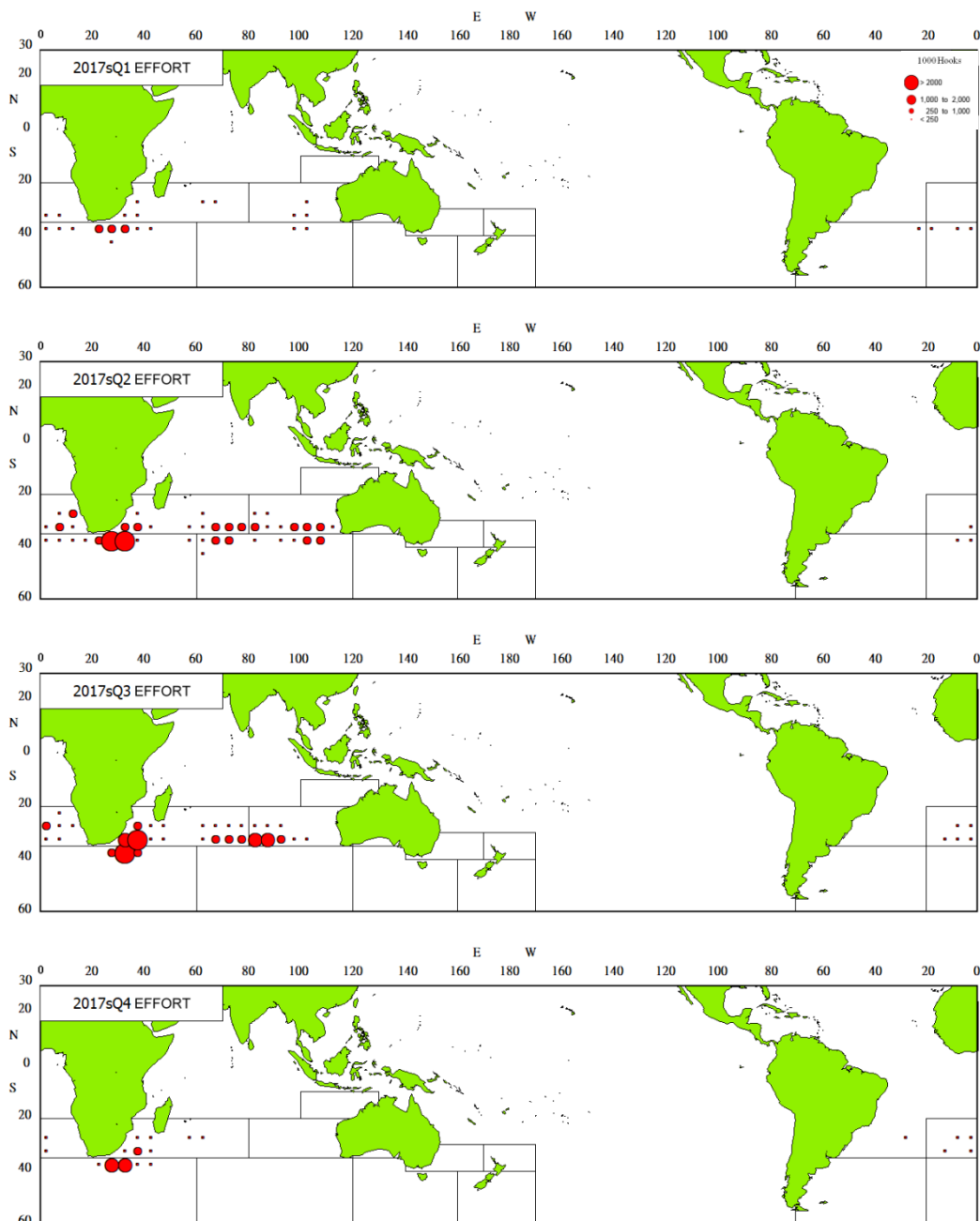


Fig.6 (4) Fishing efforts distributions by quarter of Taiwanese SBT longline fishery in 2017

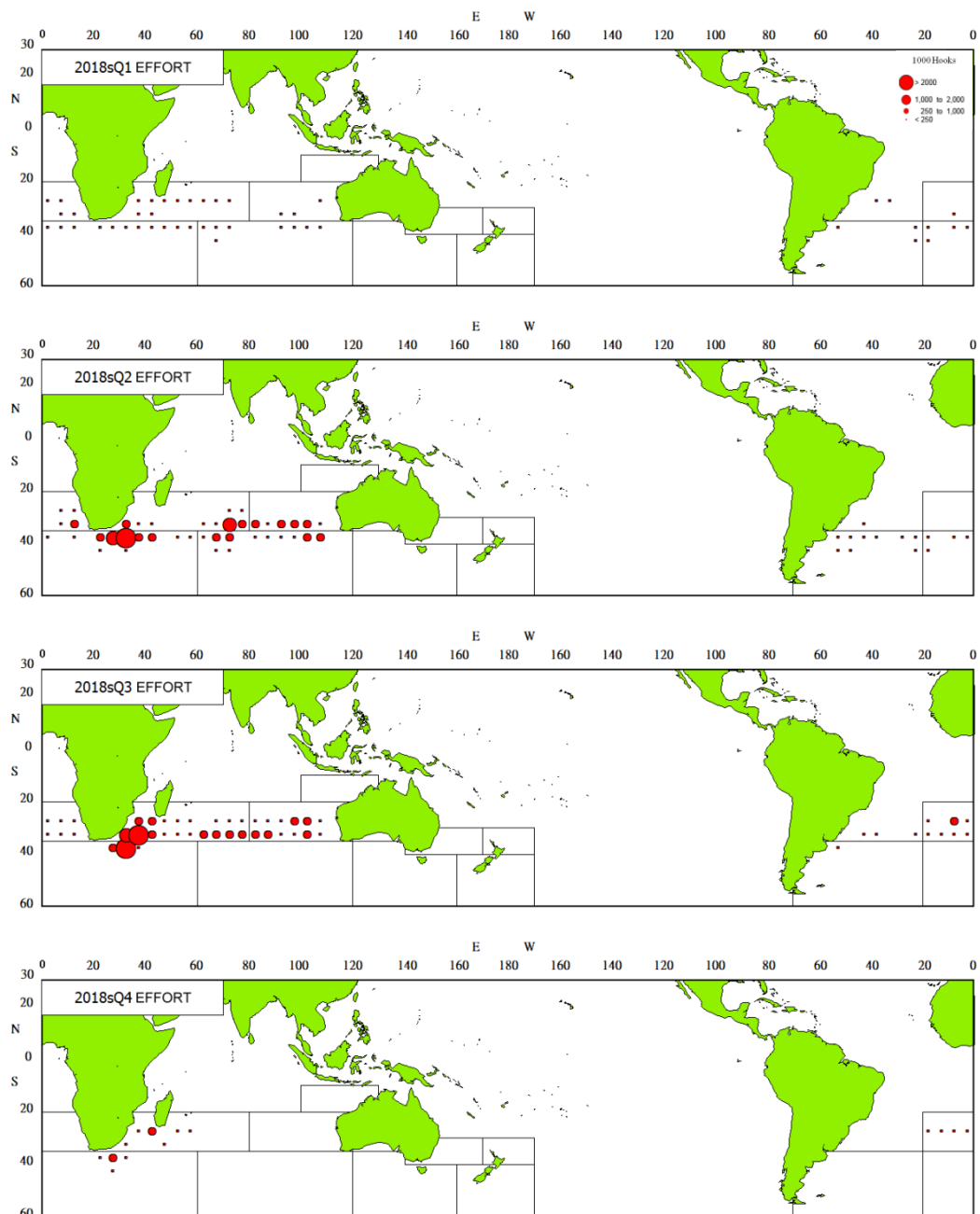


Fig.6 (5) Fishing efforts distributions by quarter of Taiwanese SBT longline fishery in 2018

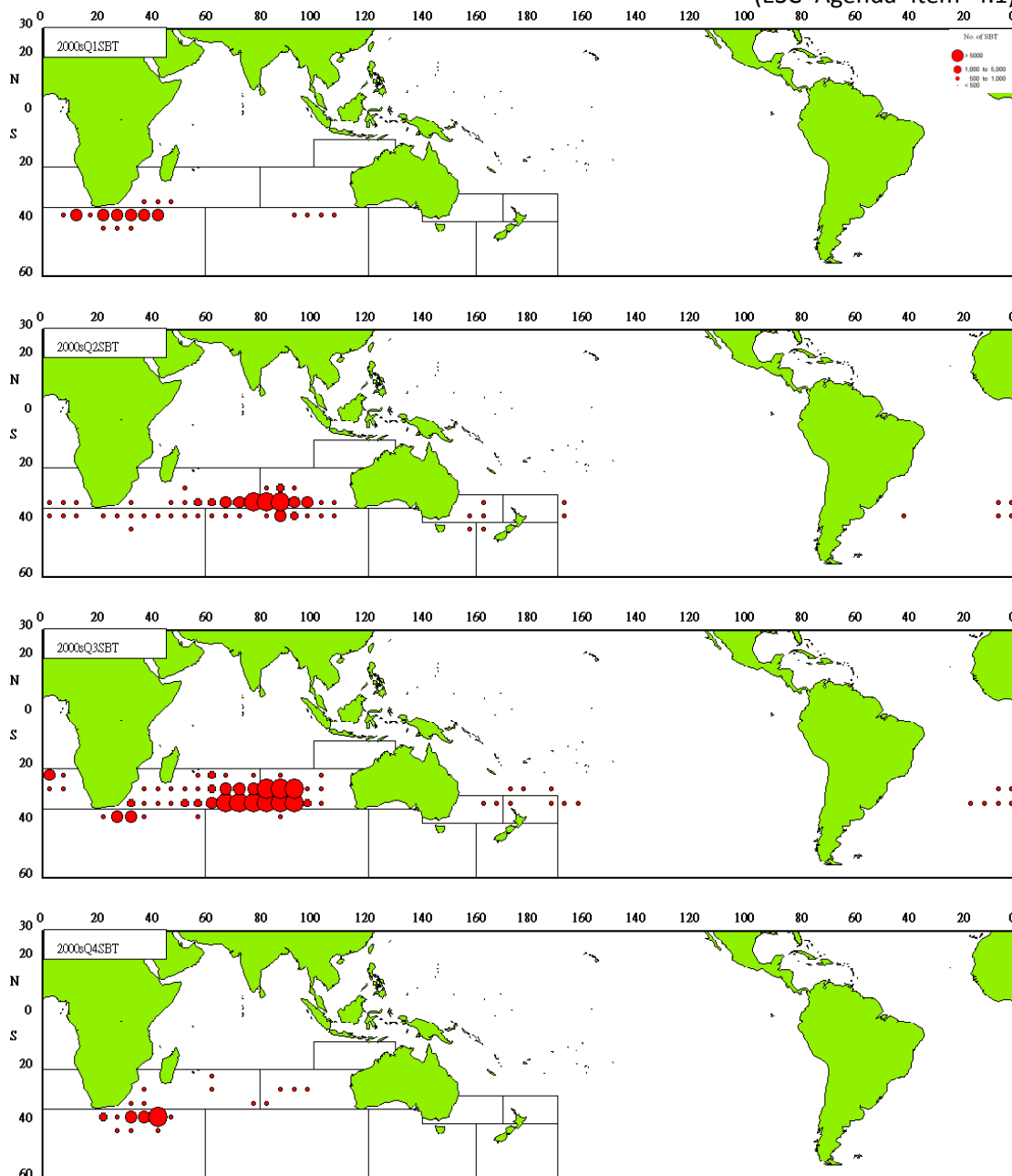


Fig.7 (1) SBT catch (in number) distributions by quarter of Taiwanese SBT longline fishery in 2000s

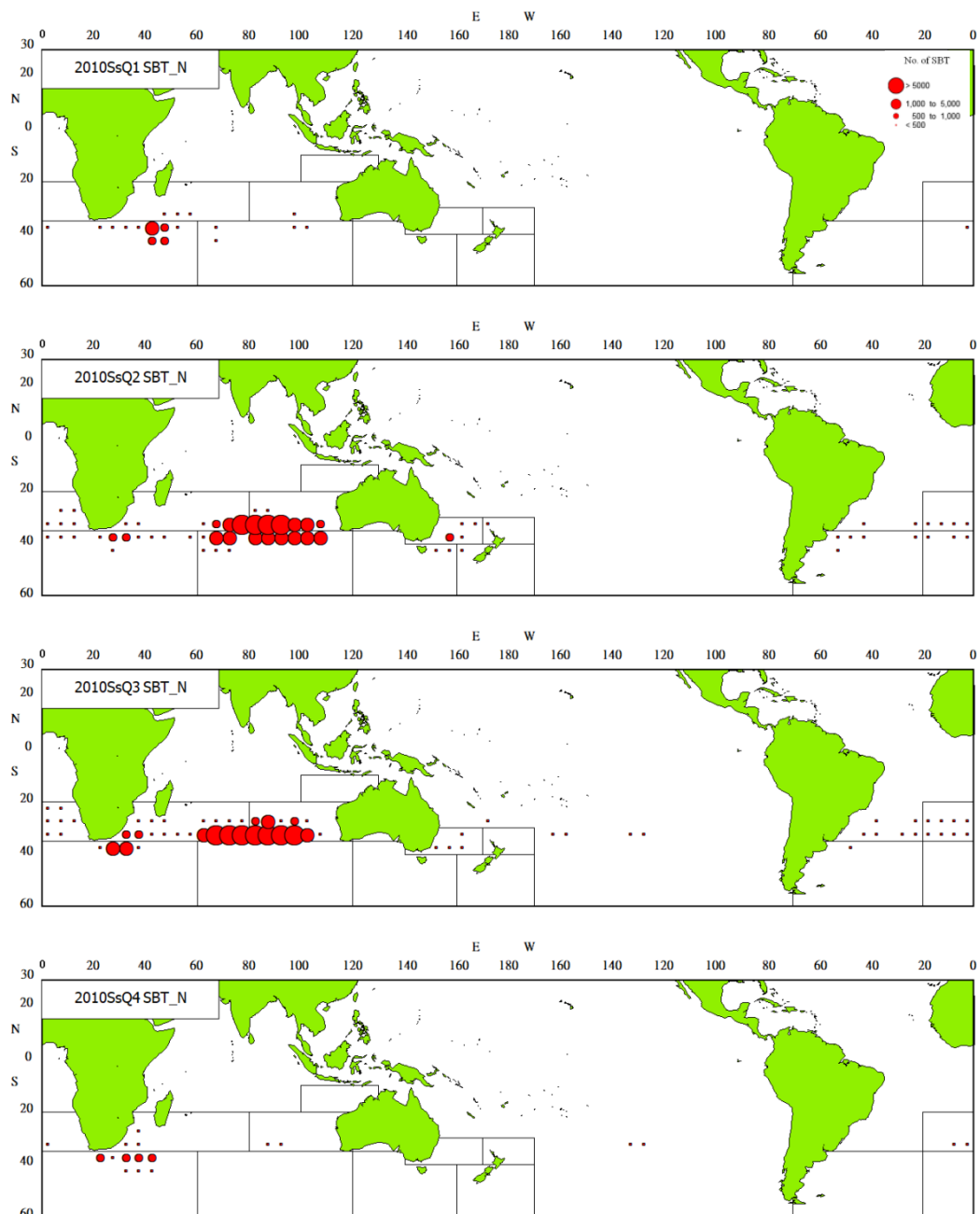


Fig.7 (2) SBT catch (in number) distributions by quarter of Taiwanese SBT longline fishery during 2010-2018

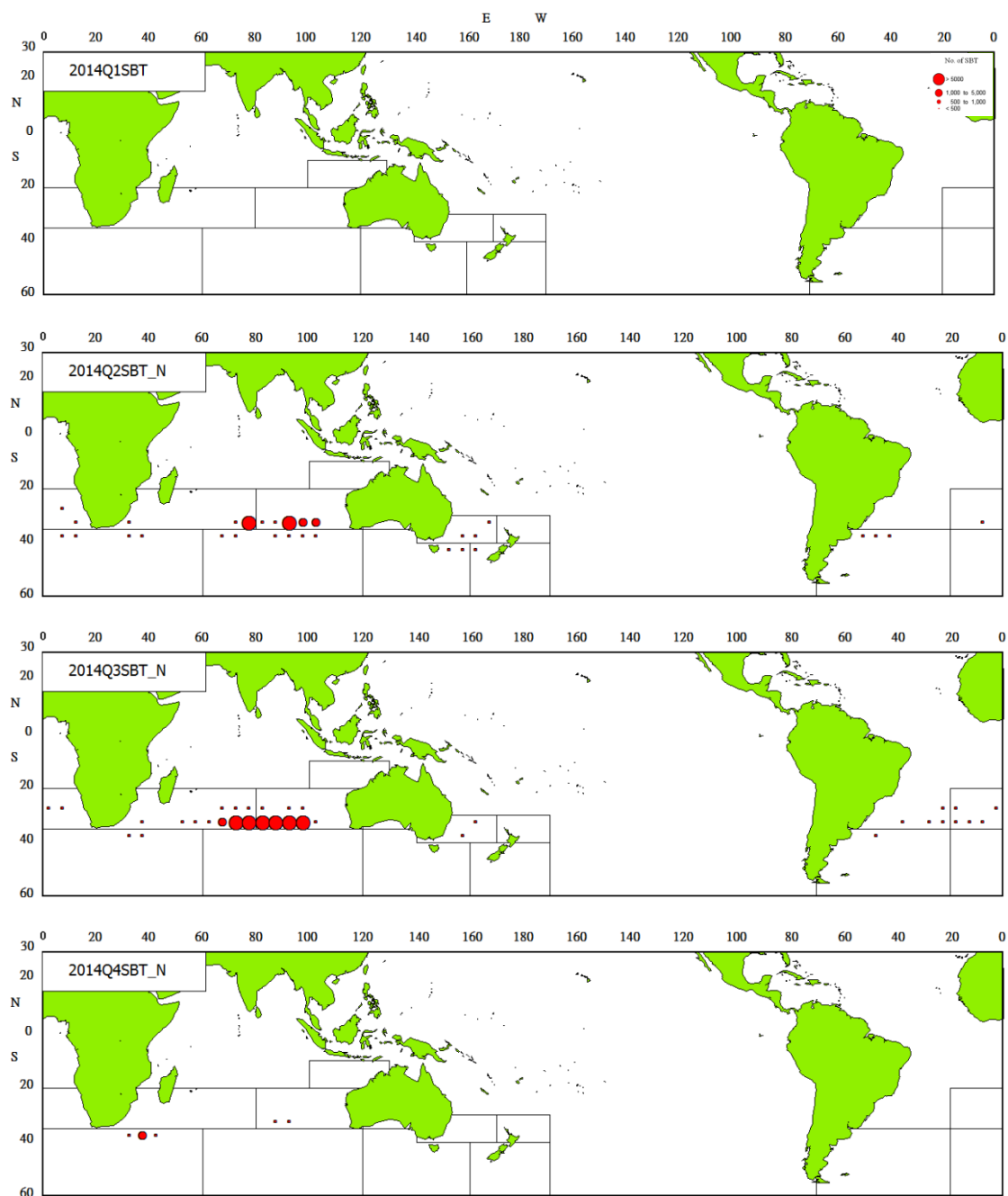


Fig.8 (1) SBT catch (in number) distributions by quarter of Taiwanese SBT longline fishery in 2014

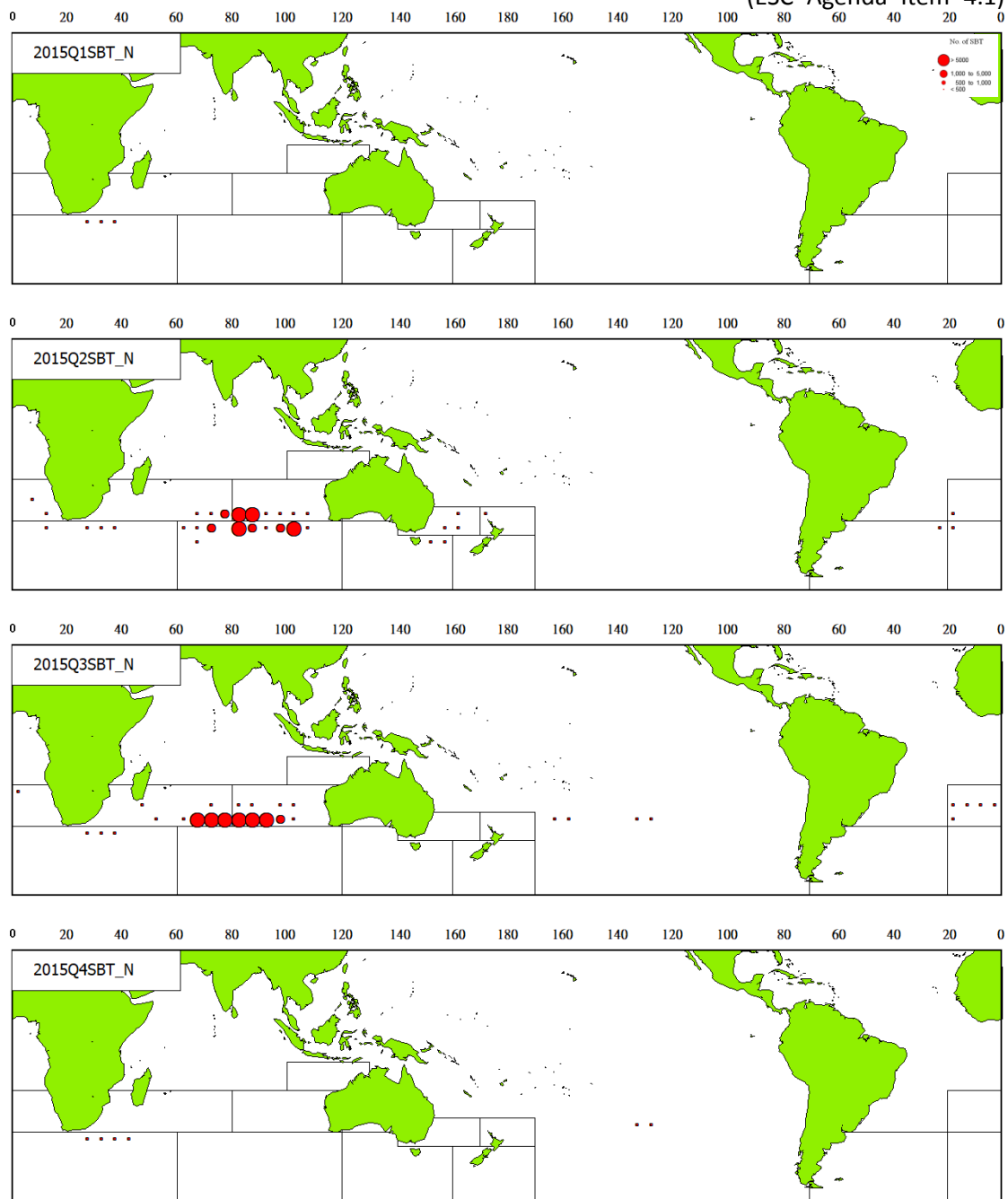


Fig.8 (2) SBT catch (in number) distributions by quarter of Taiwanese SBT longline fishery in 2015

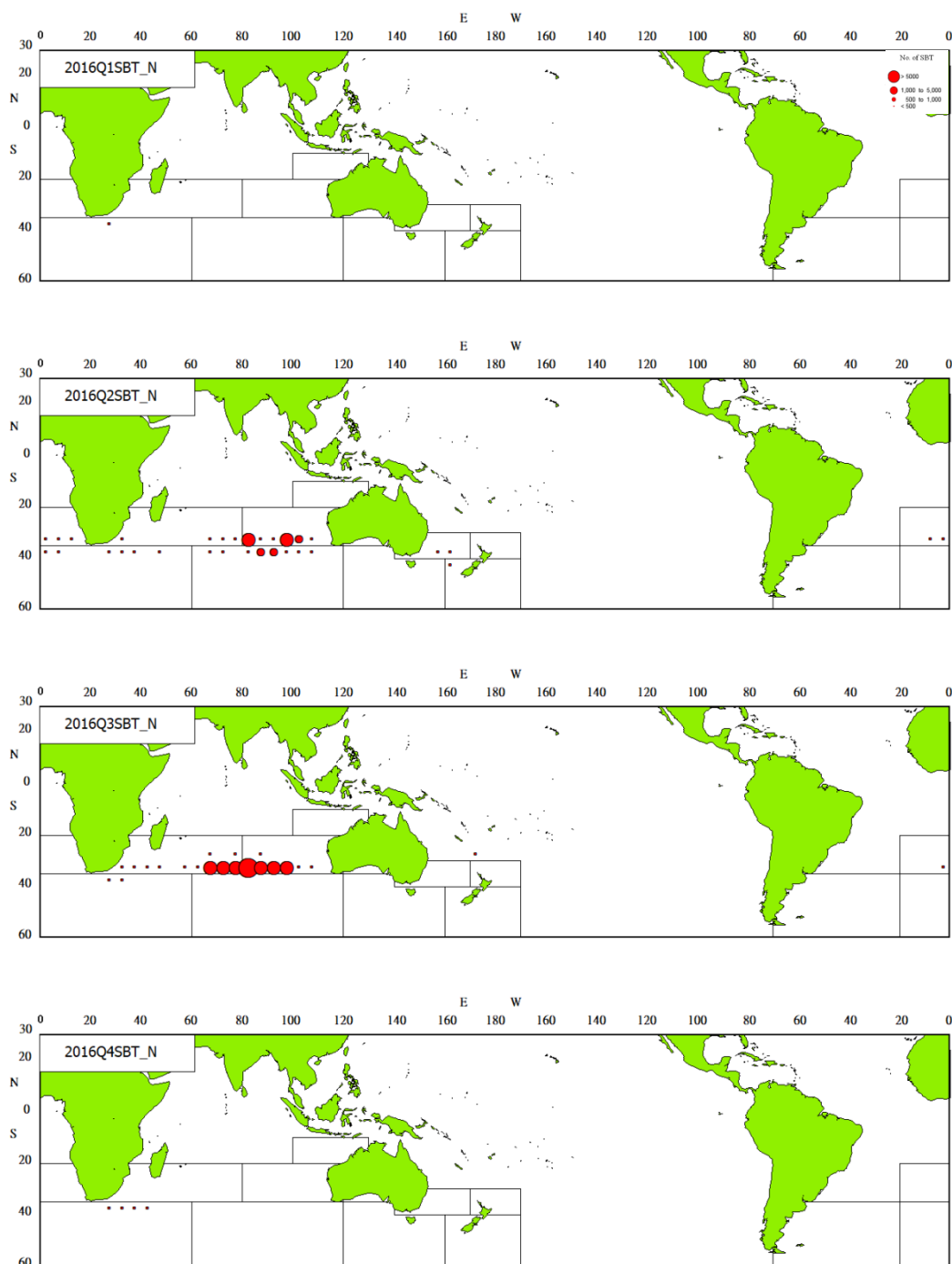


Fig.8 (3) SBT catch (in number) distributions by quarter of Taiwanese SBT longline fishery in 2016

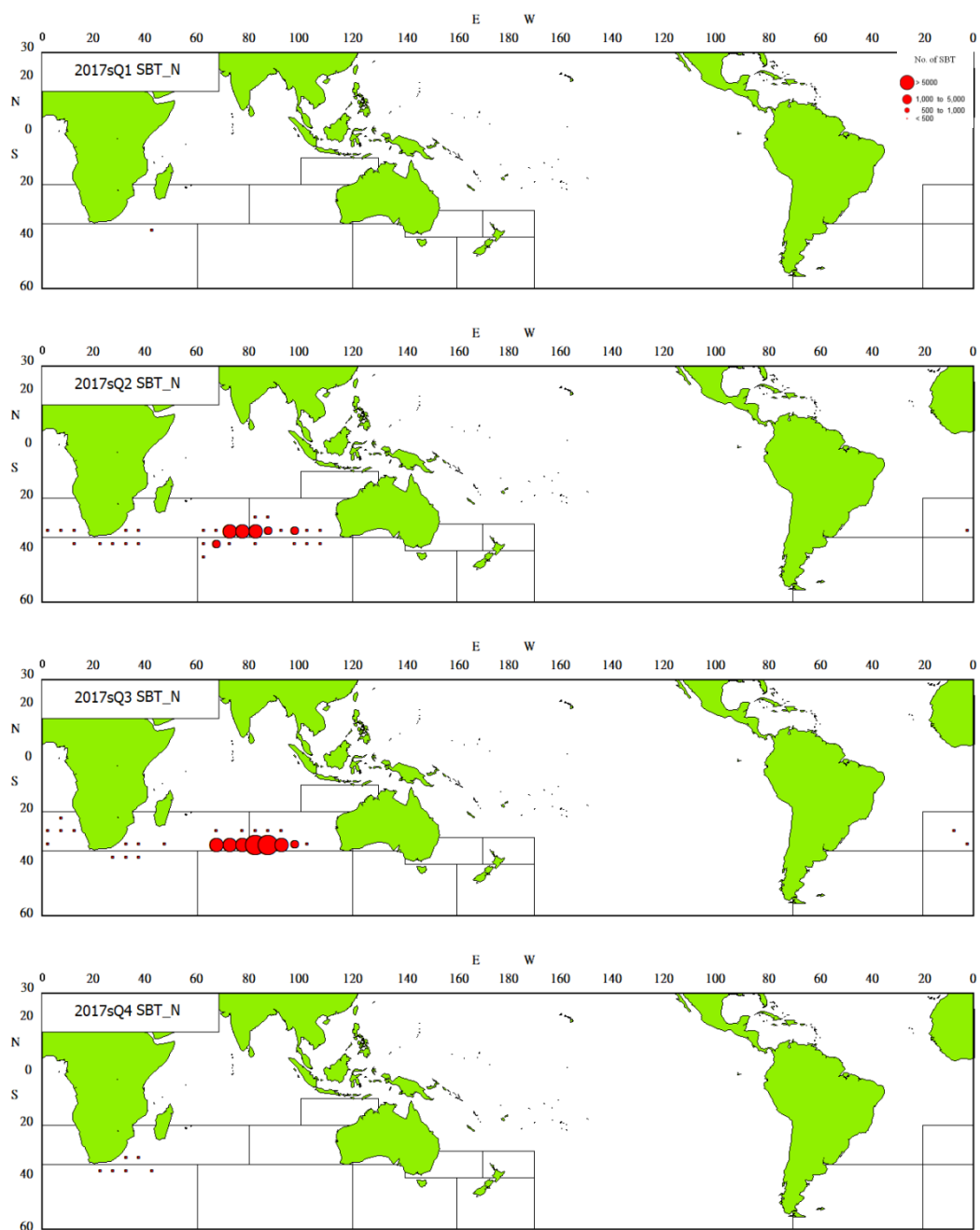


Fig.8 (4) SBT catch (in number) distributions by quarter of Taiwanese SBT longline fishery in 2017

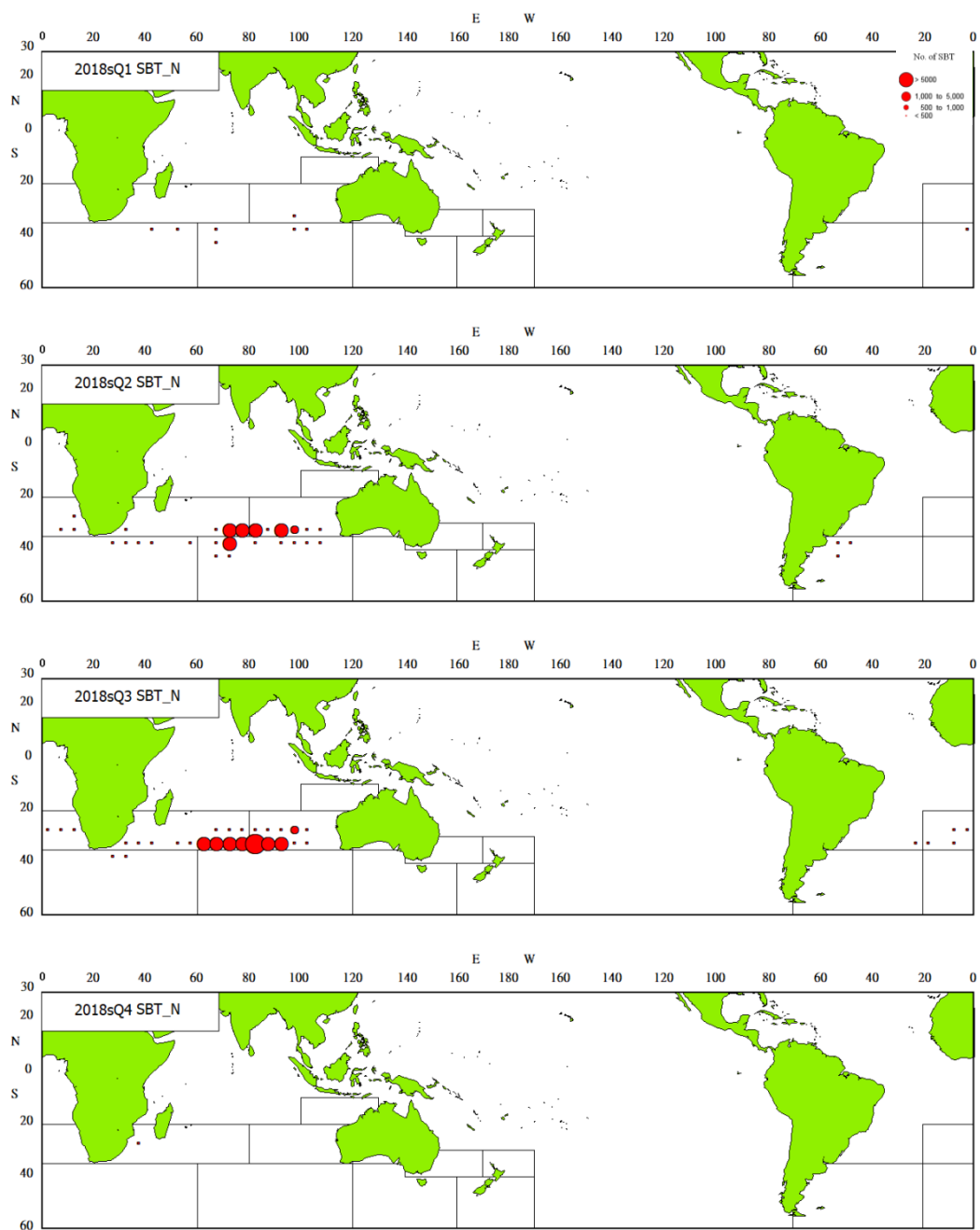


Fig.8 (5) SBT catch (in number) distributions by quarter of Taiwanese SBT longline fishery in 2018

Annex 1

Scientific Observer Program

Observer Training

To collect scientific information of tuna longliners, the scientific observer program of large scale tuna longline fishery of Taiwan was launched in 2002. After trained, observers started being deployed on board and conducting the observation program of SBT in the following year.

To work in coordination with the Fisheries Agency (FA), the Overseas Fisheries Development Council (OFDC) is responsible for implementing the program and recruiting scientific observers. The Program also invited researchers on fishery sciences and senior observers to form a special panel for designing the observer training program, items of observation, biological and by-catch information to be collected for scientific researches and the format of data records.

The qualifications of recruitment for observer is senior high school graduation, with experience on-board preferred. They are also required the competence to live and work at sea. Candidate observers who have passed the oral examination will have to take a 4-week training program, and only those who pass the training program and medical check will be qualified and deployed on board as scientific observers.

Observer training program includes basic safety training for seafaring, operations of navigation devices and VMS system, identification of catch species, sea turtles, seabirds, sharks and marine mammals, sampling skill for muscle tissue, otolith, stomach content and gonad, and data collection for fishing activities, catches and locations, and basically understanding of Conservation and Management Measures and Resolutions of the RFMOs. After 3-weeks training, they are required to undergo at sea training on a training ship for one week and have a test in identifying tuna and tuna-like species at local fish market.

The Program held 4 batches of observer training in 2016, inviting experts and scholars to provide follow-up trainings on observer safety during maritime navigation, species identification, and sampling. The Program also conducted observer experiences

sharing events periodically, sharing at-sea observation practice, sampling technique, and potential problems that observers might encounter. In 2017 and 2018, 103 and 91 employed observers have finished the program respectively.

Scientific Observer Program Design and Coverage

At the initial stage, for the purpose of encouraging industries to join the observer program, the observed vessels were offered reward catch quota after completing the observation cruise, if they fully cooperated with the observer's duties. However, this measure has been put an end since 2007. It is regarded as the obligation of industries to accept observer on board and the vessels were selected to carry observer by draw a lottery. Since 2008, upon completion of the observation missions, debriefers, served by senior observers, will examine observer's reports so as to enhance data accuracy.

The threat of Somalia piracy still exists in the tropical Indian Ocean. The same as recent years, most of our observers deployed on fishing vessels which operate in the southern Indian Ocean for the safety of observers, therefore, the observer coverage rate for SBT fishing vessels maintaining stability. In 2017 calendar year, 11 observers were deployed on 11 of the 43 fishing vessels authorized to target SBT seasonally and 5 observers were deployed on 5 of the 32 fishing vessels authorized to bycatch SBT. There were 2,342 fishing days and observed days were 1,514. There were 11 observers being deployed on 11 of the 46 fishing vessels authorized to target SBT and 3 observers were deployed on 3 of the 31 fishing vessels authorized to bycatch SBT in 2018 and there were 2,338 fishing days and observed days were 1,809. In 2017, the coverage rate of observation was 21.3% by vessels, 10.0% by hooks and 11.6% by catch. The coverage rate was accounted for 18.2% by vessels in 2018, 12.7% by hooks, and 10.2% by catch. In order to conducting effectively monitoring, it is necessary for FA to considering expanding the observer program and budget to reduce the affluence of fishing vessels changing which may involve the coverage rates.

Observer Data Collected

The data recorded by observer on board includes 3 categories: vessel and gear

attributes, set details and by-catch/incidental catch information (including sighting of marine mammals, sea turtles and sea birds).

The biological samples, including measurement of weight and length of all fishes during the observation time, and collection of otoliths, muscle tissues, stomach and gonads of SBT, were carried out by observers on board. Table 2 shows the summary of biological samples by species collected by observers from 2017 and 2018. Total number of the length measured for SBT in 2017 and 2018 were 3,484 and 3,621 respectively. Number of otolith collected for SBT by observer were 106 in 2018. In 2017 and 2018, numbers of the length measured for per species were summarized by area and month as Table 3.

Tag Return Monitoring

The tags retrieved from SBT by Taiwanese fishing vessels are 779 in total among which 693 were released by the CCSBT and 86 tagged by CSIRO during 2002-2018. The details of tag recaptures for each year are shown in Table 4. The returned tags and the related information were sent to the CCSBT Secretariat.

Problems Experienced

Although the program was fully supported by boat owners and skippers of SBT observed vessels, there are still some difficulties that could not be resolved technically. For example: Sometimes the biological sampling device is damaged, but the homeport is far from the fishing ground, it will take more than 1 month to transport the supplies and equipment needed for sampling from Taiwan to fishing ground, and sometimes the supplies could not reach to observers on board in time. Besides, the samples collected by observers may be lost when they are transferred by transshipping vessels. In addition, it is also difficult to arrange interviews with skippers for collecting information on fishing activities since these SBT fishing vessels seldom return to Taiwan when they finished SBT fishing.

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Table 1 Summary of observed catch and effort by area and by month
(a) 2017 (calendar year)

Area	Month	Numbers of vessels observed	Numbers of all vessels	Cover rate for the number of vessels	Number of hooks used by observed vessels	Number of hooks by all vessels	Cover rate for the number of hooks	Number of SBT observed	Number of SBT by all vessels	Cover rate for the number of SBT
Area2	Total	9	35	25.71%	865523	6477769	13.36%	2676	20789	12.87%
	3	-	3	-	-	35600	-	-	0	-
	4	-	4	-	-	59600	-	-	9	-
	5	6	15	40%	120399	650678	18.50%	57	478	11.92%
	6	9	27	33.33%	330691	1998301	16.55%	656	5375	12.20%
	7	8	34	23.53%	300729	2484767	12.10%	1404	10770	13.04%
	8	5	21	23.81%	113704	1109583	10.25%	559	4005	13.96%
	9	-	3	-	-	139240	-	-	152	-
	Area8	Total	8	28	28.57%	338272	2877334	11.76%	219	2025
3		-	1	-	-	47000	-	-	0	-
4		5	19	26.32%	183804	1496016	12.29%	170	1094	15.54%
5		8	26	30.77%	154468	1243348	12.42%	49	697	7.03%
6		-	4	-	-	90970	-	-	234	-
Area9	Total	4	27	14.81%	16762	3725558	0.45%	10	863	1.16%
	1	-	1	-	-	47100	-	-	87	-
	2	-	1	-	-	100203	-	-	0	-
	3	-	3	-	-	303520	-	-	0	-
	4	1	13	7.69%	2376	495740	0.48%	1	30	3.33%
	5	-	10	-	-	503090	-	-	14	-
	6	-	9	-	-	316525	-	-	12	-
	7	-	9	-	-	312625	-	-	72	-
	8	1	12	8.33%	9315	364180	2.56%	7	151	4.64%
	9	2	13	15.38%	5071	426600	1.19%	2	174	1.15%
	10	-	7	-	-	346175	-	-	67	-
	11	-	4	-	-	353800	-	-	122	-
12	-	2	-	-	156000	-	-	134	-	
Area14	Total	12	53	22.64%	617700	5328463	11.59%	905	9132	9.92%
	3	1	3	33.33%	26424	115400	22.90%	-	0	-
	4	1	2	50%	3824	20800	18.38%	-	0	-
	5	3	15	20%	35409	514745	6.88%	35	493	7.10%
	6	6	35	17.14%	160504	1581326	10.15%	309	2358	13.15%
	7	10	38	26.32%	235879	1353898	17.42%	345	2934	11.76%
	8	6	36	16.67%	146026	1541413	9.47%	213	3176	6.71%
	9	3	10	30%	9634	177631	5.42%	3	152	1.97%
	10	-	3	-	-	18450	-	-	18	-
	11	-	1	-	-	4800	-	-	1	-
	Grand Total		16	75	21.3%	1838257	18409124	10.0%	3810	32809

* The areas which had observer deployed were appeared.

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(b) 2018 (calendar year)

Area	Month	Numbers of vessels observed	Numbers of all vessels	Cover rate for the number of vessels	Number of hooks used by observed vessels	Number of hooks by all vessels	Cover rate for the number of hooks	Number of SBT observed	Number of SBT by all vessels	Cover rate for the number of SBT
Area2	Total	6	29	20.69%	657454	4593181	14.31%	2358	16781	14.05%
	3	-	2	-	-	9920	-	-	2	-
	4	2	5	40%	14542	35516	40.94%	-	0	-
	5	4	13	30.77%	91084	442186	20.60%	116	430	26.98%
	6	5	19	26.32%	195057	1345765	14.49%	556	4600	12.09%
	7	6	27	22.22%	210365	1534223	13.71%	580	7536	7.70%
	8	5	14	35.71%	146406	985080	14.86%	1106	4013	27.56%
	9	-	6	-	-	240491	-	-	200	-
	Area8	Total	9	26	34.62%	573532	3992004	14.37%	497	2888
2		-	1	-	-	40200	-	-	0	-
3		4	14	28.57%	92987	806692	11.53%	135	551	24.50%
4		7	24	29.17%	223573	1506444	14.84%	61	757	8.06%
5		9	26	34.62%	195149	1326774	14.71%	124	781	15.88%
6		3	10	30%	61823	311894	19.82%	177	799	22.15%
Area9	Total	6	30	20%	231148	1763603	13.11%	28	521	5.37%
	1	-	1	-	-	63900	-	-	188	-
	2	-	1	-	-	3800	-	-	1	-
	3	-	3	-	-	199033	-	-	2	-
	4	5	10	50%	45542	430974	10.57%	2	3	66.67%
	5	4	13	30.77%	76882	374766	20.51%	9	65	13.85%
	6	3	14	21.43%	73444	321180	22.87%	10	76	13.16%
	7	2	10	20%	35280	210600	16.75%	7	88	7.95%
	8	-	5	-	-	56750	-	-	26	-
9	-	3	-	-	102600	-	-	72	-	
Area14	Total	10	53	18.87%	752571	7126418	10.56%	740	15481	4.78%
	1	-	1	-	-	9600	-	-	0	-
	2	-	1	-	-	3150	-	-	0	-
	3	-	1	-	-	18900	-	-	0	-
	4	2	8	25%	7238	65025	11.13%	-	0	-
	5	7	14	50%	119182	657389	18.13%	9	27	33.33%
	6	6	31	19.35%	160042	1635700	9.78%	326	3612	9.03%
	7	7	43	16.28%	219478	2197515	9.99%	302	8496	3.55%
	8	6	38	15.79%	218489	1789290	12.21%	103	2987	3.45%
	9	3	11	27.27%	28142	490104	5.74%	-	259	-
10	-	5	-	-	259745	-	-	100	-	
Grand Total		14	77	18.2%	2214705	17475206	12.7%	3623	35671	10.2%

* The areas which had observer deployed were appeared.

Table 2 Number of biological samples collected by observers in 2017 and 2018

Year		2017	2018
SBT catch data recorded		3810	3623
SBT length measured		3484	3621
Otolith	SBT	60	106
Gonad	SBT	141	134
Muscle	Marlin	1	0
	Sharks	93	11
	Other fish	6	0
Vertebra	Sharks	128	93
Embryo	Sharks	4	0
caudal peduncle	Mahi mahi	51	51

Table 3 Number of the length measured for per species by area and by month
(a) 2017

Area	Area 2				Area 8		Area9			Area 14						
	5	6	7	8	4	5	4	8	9	3	4	5	6	7	8	9
Albacore	2325	4848	3616	1382	3944	4255	-	2	3	191	32	627	4301	3359	2501	9
Bigeye tuna	30	205	175	106	27	40	1	-	-	19	-	53	239	313	170	3
Pomfrets	14	29	18	7	6	3	-	-	-	-	-	-	-	-	-	-
Blue shark	38	48	81	80	67	56	-	-	-	13	5	-	8	15	49	-
Butterfly kingfish	25	63	29	1	220	71	-	-	-	-	-	-	-	-	-	-
Blue marlin	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Rudderfish	4	8	2	1	1	-	-	-	-	-	-	-	-	1	4	-
Common dolphinfish	-	14	5	6	8	2	-	-	-	35	10	-	3	6	2	-
Opah	356	517	412	120	445	457	-	-	10	-	-	56	227	218	129	1
Escolar	68	299	271	192	39	43	35	43	51	10	4	35	223	526	184	137
Longfin mako	-	-	-	-	-	1	-	-	-	-	-	-	2	1	-	-
Striped marlin	-	1	1	-	-	-	-	-	-	1	-	-	-	-	1	-
Oilfish	-	7	12	2	6	-	80	192	91	-	-	-	20	102	3	76
Southern bluefin tuna	56	569	1170	559	170	49	1	3	2	-	-	35	309	345	213	3
Indo-Pacific sailfish	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Skipjack tuna	3	-	-	-	-	1	-	-	-	2	-	-	-	-	-	-
Shortfin mako	5	20	3	3	4	2	-	-	-	-	-	1	3	1	2	-
Longbill spearfish	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Shortbill spearfish	3	1	5	3	-	-	-	-	-	-	-	-	4	4	3	-
Swordfish	12	44	34	14	20	23	-	-	1	-	-	1	18	44	17	2
Tunas nei	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wahoo	-	2	7	2	1	-	-	-	-	14	3	18	52	21	17	-
Yellowfin tuna	-	2	-	7	-	-	-	-	-	6	-	1	11	4	12	-

* The areas which had observer deployed were appeared.

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(b) 2018

Area	Area 2					Area 8				Area 9				Area 14					
	4	5	6	7	8	3	4	5	6	4	5	6	7	4	5	6	7	8	9
Albacore	491	1414	3637	3323	1049	2397	3649	4055	1471	504	103	102	6	67	1302	2539	2385	1782	353
Bigeye tuna	3	22	60	118	25	26	58	43	30	3	15	20	3	-	128	92	72	147	16
Black marlin	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blue marlin	-	-	1	1	-	-	1	1	-	-	-	-	-	-	1	1	-	-	-
Pomfrets	1	5	29	17	24	3	9	2	-	1	5	-	-	2	-	2	6	21	-
Blue shark	2	16	12	65	23	97	149	49	6	32	1	7	3	3	30	20	26	44	8
Butterfly kingfish	16	31	7	4	6	1	34	12	-	1	-	-	-	-	-	-	-	-	-
Rudderfish	-	-	2	2	2	-	2	2	3	-	1	-	-	-	1	3	2	-	-
Common dolphinfish	-	5	5	2	-	3	30	58	-	14	-	-	1	3	59	3	2	11	2
Silky shark	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Opah	51	164	316	348	266	150	427	420	113	69	1	10	1	4	124	199	116	230	62
Escolar	1	38	167	137	66	29	69	67	38	141	537	647	249	3	149	185	1026	908	51
Striped marlin	-	1	-	1	-	-	2	-	-	-	-	-	-	-	5	-	-	1	-
Oilfish	-	1	3	2	7	2	2	3	2	217	1462	1777	980	-	60	114	1353	1090	7
Rainbow runner	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Southern bluefin tuna	2	114	556	581	1106	135	61	124	175	2	9	10	7	-	9	325	302	103	-
Indo-Pacific sailfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-
Skipjack tuna	-	-	-	-	-	-	2	2	-	-	-	-	-	-	2	1	-	-	-
Shortfin mako	-	1	8	5	5	7	2	1	-	1	4	4	3	-	1	3	4	1	-
Shortbill spearfish	-	1	4	7	-	-	1	-	-	-	-	-	-	-	10	3	1	1	-
Swordfish	6	12	28	16	8	1	10	11	6	3	4	7	4	-	5	7	10	7	-
Wahoo	-	5	2	18	2	-	20	29	-	-	2	-	-	3	64	25	13	24	8
Yellowfin tuna	-	18	1	4	-	-	18	9	1	5	7	7	1	1	86	25	18	67	1

* The areas which had observer deployed were appeared.

Table 4 Number of SBT tag returned during 2002-2018

Year	Total		
		CCSBT	CSIRO
2002	18	2	16
2003	42	24	18
2004	133	112	21
2005	229	204	25
2006	259	253	6
2007	40	40	0
2008	5	5	0
2009	0	0	0
2010	27	27	0
2011	13	13	0
2012	5	5	0
2013	5	5	0
2014	1	1	0
2015	2	2	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
Grand Total	779	693	86