

National Report

Tuna Fisheries Status Report of Chinese Taipei in the Western and Central Pacific Region

Fisheries Agency, Council of Agriculture and
Overseas Fisheries Development Council

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<p><i>Scientific data was provided to the Commission in accordance with the decision relating to the provision of scientific data to the Commission by 30 April 2016</i></p>	<p>Yes</p>
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Summary

Three Taiwanese tuna fishing fleets are currently operating in the WCPFC Convention Area, namely large scale tuna longline fleet (LTLL, previous named FTLL), distant-water purse seine fleet (DWPS) and small scale tuna longline fleet (STLL, previous named CTLL). In 2015, the total catches of main tuna and tuna-like species for the three fleets were 17,569 MT for LTLL, 194,249 MT for DWPS and 29,936 MT for STLL, respectively. In 2015, 23 observers were deployed on the tuna longline fishing vessels operating in the Pacific Ocean.

1. Annual fisheries' information

The Pacific Ocean is the earliest fishing ground for Taiwanese tuna fisheries. Currently, there are three tuna fishing fleets operating in the WCPFC Convention Area: large scale tuna longliners (LTLL), distant-water purse seiners (DWPS) and small scale tuna longliners (STLL). All LTLL and DWPS vessels operate outside the EEZ of Taiwan; most of the STLL vessels operate in the EEZ of Taiwan with some operate on the high seas or in the PICS' EEZ through relevant agreements.

1.1 Fleet structure

Table 1 shows the numbers of active vessel of LTLL, DWPS and STLL fleets in recent five years (2011-2015) in the WCPFC Convention Area.

1.1.1 LTLL

The LTLL vessels refer to those vessels larger than 100 GRT. The number of active vessels was 95 in 2011 which was an increase from previous years due to shifting of some vessels from the Indian Ocean for piracy issue. These increased vessels have gradually returned to the Indian Ocean thereafter and so the number of active LTLL decreased year by year. In 2014, the number of active LTLL decreased further to 73 because nine LTLLs temporarily ceased operation for financial loss. However, the number of active LTLL fishing vessels had a slight return to 76 in 2015.

1.1.2 DWPS

Tuna purse seine fishery was introduced into Taiwan in 1982 and has become one of our major fishing fleet operating in WCPO. In 1992 the fleet reached its peak of 45 vessels, and reduced to 42 due to adjustment of business strategy of some companies. The fleet further reduced to 34 authorized in 2004 and maintained at this level ever since. The number of active purse seiners reached the lowest of recent years at 32 in 2009 for 2 fishing vessels sank, and returned to 34 in 2010 with 2 new building ones. There were 34 DWPS active vessels operating in the WCPFC Convention Area in 2015.

1.1.3 STLL

The STLL fleet operates both within and beyond the EEZ of Taiwan. Some with freezing equipment extended their fishing grounds to more distant waters operating in a similar pattern as LTLL vessel. They change their fishing grounds and target species based on fishing season and market price. In 2015 there were 1,306 STLL vessels operating in the WCPFC Convention Area.

1.2 Annual Catch in the WCPFC Convention Area

1.2.1 LTLL

The catch of major tuna and tuna-like species caught by LTLL fishery in the recent five years (2011-2015) in the WCPFC Convention Area is shown in Table 2. The catch composition distribution of tuna and tuna-like species of LTLL in recent 5 years (2011-2015) is shown in Figure 1. Mean catch percentage of major tuna and tuna-like species of our LTLL fishery in the WCPFC Convention area in the recent five years is shown in Figure 2. The dominant species of catch were albacore (34.9%), bigeye tuna (33.7%) and yellowfin tuna (13.4%).

1.2.2 DWPS

The catch of major tuna species in the WCPFC Convention Area during 2011-2015 is shown in Table 3. The most dominant species remained to be skipjack, accounting for about 87.1% of the total catch, followed by yellowfin tuna and bigeye tuna, which accounts for 11.3% and 1.6% of the total catch, respectively (Figure 3). The catch composition distribution of DWPS in recent 5 years (2011-2015) is shown in Figure 4.

1.2.3 STLL

Total catch of mainly tuna and tuna-like species caught by domestic vessels in 2015 was 7,441 MT. The dominant species of catch are yellowfin tuna (38%), billfish (27%), swordfish (17%) and bigeye tuna (9%). As to those landed in foreign ports, yellowfin and bigeye are the main species of catch. Total catch of main species by STLL from 2011 to 2015 in WCPFC Convention Area is shown in Table 4. The catch composition distribution of tuna and tuna-like species of STLL during 2013-2015 is shown in Figure 5.

1.3 Fishing Patterns

1.3.1 LTLL

LTLL fleet can be divided into two groups in accordance with target species, namely bigeye tuna targeting longline fleet operating mainly in tropical area (between 15°N and 15°S), and albacore targeting longline fleet operating in subtropical and temperate waters. The fleet targeting bigeye tuna usually conducts a year round operation, and transship their catches to transport vessels and receive fuel and supplies during transshipment. Those fishing for albacore usually entered fishing ports in the Pacific twice a year for catch landing, fuel and supply receiving. The fishing effort distribution in recent 5 years (2011-2015) is shown in Figure 6.

1.3.2 DWPS

The DWPS vessels mainly operate in the tropical waters close to the equator area targeting on skipjack. Since most of the fishing grounds are located in the EEZs of PICs, these vessels acquire fishing permits through access agreements with PICs, including PNG, FSM, Nauru, Marshall Islands, Solomon Islands, Tuvalu and Kiribati.

In early 1980s, logs were used as fish aggregation objects and sets were made on schools associated with these floating objects. This practice continued throughout the 80s and early 90s. Successful exploitation on free-swimming schools in mid 1990s has made free school setting to be the most prevailing fishing method. In 2015, about 58.2% sets were deployed on free school.

The fishing effort distributions in recent 5 years (2011-2015) is shown in Figure 7. In 2015, the fishing ground moved eastwards, compared to the previous years.

1.3.3 STLL

Most of STLL based at domestic or foreign ports mainly target on YFT for fresh sashimi markets, while some STLL vessels target on billfish or albacore. Flake ice is used as coolant on the STLL vessels, but some are equipped with freezing equipment for better preservation of their catches. The fishing effort distribution in recent 3 years (2013-2015) is shown in Figure 8.

1.4 Estimated total catches of non-target, associated and dependent species

The LTLL logbook format had been revised in 2003 to accommodate 4 more shark species (blue shark, silky shark, shortfin mako, and other sharks), sea birds, sea turtles and marine mammals. To compliance with CMM 2008-06 and CMM 2009-04, the logbook format had been revised again and included more shark species (thresher shark, tiger shark, white shark, porbeagle shark, crocodile shark, hammerhead shark and oceanic white tip shark) into logbook recording items. Annual catch of key shark species of LTLL, STLL and DWPS in 2015 is shown in Table 5.

In 2014, our observers had recorded 7 sea turtles (1 loggerhead, 2 leatherback, 1 green, 1 olive ridley and 2 unidentified turtles), 19 seabirds (1 black-footed albatross, 15 albatross nei and 3 white-chinned petrel), 2 cetaceans (1 bottlenose dolphin, 1 false-killer whale) hooked with 9,304 seabirds and 143 cetaceans sighted. In 2015, our observers had recorded 13 sea turtles (11 green, 1 leatherback and 1 olive ridley turtles), 6 seabirds (1 buller's albatross, 1 Christmas Island frigatebird, 1 sooty shearwater, 1 wandering albatross and 1 white capped albatross) and 1 cetaceans (1 false-killer whale) hooked with 3903 seabirds and 82 cetaceans sighted. Because some observation trips of 2015 have not finished in 2016, the observer data of 2015 is still in preliminary now. As for the information on cetaceans and whale sharks encircled by our purse seiners is described in section 3.8.

1.5 Trends in the fishery and future prospects of the fishery

In view of conservation of tuna species, it is the policy of the government to maintain the size of its fleets to a level that is commensurate with the availability of fishing possibilities. The government will continue implementing the policy of limited entry in tuna fisheries.

2. Research and statistic

2.1 Summary of observer programs

For better understanding the fishing activities and bycatch of the longline fishery, FA launched a pilot observer program in 2002. During 2010-2014, the number of observers deployed on LTLL, STLL and DWPS fleets in Pacific Ocean is shown in Table 6. In accordance with the government's policy in establishing an observers program and supporting the increase of observers, in 2012 the observer program was extended to the STLL fleets. Totally the number of observers deployed on longline vessels in 2015 was 23, including 12 observers for LTLL vessels and 11 observers for STLL vessels respectively.

Our observer program had received interim authorization in 2009 and received full authorization after auditing in November 2011. The forms used in our observer program are fully conformed to the standards set by WCPFC which include the fishing activities, catch number and weight, species identification, bycatch species and status. In addition, length frequency of major species and the sighting and incidental catch of ecological species were recorded, and biological samplings were

collected for biological research.

2.2 Research activities

For the purpose of improving stock assessment of highly migratory species in the Pacific Ocean, government of Taiwan has commissioned scientists to conduct a series of researches in 2015 as follows :

- Studies on abundance index and stock assessment of tropical tuna in the Western and Central Pacific and bluefin tuna in the Pacific Ocean.
- A study on CPUE standardization and stock status for billfishes in the three oceans.
- Study on age composition of southern bluefin tuna and Pacific bluefin tuna in the longline fishery.
- Study on the Pacific albacore resource.
- Studies of shark by-catch, abundance index and non-detriment findings in the three Oceans.
- Research on Incidental Catch of Ecological Related Species by Taiwanese Distant Water Tuna Longline Fisheries
- Study of reducing seabird bycatch operated on small-scale longline vessels in the Western and Central Pacific.
- Feasibility analysis on the fishing condition forecast of albacore tunas for the Taiwanese tuna longline fishery in the three oceans.
- Feasibility analysis on the fishing condition forecast of yellowfin and bigeye tunas for the Taiwanese tuna longline fishery in the three oceans.
- Feasibility analysis on the fishing condition forecast of swordfish for the Taiwanese tuna longline fishery in the three oceans.
- The feasibility analysis on purse seine fishing condition of skipjack tuna in the western and central Pacific Ocean.

The scientific papers presented at recent Pacific Ocean RFMOs meetings during 2015 to 2016 were as follows:

- Revised CPUE standardization and catch estimate of shortfin mako shark, caught by the Taiwanese large-scale longline fishery in the North Pacific Ocean. (ISC/15/SHARKWG-1/07)
- Standardized CPUE of striped marlin for the Taiwanese distant-water tuna longline fishery in the western and central North Pacific Ocean. (ISC/15/BILLWG-1/09)
- Catch and length data of striped marlin (*Kajikia audax*) from Taiwanese fisheries in the western and central North Pacific Ocean. (ISC/15/BILLWG-1/08)
- Stock Assessment of Striped Marlin (*Kajikia audax*) in the Western and Central North Pacific Ocean Using an Age-structured Model: Updated to 2013. (ISC/15/BILLWG-2/03)
- Estimation of standardized CPUE SERIES of Pacific bluefin tuna for Taiwanese longline fishery under incomplete data. (ISC/15/PBFWG-2/10)
- Update of Standardized PBF CPUE Series for Taiwanese Longline Fishery. (ISC/16/PBFWG-1/02)
- CPUE Standardization of Blue Marlin (*Makaira nigricans*) for the Taiwanese Distant-Water Tuna Longline Fishery in the Pacific Ocean. (ISC/16/BILLWG-1/10)

The scientific papers published on scientific journal during 2015 to 2016 were as follows:

- Brodziak, J., Mangel, M., & Sun, C. L. (2015). Stock-recruitment resilience of North Pacific striped marlin based on reproductive ecology. *Fisheries Research*, 166, 140-150.
- Chang, Y. J., Brodziak, J., O'Malley, J., Lee, H. H., DiNardo, G., & Sun, C. L. (2015). Model selection and multi-model inference for Bayesian surplus production models: a case study for Pacific blue and striped marlin. *Fisheries Research*, 166, 129-139.
- Chiang, W. C., Musyl, M. K., Sun, C. L., DiNardo, G., Hung, H. M., Lin, H. C., ... & Kuo, C. L. (2015). Seasonal movements and diving behaviour of black marlin (*Istiompax indica*) in the northwestern Pacific Ocean. *Fisheries Research*, 166, 92-102.
- Hui Chen, H., Chang, C. H., Sun, C. L., Shao, K. T., Yeh, S. Z., & DiNardo, G. (2016). Population Structure of Blue Marlin, *Makaira nigricans*, in the Pacific and Eastern Indian Oceans. *Zoological Studies* (in press).
- Joung, S. J., Chen, C. C., Liu, K. M., & Hsieh, T. C. (2015). Age and growth estimates of the Kwangtung skate *Dipturus kwangtungensis* in the waters of northern Taiwan. *Journal of the Marine Biological Association of the United Kingdom*, 1-8.
- Joung, S. J., Chen, J. H., Chin, C. P., & Liu, K. M. (2015). Age and Growth of the Dusky Shark, *Carcharhinus obscurus*, in the Western North Pacific Ocean. *Terrestrial, Atmospheric & Oceanic Sciences*, 26.
- Joung, S. J., Chen, N. F., Hsu, H. H., & Liu, K. M. (2016). Estimates of life history parameters of the oceanic whitetip shark, *Carcharhinus longimanus*, in the western North Pacific Ocean. *Marine Biology Research* (Accepted).
- Lee, M. A., Chang, Y., & Shimada, T. (2015). Seasonal evolution of fine-scale sea surface temperature fronts in the East China Sea. *Deep Sea Research Part II: Topical Studies in Oceanography*, 119, 20-29.
- Liu, K. M., Chin, C. P., Chen, C. H., & Chang, J. H. (2015). Estimating Finite Rate of Population Increase for Sharks Based on Vital Parameters. *PloS one*, 10(11), e0143008.
- Punt, A. E., Su, N. J., & Sun, C. L. (2015). Assessing billfish stocks: a review of current methods and some future directions. *Fisheries Research*, 166, 103-118.
- Su, N. J., Sun, C. L., Punt, A. E., Yeh, S. Z., & DiNardo, G. (2015). Environmental influences on seasonal movement patterns and regional fidelity of striped marlin *Kajikia audax* in the Pacific Ocean. *Fisheries Research*, 166, 59-66.
- Su, N. J., Sun, C. L., Tai, C. Y., & Yeh, S. Z. (2016). Length-based estimates of growth and natural mortality for blue marlin (*Makaira nigricans*) in the northwest Pacific Ocean. *Journal of Marine Science and Technology*, 24(2), 370-378.
- Sun, C. L., Chang, H. Y., Liu, T. Y., Yeh, S. Z., & Chang, Y. J. (2015). Reproductive biology of the black marlin, *Istiompax indica*, off southwestern and eastern Taiwan. *Fisheries Research*, 166, 12-20.
- Sun, C. L., Yeh, S. Z., Liu, C. S., Su, N. J., & Chiang, W. C. (2015). Age and growth of Black marlin (*Istiompax indica*) off eastern Taiwan. *Fisheries Research*, 166, 4-11.
- Tsai, C. N., Chiang, W. C., Sun, C. L., Shao, K. T., Chen, S. Y., & Yeh, S. Z. (2015). Stomach content and stable isotope analysis of sailfish (*Istiophorus platypterus*) diet in eastern Taiwan waters. *Fisheries Research*, 166, 39-46.

- Tsai, W. P., Liu, K. M., Punt, A. E., & Sun, C. L. (2015). Assessing the potential biases of ignoring sexual dimorphism and mating mechanism in using a single-sex demographic model: the shortfin mako shark as a case study. *ICES Journal of Marine Science: Journal du Conseil*, 72(3), 793-803.
- Tsai, W. P., Sun, C. L., Liu, K. M., Wang, S. B., & Lo, N. C. (2015). Cpue Standardization and Catch Estimate of Blue Shark by Taiwanese Large-Scale Tuna Longline Fishery in the North Pacific Ocean. *Journal of Marine Science and Technology*, 23(4), 567-574.

2.3 Statistics data collection system

Logbooks of LTLL, STLL and DWPS fishing vessels authorized to operate in WCPFC Convention Area are collected while calling port or transshipping. All fleets are required to submit catch reports periodically while fishing: fishing vessels of LTLL and DWPS report weekly and the STLL fishing vessels operating outside of our EEZ report monthly.

To collect fishery data in real time, Taiwan implemented electronic logbook reporting on LTLL and DWPS fleets in 2014, and which was applied to STLL fleet in 2015. Fishing vessels are required to transmit their fishing data daily.

In addition, the fishing vessels and the fish traders have to report the trade and transshipment data. Market State data on LTLL are collected from the Organization for the Promotion of Responsible Tuna Fishery (OPRT) and from fish traders at foreign ports; as to the landing of STLL fishery in foreign ports, information on the fishing activities of the fishery was obtained from port States trading companies and such information together with available commercial trade data was used for the catch estimation.

2.4 Data coverage of catches, effort and size data for all species

2.4.1 Longline fisheries

The logbook is the main data source of catch and effort for all species, supplemented by trade data. The size data of all species is mainly from the first 30 fish caught for each setting recorded on logbook. A port-sampling program conducted in domestic ports aims at collecting the length data of tuna and tuna-like catch. The observer program has been collecting size data for all species. These data have already been used and reported in some researches.

2.4.2 DWPS fishery

The logbook is the source of catch and effort data. Trade data has been collected for estimating the catch composition of bigeye tuna and yellowfin tuna. Length data was collected from fishing vessels. To strengthen length data collection of DWPS fishery, the fishing fleet started collecting length data from December, 2013. At least ten fishes, mainly skipjack and tuna species, are measured the fork length randomly per set.

3. Implementation of Conservation and Management Measure

3.1 CMM 2005-03

In accordance with CMM 2005-03, all CCMs shall report annually to the WCPFC Commission all catches of albacore north of the equator and all fishing effort north of the equator in fisheries directed at albacore. In 2015, the total catch of north Pacific albacore made by our fishing fleet was 3,020 MT with 2,635 MT in the north Convention area, and 23 LTLL vessels directed at albacore in the North Pacific Ocean

with 2,401 fishing days; 2,150 days was deployed in the north Convention area.

3.2 CMM 2006-04

In accordance with CMM 2006-04, CCMs shall report annually to the Commission the catch levels of their fishing vessels that have taken striped marlin as a bycatch as well as the number and catch levels of vessels fishing for striped marlin in the Convention Area south of 15°S. The bycatch of striped marlin in the Convention area south of 15°s during the period 2011-2015 is shown in Table 7. None of our fishing vessel targets on striped marlin.

3.3 CMM 2007-01

In order to estimate observer coverage rates on longline vessels fishing according CMM 2007-01 and in accordance with the decision of WCPFC11, Table 8 provides the information of observer coverage rate estimates for LTL and STLL of 2015.

3.4 CMM 2009-03

In accordance with CMM 2009-03, the number of the fishing vessels for swordfish in the Convention Area south of 20°S was limited to the number in any year during 2000-2005, and the catch of swordfish caught in the Convention Area south of 20°S is limited to the amount caught in any year during the period 2000-2006. The information mentioned above is shown in Table 9.

3.5 CMM 2009-06

In accordance with CMM 2009-06, CCMs shall report on all transshipment activities (including transshipment activities that occur in ports or EEZs) in Part 1 of its Annual Report. Table 10 shows the information of transshipment activities of our fishing fleets in 2015.

3.6 CMM 2010-05

In accordance with CMM 2010-05, CCMs shall report annually to the Commission the catch levels of their fishing vessels that have taken South Pacific Albacore as a bycatch as well as the number and catch levels of vessels actively fishing for South Pacific albacore in the Convention area south of 20°S. The catch of South Pacific albacore in the convention area south of 20°s during the period 2006-2015 and the number of longline vessels fishing are shown in Table 11.

3.7 CMM 2010-07

In accordance with CMM 2010-07, each CCM shall include key shark species, as identified by the Scientific Committee, in their annual reporting to the Commission of annual catch and fishing effort statistics by gear type, including available historical data, in accordance with the WCPF Convention and agreed reporting procedures. The total catch of key shark species by fishery in 2015 shows in Table 5.

3.8 CMM 2011-03 and CMM 2012-04

In accordance with CMM 2011-03 and CMM 2012-04, CCMs shall advise in their Part 1 Annual Report of any instances in which cetaceans and whale sharks have been encircled by the purse seine nets of their flagged vessels, respectively. Table 12 shows detailed information on the cetaceans and whale shark encircled during operation reported by fishing masters of our purse seine fleet.

3.9 CMM 2011-04

In accordance with CMM 2011-04, each CCM shall estimate, through data collected from observer programs and other means, the number of releases of oceanic whitetip shark, including the status upon release (dead or alive), and report this information to the WCPFC in Part 1 of their Annual Reports. In 2015, our observers recorded 3 dead, 17 alive and 24 unknown status of released oceanic whitetip shark in the WCPFC Convention Area, and we used this information to estimate the number of released oceanic whitetip shark taken by our longline fleets which was 236 (40 dead, 20 alive and 176 unknown) for LTLL and 2,677 (84 dead, 1,338 alive and 1,255 unknown) for STLL. The discard information of oceanic whitetip shark of DWPS is related in Table 5.

3.10 CMM 2007-04 and CMM 2012-07

In accordance with CMM 2007-04 and CMM 2012-07, CCMs shall annually provide to the Commission, in part 1 of their annual reports, all available information on interactions with seabirds reported or collected by observers, including mitigation used, observed and reported species specific seabird bycatch rates and numbers, to enable the Scientific Committee to estimate seabird mortality in all fisheries to which the WCPFC Convention applies. All Taiwanese longliners operating in the area south of 30 degrees south are required to deploy at least two of the following seabird mitigation measures, namely tori lines, weighted branch lines and night setting with minimum deck lighting. For Taiwanese longliners larger than 24m operating in the Convention area north of 23 degrees north are required to employ tori lines and one of the following seabird mitigation measures, namely tori lines, weighted branch lines night setting with minimum deck lighting, line shooter or management of offal discharge. In addition, fishing vessels are required to carry de-hookers and line cutters on board for the purpose of releasing seabirds alive. The information regarding interactions with seabirds is shown in Table 13-16.

3.11 CMM 2013-08

In accordance with CMM 2013-08, CCMs shall estimate, through data collected from observer programs and other means, the number of releases of silky shark caught in the Convention Area, including the status upon release (dead or alive), and report this information to the WCPFC in Part 1 of their Annual Reports. In 2015, there were 20 dead, 53 alive and 263 status unknown of released silky shark recorded in our observer data in the WCPFC Convention Area. We estimated that there were 1,385 (321 dead, 241 alive and 823 unknown) for LTLL and 22,253 (335 dead, 3,430 alive and 18,488 unknown) for STLL in 2015 which was based on the information of our observer data. Discard of silky shark of DWPS already related in Table 5.

Table 1. The number of active fishing vessel by fishery in the WCPFC Convention Area during 2011-2015.

Year	LTLL	DWPS	STLL
2011	95	34	1,376
2012	87	34	1,326
2013	82	34	1,296
2014	73	34	1,275
2015	76	34	1,306

Table 2. The catch (in MT, round weight) of major tuna and tuna-like species of LTLL fishery in the WCPFC Convention Area during 2011-2015.

Year	N-ALB	S-ALB	BET	YFT	SWO	MLS	BUM	BLM	SKJ	TOTAL
2011	2,818	4,121	6,579	3,167	1,554	257	1166	22	155	19,839
2012	1,592	4,064	5,770	2,059	1,319	249	975	7	214	16,249
2013	2,035	4,498	5,486	1,441	1,386	222	934	1	179	16,182
2014	1,730	3,757	6,005	2,057	1,621	275	1,063	5	120	16,633
2015*	2,251	3,275	5,331	2,848	1,781	243	1,670	8	162	17,569

* Preliminary estimate

Table 3. The catch (in MT, round weight) of major tuna species of DWPS fishery in the WCPFC Convention Area during 2011-2015.

Year	SKJ	YFT	BET	Total
2011	155,641	18,143	2,151	175,935
2012	172,664	25,750	2,239	200,653
2013	186,330	22,659	3,491	212,480
2014	213,154	20,548	3,418	237,120
2015*	160,597	28,593	5,059	194,249

* Preliminary estimate

Table 4. The catch (in MT, round weight) of tuna and tuna-like species of the STLL fishery in WCPFC Convention Area during 2011-2015.

Year	ALB	BET	YFT	PBF	SWO	BILL**
2011	9,276	4,696	18,153	292	3,239	7,046
2012	8,505	5,224	14,889	210	3,430	6,430
2013	10,870	5,114	13,558	331	2,932	7,337
2014	5,264	4,013	10,200	483	2,214	6,625
2015*	5,673	4,103	11,270	577	2,574	5,739

* Preliminary estimate

**BILL: striped marlin, blue marlin, black marlin, and other billfish

Table 5. The catches (in MT, round weight) of key shark species* of LTLL, STLL and DWPS fisheries in the WCPFC Convention Area in 2015 (preliminary estimate).

	BSH	FAL	MAK		OCS	PTH	BTH	ALV	SPZ	SPL	SPK	EUB	POR	SHK
			SMA	LMA										
LTLL	1,683	0	624	19	0	53	62	0	16	4	0	0	0	126
STLL	7,756	0	575		0	132	329	0	101	145	0	0	0	1,341
DWPS**	0	33	0		1	0	0	0	0	0	0	0	0	9

* Our domestic law had ban all fisheries from catching whale sharks since 2008. Therefore, the table excludes whale shark.

** Discards

Table 6. The number of observers deployed on LTLL, STLL and DWPS fisheries in the Pacific Ocean during 2011-2015.

	LTLL	STLL	DWPS
2011	15	-	-*
2012	20	12	-*
2013	15	9	-*
2014	13	11	-*
2015	12	11	-*

* In accordance with CMM 2008-01, all our DWPS fishing vessels have to be deployed PIC observer on board and the observer coverage of for DWPS reached 100%.

Table 7. The catch of striped marlin in the area of south of 15°S during 2011-2015.

Year	Catch (MT)
2011	132
2012	82
2013	64
2014	38
2015*	97

* Preliminary estimate

Table 8. The estimate of observer coverage rate for Taiwanese longline fisheries in 2015.

Fishery	Days at Sea		
	Total estimated	Observer	Coverage rate
LTLL	21,039	1,793	8.5%
STLL	78,146	1,936	2.5%

Table 9. The catch of swordfish and the number of the longliner operating in the area

of south of 20°S during 2001-2015.

Year	Catch (MT)	Number of fishing vessel	
		Seasonal Target	Bycatch
2000	54	10	58
2001	208	10	58
2002	233	10	59
2003	248	12	72
2004	466	8	56
2005	202	6	59
2006	198	4	53
2007	217	3	46
2008	61	0	53
2009	133	7	46
2010	105	4	40
2011	98	3	66
2012	119	0	57
2013	140	0	72
2014	105	0	48
2015*	116	0	45

* Preliminary estimate

Table 10. The transshipment aggregated information in 2015

Offloaded / Received	Location of transshipment	Area of transshipment	Product Form	Area of Catch	Gear Type	Number of Transshipment	BET	ALB	YFT	SKJ	SWO	BUM	MLS	SKX	OTH	
Offloaded	High sea	WCPFC area	Frozen	Catch in EEZ of WCPFC member	Longliner	185	74	0	32	0	8	0	2	0	0	
				Catch in WCPFC area			5,817	1,340	1,515	2	1,089	1,041	124	715	783	
		Other Pacific		Catch in WCPFC area		27	278	622	51	0	102	44	8	33	69	
				Catch in other Pacific			25	56	26	0	0	0	0	0	0	
	Port	WCPFC area		Catch in EEZ of WCPFC member		Purse seiner	257	976	1,192	2,546	2,952	74	344	4	220	635
				Catch in WCPFC area				1,598	5,133	5,204	8,938	211	357	72	403	802
				Catch in other Pacific				7	96	1	0	3	3	1	0	19
				Catch in EEZ of WCPFC member				548	1	4,390	26,339	0	0	0	0	21
				Catch in WCPFC area				2,618	1	26,944	115,180	0	0	0	0	1,815

Table 11. The catch of south Pacific albacore and the number of fishing vessel in the area of south of 20°S during 2006-2015.

Year	Catch (tonnes)		Number of vessels fishing for South Pacific albacore
	Target	Bycatch	
2006	5,042	0	57
2007	4,329	276	49
2008	1,848	59	53
2009	3,350	22	53
2010	4,231	121	44
2011	3,887	91	69
2012	2,815	39	57
2013	3,729	162	62
2014	3,670	103	52
2015*	3,203	61	45

* Preliminary

Table 12. The fishing master report on cetaceans/whale sharks encircled incidentally in operations of purse seine fishery in 2015.

DATE	Longitude	Latitude	Species	Number	Reason	Measure for ensure safe release	Status on release
2015/01/17	E157°57'	S05°38'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/01/01	E172°28'	S03°25'	unidentified dolphin	9	not deliberately encircled	unknown	died
2015/02/02	E170°38'	N02°01'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/01/06	E167°17'	N01°42'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/05/16	W175°37'	S02°19'	False killer whale	7	not deliberately encircled	stop hauling	alive
2015/05/10	E178°40'	N00°14'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/05/08	E178°33'	S01°49'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/02/27	E145°57'	S00°03'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/05/02	E168°17'	S00°16'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/06/09	W172°32'	S00°49'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/03/15	E172°33'	S00°55'	unidentified dolphin	1	not deliberately encircled	stop hauling	alive
2015/06/11	W169°58'	S00°40'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/06/17	E169°42'	S02°39'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/06/19	E165°20'	N01°39'	Whale shark	1	not deliberately encircled	pulling sharks to release	alive
2015/06/22	W169°54'	S00°17'	False killer whale	1	not deliberately encircled	Cutting net	alive
2015/06/24	W170°45'	S00°46'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/07/08	E163°18'	N03°40'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/07/09	E163°18'	N03°51'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/07/09	E163°24'	N03°48'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/07/11	E161°33'	N04°23'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/07/21	E163°27'	N02°25'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/07/23	E172°27'	S01°01'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/07/29	E169°49'	S02°21'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/08/13	E168°45'	S01°44'	Whale shark	1	not deliberately encircled	stop operating	alive

2015/08/16	E171°16'	S01°15'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/08/20	E165°23'	N04°51'	unidentified whale	1	not deliberately encircled	stop hauling	alive
2015/08/22	E168°27'	N02°37'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/08/22	E170°53'	S00°28'	unidentified whale	1	not deliberately encircled	release	alive
2015/08/26	E170°41'	N00°15'	unidentified whale	1	not deliberately encircled	stop hauling	alive
2015/10/07	E168°52'	S01°11'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/10/07	E169°47'	N01°44'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/10/19	E168°22'	N01°11'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/10/23	E168°35'	N00°15'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/11/21	E178°57'	S02°42'	unidentified dolphin	1	not deliberately encircled	stop operating	died
2015/12/09	E167°29'	N04°48'	unidentified whale	1	not deliberately encircled	stop hauling	alive
2015/12/10	E176°56'	S00°06'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/12/14	E166°20'	N02°33'	Whale shark	1	not deliberately encircled	release	alive
2015/12/16	E166°29'	N02°38'	Whale shark	1	not deliberately encircled	stop operating	alive

Table 13. The seabird bycatch information of longline fishery in the area of south of 30°S during 2011-2015.

Year	Fishing effort				Observed seabird hooked	
	Number of vessels	Number of hooks	Observed hooks	% hooks observed	Number	Rate
2011	32	2,678,483	335,746	12.5%	123	0.366
2012	27	3,142,654	641,731	20.4%	8	0.012
2013	24	3,921,402	390,427	10.0%	4	0.010
2014*	27	5,688,623	350,827	6.2%	3	0.009
2015*	27	3,829,322	419,452	11.0%	4	0.010

* Preliminary

Table 14. The seabird bycatch information of longline fishery in the area of north of 23°N during 2011-2015.

Year	Fishing effort				Observed seabird hooked	
	Number of vessels	Number of hooks	Observed hooks	% hooks observed	Number	Rate
2011	465	64,460,898	0	0.0%	0	-
2012	495	51,349,311	122,160	0.2%	3	0.025
2013	442	21,338,293	385,993	1.8%	6	0.016
2014*	442	23,542,222	354,224	1.5%	16	0.045
2015*	473	20,423,250	208,703	1.0%	0	0.000

* Preliminary

Table 15. The seabird bycatch information of longline fishery in the area of 23°N - 30°S during 2011-2015.

Year	Fishing effort				Observed seabird hooked	
	Number of vessels	Number of hooks	Observed hooks	% hooks observed	Number	Rate
2011	892	253,889,416	2,710,106	1.1%	4	0.001
2012	929	200,889,530	4,220,207	2.1%	5	0.001
2013	876	176,278,326	4,010,888	2.3%	0	0.000
2014*	797	141,274,339	2,547,934	1.8%	0	0.000
2015*	807	160,380,173	3,032,608	1.9%	2	0.001

* Preliminary

Table 16. The number of observed seabird bycatch of longline fishery by species and by area during 2011-2015.

Year	Species	South of 30°S	North of 23°N	23°N - 30°S
2011	Black-browed albatross	1		
	Buller's albatross	1		
	Wandering albatross	10		
	Unidentified albatross	96		
	Flesh-footed shearwater	6		
	Tropical shearwater			1
	Wedge-tailed shearwater	2		
	Black petrel	1		
	White-chinned petrel	4		1
	Brown booby			2
	Unidentified seabirds	2		
Total		123	0	4
2012	Black-footed albatross		2	
	Campbell albatross	1		
	Wandering albatross	2		
	Unidentified albatross	5	1	
	Frigatebird			4
	Masked booby			1
Total		8	3	5
2013	Black-footed albatross		2	
	Unidentified albatross	3	4	
	White-chinned petrel	1		
	Total		4	6
2014	Black-footed albatross		1	
	Laysan albatross		4	
	Unidentified albatross		11	
	White-chinned petrel	3		
	Total		3	16
2015*	Buller's albatross	1		
	Christmas Island frigatebird			1
	Sooty shearwater			1
	Wandering albatross	1		
	White capped albatross	2		
	Total		4	0

* Preliminary

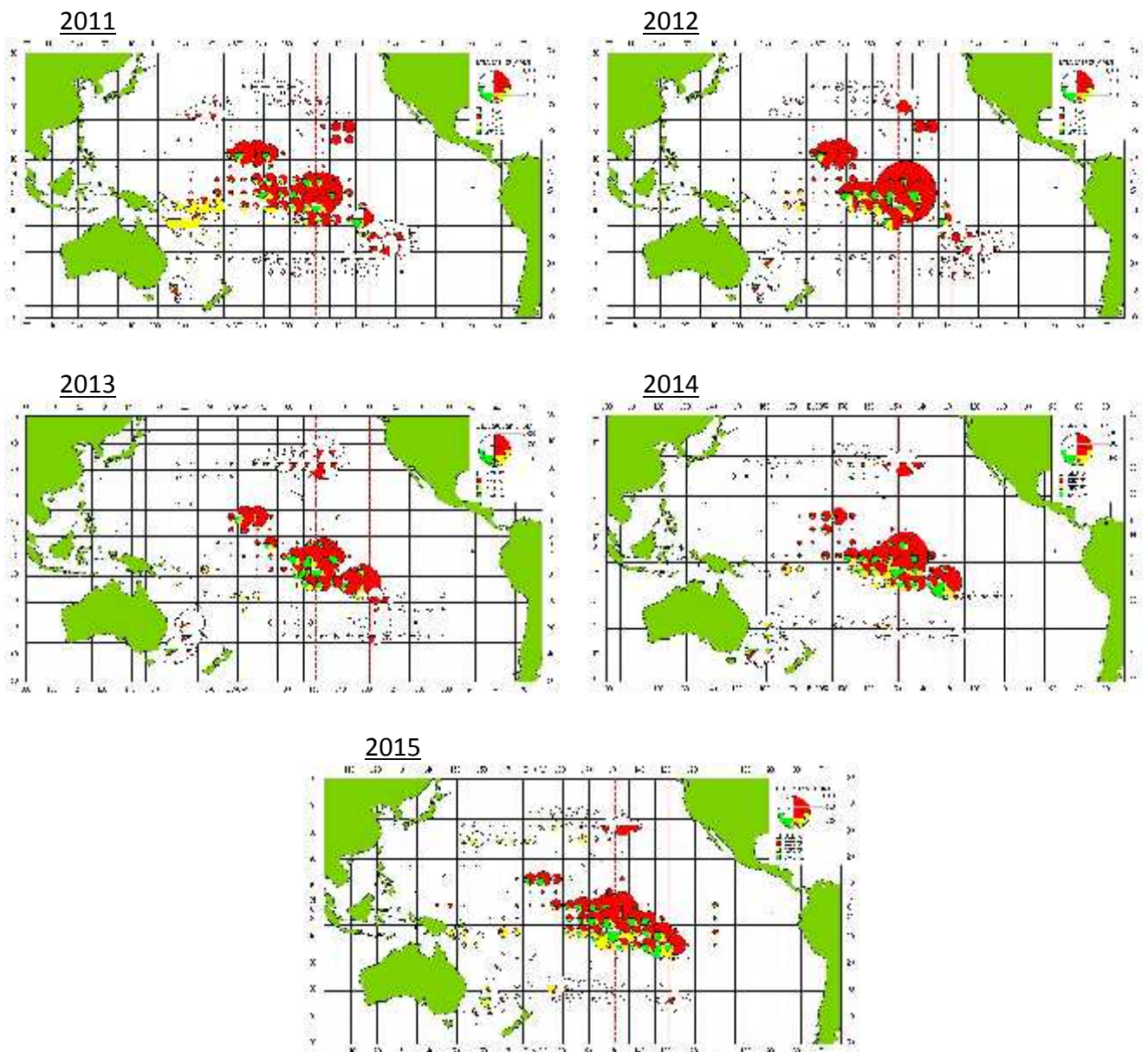


Figure 1. The catch composition distributions of tuna and tuna-like species of LTLF fishery during 2011-2015. The figures of 2014 and 2015 are still in preliminary.

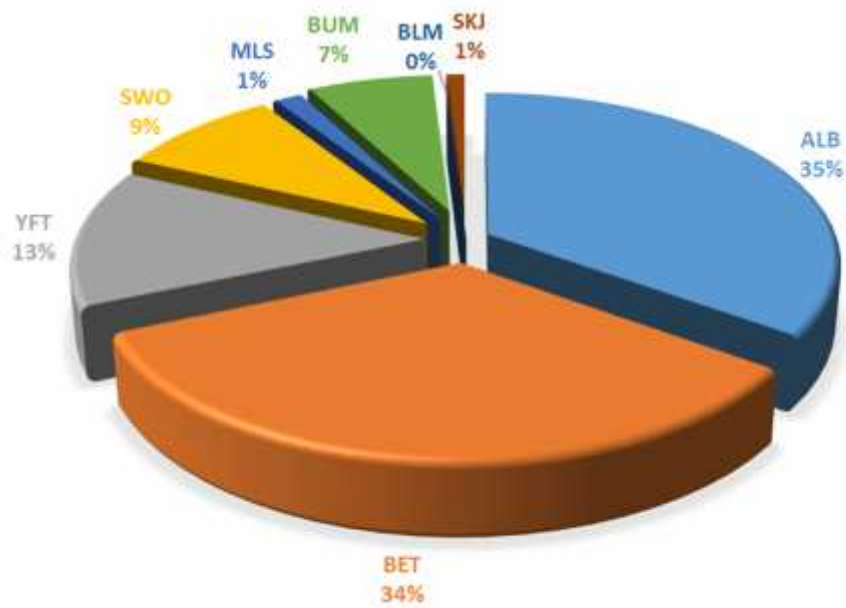
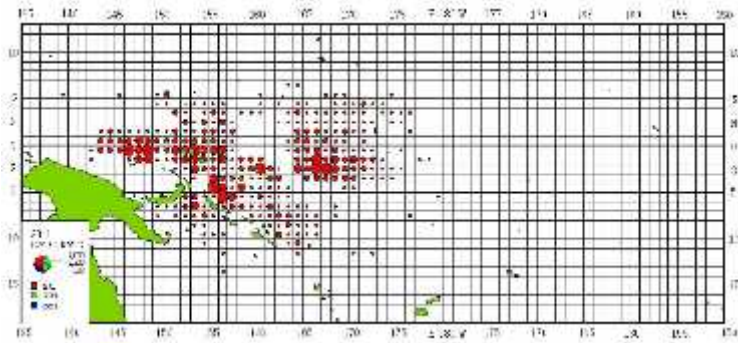


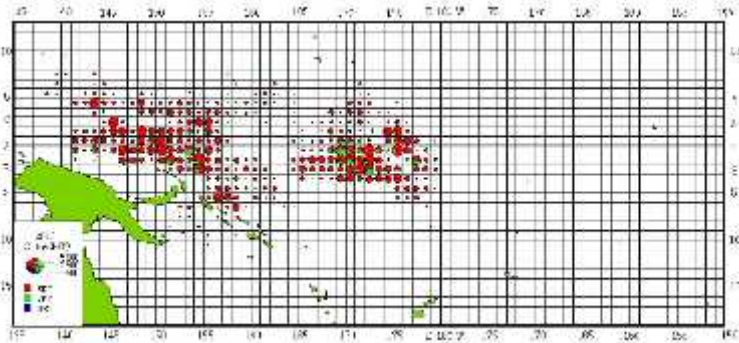
Figure 2. The catch composition of major tuna and tuna-like species for LTLL fishery in the WCPFC Convention area during 2011-2015.



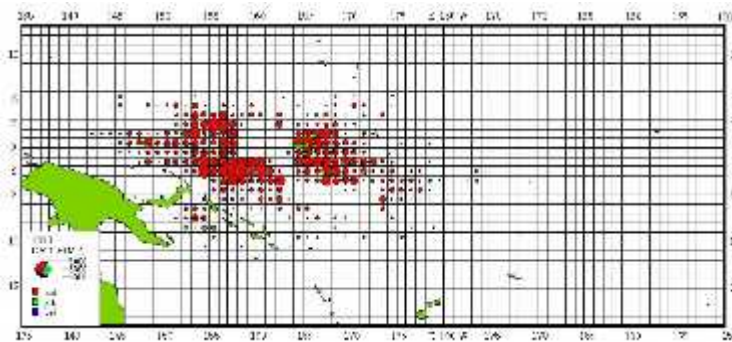
Figure 3. The catch composition of major tuna species for DWPS fishery in the WCPFC Convention area during 2011-2015.



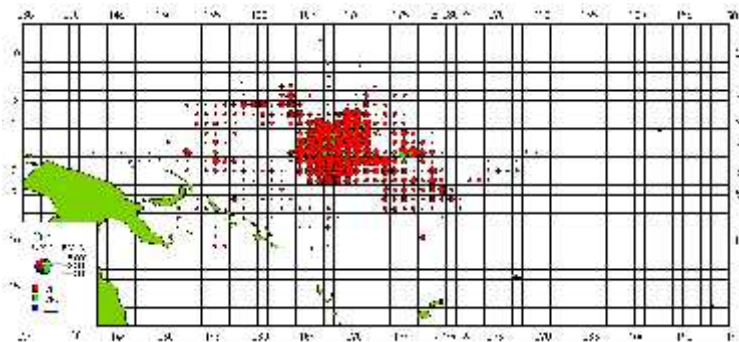
2011



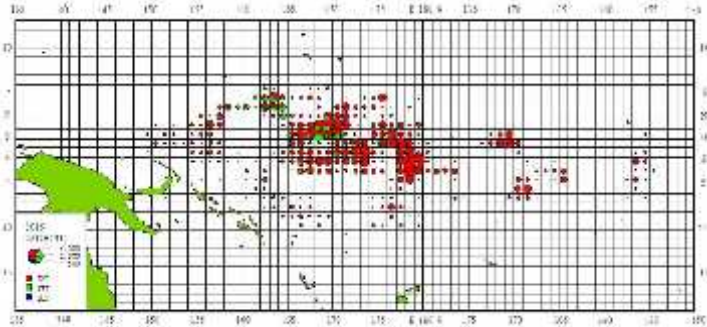
2012



2013



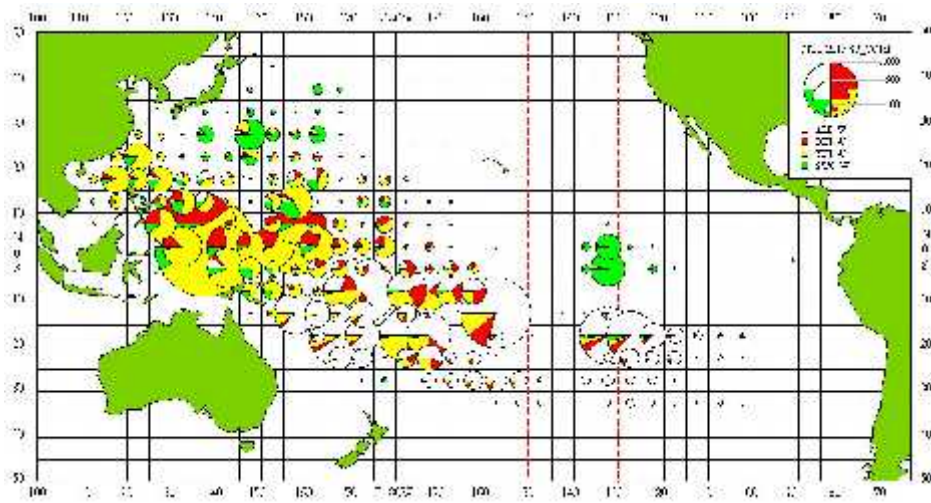
2014



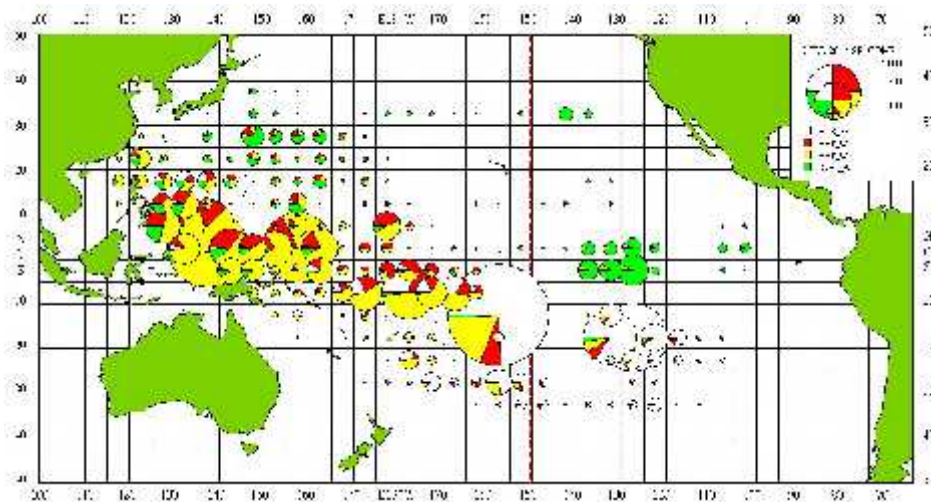
2015

Figure 4. The catch composition distributions of DWPS fleet during 2011-2015.

2013



2014



2015

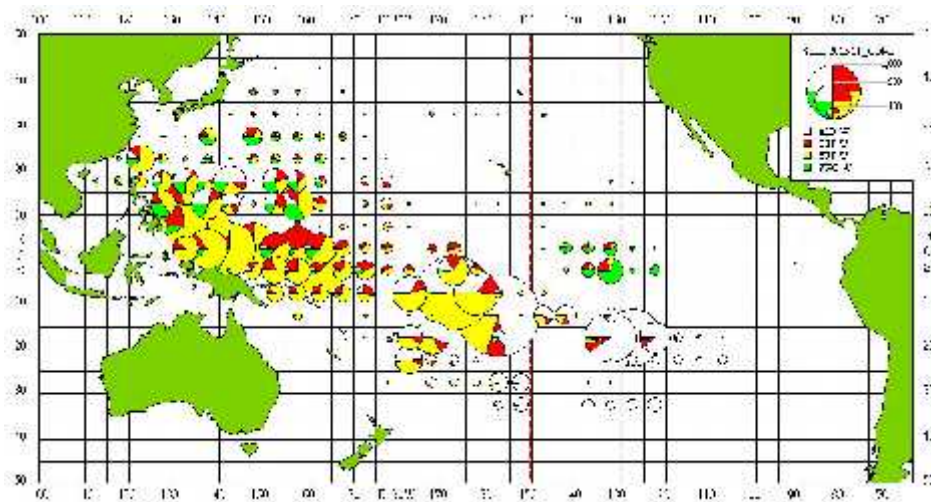
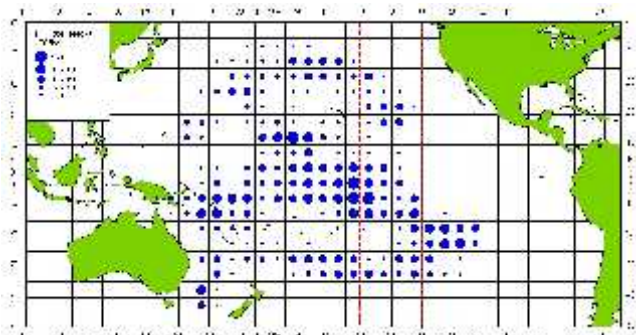
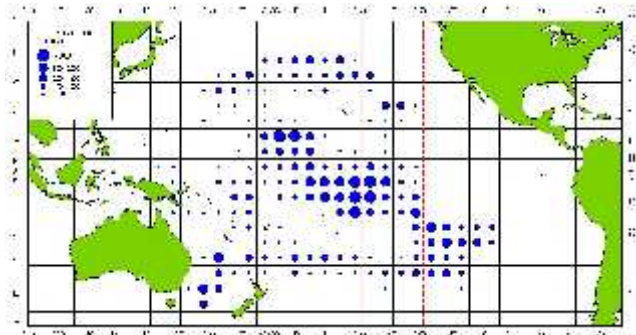


Figure 5. The catch composition distributions of tuna and tuna-like species of STLL fishery during 2013-2015. The figures of 2014 and 2015 are still in preliminary.

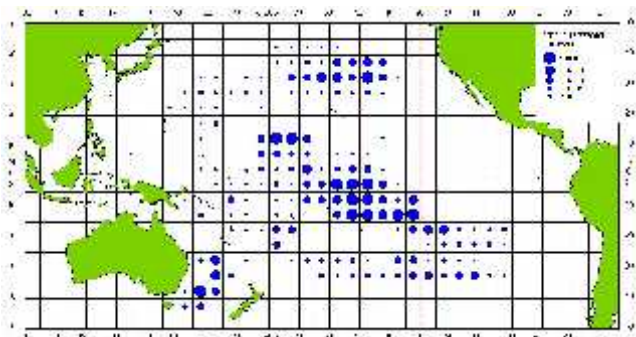
2011



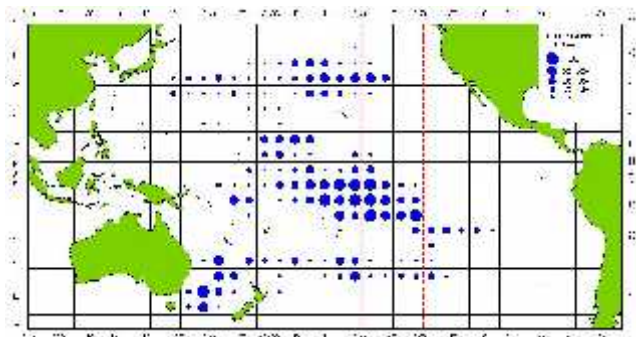
2012



2013



2014



2015

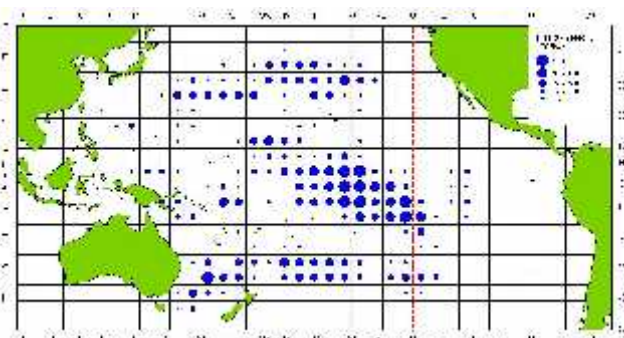
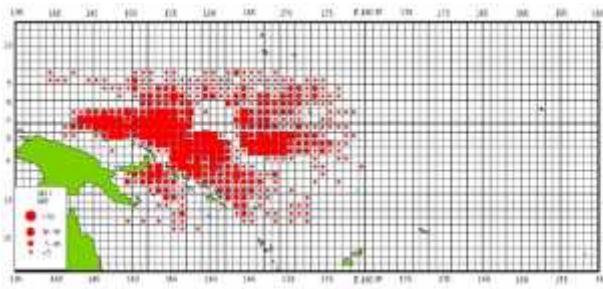
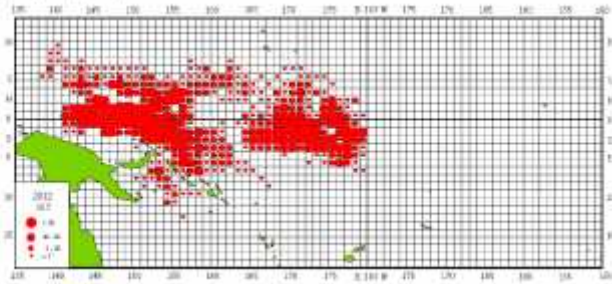


Figure 6. The effort distributions of LTL fishery during 2011-2015. The figures of 2014 and 2015 are still in preliminary.

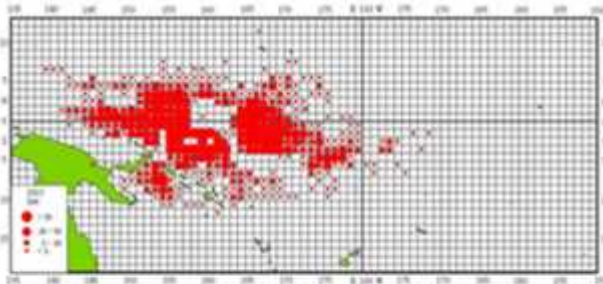


2011

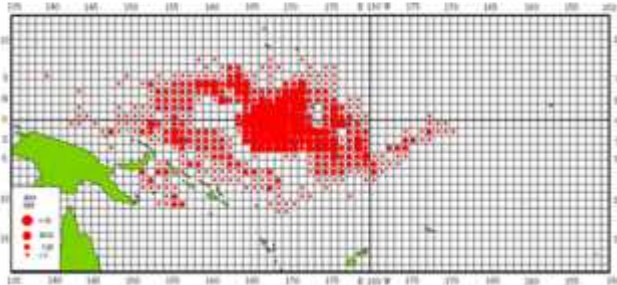
2012



2013



2014



2015

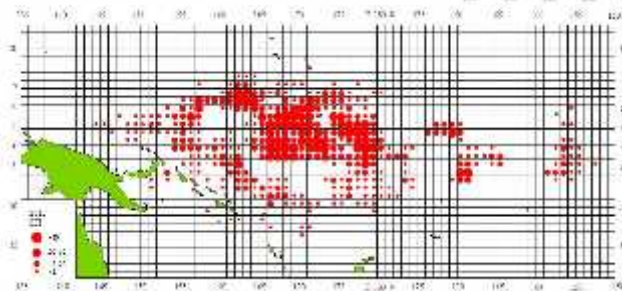
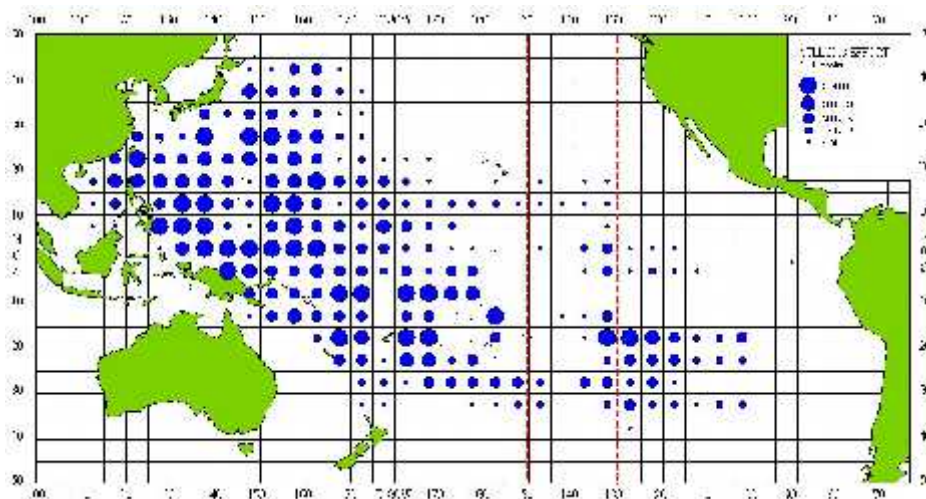
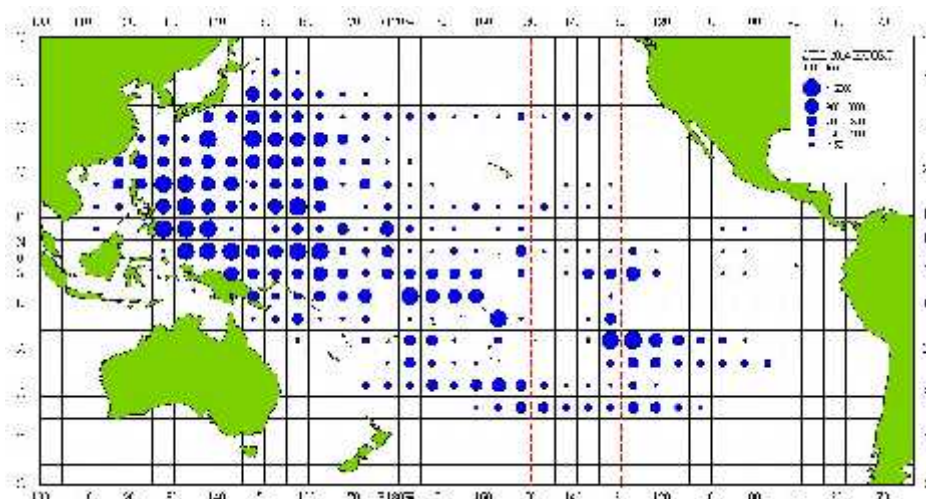


Figure 7. The effort distributions of DWPS fleet during 2011-2015.

2013



2014



2015

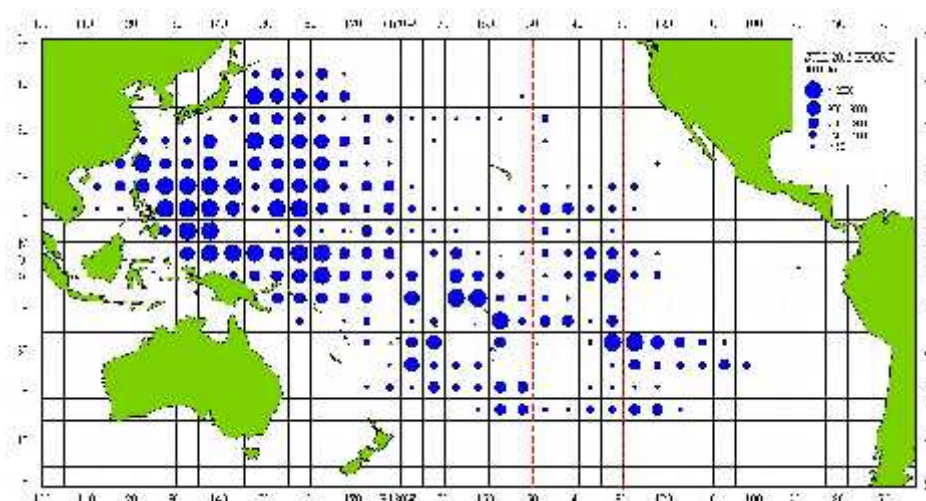


Figure 8. The effort distributions of STLL fishery during 2013-2015. The figures of 2014 and 2015 are still in preliminary.

National Report

Tuna Fisheries Status Report of Chinese Taipei in the Western and Central Pacific Region

Fisheries Agency, Council of Agriculture and
Overseas Fisheries Development Council

August, 2016

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<p><i>Scientific data was provided to the Commission in accordance with the decision relating to the provision of scientific data to the Commission by 30 April 2016</i></p>	<p>Yes</p>
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Summary

Three Taiwanese tuna fishing fleets are currently operating in the WCPFC Convention Area, namely large scale tuna longline fleet (LTLL, previous named FTLL), distant-water purse seine fleet (DWPS) and small scale tuna longline fleet (STLL, previous named CTLL). In 2015, the total catches of main tuna and tuna-like species for the three fleets were 17,569 MT for LTLL, 194,249 MT for DWPS and 29,936 MT for STLL, respectively. In 2015, 23 observers were deployed on the tuna longline fishing vessels operating in the Pacific Ocean.

1. Annual fisheries' information

The Pacific Ocean is the earliest fishing ground for Taiwanese tuna fisheries. Currently, there are three tuna fishing fleets operating in the WCPFC Convention Area: large scale tuna longliners (LTLL), distant-water purse seiners (DWPS) and small scale tuna longliners (STLL). All LTLL and DWPS vessels operate outside the EEZ of Taiwan; most of the STLL vessels operate in the EEZ of Taiwan with some operate on the high seas or in the PICS' EEZ through relevant agreements.

1.1 Fleet structure

Table 1 shows the numbers of active vessel of LTLL, DWPS and STLL fleets in recent five years (2011-2015) in the WCPFC Convention Area.

1.1.1 LTLL

The LTLL vessels refer to those vessels larger than 100 GRT. The number of active vessels was 95 in 2011 which was an increase from previous years due to shifting of some vessels from the Indian Ocean for piracy issue. These increased vessels have gradually returned to the Indian Ocean thereafter and so the number of active LTLL decreased year by year. In 2014, the number of active LTLL decreased further to 73 because nine LTLLs temporarily ceased operation for financial loss. However, the number of active LTLL fishing vessels had a slight return to 76 in 2015.

1.1.2 DWPS

Tuna purse seine fishery was introduced into Taiwan in 1982 and has become one of our major fishing fleet operating in WCPO. In 1992 the fleet reached its peak of 45 vessels, and reduced to 42 due to adjustment of business strategy of some companies. The fleet further reduced to 34 authorized in 2004 and maintained at this level ever since. The number of active purse seiners reached the lowest of recent years at 32 in 2009 for 2 fishing vessels sank, and returned to 34 in 2010 with 2 new building ones. There were 34 DWPS active vessels operating in the WCPFC Convention Area in 2015.

1.1.3 STLL

The STLL fleet operates both within and beyond the EEZ of Taiwan. Some with freezing equipment extended their fishing grounds to more distant waters operating in a similar pattern as LTLL vessel. They change their fishing grounds and target species based on fishing season and market price. In 2015 there were 1,306 STLL vessels operating in the WCPFC Convention Area.

1.2 Annual Catch in the WCPFC Convention Area

1.2.1 LTLL

The catch of major tuna and tuna-like species caught by LTLL fishery in the recent five years (2011-2015) in the WCPFC Convention Area is shown in Table 2. The catch composition distribution of tuna and tuna-like species of LTLL in recent 5 years (2011-2015) is shown in Figure 1. Mean catch percentage of major tuna and tuna-like species of our LTLL fishery in the WCPFC Convention area in the recent five years is shown in Figure 2. The dominant species of catch were albacore (34.9%), bigeye tuna (33.7%) and yellowfin tuna (13.4%).

1.2.2 DWPS

The catch of major tuna species in the WCPFC Convention Area during 2011-2015 is shown in Table 3. The most dominant species remained to be skipjack, accounting for about 87.1% of the total catch, followed by yellowfin tuna and bigeye tuna, which accounts for 11.3% and 1.6% of the total catch, respectively (Figure 3). The catch composition distribution of DWPS in recent 5 years (2011-2015) is shown in Figure 4.

1.2.3 STLL

Total catch of mainly tuna and tuna-like species caught by domestic vessels in 2015 was 7,441 MT. The dominant species of catch are yellowfin tuna (38%), billfish (27%), swordfish (17%) and bigeye tuna (9%). As to those landed in foreign ports, yellowfin and bigeye are the main species of catch. Total catch of main species by STLL from 2011 to 2015 in WCPFC Convention Area is shown in Table 4. The catch composition distribution of tuna and tuna-like species of STLL during 2013-2015 is shown in Figure 5.

1.3 Fishing Patterns

1.3.1 LTLL

LTLL fleet can be divided into two groups in accordance with target species, namely bigeye tuna targeting longline fleet operating mainly in tropical area (between 15°N and 15°S), and albacore targeting longline fleet operating in subtropical and temperate waters. The fleet targeting bigeye tuna usually conducts a year round operation, and transship their catches to transport vessels and receive fuel and supplies during transshipment. Those fishing for albacore usually entered fishing ports in the Pacific twice a year for catch landing, fuel and supply receiving. The fishing effort distribution in recent 5 years (2011-2015) is shown in Figure 6.

1.3.2 DWPS

The DWPS vessels mainly operate in the tropical waters close to the equator area targeting on skipjack. Since most of the fishing grounds are located in the EEZs of PICs, these vessels acquire fishing permits through access agreements with PICs, including PNG, FSM, Nauru, Marshall Islands, Solomon Islands, Tuvalu and Kiribati.

In early 1980s, logs were used as fish aggregation objects and sets were made on schools associated with these floating objects. This practice continued throughout the 80s and early 90s. Successful exploitation on free-swimming schools in mid 1990s has made free school setting to be the most prevailing fishing method. In 2015, about 58.2% sets were deployed on free school.

The fishing effort distributions in recent 5 years (2011-2015) is shown in Figure 7. In 2015, the fishing ground moved eastwards, compared to the previous years.

1.3.3 STLL

Most of STLL based at domestic or foreign ports mainly target on YFT for fresh sashimi markets, while some STLL vessels target on billfish or albacore. Flake ice is used as coolant on the STLL vessels, but some are equipped with freezing equipment for better preservation of their catches. The fishing effort distribution in recent 3 years (2013-2015) is shown in Figure 8.

1.4 Estimated total catches of non-target, associated and dependent species

The LTLL logbook format had been revised in 2003 to accommodate 4 more shark species (blue shark, silky shark, shortfin mako, and other sharks), sea birds, sea turtles and marine mammals. To compliance with CMM 2008-06 and CMM 2009-04, the logbook format had been revised again and included more shark species (thresher shark, tiger shark, white shark, porbeagle shark, crocodile shark, hammerhead shark and oceanic white tip shark) into logbook recording items. Annual catch of key shark species of LTLL, STLL and DWPS in 2015 is shown in Table 5.

In 2014, our observers had recorded 7 sea turtles (1 loggerhead, 2 leatherback, 1 green, 1 olive ridley and 2 unidentified turtles), 19 seabirds (1 black-footed albatross, 15 albatross nei and 3 white-chinned petrel), 2 cetaceans (1 bottlenose dolphin, 1 false-killer whale) hooked with 9,304 seabirds and 143 cetaceans sighted. In 2015, our observers had recorded 13 sea turtles (11 green, 1 leatherback and 1 olive ridley turtles), 6 seabirds (1 buller's albatross, 1 Christmas Island frigatebird, 1 sooty shearwater, 1 wandering albatross and 1 white capped albatross) and 1 cetaceans (1 false-killer whale) hooked with 3903 seabirds and 82 cetaceans sighted. Because some observation trips of 2015 have not finished in 2016, the observer data of 2015 is still in preliminary now. As for the information on cetaceans and whale sharks encircled by our purse seiners is described in section 3.8.

1.5 Trends in the fishery and future prospects of the fishery

In view of conservation of tuna species, it is the policy of the government to maintain the size of its fleets to a level that is commensurate with the availability of fishing possibilities. The government will continue implementing the policy of limited entry in tuna fisheries.

2. Research and statistic

2.1 Summary of observer programs

For better understanding the fishing activities and bycatch of the longline fishery, FA launched a pilot observer program in 2002. During 2010-2014, the number of observers deployed on LTLL, STLL and DWPS fleets in Pacific Ocean is shown in Table 6. In accordance with the government's policy in establishing an observers program and supporting the increase of observers, in 2012 the observer program was extended to the STLL fleets. Totally the number of observers deployed on longline vessels in 2015 was 23, including 12 observers for LTLL vessels and 11 observers for STLL vessels respectively.

Our observer program had received interim authorization in 2009 and received full authorization after auditing in November 2011. The forms used in our observer program are fully conformed to the standards set by WCPFC which include the fishing activities, catch number and weight, species identification, bycatch species and status. In addition, length frequency of major species and the sighting and incidental catch of ecological species were recorded, and biological samplings were

collected for biological research.

2.2 Research activities

For the purpose of improving stock assessment of highly migratory species in the Pacific Ocean, government of Taiwan has commissioned scientists to conduct a series of researches in 2015 as follows :

- Studies on abundance index and stock assessment of tropical tuna in the Western and Central Pacific and bluefin tuna in the Pacific Ocean.
- A study on CPUE standardization and stock status for billfishes in the three oceans.
- Study on age composition of southern bluefin tuna and Pacific bluefin tuna in the longline fishery.
- Study on the Pacific albacore resource.
- Studies of shark by-catch, abundance index and non-detriment findings in the three Oceans.
- Research on Incidental Catch of Ecological Related Species by Taiwanese Distant Water Tuna Longline Fisheries
- Study of reducing seabird bycatch operated on small-scale longline vessels in the Western and Central Pacific.
- Feasibility analysis on the fishing condition forecast of albacore tunas for the Taiwanese tuna longline fishery in the three oceans.
- Feasibility analysis on the fishing condition forecast of yellowfin and bigeye tunas for the Taiwanese tuna longline fishery in the three oceans.
- Feasibility analysis on the fishing condition forecast of swordfish for the Taiwanese tuna longline fishery in the three oceans.
- The feasibility analysis on purse seine fishing condition of skipjack tuna in the western and central Pacific Ocean.

The scientific papers presented at recent Pacific Ocean RFMOs meetings during 2015 to 2016 were as follows:

- Revised CPUE standardization and catch estimate of shortfin mako shark, caught by the Taiwanese large-scale longline fishery in the North Pacific Ocean. (ISC/15/SHARKWG-1/07)
- Standardized CPUE of striped marlin for the Taiwanese distant-water tuna longline fishery in the western and central North Pacific Ocean. (ISC/15/BILLWG-1/09)
- Catch and length data of striped marlin (*Kajikia audax*) from Taiwanese fisheries in the western and central North Pacific Ocean. (ISC/15/BILLWG-1/08)
- Stock Assessment of Striped Marlin (*Kajikia audax*) in the Western and Central North Pacific Ocean Using an Age-structured Model: Updated to 2013. (ISC/15/BILLWG-2/03)
- Estimation of standardized CPUE SERIES of Pacific bluefin tuna for Taiwanese longline fishery under incomplete data. (ISC/15/PBFWG-2/10)
- Update of Standardized PBF CPUE Series for Taiwanese Longline Fishery. (ISC/16/PBFWG-1/02)
- CPUE Standardization of Blue Marlin (*Makaira nigricans*) for the Taiwanese Distant-Water Tuna Longline Fishery in the Pacific Ocean. (ISC/16/BILLWG-1/10)

The scientific papers published on scientific journal during 2015 to 2016 were as follows:

- Brodziak, J., Mangel, M., & Sun, C. L. (2015). Stock-recruitment resilience of North Pacific striped marlin based on reproductive ecology. *Fisheries Research*, 166, 140-150.
- Chang, Y. J., Brodziak, J., O'Malley, J., Lee, H. H., DiNardo, G., & Sun, C. L. (2015). Model selection and multi-model inference for Bayesian surplus production models: a case study for Pacific blue and striped marlin. *Fisheries Research*, 166, 129-139.
- Chiang, W. C., Musyl, M. K., Sun, C. L., DiNardo, G., Hung, H. M., Lin, H. C., ... & Kuo, C. L. (2015). Seasonal movements and diving behaviour of black marlin (*Istiompax indica*) in the northwestern Pacific Ocean. *Fisheries Research*, 166, 92-102.
- Hui Chen, H., Chang, C. H., Sun, C. L., Shao, K. T., Yeh, S. Z., & DiNardo, G. (2016). Population Structure of Blue Marlin, *Makaira nigricans*, in the Pacific and Eastern Indian Oceans. *Zoological Studies* (in press).
- Joung, S. J., Chen, C. C., Liu, K. M., & Hsieh, T. C. (2015). Age and growth estimates of the Kwangtung skate *Dipturus kwangtungensis* in the waters of northern Taiwan. *Journal of the Marine Biological Association of the United Kingdom*, 1-8.
- Joung, S. J., Chen, J. H., Chin, C. P., & Liu, K. M. (2015). Age and Growth of the Dusky Shark, *Carcharhinus obscurus*, in the Western North Pacific Ocean. *Terrestrial, Atmospheric & Oceanic Sciences*, 26.
- Joung, S. J., Chen, N. F., Hsu, H. H., & Liu, K. M. (2016). Estimates of life history parameters of the oceanic whitetip shark, *Carcharhinus longimanus*, in the western North Pacific Ocean. *Marine Biology Research* (Accepted).
- Lee, M. A., Chang, Y., & Shimada, T. (2015). Seasonal evolution of fine-scale sea surface temperature fronts in the East China Sea. *Deep Sea Research Part II: Topical Studies in Oceanography*, 119, 20-29.
- Liu, K. M., Chin, C. P., Chen, C. H., & Chang, J. H. (2015). Estimating Finite Rate of Population Increase for Sharks Based on Vital Parameters. *PloS one*, 10(11), e0143008.
- Punt, A. E., Su, N. J., & Sun, C. L. (2015). Assessing billfish stocks: a review of current methods and some future directions. *Fisheries Research*, 166, 103-118.
- Su, N. J., Sun, C. L., Punt, A. E., Yeh, S. Z., & DiNardo, G. (2015). Environmental influences on seasonal movement patterns and regional fidelity of striped marlin *Kajikia audax* in the Pacific Ocean. *Fisheries Research*, 166, 59-66.
- Su, N. J., Sun, C. L., Tai, C. Y., & Yeh, S. Z. (2016). Length-based estimates of growth and natural mortality for blue marlin (*Makaira nigricans*) in the northwest Pacific Ocean. *Journal of Marine Science and Technology*, 24(2), 370-378.
- Sun, C. L., Chang, H. Y., Liu, T. Y., Yeh, S. Z., & Chang, Y. J. (2015). Reproductive biology of the black marlin, *Istiompax indica*, off southwestern and eastern Taiwan. *Fisheries Research*, 166, 12-20.
- Sun, C. L., Yeh, S. Z., Liu, C. S., Su, N. J., & Chiang, W. C. (2015). Age and growth of Black marlin (*Istiompax indica*) off eastern Taiwan. *Fisheries Research*, 166, 4-11.
- Tsai, C. N., Chiang, W. C., Sun, C. L., Shao, K. T., Chen, S. Y., & Yeh, S. Z. (2015). Stomach content and stable isotope analysis of sailfish (*Istiophorus platypterus*) diet in eastern Taiwan waters. *Fisheries Research*, 166, 39-46.

- Tsai, W. P., Liu, K. M., Punt, A. E., & Sun, C. L. (2015). Assessing the potential biases of ignoring sexual dimorphism and mating mechanism in using a single-sex demographic model: the shortfin mako shark as a case study. *ICES Journal of Marine Science: Journal du Conseil*, 72(3), 793-803.
- Tsai, W. P., Sun, C. L., Liu, K. M., Wang, S. B., & Lo, N. C. (2015). Cpue Standardization and Catch Estimate of Blue Shark by Taiwanese Large-Scale Tuna Longline Fishery in the North Pacific Ocean. *Journal of Marine Science and Technology*, 23(4), 567-574.

2.3 Statistics data collection system

Logbooks of LTLL, STLL and DWPS fishing vessels authorized to operate in WCPFC Convention Area are collected while calling port or transshipping. All fleets are required to submit catch reports periodically while fishing: fishing vessels of LTLL and DWPS report weekly and the STLL fishing vessels operating outside of our EEZ report monthly.

To collect fishery data in real time, Taiwan implemented electronic logbook reporting on LTLL and DWPS fleets in 2014, and which was applied to STLL fleet in 2015. Fishing vessels are required to transmit their fishing data daily.

In addition, the fishing vessels and the fish traders have to report the trade and transshipment data. Market State data on LTLL are collected from the Organization for the Promotion of Responsible Tuna Fishery (OPRT) and from fish traders at foreign ports; as to the landing of STLL fishery in foreign ports, information on the fishing activities of the fishery was obtained from port States trading companies and such information together with available commercial trade data was used for the catch estimation.

2.4 Data coverage of catches, effort and size data for all species

2.4.1 Longline fisheries

The logbook is the main data source of catch and effort for all species, supplemented by trade data. The size data of all species is mainly from the first 30 fish caught for each setting recorded on logbook. A port-sampling program conducted in domestic ports aims at collecting the length data of tuna and tuna-like catch. The observer program has been collecting size data for all species. These data have already been used and reported in some researches.

2.4.2 DWPS fishery

The logbook is the source of catch and effort data. Trade data has been collected for estimating the catch composition of bigeye tuna and yellowfin tuna. Length data was collected from fishing vessels. To strengthen length data collection of DWPS fishery, the fishing fleet started collecting length data from December, 2013. At least ten fishes, mainly skipjack and tuna species, are measured the fork length randomly per set.

3. Implementation of Conservation and Management Measure

3.1 CMM 2005-03

In accordance with CMM 2005-03, all CCMs shall report annually to the WCPFC Commission all catches of albacore north of the equator and all fishing effort north of the equator in fisheries directed at albacore. In 2015, the total catch of north Pacific albacore made by our fishing fleet was 3,020 MT with 2,635 MT in the north Convention area, and 23 LTLL vessels directed at albacore in the North Pacific Ocean

with 2,401 fishing days; 2,150 days was deployed in the north Convention area.

3.2 CMM 2006-04

In accordance with CMM 2006-04, CCMs shall report annually to the Commission the catch levels of their fishing vessels that have taken striped marlin as a bycatch as well as the number and catch levels of vessels fishing for striped marlin in the Convention Area south of 15°S. The bycatch of striped marlin in the Convention area south of 15°s during the period 2011-2015 is shown in Table 7. None of our fishing vessel targets on striped marlin.

3.3 CMM 2007-01

In order to estimate observer coverage rates on longline vessels fishing according CMM 2007-01 and in accordance with the decision of WCPFC11, Table 8 provides the information of observer coverage rate estimates for LTL and STLL of 2015.

3.4 CMM 2009-03

In accordance with CMM 2009-03, the number of the fishing vessels for swordfish in the Convention Area south of 20°S was limited to the number in any year during 2000-2005, and the catch of swordfish caught in the Convention Area south of 20°S is limited to the amount caught in any year during the period 2000-2006. The information mentioned above is shown in Table 9.

3.5 CMM 2009-06

In accordance with CMM 2009-06, CCMs shall report on all transshipment activities (including transshipment activities that occur in ports or EEZs) in Part 1 of its Annual Report. Table 10 shows the information of transshipment activities of our fishing fleets in 2015.

3.6 CMM 2010-05

In accordance with CMM 2010-05, CCMs shall report annually to the Commission the catch levels of their fishing vessels that have taken South Pacific Albacore as a bycatch as well as the number and catch levels of vessels actively fishing for South Pacific albacore in the Convention area south of 20°S. The catch of South Pacific albacore in the convention area south of 20°s during the period 2006-2015 and the number of longline vessels fishing are shown in Table 11.

3.7 CMM 2010-07

In accordance with CMM 2010-07, each CCM shall include key shark species, as identified by the Scientific Committee, in their annual reporting to the Commission of annual catch and fishing effort statistics by gear type, including available historical data, in accordance with the WCPF Convention and agreed reporting procedures. The total catch of key shark species by fishery in 2015 shows in Table 5.

3.8 CMM 2011-03 and CMM 2012-04

In accordance with CMM 2011-03 and CMM 2012-04, CCMs shall advise in their Part 1 Annual Report of any instances in which cetaceans and whale sharks have been encircled by the purse seine nets of their flagged vessels, respectively. Table 12 shows detailed information on the cetaceans and whale shark encircled during operation reported by fishing masters of our purse seine fleet.

3.9 CMM 2011-04

In accordance with CMM 2011-04, each CCM shall estimate, through data collected from observer programs and other means, the number of releases of oceanic whitetip shark, including the status upon release (dead or alive), and report this information to the WCPFC in Part 1 of their Annual Reports. In 2015, our observers recorded 3 dead, 17 alive and 24 unknown status of released oceanic whitetip shark in the WCPFC Convention Area, and we used this information to estimate the number of released oceanic whitetip shark taken by our longline fleets which was 236 (40 dead, 20 alive and 176 unknown) for LTLL and 2,677 (84 dead, 1,338 alive and 1,255 unknown) for STLL. The discard information of oceanic whitetip shark of DWPS is related in Table 5.

3.10 CMM 2007-04 and CMM 2012-07

In accordance with CMM 2007-04 and CMM 2012-07, CCMs shall annually provide to the Commission, in part 1 of their annual reports, all available information on interactions with seabirds reported or collected by observers, including mitigation used, observed and reported species specific seabird bycatch rates and numbers, to enable the Scientific Committee to estimate seabird mortality in all fisheries to which the WCPFC Convention applies. All Taiwanese longliners operating in the area south of 30 degrees south are required to deploy at least two of the following seabird mitigation measures, namely tori lines, weighted branch lines and night setting with minimum deck lighting. For Taiwanese longliners larger than 24m operating in the Convention area north of 23 degrees north are required to employ tori lines and one of the following seabird mitigation measures, namely tori lines, weighted branch lines night setting with minimum deck lighting, line shooter or management of offal discharge. In addition, fishing vessels are required to carry de-hookers and line cutters on board for the purpose of releasing seabirds alive. The information regarding interactions with seabirds is shown in Table 13-16.

3.11 CMM 2013-08

In accordance with CMM 2013-08, CCMs shall estimate, through data collected from observer programs and other means, the number of releases of silky shark caught in the Convention Area, including the status upon release (dead or alive), and report this information to the WCPFC in Part 1 of their Annual Reports. In 2015, there were 20 dead, 53 alive and 263 status unknown of released silky shark recorded in our observer data in the WCPFC Convention Area. We estimated that there were 1,385 (321 dead, 241 alive and 823 unknown) for LTLL and 22,253 (335 dead, 3,430 alive and 18,488 unknown) for STLL in 2015 which was based on the information of our observer data. Discard of silky shark of DWPS already related in Table 5.

Table 1. The number of active fishing vessel by fishery in the WCPFC Convention Area during 2011-2015.

Year	LTLL	DWPS	STLL
2011	95	34	1,376
2012	87	34	1,326
2013	82	34	1,296
2014	73	34	1,275
2015	76	34	1,306

Table 2. The catch (in MT, round weight) of major tuna and tuna-like species of LTLL fishery in the WCPFC Convention Area during 2011-2015.

Year	N-ALB	S-ALB	BET	YFT	SWO	MLS	BUM	BLM	SKJ	TOTAL
2011	2,818	4,121	6,579	3,167	1,554	257	1166	22	155	19,839
2012	1,592	4,064	5,770	2,059	1,319	249	975	7	214	16,249
2013	2,035	4,498	5,486	1,441	1,386	222	934	1	179	16,182
2014	1,730	3,757	6,005	2,057	1,621	275	1,063	5	120	16,633
2015*	2,251	3,275	5,331	2,848	1,781	243	1,670	8	162	17,569

* Preliminary estimate

Table 3. The catch (in MT, round weight) of major tuna species of DWPS fishery in the WCPFC Convention Area during 2011-2015.

Year	SKJ	YFT	BET	Total
2011	155,641	18,143	2,151	175,935
2012	172,664	25,750	2,239	200,653
2013	186,330	22,659	3,491	212,480
2014	213,154	20,548	3,418	237,120
2015*	160,597	28,593	5,059	194,249

* Preliminary estimate

Table 4. The catch (in MT, round weight) of tuna and tuna-like species of the STLL fishery in WCPFC Convention Area during 2011-2015.

Year	ALB	BET	YFT	PBF	SWO	BILL**
2011	9,276	4,696	18,153	292	3,239	7,046
2012	8,505	5,224	14,889	210	3,430	6,430
2013	10,870	5,114	13,558	331	2,932	7,337
2014	5,264	4,013	10,200	483	2,214	6,625
2015*	5,673	4,103	11,270	577	2,574	5,739

* Preliminary estimate

**BILL: striped marlin, blue marlin, black marlin, and other billfish

Table 5. The catches (in MT, round weight) of key shark species* of LTLL, STLL and DWPS fisheries in the WCPFC Convention Area in 2015 (preliminary estimate).

	BSH	FAL	MAK		OCS	PTH	BTH	ALV	SPZ	SPL	SPK	EUB	POR	SHK
			SMA	LMA										
LTLL	1,683	0	624	19	0	53	62	0	16	4	0	0	0	126
STLL	7,756	0	575		0	132	329	0	101	145	0	0	0	1,341
DWPS**	0	33	0		1	0	0	0	0	0	0	0	0	9

* Our domestic law had ban all fisheries from catching whale sharks since 2008. Therefore, the table excludes whale shark.

** Discards

Table 6. The number of observers deployed on LTLL, STLL and DWPS fisheries in the Pacific Ocean during 2011-2015.

	LTLL	STLL	DWPS
2011	15	-	-*
2012	20	12	-*
2013	15	9	-*
2014	13	11	-*
2015	12	11	-*

* In accordance with CMM 2008-01, all our DWPS fishing vessels have to be deployed PIC observer on board and the observer coverage of for DWPS reached 100%.

Table 7. The catch of striped marlin in the area of south of 15°S during 2011-2015.

Year	Catch (MT)
2011	132
2012	82
2013	64
2014	38
2015*	97

* Preliminary estimate

Table 8. The estimate of observer coverage rate for Taiwanese longline fisheries in 2015.

Fishery	Days at Sea		
	Total estimated	Observer	Coverage rate
LTLL	21,039	1,793	8.5%
STLL	78,146	1,936	2.5%

Table 9. The catch of swordfish and the number of the longliner operating in the area

of south of 20°S during 2001-2015.

Year	Catch (MT)	Number of fishing vessel	
		Seasonal Target	Bycatch
2000	54	10	58
2001	208	10	58
2002	233	10	59
2003	248	12	72
2004	466	8	56
2005	202	6	59
2006	198	4	53
2007	217	3	46
2008	61	0	53
2009	133	7	46
2010	105	4	40
2011	98	3	66
2012	119	0	57
2013	140	0	72
2014	105	0	48
2015*	116	0	45

* Preliminary estimate

Table 10. The transshipment aggregated information in 2015

Offloaded / Received	Location of transshipment	Area of transshipment	Product Form	Area of Catch	Gear Type	Number of Transshipment	BET	ALB	YFT	SKJ	SWO	BUM	MLS	SKX	OTH	
Offloaded	High sea	WCPFC area	Frozen	Catch in EEZ of WCPFC member	Longliner	185	74	0	32	0	8	0	2	0	0	
				Catch in WCPFC area			5,817	1,340	1,515	2	1,089	1,041	124	715	783	
		Other Pacific		Catch in WCPFC area		27	278	622	51	0	102	44	8	33	69	
				Catch in other Pacific			25	56	26	0	0	0	0	0	0	
	Port	WCPFC area		Catch in EEZ of WCPFC member		Purse seiner	257	976	1,192	2,546	2,952	74	344	4	220	635
				Catch in WCPFC area				1,598	5,133	5,204	8,938	211	357	72	403	802
				Catch in other Pacific				7	96	1	0	3	3	1	0	19
				Catch in EEZ of WCPFC member				548	1	4,390	26,339	0	0	0	0	21
				Catch in WCPFC area				2,618	1	26,944	115,180	0	0	0	0	1,815

Table 11. The catch of south Pacific albacore and the number of fishing vessel in the area of south of 20°S during 2006-2015.

Year	Catch (tonnes)		Number of vessels fishing for South Pacific albacore
	Target	Bycatch	
2006	5,042	0	57
2007	4,329	276	49
2008	1,848	59	53
2009	3,350	22	53
2010	4,231	121	44
2011	3,887	91	69
2012	2,815	39	57
2013	3,729	162	62
2014	3,670	103	52
2015*	3,203	61	45

* Preliminary

Table 12. The fishing master report on cetaceans/whale sharks encircled incidentally in operations of purse seine fishery in 2015.

DATE	Longitude	Latitude	Species	Number	Reason	Measure for ensure safe release	Status on release
2015/01/17	E157°57'	S05°38'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/01/01	E172°28'	S03°25'	unidentified dolphin	9	not deliberately encircled	unknown	died
2015/02/02	E170°38'	N02°01'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/01/06	E167°17'	N01°42'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/05/16	W175°37'	S02°19'	False killer whale	7	not deliberately encircled	stop hauling	alive
2015/05/10	E178°40'	N00°14'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/05/08	E178°33'	S01°49'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/02/27	E145°57'	S00°03'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/05/02	E168°17'	S00°16'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/06/09	W172°32'	S00°49'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/03/15	E172°33'	S00°55'	unidentified dolphin	1	not deliberately encircled	stop hauling	alive
2015/06/11	W169°58'	S00°40'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/06/17	E169°42'	S02°39'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/06/19	E165°20'	N01°39'	Whale shark	1	not deliberately encircled	pulling sharks to release	alive
2015/06/22	W169°54'	S00°17'	False killer whale	1	not deliberately encircled	Cutting net	alive
2015/06/24	W170°45'	S00°46'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/07/08	E163°18'	N03°40'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/07/09	E163°18'	N03°51'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/07/09	E163°24'	N03°48'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/07/11	E161°33'	N04°23'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/07/21	E163°27'	N02°25'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/07/23	E172°27'	S01°01'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/07/29	E169°49'	S02°21'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/08/13	E168°45'	S01°44'	Whale shark	1	not deliberately encircled	stop operating	alive

2015/08/16	E171°16'	S01°15'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/08/20	E165°23'	N04°51'	unidentified whale	1	not deliberately encircled	stop hauling	alive
2015/08/22	E168°27'	N02°37'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/08/22	E170°53'	S00°28'	unidentified whale	1	not deliberately encircled	release	alive
2015/08/26	E170°41'	N00°15'	unidentified whale	1	not deliberately encircled	stop hauling	alive
2015/10/07	E168°52'	S01°11'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/10/07	E169°47'	N01°44'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/10/19	E168°22'	N01°11'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/10/23	E168°35'	N00°15'	Whale shark	1	not deliberately encircled	stop operating	alive
2015/11/21	E178°57'	S02°42'	unidentified dolphin	1	not deliberately encircled	stop operating	died
2015/12/09	E167°29'	N04°48'	unidentified whale	1	not deliberately encircled	stop hauling	alive
2015/12/10	E176°56'	S00°06'	Whale shark	1	not deliberately encircled	stop hauling	alive
2015/12/14	E166°20'	N02°33'	Whale shark	1	not deliberately encircled	release	alive
2015/12/16	E166°29'	N02°38'	Whale shark	1	not deliberately encircled	stop operating	alive

Table 13. The seabird bycatch information of longline fishery in the area of south of 30°S during 2011-2015.

Year	Fishing effort				Observed seabird hooked	
	Number of vessels	Number of hooks	Observed hooks	% hooks observed	Number	Rate
2011	32	2,678,483	335,746	12.5%	123	0.366
2012	27	3,142,654	641,731	20.4%	8	0.012
2013	24	3,921,402	390,427	10.0%	4	0.010
2014*	27	5,688,623	350,827	6.2%	3	0.009
2015*	27	3,829,322	419,452	11.0%	4	0.010

* Preliminary

Table 14. The seabird bycatch information of longline fishery in the area of north of 23°N during 2011-2015.

Year	Fishing effort				Observed seabird hooked	
	Number of vessels	Number of hooks	Observed hooks	% hooks observed	Number	Rate
2011	465	64,460,898	0	0.0%	0	-
2012	495	51,349,311	122,160	0.2%	3	0.025
2013	442	21,338,293	385,993	1.8%	6	0.016
2014*	442	23,542,222	354,224	1.5%	16	0.045
2015*	473	20,423,250	208,703	1.0%	0	0.000

* Preliminary

Table 15. The seabird bycatch information of longline fishery in the area of 23°N - 30°S during 2011-2015.

Year	Fishing effort				Observed seabird hooked	
	Number of vessels	Number of hooks	Observed hooks	% hooks observed	Number	Rate
2011	892	253,889,416	2,710,106	1.1%	4	0.001
2012	929	200,889,530	4,220,207	2.1%	5	0.001
2013	876	176,278,326	4,010,888	2.3%	0	0.000
2014*	797	141,274,339	2,547,934	1.8%	0	0.000
2015*	807	160,380,173	3,032,608	1.9%	2	0.001

* Preliminary

Table 16. The number of observed seabird bycatch of longline fishery by species and by area during 2011-2015.

Year	Species	South of 30°S	North of 23°N	23°N - 30°S
2011	Black-browed albatross	1		
	Buller's albatross	1		
	Wandering albatross	10		
	Unidentified albatross	96		
	Flesh-footed shearwater	6		
	Tropical shearwater			1
	Wedge-tailed shearwater	2		
	Black petrel	1		
	White-chinned petrel	4		1
	Brown booby			2
	Unidentified seabirds	2		
Total	123	0	4	
2012	Black-footed albatross		2	
	Campbell albatross	1		
	Wandering albatross	2		
	Unidentified albatross	5	1	
	Frigatebird			4
	Masked booby			1
Total	8	3	5	
2013	Black-footed albatross		2	
	Unidentified albatross	3	4	
	White-chinned petrel	1		
	Total	4	6	0
2014	Black-footed albatross		1	
	Laysan albatross		4	
	Unidentified albatross		11	
	White-chinned petrel	3		
	Total	3	16	0
2015*	Buller's albatross	1		
	Christmas Island frigatebird			1
	Sooty shearwater			1
	Wandering albatross	1		
	White capped albatross	2		
	Total	4	0	2

* Preliminary

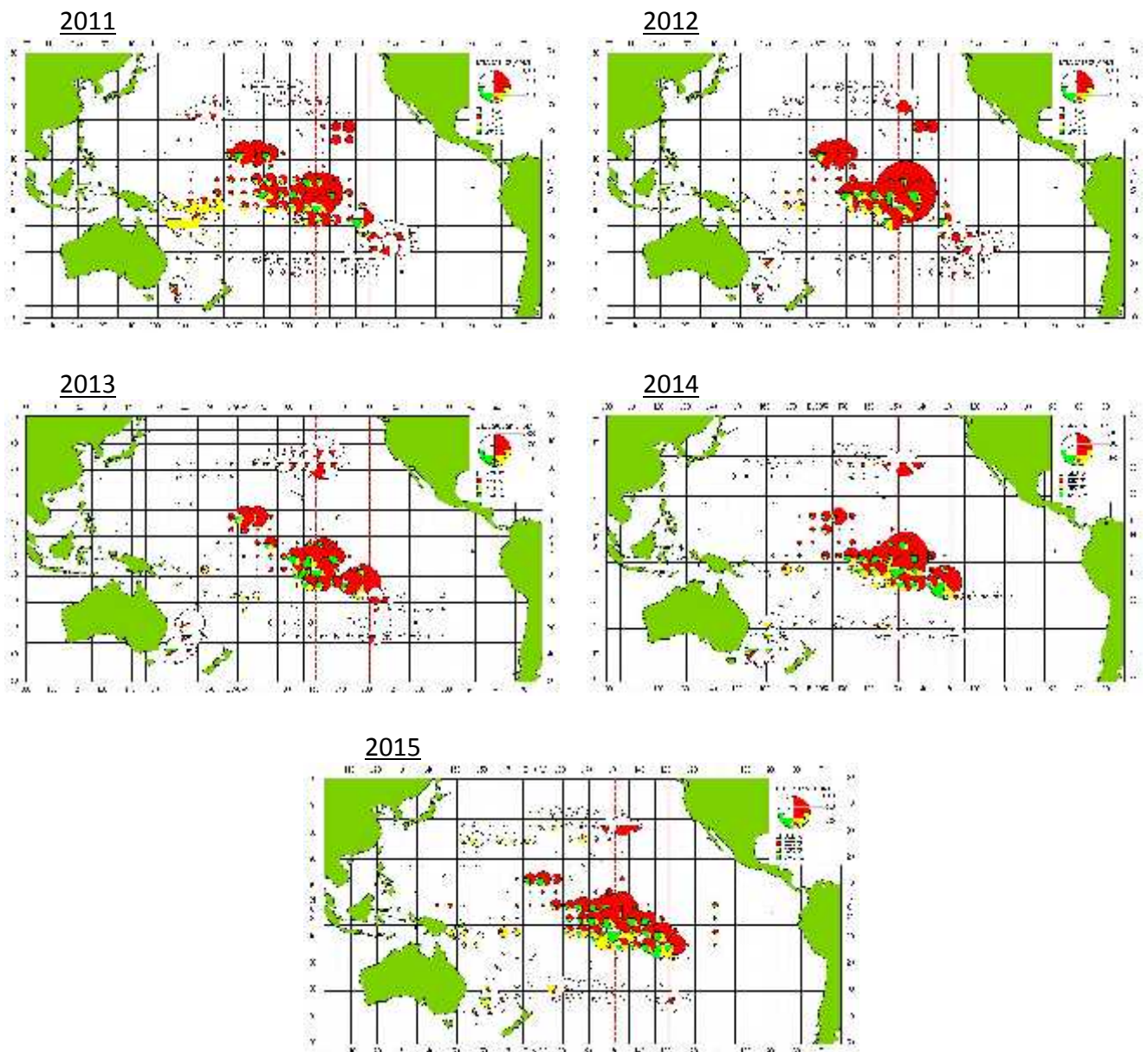


Figure 1. The catch composition distributions of tuna and tuna-like species of LTLL fishery during 2011-2015. The figures of 2014 and 2015 are still in preliminary.

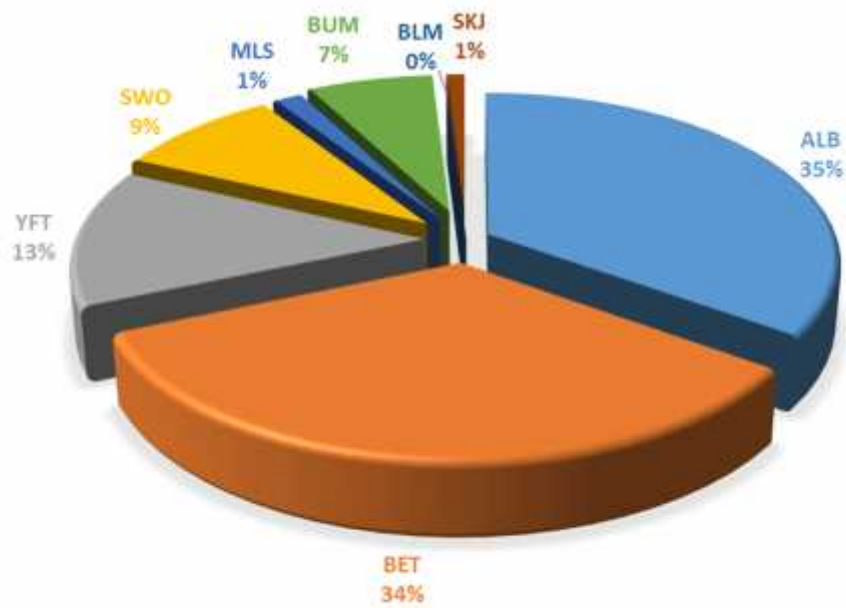


Figure 2. The catch composition of major tuna and tuna-like species for LTLL fishery in the WCPFC Convention area during 2011-2015.

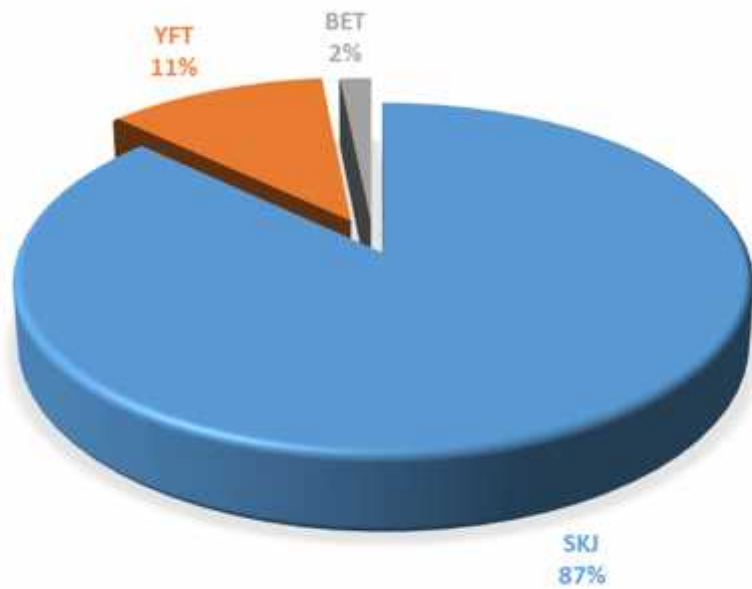
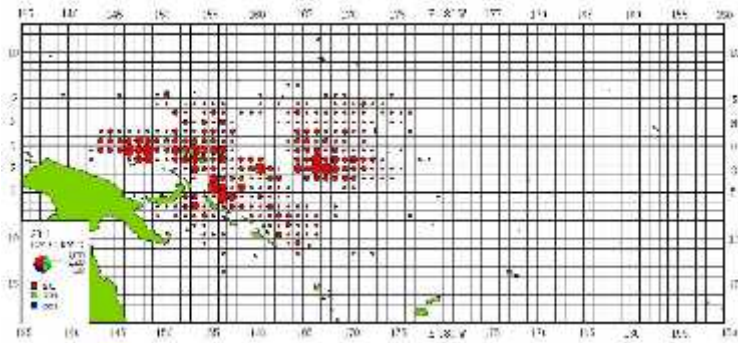
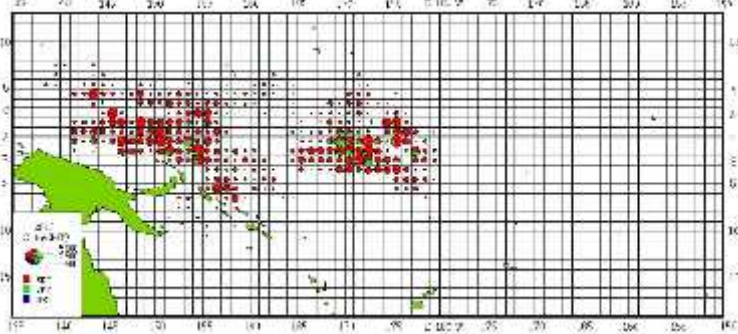


Figure 3. The catch composition of major tuna species for DWPS fishery in the WCPFC Convention area during 2011-2015.

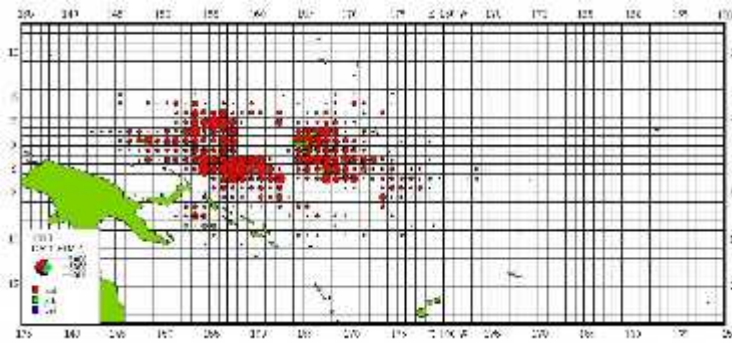


2011

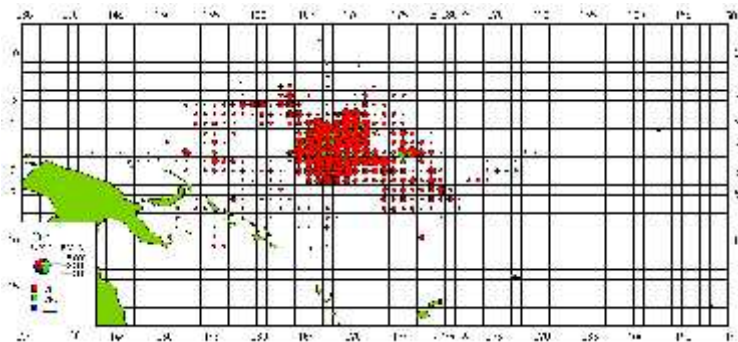
2012



2013



2014



2015

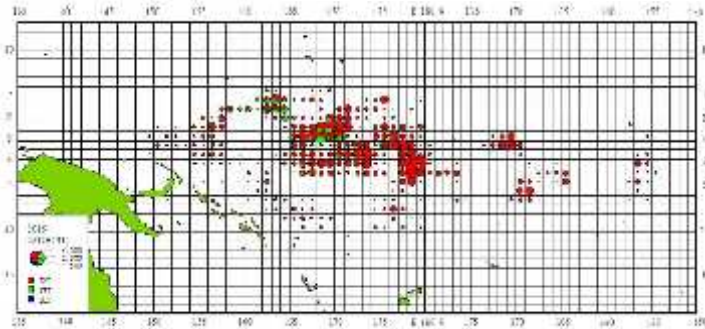
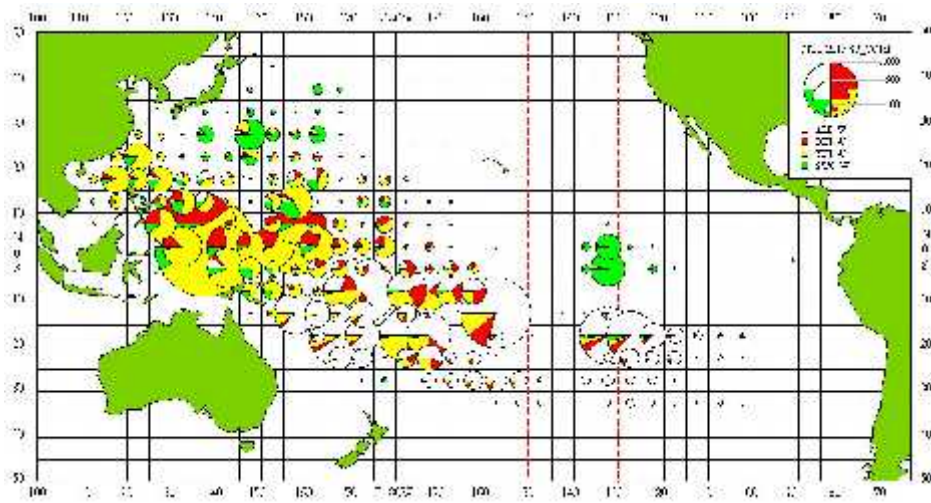
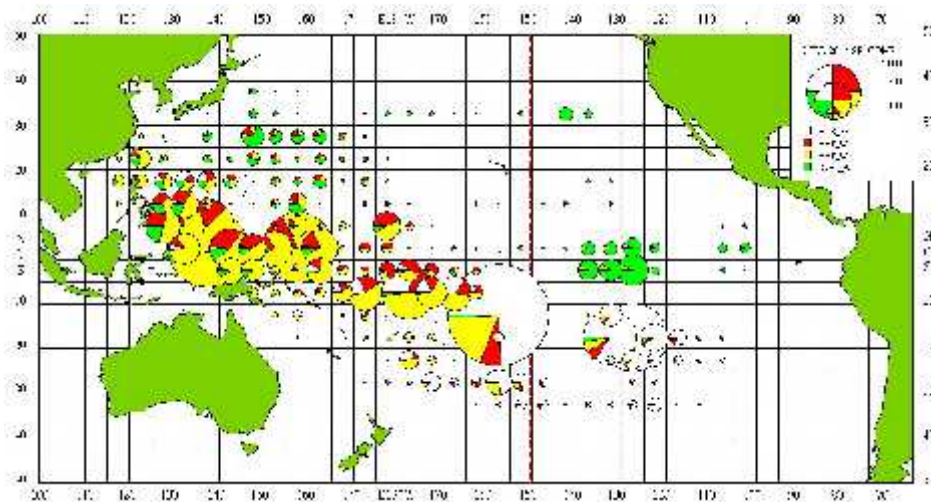


Figure 4. The catch composition distributions of DWPS fleet during 2011-2015.

2013



2014



2015

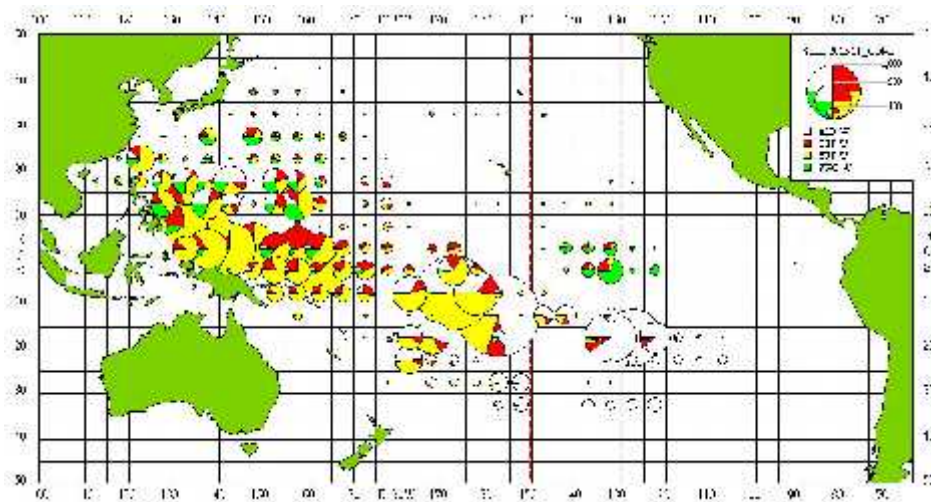
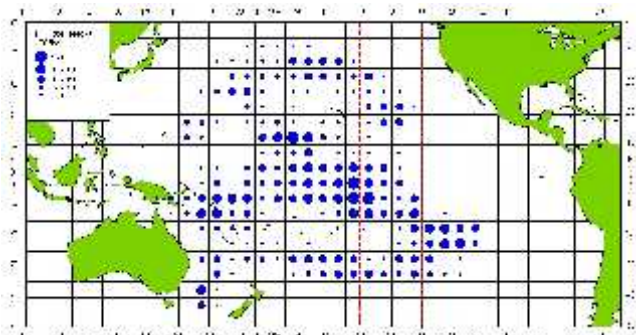
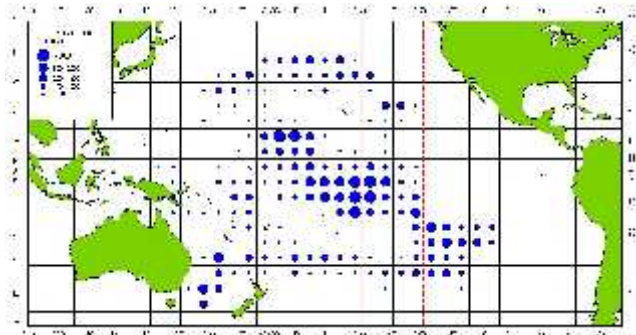


Figure 5. The catch composition distributions of tuna and tuna-like species of STLL fishery during 2013-2015. The figures of 2014 and 2015 are still in preliminary.

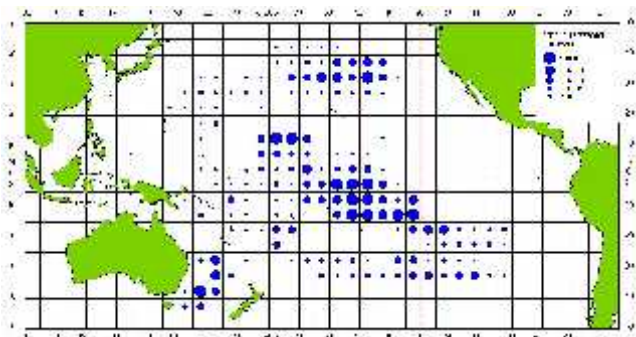
2011



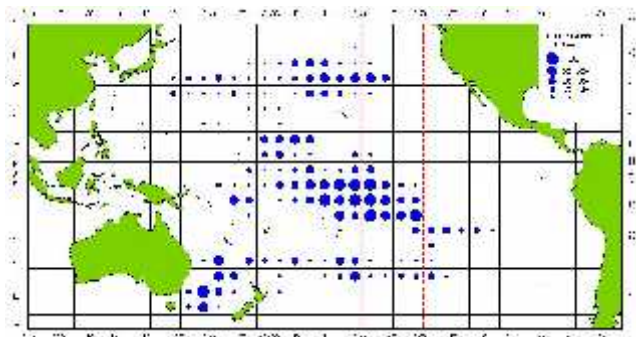
2012



2013



2014



2015

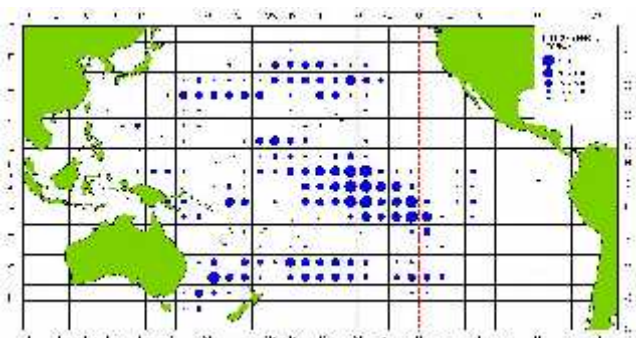
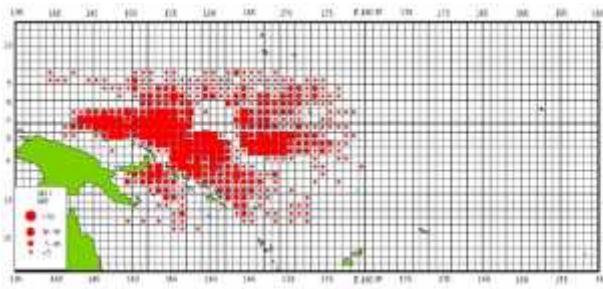
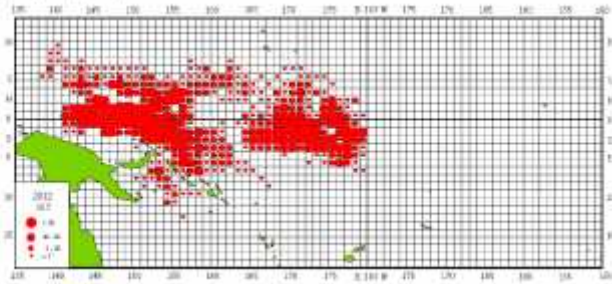


Figure 6. The effort distributions of LTL fishery during 2011-2015. The figures of 2014 and 2015 are still in preliminary.

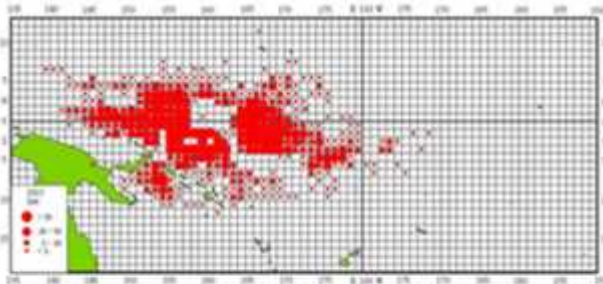


2011

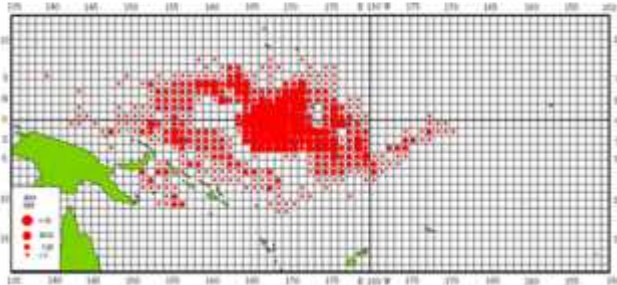
2012



2013



2014



2015

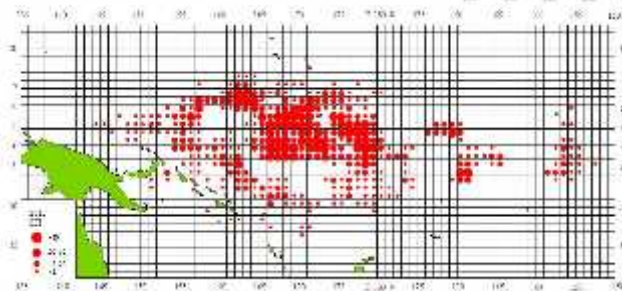
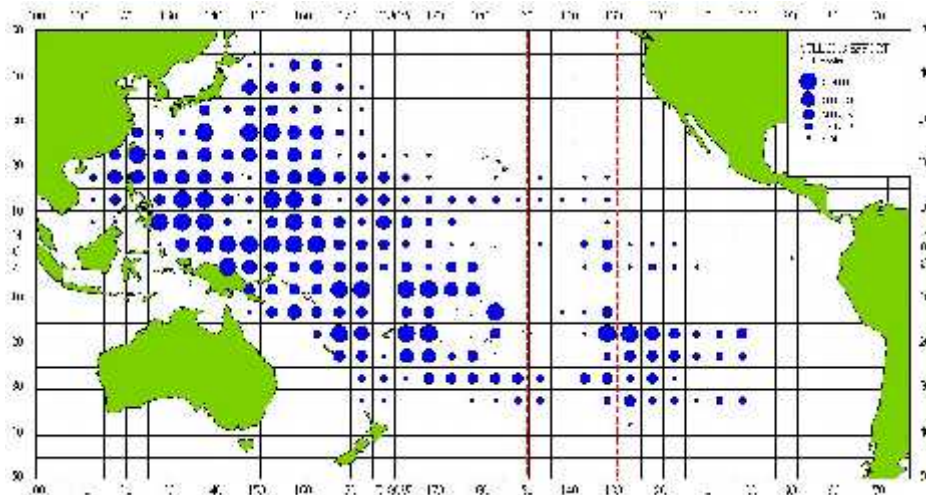
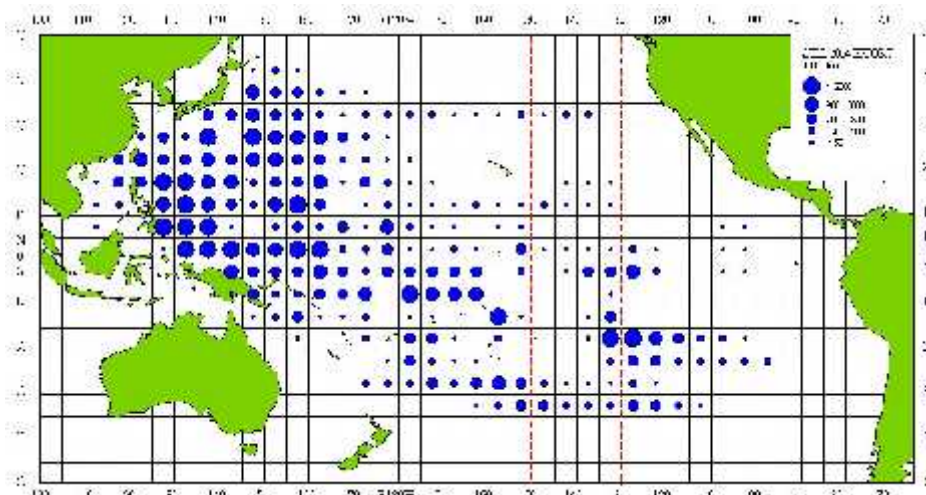


Figure 7. The effort distributions of DWPS fleet during 2011-2015.

2013



2014



2015

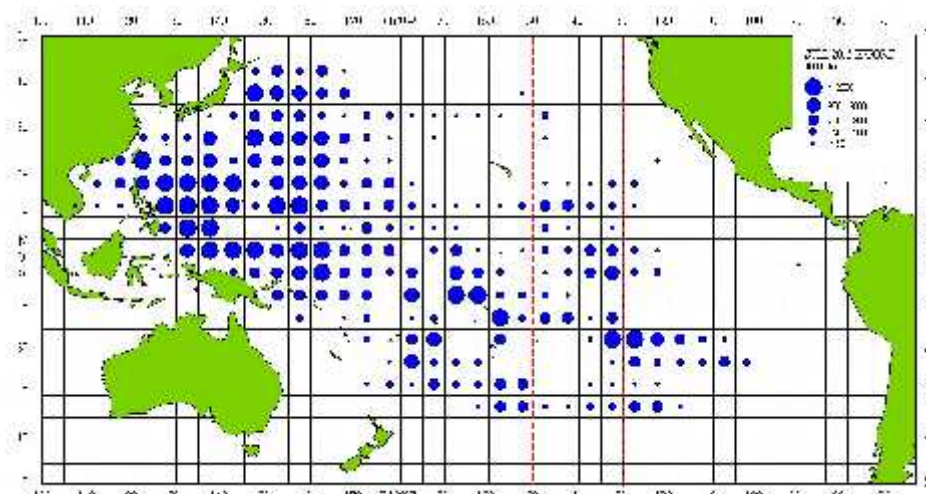


Figure 8. The effort distributions of STLL fishery during 2013-2015. The figures of 2014 and 2015 are still in preliminary.