



CURRENT STATUS OF THE POLE-AND-LINE FISHERY IN EASTERN PART OF INDONESIA

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ABSTRACT

The promotion of pole-and-line fishery for a selective gear operating in the Indonesian tuna management area is considered as the proper policy in response to the increasing market demand with tuna eco-labeled. Appropriate information in addressing the current status of the pole-and-line fishery in Indonesia is an important step in order to support the promotion. Data used to describe the fishery were obtained through scientific port sampling program in collaboration between RCFMC and WCPFC in 2010 to 2014 and also scientific observer onboard program collaboration RCFMC and CRAC Co. Ltd. in 2013. The results show that presently the number of pole and line fleets was decreased significantly and remain about 232 fleets in Sorong, Bitung and Kendari and Larantuka. The national annual total catch of pole-and line during 1980 – 2013 was recorded between 24,000 and 160,000 tons per year (average 98,117 tons per year). This value is estimated to contribute about 20% of Indonesia annual total catch of tuna in FMAs 713-717. The pole-and-line catch rates based at Bitung, Kendari and Sorong were fluctuated in each year with the range respective between 8.79 and 17.93 tons/trip/vessel, 4.78 and 5.36 ton/trip/vessel and about 7.99 ton ton/trip/vessel. Pole-and-line fishery operated in Indonesian FMAs 713-717 is considered as selective fishery, with > 80 % catches of skipjack in matured stage. The tuna-live bait fish ratio in Indonesian pole-and-line was 4.41 :1, then an improvement of live bait ratio as well as its management is required.

Keywords: Current status; pole and line; Indonesia

INTRODUCTION

Pole-and-line that locally known as *huhate* has been used as a fishing gear by Indonesian fishers since long time ago to capture mainly skipjack (*Katsuwonus pelamis*). The pole-and-line fishery has been developed mainly in the eastern part of Indonesia particularly in the water northern off Papua, Sulawesi and Maluku. Fishing operation of pole-and-line is mainly in within five out of eleven Indonesian Fisheries Management Areas or FMA that are FMA 713, 714, 715, 716 and 717.

The pole-and-line fishing method is involving two interlinked fisheries both live bait fisheries and tuna fisheries. Live bait fisheries is supporting the pole-and-line fishing operation in targeting skipjack. The sustainability and availability of live bait for pole-and-line operation is essential for this fishery. To date Indonesia does not have a specific management measure ensuring long-term sustainability of live bait resources.

Pole-and-line fishers operate their gear either within free fish schooling or around drifting log or flotsam. They are also fishing in the around of seamounts to target the free schooling of skipjack. The Indonesian pole-and-line fishers are mostly using *fish aggregating devices* (FADs) in their fishing. The use of FAD in pole-and-line fishery are mainly to attract fish school but at the same time during the fishing operation is still utilized live-bait to manipulate line hook with the live bait and catch the skipjack schooling. While targeting skipjack, the pole-and-line fishing operation also catch small number of juvenile yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*) and neritic tuna as by catch.

The tuna resources in FMAs 713 to 717 are not only caught by pole and line but also other gears such as purse seine, tuna long line, hand line and troll line. In 2015, Directorate General of Capture Fisheries (DGCF)-Ministry of Marine Affairs and Fisheries (MMAF) Republic of Indonesia has registered about 398 tuna vessels to the Western and Central Pacific

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Fisheries Commission-WCPFC (<https://www.wcpfc.int/record-fishing-vessel-database>) consisted of 26 pole-and-liners, 160 tuna long liners, 124 purse seines, 1 gillnetters, 4 hand liners, 26 fish carriers, 55 support vessels, 2 not specified fishing vessels. Due to the result of there having been Ministry of Marine Affairs and Fisheries regulations particularly Ministerial Decree No. 56 year 2014 about moratorium fishing business licensing in Indonesia FMA, it is predicted that the number of each fleet is far below the actual number. The vessel owner has officially registered their fleets to the RFMOs through the Indonesian government (DGCF) due to the requirement by the market, but it is not the case for most vessels selling domestically their catch.

Most of the pole-and-line catch from Indonesia is locally marketed (Gillett, 2011). While there is also a growing demand from tuna fish processing industries to only accept an eco-labeling and eco-certified fishing product which a pole and line fisheries has a better position compare to purse seiner. For example, the UK canned tuna market has a very effective public campaign promoting a shifting to pole-and-line product and this also followed by the US market (Gillett, 2010). It is predicted that the demand of pole-and-line product will increase in the near future. Indonesia needs to consider seriously improving and developing the management of pole-and-line fisheries to anticipate the market demand. This paper describes the current status of the pole-and-line fishery in Indonesia.

MATERIALS AND METHODS

Primary data were obtained from research collaboration between Research Center for Fisheries Management and Conservation or RCFMC and Western and Central Pacific Fisheries Commission or WCPFC through port sampling program between 2010 and 2014. Primary data were also obtained from research collaboration RCFMC and Citra Raja Ampat Canning or CRAC Co. Ltd through onboard observer program in 2013. CRAC Co Ltd is a fishery company based in Sorong-West Papua which operates pole-and-line fleet. The main fishing ground of CRAC Co Ltd.'s pole-and-line fleets are Indonesian FMA 717.

Data of pole-and-line fishery recorded from port sampling program included: fishing ground or estimation of FADs position obtained from skipper, effort includes number fishing day, estimation number of live-bait fish used in bucket, number of fisher or crew, catch includes total catch in kg or ton,

composition of catch by species, and catch size in fork-length. Data recorded from on board observer program included effort in number of effective fishing days, number live-bait fish used in buckets, species of live-bait used, number and position of FADs visited, number of free schooling which is fished, catch includes number but regardless of species. Observer program was also recorded the data of periods or time when the pole-and-lines were not fished. The reasons pole-and-liner is not fishing include bad weather, steaming to and from the fishing grounds, preparing for fishing, time spent in handling the catch and no bait available.

Secondary data were obtained from Bitung Oceanic Fishing Port, Kendari Oceanic Fishing Port, Citra Raja Ampat Canning Co. Ltd. Located in Sorong. The data included number of vessel landing, vessel specification, and monthly catch of pole-and-line fleet. The catch rate or catch ability is calculated using equation as presented by Petrere *et al.*(2010) as below:

$$CPUE = \frac{\sum C_i}{\sum f_i} = \frac{\bar{C}}{\bar{f}} \dots\dots\dots(1)$$

where, C_i is i^{th} catch (ton), f_i is its respective fishing effort (effective day of fishing).

RESULTS AND DISCUSSION

Results

Fleet

The fleets were noted by referring to Indonesian Pole-and-line and Hand Line Fisheries Association or *Asosiasi Perikanan Pole-and-line dan Handline Indonesia* or AP2HI, in the absent of official data from DGCF. In 2015, AP2HI noted the active number of pole-and-line fleet in Sorong, Bitung and Kendari are 132 units. The number pole-and-line in Sorong is 34 units with size ranged 49-98 GT. The number pole-and-line in Bitung is 62 units with size ranged 20-143 GT, and in Kendari, the number is 36 units with size ranged 14-34 GT. Gillett (2014) reported that about 80 to 100 pole-and-line vessels are based in Larantuka, but only about 60% are operationally active. Pole-and-line fleet structure of Sorong, Bitung and Kendari is presented in Figure 1. The Average crew of pole-and-line based in Sorong, Bitung and Kendari were 25 fishers, 30 fishers and 22 fishers respectively.

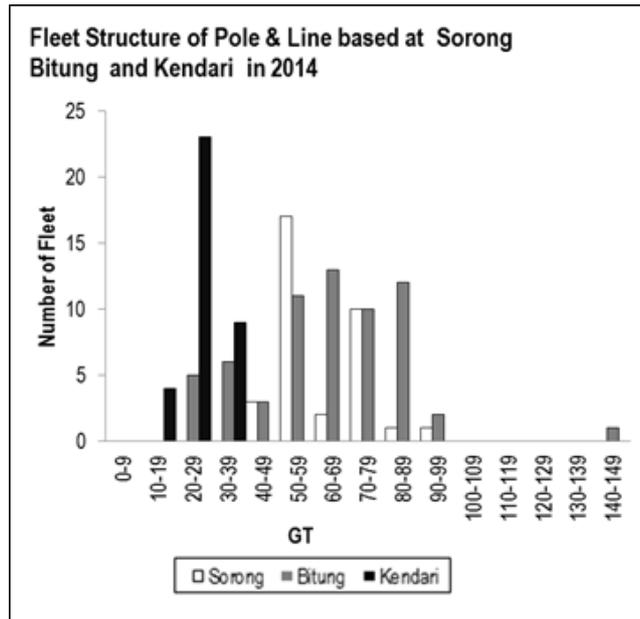


Figure 1. Fleet structure of pole-and-line based at Sorong, Bitung and Kendari in 2014.

Fishing Ground

The fishing ground of pole-and-line fishery is indicated by location the fishers deploy the Fish Aggregating Devices or FADs. Pole-and-line fishers have rarely fished in free schooling fish recently. They are highly dependent on FADs as a factor of success in the fishing practice. Inaccuracy of number and position of FADs in the fishing ground are the outstanding issue facing by fisheries manager. Achieving an estimate of the total number and position of FADs in the fishing ground proved difficult. This was largely the result of the current lack of effective systems of FAD registration and monitoring, and also because of the desire of fishing companies and vessel skippers to keep FADs position information

confidential. Although current fisheries laws require the registration of FADs and owners of FADs to supply positional and vesseluse information for each FAD installed to Directorate General of Capture Fisheries in Jakarta. These laws have not yet been effectively implemented and adhered to. In general, National, Provincial, Regency and District offices of Ministry of Marine Affairs and Fisheries (MMAF) were unable to provide information of numbers and locations of FADs.

The positions of FADs that are presented in Figure 2 were obtained from enumerator program in Kendari, Bitung and Sorong as well as observer program in Sorong. The FADs position present in Figure 2 are not only for pole-and-line but include of purse seine and hand line/troll line fisheries as well.

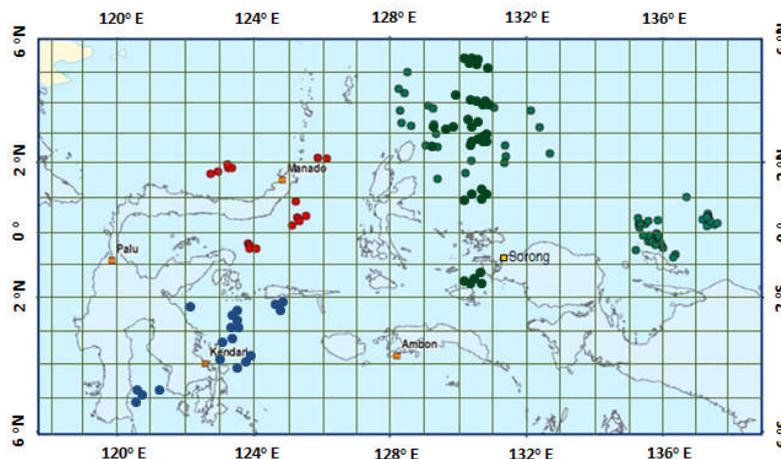


Figure 2. The FADs position which indicate as pole-and-line fishing ground.

Live-Baitfish

The pole-and-line uses live-bait which is combined with water sprayed in the fishing to attract tuna and catch them. The live-baitfish is captured in a separate fishing operation using lift net gear or bagan. Bagan operates in the inshore waters and indicate as live-bait fishing ground. Pole-and-line fleets based at Sorong obtained live bait from bagans operate in Misol, Kabui and Aljui. The other potensial bait fishing ground of pole-and line based Sorong are Fofak bay, Makebon, Redekorido, Rumberpon dan Ansoes bay.

Pole-and-line based at Bitung obtained live fish bait from bagans operate in Batu Putih Beach, Rondor Beach, Magogimbun bay and Matabulu waters. While pole-and-line based at Kendari obtained the live-baitfish from bagans operate in around of Umbele Island. Result of observation show that at least 15 species of baitfish identified during observer program in Sorong as presented in Table 1. The common species of live-baitfish used by pole-and-line based at Sorong. Live bait fish composition dominated by gold anchovy was 34.1 % of seven buckets (about 35 kg) samples.

Table 1. Live bait composition caught by bagan in vicinity of Misol, Kajui and Aljui waters-Sorong-West Papua during observer program in 2013.

Local Name	Indonesia Name	Common Name	Composition (%)
PuriMerah	Teri	Gold anchovy	34.1
Puriputih	Teri	Blue anchovy	17.2
Purihitam	Teri	Oceanic anchovy	10.6
Lompe	Lompa	Little priest	7.6
Maeroa	Kasan	Little sprat	6.7
Gosao	Kasan	Blue sprat	5.8
Tendipang	Tembang	Sardine	4.1
Make	Tembang	Sardine	3.2
Sardin	Sardin	Sardine	2.4
Lolosimerah	Pisang-pisang	Fusilier	2.0
Lolosi	Pisang-pisang	Fusilier	1.8
Lolot (Sangsa)	Kembung	White lined	1.3
Momar (Malalugis)	Layang	Round scad	1.1
Tude	Bentong	Big-eye scad	1.1
Suntung	Cumi-cumi	Squid	1.0

The amount of tuna captured divided by the amount of bait used is known as tuna-baitfish ratio. Result of study in Sorong in 2013 shows that the average of baitfish used per trip per vessel was about 568 buckets or about 2.84 ton baitfish, one bucket contains about 5 kg baitfish. Total trip of 31 active pole-and-liners based at Sorong in 2013 was about 262, and the total of bait fish about 744.1 ton per year. The total catch of pole-and-line was about 3,285 ton tuna in 2013, so that tuna-baitfish ratio was 4.41:1.

Catch Rate

Result of port sampling program by enumerator

in the three landing bases i.e.Bitung, Kendari and Sorong are presented in Table 2, indicating that catch rate of pole-and-line based at Bitung is fluctuated in each year between 8.79 ton/trip/vessel and 17.93 ton/trip/vessel. The catch rate pole-and-line based at Kendari was relatively stable i.e. 4.78 ton/trip/vessel and 5.36 ton/trip/vessel. Catch rate pole-and-line from Sorong was only one year i.e. 7.99 ton ton/trip/vessel (Table 2). The average of the effective day of pole-and-line vessel based at Sorong, Bitung and Kendari were about 8, 10 and 6 days per trip, respectively. The effective day is defined as the day when the pole-and line vessel is fishing.

Table 2. Catch rate of pole-and-line based at Bitung, Kendari and Sorong in 2010-2014.

Year	Landing Places	Fishing Gear	Number of Trip	Catch (TON)			Total	Catch Rate (ton/trip/vessel)
				SKJ	YFT	BET		
2010	Bitung	PL	125	1,046.7	19.6	28.7	1,095.0	8.76
	Kendari	PL	492	2,103.2	238.6	0.0		
2011	Bitung	PL	92	523.1	0.0	10.3	533.4	5.80
	Kendari	PL	469	1,613.9	565.2	41.7	2,220.8	4.74
2012	Bitung	PL	75	1,125.4	0.0	96.6	1,322.0	17.63
	Kendari	PL	212	949.9	34.6	0.0	985.5	4.64
2013	Bitung	PL	218	3,046.3	317.7	83.5	3,465.7	15.81
	Kendari	PL	229	685.9	0.0	0.0	685.9	3.00
2014	Bitung	PL	173	2,117.8	172.1	47.5	2,537.4	14.67
	Kendari	PL	98	370.5	118.6	0.0	489.1	4.99
	Sorong	PL	68	414.5	112.7	10.5	543.1	7.91

Commercial pole-and-line fishing has begun to operate in the area of Eastern Indonesia when Indonesian government established some Government pole-and-line companies such as Usaha Mina and Perikani in early 1970s. Usaha Mina Company based at Sorong-Papua and Perikani Company based at Ambon-Maluku and also Bitung-North Sulawesi. Since the last 15 years the government pole-and-line companies were no longer operating and since then

started developing private pole-and-line companies. There are about 15 fisheries private companies that operate pole-and-line in the area. The catch estimate of pole-and-line operated in Indonesian FMAs 713, 714, 715, 716 and 717 is based on the result of national tuna catch estimate in 2014 lead by DGCF-MMAF (Figure 4). The catch of pole-and line during 1980 – 2013 was fluctuated between 24,000 and 160,000 ton per year with average 98,117 ton per year.

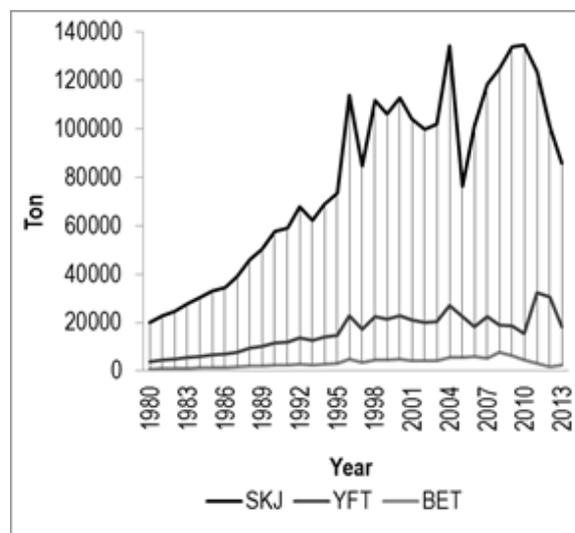


Figure 4. The estimate of total catch of pole-and-line operated in Indonesian FMAs 713-717.

Note: SKJ=skipjack tuna, YFT= yellowfin tuna, BET bigeye tuna

Catch Composition

Target of pole-and-line is skipjack tuna (*Katsuwonus pelamis*) with by-catch of yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*) in juvenile stage and few of neritic tuna as well as sheer fish includes. Neritic tunas caught by pole-and-line include frigate tuna (*Auxist hazard*), bullet tuna (*Auxis*

rochei), kawa-kawa (*Euthynnus affinis*) and longtail tuna (*Thunnus tonggol*). Results of port sampling program in Sorong, Bitung and Kendari show that composition of skipjack tuna was about 77.1 – 92.7 % of the total catch of tuna with average 77.8 %, 83.7 % and 80.7 % in, in Sorong and Kendari, respectively (Tables 3, 4 and 5).

Table 3. The catch composition of pole-and-line based at Sorong

Year	Catch composition (%)		
	Skipjack tuna	Yellowfin tuna	Bigeye tuna
2012	77.1	16.5	6.4
2013	78.4	19.7	1.9
Average	77.8	13.0	4.2

Table 4. The catch composition of pole-and-line based at Bitung

Year	Catch composition(%)		
	Skipjack tuna	Yellowfin tuna	Bigeye tuna
2007	81.0	15.4	3.6
2008	82.5	12.4	5.0
2009	87.0	10.0	3.0
2010	87.0	10.0	3.0
2011	77.3	20.4	2.3
2012	92.7	3.3	4.0
2013	78.3	19.9	1.8
Average	83.7	13.1	3.2

Table 5. The catch composition of pole-and-line based at Kendari.

Year	Catch composition (%)		
	Skipjack tuna	Yellowfin tuna	Bigeye tuna
2007	81.0	15.4	3.6
2008	82.5	12.4	5.0
2009	87.0	10.0	3.0
2010	87.0	9.9	3.1
2011	77.0	20.0	2.0
2012	68.8	30.9	0.3
2013	80.9	16.5	2.6
Average	80.7	16.4	2.9

Catch size

The size (fork length, FL) of sample of skipjack

tuna caught using pole-and-line at port sampling based at Sorong in 2013 ranged between 25 – 70 cm, with highest modus of 56-58 cm in April (Figure 5).

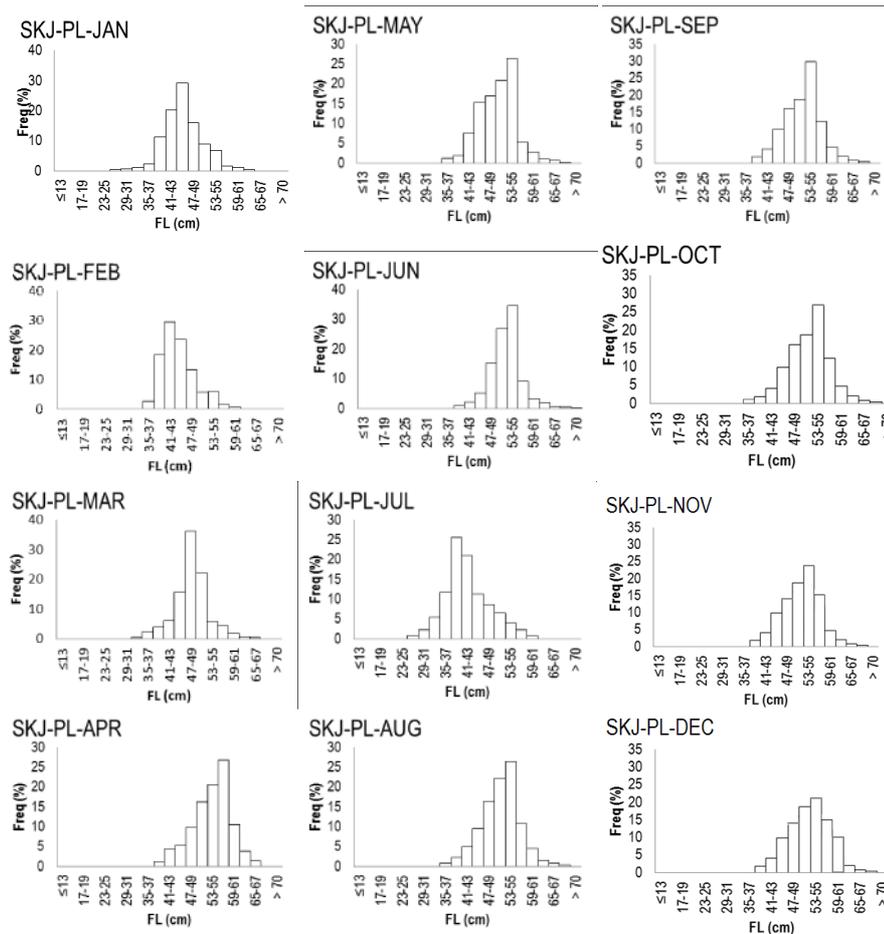


Figure 5. Size distribution of skipjack tuna caught by pole-and-line based at Sorongin 2013.

Discussion

Capture Fisheries Statistics of Indonesia 2012 (DGCF, 2013) reported that number of unit pole-and-liners 7,338 units. That number is alleged excess of the real number and requires clarification. Number pole-and-liner reported by Indonesian Pole-and-line and Hand Line Fisheries Association or Asosiasi Perikanan Pole-and-line dan Handline Indonesia (AP2HI) seems more plausible that 134 units in 2014. Decrease the number of pole-and-liners may have occurred, but a decrease of about 7,000 in a year is too much. The decrease of number of pole-and-line is caused some fishers shifted the gear to other gear such as deep hand line in order to catch large tuna such as yellowfin tuna and bigeye tuna to get much higher price. Increasing difficulty in obtaining live bait fish has resulted many pole-and-lines stops fishing. Overlap fishing ground with other fishing gear particularly with purse seine was also resulted decreasing the catch of pole-and-line (Pers. Comm. with Mr. Suyoto operational manager of CRAC Co. Ltd.-Sorong, 2014).

In practical reason mostly pole-and-liners are preferably operated in around *fish aggregating devices* (FADs) where fish schoolings are already densely aggregated. Beside pole-and-line, other fishing gears particularly purse seine and troll line/hand line are also using FADs in their fishing. Achieving an estimate of the total number and position of anchored tuna FADs in Indonesia's FMA's 713 – 717 proved difficult. This was largely the result of the current lack of effective systems of FAD registration and monitoring, and also because of the desire of fishing companies and vessel skippers to keep FAD position information confidential.

In term of *live-baitfish* three major groups of live-baitfish associate to the Indonesian pole-and-line fisheries i.e. anchovies, sprats and sardine. The efficiency of the use of live-baitfish is indicated by the tuna-live baitfish ratio. The newest information of tuna-live baitfish ratio in Western and Central Pacific Ocean (WCPO) was 31.5 : 1 in the period 1977-1980 (Gillett, 2010 in IPNLF, 2012). The tuna-live baitfish ratio in

Indian Ocean was 7.4 – 10.0 : 1 (Anderson, 1997 in IPNLF, 2012). Tuna-live baitfish ratio in Indonesia was very low i.e. 4.41 :1. The low of the value of tuna-live baitfish ratio can be affected by several factors such as the baitfish species used, fishing style, and other factors such as lowskill of bait spreader.

The differences of pole-and-line's catch rate for each fishing base (Sorong, Bitung and Kendari) likely are influenced by size of vessel, number of crew (fisher) and number of effective fishing day. Pole-and-line vessel with size 61 GT, 25 number of crew and effective fishing day 8 day/trip based at Sorong gain in average 7.99 tons/trip/vessel. Pole-and-line vessel with average size 64 GT, 30 number of crew and effective fishing day 10 day/trip based at Bitung has in average catch rate about 12.64 tons/trip/vessel. Pole-and-line vessel with average size 27 GT, 22 number of crew and effective fishing day 6 days/trip based at Kendari has in average catch rate about 4.97 tons/trip/vessel. Suprianto *et al.* (2012) noted that pole-and-line fleets based at Belang, North Sulawesi has in average catch rate 2.04 ton/trip/vessel in 2012. Pole-and-line vessel based at Belang known as *funai* with average size about 15 GT, number of crew about 8 fishers and effective fishing day about 5 days.

The average catch of pole-and-line in Indonesia during 1980 – 2013 was 98,117 tons per year. The amount is approximately 30% of the total of world's pole-and-line catches which reached an average between 300,000 and 400,000 tons in the 1970s to the mid-2000s (Gillett, 2011). In the context of Indonesian tuna fisheries in FMA 713-717, the pole-

and-line fishery contributes about 20% of Indonesia total tuna catch in FMA 713-717 i.e. 480,020 tons as reported to WCPFC in 2014.

The main target of pole-and-line is skipjack with main baycatch juvenile YFT and BET. Percentage of juvenile yellowfin tuna reached 13.0 – 16.4 % and juvenile bigeye tuna was 2.9 – 4.2 % of the total catch. It is possibly caused the pole-and-line fishing in around FADs. The exact reasons for the association of juvenile bigeye tuna and FADs are still not known (Dagorn *et al.* 2007). But, Castro *et al.* (2002) stated that FADs provide protection to juvenile bigeye tuna while also providing them with a good food supply, which increases their chances of survival. In addition, drifting objects may help juvenile bigeye and other species migrate to adult habitats. The floating objects are also believed primarily for protection from predators, as a source of food availability and to increase survival of eggs, larvae and juveniles (Gooding & Magnuson, 1967). Juvenile bigeye may also use FADs as a meeting point to develop larger schools (Fréon and Dagorn 2000). Discriminating juvenile tuna from s

Based on FL of skipjack caught by pole-and-line based at Sorong in 2013 it indicates that the length of first captured (L_c) ranged from 41 to 55 cm. If the length of first matured (L_m) of skipjack is 40 cm FL (Naganuma, 1979) so that the size of $L_c > L_m$, this shows about 84.1 % of the catch in mature condition (Table 6). This phenomenon is different from the catch of yellowfin and bigeye that all catch tend to be immatured.

Taking into account that the pole-and-line gear is

Table 6. The composition (%) of matured (FL > 40 cm) and immatured (FL < 40 cm) of skipjack caught by pole-and-line based at Sorong in 2013.

L_m	%												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
< 40 cm	15.8	20.8	6.7	12	3.1	1.0	45.8	3.1	1.7	2.9	18.8	70.2	15.9
> 40 cm	84.2	79.2	93.3	98.8	96.9	99.0	54.2	96.9	98.3	97.1	81.2	29.8	84.1

selective indicated by more than 80% of the catch dominated by skipjack. Table 6 show that skipjacks caught by pole-and-line were mostly in matured stage excepted in July and September. Based on that evidence, pole-and-line is recommended to promote as a gear for Indonesian tuna fisheries. The important improvement which can be meanwhile it should improve the live bait fisheries to support with it operation. It is also required increasing the tuna-live baitfish ratio through better practice of pole-and-line fishery.

CONCLUSION

The number of pole-and-line fleets has been sharply decreased since 2012 from 7,338 units to only 232 units in 2014. The fleets are mainly based in Sorong, Bitung and Kendari. The national annual total catch of pole-and-line during 1980–2013 is estimated between 24,000 and 160,000 tons per year (in average 98,117 tons per year). The catch contributed about 20% of Indonesia annual total catch of tuna caught in Indonesian FMAs 713-717. The pole-and-line catch rates based at Bitung, Kendari and Sorong are fluctuated each year ranging between 8.79 and 17.93 tons/trip/vessel, 4.78 and 5.36 tons/trip/vessel and about 7.99 tons/trip/vessel, respectively. Skipjack caught by pole-and-line vessels operated in Indonesian FMAs 713-717 are mostly (more than 80 % of total catch) mature. The tuna-live baitfish ratio 4.41 : 1 for Indonesian pole-and-line was very low. Current work found that pole-and-line is a selective gear which was caught skipjack mostly as matured stage and recommends to promote this gear to be used in developing fishery in Indonesia, especially for Indonesian tuna fisheries, in meantime by improving the tuna-live baitfish ratio.

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