Updated information on catch and effort of yellowfin tuna (*Thunnus albacares*) from Indonesian tuna longline fishery

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Abstract

Yellowfin tuna (*Thunnus albacares*) is one of the main targets for Indonesian tuna longline fishery in the Eastern Indian Ocean. There were two types of data used in this study; first was the skipper's "logbook" data from the state-owned commercial tuna longline vessels based in Benoa Port (1978-1995), and the later was the scientific observer data conducted by Research Institute for Tuna Fisheries (RITF) from 2005 to 2018. Both data then combined to produce nominal catch per unit of effort (CPUE) (no. fish/100 hooks). The result showed that the catch rates of yellowfin tuna is declining over the years. The highest CPUE recorded was in 1982 (0.94), while the lowest was in 2015 (0.03). Efforts distributed mainly within 0-35 ^{o}S and 75 – 130 ^{o}E. While high average CPUE areas mainly occurred between 5-10 ^{o}S and 80-130 ^{o}E. We are still in progress of completing the skipper's "logbook" data entry in a hope of presenting the appropriate yellowfin tuna standardized CPUE in the future.

Keywords: Nominal CPUE; yellowfin tuna; longline fishery; Eastern Indian Ocean

Introduction

Yellowfin tuna (*Thunnus albacares*) is one of the most exploited tuna species in all ocean includes Indian Ocean. Annual total catch of yellowfin tuna in Indian Ocean increased significantly since 1980's. The average of annual catch was 399,830 metric ton (t) between 2013 and 2017, in 2017 the total annual catch approximately 409,101 t (IOTC, 2018). In the last 4 years (2015-2018), the IOTC stated that the yellowfin status was in the overfished and became the subject to overfishing (IOTC, 2018).

Abundance indices (e.g. CPUE) convey important information concerning the status of fisheries stocks because it related to the biomass. Furthermore, those indices are necessary to run simple models and they are also used as auxiliary data in more detailed stock assessment models (Maunder & Punt, 2004). The information nominal CPUE as well as standardized ones have been presented by a number of scientists in recent years (Matsumoto et al., 2018; Winker et al., 2017; Yeh & Chang, 2015; Dai et al., 2002). However, lack of detailed data has hampered the calculation of standardized CPUE in the recent decades caught by other fleets or in areas where Japanese or Taiwanese longline fleets have not operated in (e.g. eastern Indian Ocean). Therefore, this paper provides new information on nominal CPUE in the east of Indian Ocean

based Indonesian tuna longline fleets. We believe the results are valuable in term of fill the research gap and contribute as an auxiliary information to assess the status of YFT in the Indian Ocean.

Materials and methods

There were two types of data used in this study; first was the skipper's logbook data from the state-owned commercial tuna longline vessels based in Benoa Port (1978-1995), and the second was the scientific observer data conducted by Research Institute for Tuna Fisheries (RITF) from 2005 to 2018 and National Observer Program, conducted by Directorate General of Capture Fisheries (DGCF) since 2016. The skipper's logbook data contained 35,687 set-by-set data. However, 8.22% of the datasets were excluded due to cleaning process. No data in 1986 was due to the oil price hike, but the operation was resumed the next year. On the other hand, the scientific observer data were collected from October 2005 to December 2018. There were 3092 longline sets recorded by the scientific observer with the fishing areas during 2005-2018 between 0-35^{o}S and 75 – 130^{o}E. These data then plotted on a 5x5-degree square basis.

Catch is declared in number of fish and effort in total number of hooks/set. Catch rates is define as number of yellowfin caught per 100 hooks. The graphs in produced with Microsoft Excel Office 2019 and the maps is drawn with QGIS Desktop 3.4.4.

Results

The scientific observer program started in 2005 as an Indonesia-Australia collaboration (Project FIS/2002/074 of Australian Centre for International Agricultural Research), and since 2010 it has been conducted by the Research Institute for Tuna Fisheries (Indonesia) and DGCF since 2016. Scientific observers and national observers recorded catch and operational data at sea following Indonesian tuna longline commercial vessels from 2005-2018 and 2016-2018, respectively. The combined dataset contained 121 trips, 3092 sets, 3499 days-at-sea, and more than 3.5 million hooks deployed, respectively (Table 1). The number of the hooks between floats were ranged between 11 – 18 hooks per float.

The effort distribution based on scientific observer data during 2005-2017 distributed within 0-35^{o}S and 75-130^{o}E, with the highest effort occurred within 10-15 ^{o}S (Figure 2). High CPUE of yellowfin tuna occurred between 5-20 ^{o}S and 30-35 ^{o}S (Figure 3). Distribution pattern of CPUE of yellowfin tuna indicated that yellowfin tuna mainly concentrated in waters between 5^{o}N and 10^{o}S, with the mean CPUE ranged from 0.05-0.81 fish/100 hooks.

Nominal catch per unit effort of YFT during 1978-1995 was relatively declining (Sadiyah et al., 2011). It was in its peaks (0.78 – 0.94 fish/100 hooks) until the deep longline technique introduced in 1983 (Sadiyah et al., 2011; Gafa et al., 2000). The number of the hooks between float used prior 1983 was 6 hooks between floats, meanwhile 10 hooks between floats used in 1983 due to the changing of the fishing technique targeting BET (Sadiyah et al. 2011). In the other hand, the annual average of CPUE of scientific observer data (2005-2017) was relatively steady over the years, the highest catch was recorded in 2010 with an average of 0.12 fish/100 hooks and the lowest was in 2015 with 0.03 fish/ 100 hooks but slightly increased in 2018 (0.05 fish/100 hooks) (Figure 1).

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Conclusion

CPUE (no. fish/100 hooks) of yellowfin tuna showing a declining trend over the years. The highest CPUE recorded was in 1982 (0.94), while the lowest was in 2015 (0.03). Efforts distributed mainly within 0-35 ^{o}S and 75 – 130 ^{o}E. While high average CPUE areas mainly occurred between 5-10 ^{o}S and 80-130 ^{o}E. We are still in progress of completing the logbook data entry in a hope of presenting standardized CPUE in the next couple of years.

Future Work

A work on standardized CPUE on YFT is expected after the completing and validating the skipper's logbook data. We hope it can be presented at the next WPTT meeting.

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Table 1. Summary of observed fishing effort from Indonesian tuna longline fishery during 2005–2018

Year	Trips	Sets	Total Hooks	Hooks per Set	Hooks per Float	Mean Latitude	Mean Longitude
2005	9	108	157,065	1,454.31	18.6	14.3ºS	111.8ºE
2006	13	401	577,243	1,439.51	11.2	16.9ºS	113.4ºE
2007	13	265	406,135	1,532.58	14.0	17.0ºS	103.5ºE
2008	15	370	483,662	1,307.19	13.0	14.2ºS	107.3ºE
2009	13	283	323,042	1,141.49	12.1	11.4ºS	113.2ºE
2010	6	165	220,394	1,335.72	13.6	12.0ºS	113.3ºE
2011	3	105	110,384	1,051.28	12.0	13.7ºS	117.4ºE
2012	8	198	290,265	1,465.98	14.1	18.9ºS	104.5ºE
2013	7	225	252,919	1,124.08	12.7	12.4ºS	114.6ºE
2014	5	167	193,740	1,160.12	15.0	11.0ºS	105.7ºE
2015	5	148	172,463	1,165.29	14.1	10.8ºS	103.8ºE
2016	8	244	324,068	1,314.89	15.2	10.6ºS	107.5ºE
2017	10	218	279,204	1,214.04	17.2	11.8ºS	99.1ºE
2018	6	195	262,856	1,347.98	14.8	14.5ºS	105.3ºE

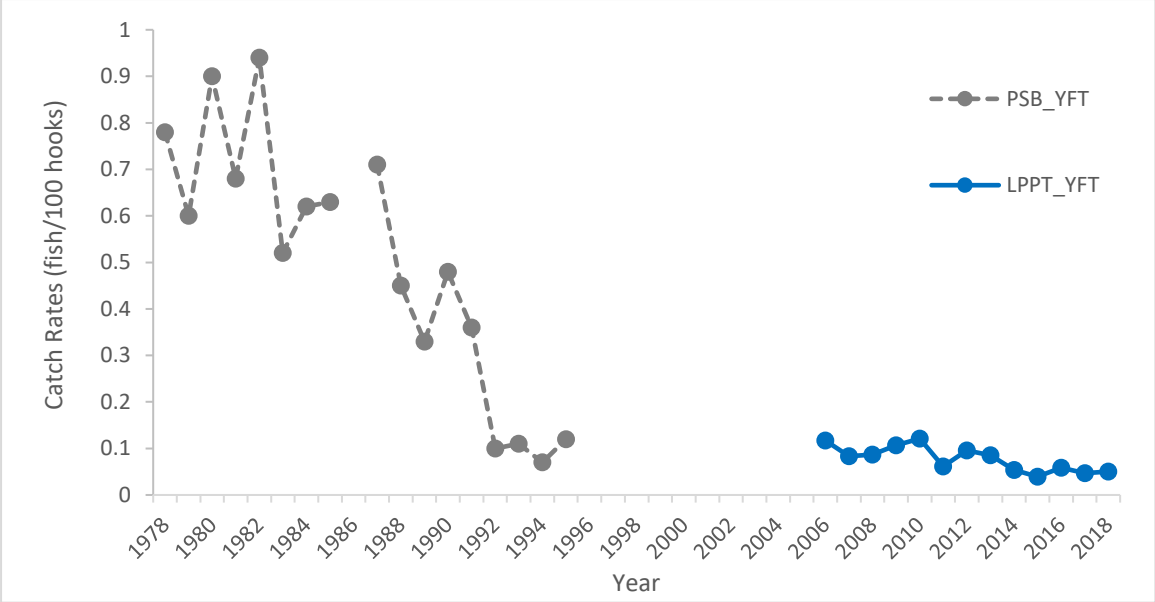

Figure 1. Average nominal catch per unit effort (no. fish/100 hooks) of yellowfin tuna (remarks: the early nominal CPUE data was reproduced from Sadiyah *et al*., 2011).

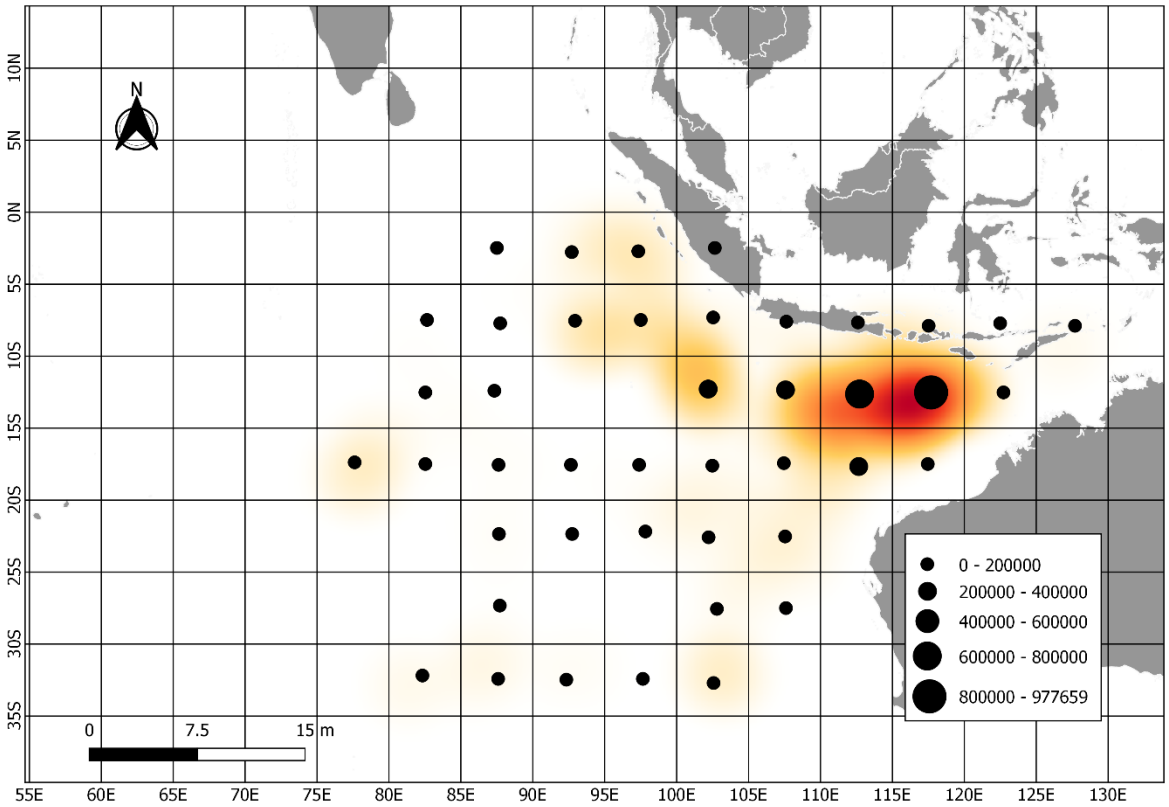

Figure 2. The distribution of effort (number of hooks) based on observer data collected from longline fishery in Indian Ocean (2005 – 2018)

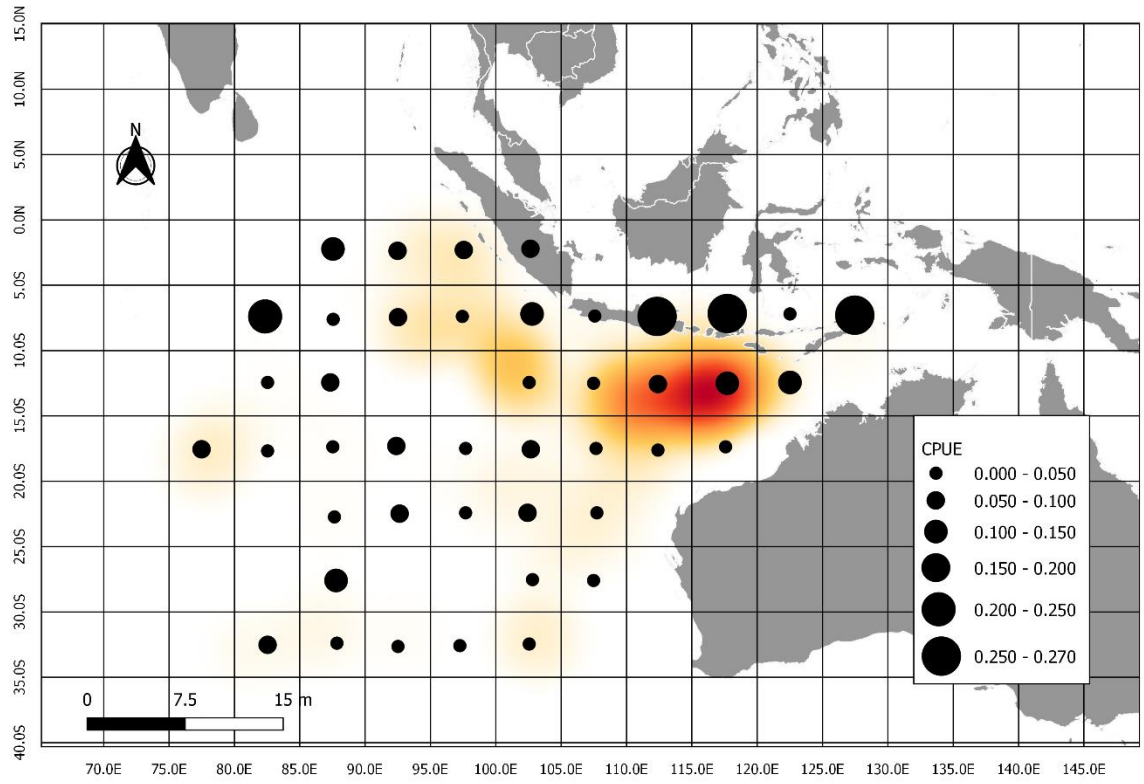

Figure 3. The distribution of CPUE of yellowfin tuna based on observer data collected from Indonesian longline fishery in Indian Ocean (2005 – 2018)