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

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Abstract

Albacore tuna (*Thunnus alalunga*) is one of the main targets for Indonesian tuna longline fishery in the Eastern Indian Ocean. The fishery has begun since early 1980's, when deep longline introduced. 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 2017. Both then combined to produce nominal catch-per-unit-of-effort (CPUE) (no. fish/100 hooks). The result showed that the catch rates of albacore tuna was very low at the start of the series (1978-1995) which below 0.2/100 hooks, but higher at the recent decade (2005-2017), which around 0.2-0.4/100 hooks. Efforts were geographically distributed within the area bordered by 5 – 35^{o}S and 75 – 130^{o}E. High CPUE mainly occurred in sub area between 25^{o}S and 35^{o}S. We are still in progress of completing the skipper's "logbook" data entry in a hope of presenting the appropriate standardized CPUE in the future.
Keywords: abundance; albacore; longline; Indian Ocean

Introduction

Large scale tuna fisheries in Indonesia commenced in late 1965 (Simorangkir, 2000), while the small-scale tuna fisheries starter earlier. Several tuna species were landed in fishing port along the coast of Western Sumatra and Southern Java as part of East Indian Ocean. Among those species, albacore (*Thunnus alalunga* Bonnaterre 1788) was considered as incidental catch of this fishery. Previous study indicated that albacore belongs to the group of highly migratory species and markedly as one of the economically important species targeted by tuna longline fleets operated in various oceanic waters such as Pacific, Indian and Atlantic Oceans as well as Mediterranean Sea ((Chen, Lee, & Tzeng, 2005; Childers, Snyder, & Kohin, 2011; Huang, Hsu, Lee, & Yeh, 2003; Zárate, 2011). It widely distributed across the oceanic waters embracing area of 50^{o}N to 40^{o}S, with the exception of 25^{o}N in the Indian Ocean (Collette & Nauen, 1983; Yoshida & Otsu, 1963). In the last four decades albacore has been exploited by large scale commercial Japanese longline vessels that started in mid-1950 and

followed by Taiwanese, Korean and Indonesian fishing vessels within the years of 1954, 1966 and 1975, respectively (Nishida & Tanaka, 2008; Simorangkir, 2000).

Recent data indicated that Indonesian vessels comprised about 26% of the total Indian albacore catch by all fishing countries (IOTC-WPTmT06, 2016). Albacore mostly caught by deep freezing longlines (90%), but in recent years the catch levels of albacore for the fresh-tuna longline fishery of Taiwan, China have increased (IOTC-WPTmT06, 2016). It prompted a change in catch composition between deep freezing longline and fresh longline. The landing of albacore by the Indonesian longline fleets operating in the Indian Ocean during 2005-2016 was estimated between 5,636-12,970 ton with average ~9,000 ton. Port of Benoa contributes around 71.3% of total albacore tuna production in Indonesia. It also noted that in recent decade, the production of albacore tuna is declining.

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 (Fonteneau, 2016; Guan, Tang, Zhu, Tian, & Xu, 2016; Hoyle, Yeh, Kim, & Matsumoto, 2016; Nishida et al., 2016). 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 albacore 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 (1978-2008, but only 1978-1995 were showed), and the second was the scientific observer data conducted by Research Institute for Tuna Fisheries (RITF) from 2005 to 2017 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 2017. There were 2897 longline sets recorded by

the scientific observer with the fishing areas during 2005-2017 between 0-35°S and 75 – 130°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/sets. Catch rates is define as number of albacores caught per 100 hooks. The graphs in produced with Microsoft office Excel 2016 and the maps is drawn with QGIS 3.4.1.

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 2005-2017 and 2016-2017, respectively. The combined dataset contained 115 trips, 2887 sets, 3499 days-at-sea, and more than 3.5 million hooks deployed, respectively (Table 1). Efforts were geographically distributed within the area bordered by 5 – 35°S and 75 – 130°E. High CPUE mainly occurred in sub area between 25°S and 35°S.

Nominal catch per unit effort of albacore during 1978-1995 was relatively low (<0.2/100 hooks), because most of the fleets were after yellowfin tuna as the main target (Sadiyah, Dowling, & Prisantoso, 2011). Even with the introduction of deep longline technique in early 1980's did not affect much on the catch rates. A spike in 1987, perhaps due to increase of abundance after a year off. On the other hand, the annual average of CPUE of scientific observer data (2005-2017) was higher (between 0.2-0.4/100 hooks), although the series were more susceptible to uncertainty. The main obstacle of fishery-independent data, such as scientific observer data was the lack of spatial coverage which hampered the calculation on nominal catch rates (Figure 1).

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FIS/2002/074: Capacity Development to Monitor, Analyze and Report on Indonesian Tuna Fisheries.

Future Work

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

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Table 1. Summary of observed fishing effort from Indonesian tuna longline fishery during 2005–2017.

Year	Trips	Sets	Days at Sea	Total Hooks	Hooks per Set		Hooks per Float		Mean Latitude		Mean Longitude	
2005	9	108	117	157,065	1,454.31	(151.8)	18.6	(1.5)	14.3ºS	(1.0º)	111.8ºE	(2.1º)
2006	13	401	401	577,243	1,439.51	(214.9)	11.2	(3.9)	16.9ºS	(6.0º)	113.4ºE	(5.4º)
2007	13	265	258	406,135	1,532.58	(326.5)	14.0	(4.4)	17.0ºS	(6.4º)	103.5ºE	(13.3º)
2008	15	370	404	483,662	1,307.19	(385.9)	13.0	(4.5)	14.2ºS	(2.6º)	107.3ºE	(14.1º)
2009	13	283	288	323,042	1,141.49	(234.7)	12.1	(4.9)	11.4ºS	(3.3º)	113.2ºE	(5.6º)
2010	6	165	152	220,394	1,335.72	(457.5)	13.6	(5.2)	12.0ºS	(3.3º)	113.3ºE	(6.0º)
2011	3	105	111	110,384	1,051.28	(173.9)	12.0	-	13.7ºS	(0.9º)	117.4ºE	(1.3º)
2012	8	198	192	290,265	1,465.98	(559.1)	14.1	(2.3)	18.9ºS	(7.8º)	104.5ºE	(10.8º)
2013	7	225	198	252,919	1,124.08	(210.4)	12.7	(2.1)	12.4ºS	(1.1º)	114.6ºE	(6.6º)
2014	5	167	265	193,740	1,160.12	(176.9)	15.0	(2.0)	11.0ºS	(1.7º)	105.7ºE	(7.5º)
2015	5	148	241	172,463	1,165.29	(145.2)	14.1	(3.2)	10.8ºS	(2.7º)	103.8ºE	(8.1º)
2016	8	244	383	324,068	1,314.89	(146.4)	15.2	(6.4)	10.6ºS	(3.8º)	107.5ºE	(9.4º)
2017	10	218	489	279,204	1.214.04	(395.3)	17.2	(4.8)	11.8ºS	(8.9º)	99.1ºE	(4.4º)

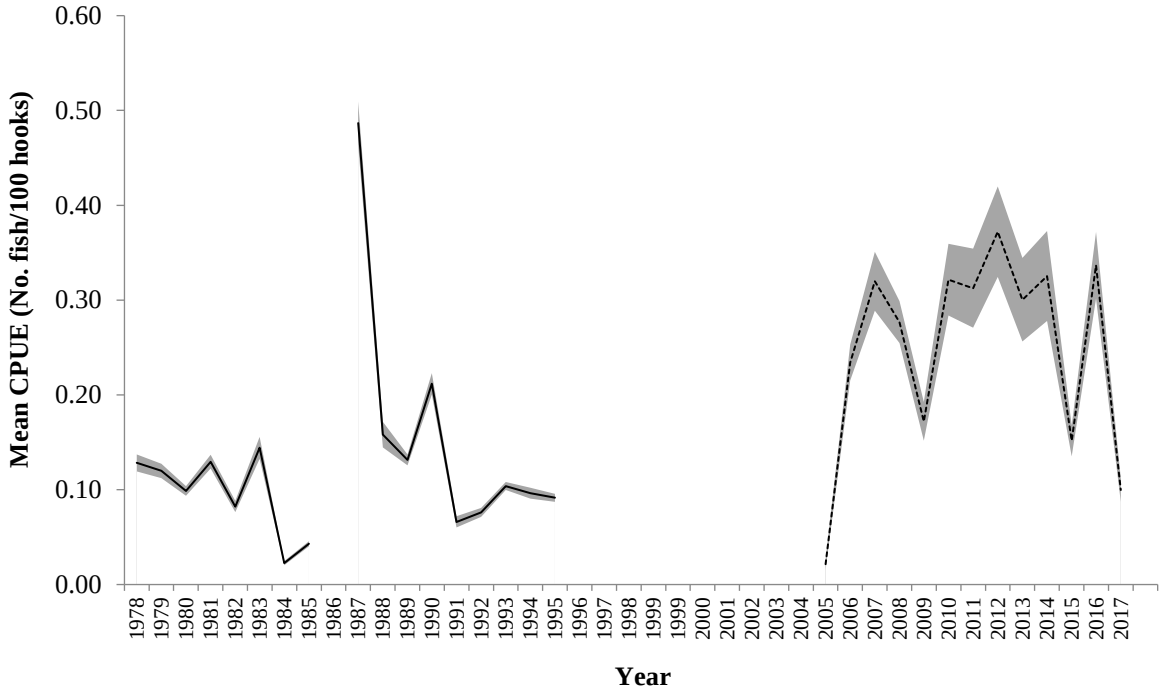

Figure 1. Average nominal catch-per-unit-effort (no. fish/100 hooks) of albacore tuna (remarks: the early nominal CPUE data was reproduced from Sadiyah, Dowling & Prisantoso (2011)).

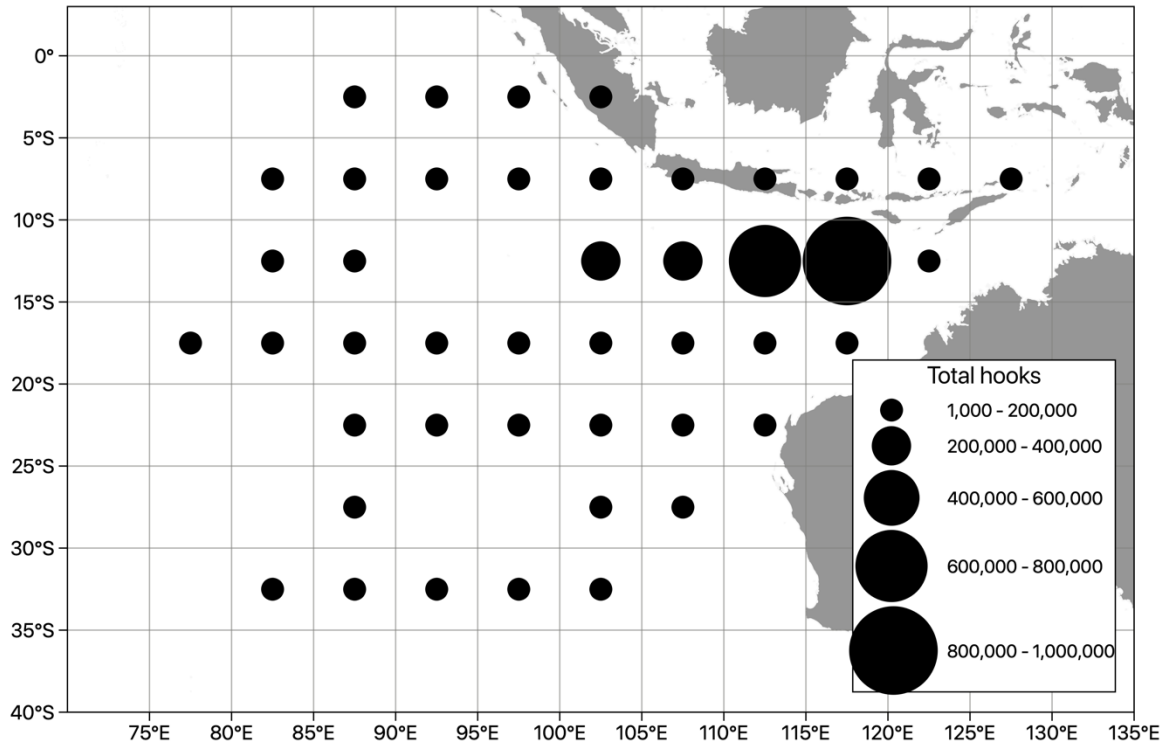

Figure 2. The distribution of effort (total hooks) of albacore tuna based on observer data collected from longline fishery in Indian Ocean (2005 – 2017).

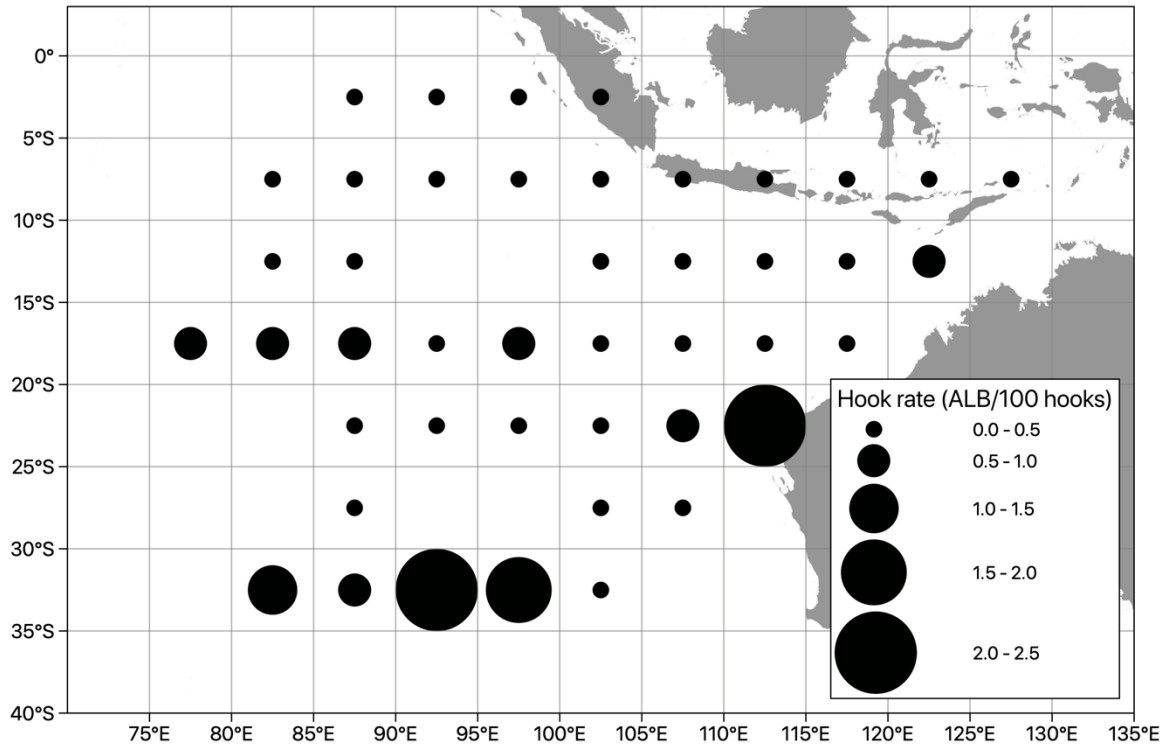

Figure 3. The distribution of CPUE of albacore tuna based on observer data collected from Indonesian longline fishery in Indian Ocean (2005 – 2017).