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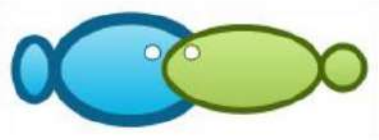
by Yusrizal,erick N,syarif S,agus Jaenudin Sopiyan D,basino,m R. Aulia,sayuri E,yuli P

Submission date: 17-Nov-2021 09:24PM (UTC+0700)
Submission ID: 1705588594
File name: Bioflux_Composition_of_target_species.pdf (667.87K)
Word count: 2896
Character count: 15087



Composition of target species, bycatch, hook rate and fluctuation for longline tuna fishing in the Eastern Indian Ocean, Indonesia

[1]Yusrizal, [1]Erick Nugraha, [1]Syarif Syamsuddin, [2]Agus Jaenudin, [3]Sopiyan Danapraja, [4]Basino, [5]M R. Aulia, [6]Sayuri Endo, [7]Yuli Purwanto

[1] Department of Fishing Technology, Faculty of Fishing Technology, Jakarta Fisheries University, South Jakarta, Indonesia; [2] Fisheries Bycatch, WWF Indonesia; [3] Department Fisheries Extension, Faculty of Fisheries Extension, Jakarta Fisheries University, Jakarta, Indonesia; [4] Department of Machinery, Faculty of Fisheries Fishing Technology, Jakarta Fisheries University, South Jakarta, Indonesia; [5] Faculty Fishing Technology, Jakarta Fisheries University, South Jakarta, Indonesia; [6] Japan Agency of Maritime Education and Training for Seafarers, Marine Technical College, Hyogo, Japan; [7] Faculty of Capture Fisheries, Polytechnic Marine and Fisheries Bitung, Bitung, North Sulawesi, Indonesia.
Corresponding author: E. Nugraha, nugraha_eriq1@yahoo.co.id

Abstract. The present research was conducted on the composition of target species and bycatch, hook rate and catch fluctuation with tuna longline fishing gear in Indian Ocean at positions 15°00"–22°00"S and 100°00"–112°00"E from November 2018 to April 2019. The results of the observations revealed a phenomenon that the composition of target species was 59% with a bycatch of 39%. The catch rate varied between 0.03 and 0.46 with a high catch rate occurred in January. In the target species group the dominant catch consisted of *Thunnus alalunga* whereas the bycatch fish group was dominated by *Lepidocybium flavobrunneum*. Both species are catches caught the most in the span of observation. Fluctuations in catches indicate that the fish season in the observation period occurs in successive months, namely December, January and February. Based on the type of fish caught, it is suspected that the setting of the branch line can reach the swimming layer of *T. alalunga* which is deeper than of *Thunnus obesus* and *Thunnus albacares*.
Key Words: tuna longline, tuna season, catch composition, tuna distribution, fishing ground.

Introduction. Indonesia is currently the largest producer of tuna in the Indian Ocean (Novianto et al 2019). Indonesia, there are various fishing gears to catch *Katsuwonus pelamis* such as: long line, hand line, pole and line, purse seine and gill net (Nainggolan et al 2017; Center for Marine and Fisheries Education 2015). Long line tuna is a fishing gear used to catch tuna, where in the long line series there are 1,000-2,000 hooks for a one time setting (Nainggolan 2007). The fishing gear is passive, after the fishing line is placed into the water, the boat's engine is turned off, so that the boat and the fishing gear are drifting (Saputra et al 2011).

According to Nugraha et al (2020a) environmentally friendly fishing gear is a fishing gear that has no negative impact on the environment and did not damage the bottom of waters. Tuna long line is an effective fishing gear for catching tuna (Watson & Kerstetter 2006). According to Baskoro et al (2014) tuna is effectively caught with a long line fishing gear because of its construction can reach the depth of the tuna swimming layer. The tuna longline yield is divided into the target species and bycatches. Determination of the fishing ground can be expected from the waters condition that is the habitat of a species (Nugraha et al 2020b).

The target species of tuna longline fishing gear are *Thunnus obesus*, *Thunnus albacares*, *Thunnus maccoyii* and *Thunnus alalunga*. The bycatch consists of catches that have economic value (by-product) and which have no economic value or are thrown back

into the sea (discard). Fish bycatch are fish caught on the tuna longline other than the target species (Setyadji & Nugraha 2012). The target species and bycatch of the present study can be seen in Table 1.

Table 1

Target species and bycatch during observation

Common name	*Scientific name*
Albacore	*Thunnus alalunga*
Yellow fin	*Thunnus albacares*
Big eye	*Thunnus obesus*
Bluefin	*Thunnus maccoyii*
Marlin	*Istiophoridae rafinesque*
Moonfish	*Lampris guttatus*
Black marlin	*Istiompax indica*
Narrow-barred Spanish mackerel	*Scomberomorus commerson*
Escolar	*Lepidocybium flavobrunneum*
Swordfish	*Xiphias gladius*
Leafscale gulper shark	*Centrophorus squamosus*

The value of the catch rate is an indicator of the high or low abundance of tuna in these waters. Catch rate value means the number of tuna caught per 100 hooks (Baskoro et al 2014).

Nainggolan (2007) stated that one of the aspects that support the success of tuna fishing operations is the determination of the right fishing grounds. Indian Ocean is the main commodity producer of fisheries resources owned by Indonesia, one of which is tuna fisheries (Widianto & Nikijuluw 2003). Construction and parts of tuna longline fishing gear can be seen in Figure 1.

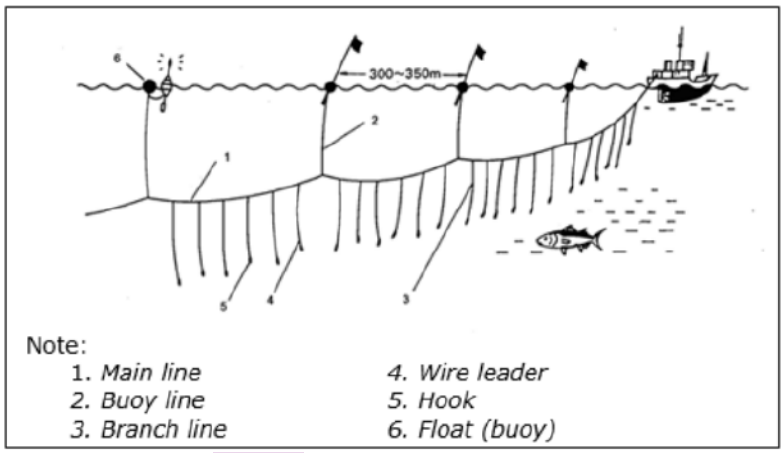


Figure 1. Long line (PPKP 2015).

The present study aimed to identify the composition of the target species, bycatch, hook rate and catch fluctuation of a tuna longline fishing operation in the Eastern Indian Ocean which was carried out within 5 months from November 2018 to April 2019 with the fishing ground at the position of 15^{0}00"–22^{0}00"S and 100^{0}00"–112^{0}00"E.

Material and Method. Data was obtained from fishing operations using tuna long line fishing gear then the catches were tabulated according to several types which were grouped in two large groups as target species and bycatch. The hook rate reflects the number of catches per hundred hooks. Catching composition was calculated according to

the target species and bycatch ratio, while the catch fluctuations during the fishing operation were tabulated monthly to see the best catch time in during the observation.

Results and Discussion

Target species and bycatch. The catches obtained during fishing operations were represented by 1,714 fish samples with the detailed species presented in Table 2.

Table 2

Total tuna longline catching in the Eastern Indian Ocean from November 2018 to April 2019

Species	*Amount (fish)*	*Nov 2018*	*Dec 2018*	*Jan 2019*	*Feb 2019*	*Mar 2019*	*Apr 2019*
Thunnus alalunga	836	7	278	241	214	38	108
Thunnus albacares	21	4	0	1	9	1	6
Thunnus obesus	73	24	3	17	9	6	14
Thunnus maccoyii	34	1	5	6	16	4	2
Istiophoridae rafinesque	13	1	3	3	3	2	1
Lampris guttatus	27	1	8	7	4	2	5
Istiompax indica	1	1	0	0	0	0	0
Scomberomorus commerson	43	1	4	13	17	7	1
Lepidocybium flavobrunneum	498	1	91	146	174	39	47
Xiphias gladius	14	1	2	0	3	1	7
Centrophorus squamosus	103	2	25	19	16	26	15

From Table 2 it can be concluded that, during data acquisition, there were 11 species consisted of 4 tuna species, which where categorized as target species and 7 other species of fish which were categorized as bycatch fish.

The identification results concerning the catch composition showed 59% target species and 41% bycatch.

In Figure 2 it can be seen that the distribution of catch composition in the target species was dominated by *T. alalunga*, other tuna species were present in relatively small percentage. The data distribution gives an indication concerning the higher catch which was represented by *T. alalunga* as a target species.

The dominance pattern of the catch of the target species is also found in the bycatch phenomena data where there are species of *Lepidocybium flavobrunneum* that were caught in a very high percentage.

The distribution of data also shows that there was a large size catch of 103 *Centrophorus squamosus* included in the bycatch type.

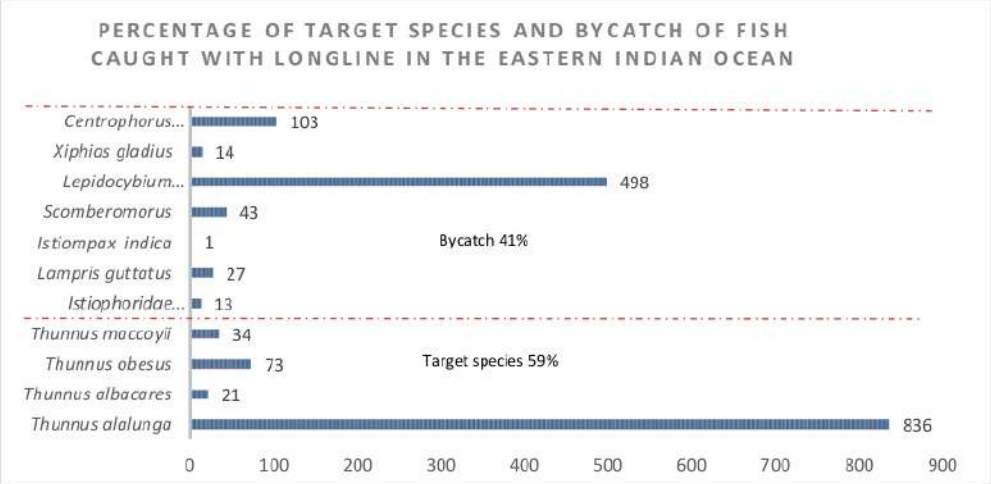


Figure 2. Percentage of target species and by catch of fish caught with tuna longline in the Eastern Indian Ocean from November 2018 to April 2019.

Hook rate. According to Bahtiar et al (2013) the value of the hook rate from December to April from 2005 to 2010 was 0.13. The hook rate ratio comparison between our results and literature is not too significant; the difference is only 0.09. The range of hook rate in the period of capture ranged from 0.03 to 0.46. The hook rate values appeared to be relatively small sized in November and March. The overall distribution of hook rate is presented in Figure 3.

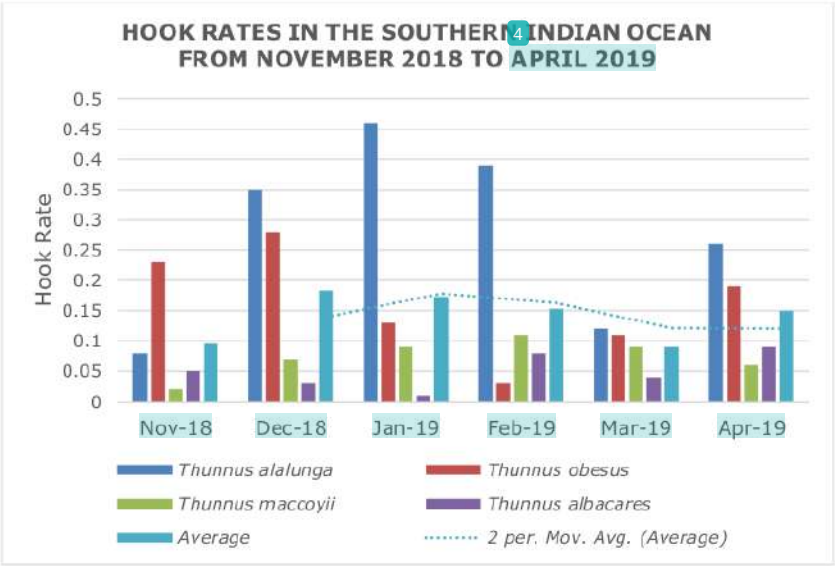


Figure 3. Distribution of tuna longline hook rates in the Indian Ocean from November 2018 to April 2019.

The distribution of the hook rate during the observation showed the peak value of the hook rate in January which was dominated by *T. alalunga* catch. The analysis shows that there is a pattern of distribution of the hook rate that forms a normal distribution with

the peak in January. The distribution also shows that a good hook rate was found in three consecutive months, namely December, January and February.

Analysis of the moving average shows that the average hook rate forms a peak and it is assumed that the hook rate will rise again after April. The distribution of the hook rate value is small in March but the distribution is relatively the same for each target species.

Fluctuations of target species. Fluctuations of target species show a pattern that is relatively the same as the pattern of catching rate distribution. High catches occurred in the three consecutive months of December, January and February, with the catching peak in January (Figure 4).

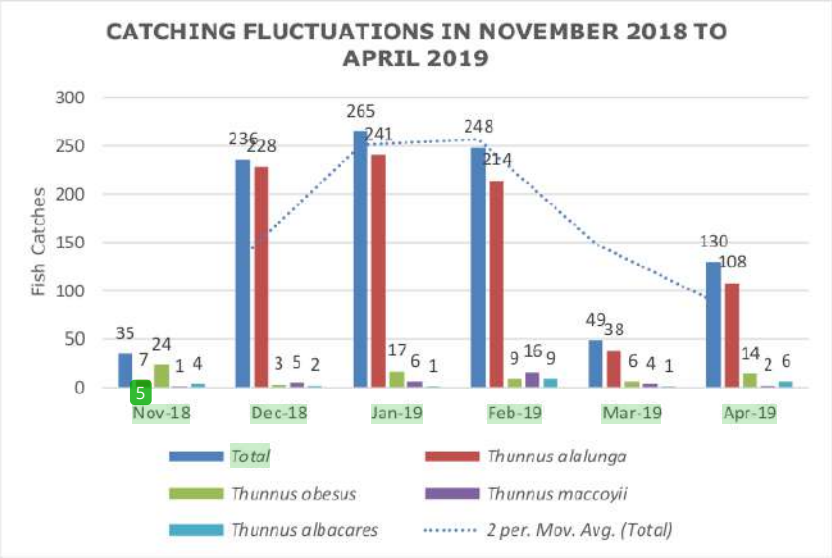


Figure 4. Catching fluctuation.

By identifying the catch rate and the catch fluctuation distribution as analyzed from the catching data distribution, it can be said that in December, January and February is the season of fish with large size catches on *T. alalunga* species. This fact can be seen from the number of catches for these months, reaching values between 200 and 260 fishes with a catch rate of 0.35 to 0.46.

Composition and percentage of target species. The target species categories for tuna longline fishing gear are various types of large size tuna. In the present study the target species are tuna species as shown in Figure 5.

During the observation there were 924 tuna as target species from total catching for six months in the Eastern Indian Ocean from November 2018 to April 2019 (Table 3).

Figure 5. *Thunnus alalunga, Thunnus albacares, Thunnus obesus, Thunnus maccoyii* (original).

Table 3

Percentage of target species

Time	*Thunnus alalunga*	*Thunnus obesus*	*Thunnus maccoyii*	*Thunnus albacares*	*Total*
November	7	24	0	4	35
December	228	3	5	0	236
January	241	17	6	1	239
February	214	9	16	9	243
March	38	6	4	1	44
April	108	14	2	6	127
Total	836	73	33	21	924
Percentage (%)	87	8	3	2	100

A graphical representation concerning the percentage of the target species can be seen in Figure 6.

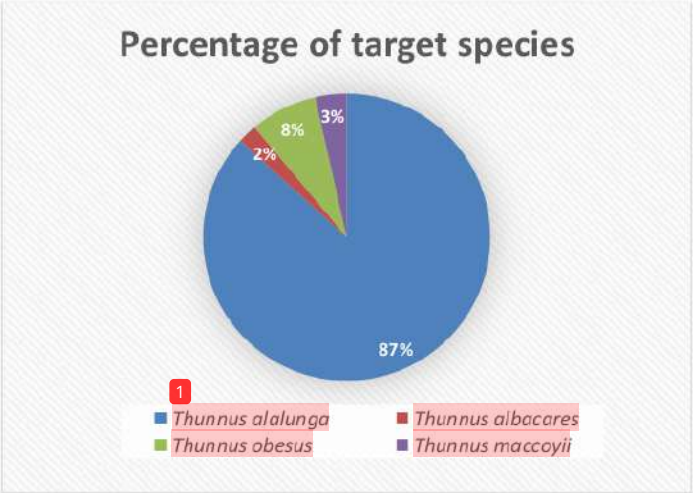


Figure 6. Percentage of target species.

Conclusions. The present study concluded that the ratio of the target species to the bycatch from this observation was 59% to 39% with the catches dominated by *T. alalunga* in the target species group and *L. flavobrunneum* in the bycatch category.

We obtained a relatively similar distribution pattern between the distribution of the catch rate and the distribution of catch fluctuations with the peak catching time occurred in January.

Further, full year round observations should be performed so that we can get an overview of the information on all the parameters above in a complete cycle of seasons in Indonesia.

References

Bahtiar A., Barata A., Novianto D., 2013 Distribution of Tuna Rawai fishing line in the Indian Ocean. Journal of Tuna Fisheries Research Workshop, Bali, Indonesia, pp. 195-202.

Baskoro M. S., Nugraha B., Wiryawan B., 2014 Composition of capture and rate of Tuna Rawai fishing based at Benoa Fishing Port. WWF-Indonesia, Bali, pp. 1126-1132.

Nainggolan C., 2007 Fishing methods. Open University, Jakarta, Indonesia.

Nainggolan C., Suwardjo D., Hutajulu J., Suharyanto, Syamsuddin S., Effendy A., Basith A., Yusrizal, Handri M., Nugraha E., Krisnafi Y., Matheis A., Irwansyah, Irwan, Khoerul, Novianto D., 2017 Analyses of pole and line fishery: catch composition and use of live bait for catching skipjack tuna *Katsuwonus pelamis* and yellowfin tuna *Thunnus albacares* in FMA 715, Indonesia. AACL Bioflux 10(6):1627-1637.

Novianto D., Ilham, Nainggolan C., Syamsuddin S., Effendi A., Halim S., Krisnafi Y., Handri M., Basith A., Yusrizal, Nugraha E., Suciadi C., Setyadji B., 2019 Developing an abundance index of skipjack tuna (*Katsuwonus pelamis*) from a coastal drifting gillnet fishery in the Southern Waters of Indonesia. Fishes 4, 10; doi:10.3390/fishes4010010

Nugraha E., Gunawan R., Danapraja S., Yusrizal, Kusdinar A., Waluyo A. S., Hutajulu J., Prayitno H., Halim S., Sutisna D. H., 2020a The sea surface temperature effect on the length and size of skipjack tuna (*Katsuwonus pelamis*) catches in the Banda Sea, Indonesia. AACL Bioflux 13(1):1-18.

Nugraha E., Yudho G. S., Jaenudin A., Yusrizal, Kusmedy B., Kusnidar A., Husen E. S., 2020b Relationship between length and weight of skipjack tuna (*Katsuwonus pelamis*) purse seine catching in the Maluku Sea, Indonesia. AACL Bioflux 13(1):330-345.

Saputra S. W., Solichin A., Wijayanto D., Kurohman F., 2011 Productivity and Business Feasibility of Tuna Longliner in Cilacap Regency, Central Java. Diponegoro University Fisheries Science Journal, Semarang, 6(2):84-91.

Setyadji B., Nugraha B., 2012 Bycatch products of Tuna longline in the Indian Ocean Based in Benoa. Journal of Tuna Fisheries Research Workshop, Bali, Indonesia, pp. 43-51.

Watson J. W., Kerstetter D. W., 2006 Pelagic longline fishing gear: a brief history and review of research efforts to improve selectivity. Marine Technology Society Journal 40(3):5-10.

Widianto, Nikijuluw V. P. H., 2003 Investment guidelines for tuna commodities in Indonesia. Directorate of Capital and Investment Systems, Directorate General of Institutional and Marketing Capacity Building at the Ministry of Maritime Affairs and Fisheries, Jakarta, Indonesia, pp. 6-31.

*** Center for Marine and Fisheries Education, 2015 Modifying Longline Tuna Modules. Center for Marine and Fisheries Education, Jakarta, Indonesia.

Received: 27 February 2020. Accepted: 02 June 2020. Published online: 10 June 2020.
Authors:
Yusrizal, Jakarta Fisheries University, Faculty of Fishing Technology, Fishing Technology, Indonesia, Jakarta, South Jakarta, Pasar Minggu, Jl. AUP no.1, e-mail: buyung_trc@yahoo.co.id
Erick Nugraha, Jakarta Fisheries University, Faculty of Fishing Technology, Fishing Technology, Indonesia, Jakarta, South Jakarta, Pasar Minggu, Jl. AUP no. 1, e-mail: nugraha_eriq1@yahoo.co.id
Syarif Syamsuddin, Jakarta Fisheries University, Faculty of Fishing Technology, Fishing Technology, Indonesia, Jakarta, South Jakarta, Pasar Minggu, Jl. AUP no. 1, e-mail: panggilakusyarif@gmail.com
Sopiyan Danapraja, Jakarta Fisheries University, Faculty of Fisheries Extension, Department Fisheries Extension, Indonesia, Jakarta, South Jakarta, Pasar Minggu, Jl. AUP no. 1, e-mail: sopiyanraja@gmail.com
Agus Jaenudin, Fisheries Bycatch Officer, WWF-Indonesia, Jl. Pemuda 1 no. 2 Renon Denpasar, Bali, e-mail: ajaenudin.agus@gmail.com
Basino, Jakarta Fisheries University, Fisheries Machinery, Fishing Technology Department, Indonesia, Jakarta, South Jakarta, Pasar Minggu, Jl. AUP no. 1, e-mail: basinomusyaffa@gmail.com
M Rajief Aulia, Jakarta Fisheries University, Faculty Fishing Technology, Fishing Technology Department, Jakarta, Indonesia, Jl. AUP no.1 Pasar Minggu, South Jakarta, e-mail: mrajief354@gmail.com
Sayuri Endo, Japan Agency of Maritime Education and Training for Seafarers, Marine Technical College, Japan, Hyogo, Ashiya, 12-24, Nishikura-cho, e-mail: mantani-s6ea@jmets.ac.jp
Yuli Purwanto, Bitung Fisheries Polytechnic, Faculty of Fishing Technology, Indonesia, North Sulawesi, Jl. Tandurusa, Aertembaga Dua, Kota Bitung, e-mail: yuli.purwanto38@gmail.com

How to cite this article:
Yusrizal, Nugraha E., Syamsuddin S., Danapraja S., Jaenudin A., Basino, Aulia M. R., Endo S., Purwanto Y., 2020 Composition of target species, bycatch, hook rate and fluctuation for longline tuna fishing in the Eastern Indian Ocean, Indonesia. AACL Bioflux 13(3):1445-1452.

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