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"Composition of Target Species, Bycatch, Hook Rate and Fluctuation for Longline Tuna Fishing in the Eastern Indian Ocean, Indonesia"

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Januari, 2020

Composition of Target Species, Bycatch, Hook Rate and Fluctuation for Longline Tuna Fishing in the Eastern Indian Ocean, Indonesia

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Abstract. Research 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^{0}00"–22^{0}00"S and 100^{0}00"–112^{0}00"E in November 2018 to April 2019. The results of these observations revealed a phenomenon that the composition of target species was 59 percent with a bycatch of 39%. The catch rate varies between 0.03 to 0.46 with a high catch rate occurring in January. In the target species group the dominant catch are *Thunnus alalunga* whereas the bycatch fish group is dominated by the species of *Lepidocybium flavobrunneum*. Both of these types 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 *Thunnus alalunga* which is deeper than *Thunnus obesus* swimming layer and *Thunnus albacares* so that the *Thunnus alalunga* type contributes deeper than *Thunnus obesus* and *Thunnus albacares* swimming layer. which is high as a catch in this observation.

Key Words: tuna longline, Bycatch, Catch Composition, hook rate

Introduction. Indonesia is currently the largest producer of tuna in the Indian Ocean (Novianto, 2019). In Indonesia, there are various fishing gears to catch *K. pelamis* such as: long line, hand line, pole and line, purse seine and gill net (Nainggolan, 2017). Long line tuna is a fishing gear used to catch tuna. explained in the long line series there are 1000-2000 hooks for a one time setting (Nainggolan, 2007). The fishing gear is passive, after the fishing line is deploy into the water, the boat's engine is turned off, so that the boat and the fishing gear are drifting (Saputra, 2011)

Tuna long line is an effective fishing gear for catching tuna (Watson and Kerstetter 2006). According to Baskoro (2014) tuna is effectively caught with a long line fishing gear because of its construction that 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 E, et al 2020)

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 and Nugraha 2012). The target species and bycatch could be seen in table 1 below:

Table 1

Target species and bycatch fish that catching along 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*
Mackerel	*Scomberomorus*
Escolar	*Lepidocybium flavobrunneum*
Swordfish	*Xiphias gladius*
Shark	*Centrophorus squamosus*

The value of the catch rate is an indication of the high and low abundance of tuna in these waters. Catch rate value means the number of tuna caught per 100 hooks (Baskoro, 2014).

Nainggolan (2007) said that One of the things that supports 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 and Nikijuluw, 2003). Construction and parts of tuna longline fishing gear can be seen at Figure 1 below.

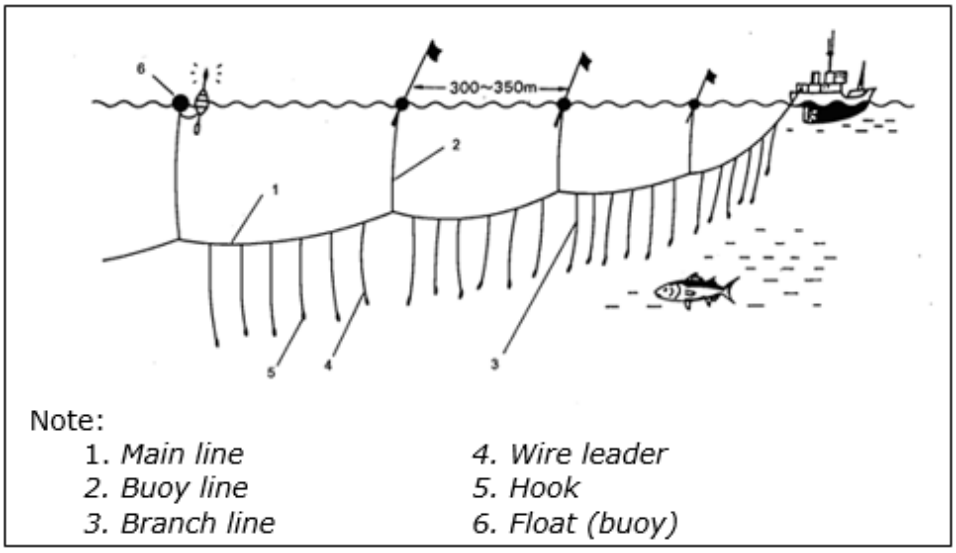

Figure 1. *Long line* (PPKP, 2015)

This study aims 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 is 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 obtained from fishing operations using tuna long line fishing gear then the catches are tabulated according to several types which are grouped in two large groups as target species and bycatch. The hook rate is obtained from the formula of the number of catches per hundred hooks. The composition is obtained by the ratio of the percentage

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

Result.

Target species and Bycatch

The number of catches obtained during fishing operations took place 1,714 with the details of the tabulated results as follows on the table 2.

Table 2

Total Catching the Tuna longline in the Eastern Indian Ocean from November 2018 to April 2019

Species	Amount	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	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 the table 2 we can show that the types of fish caught during data acquisition were 11 types with details of 4 types of tuna which were categorized as target species and 7 other types of fish which were categorized as bycatch fish.

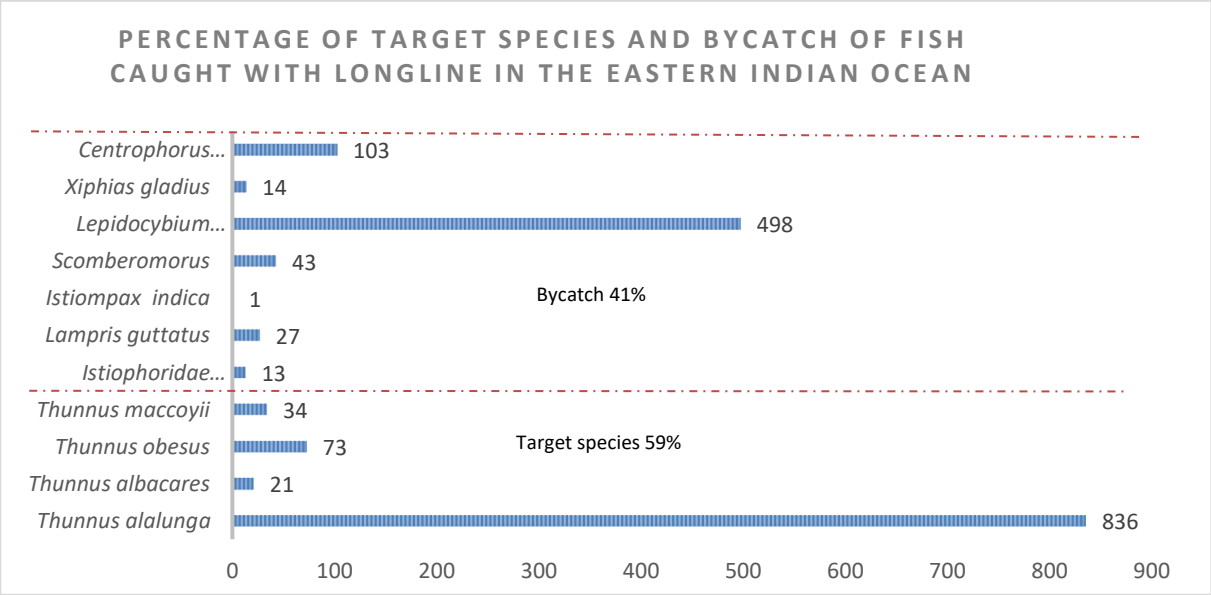

Figure 2. Percentage of target species and by catch of fish caught with tuna longline in the Eastern Indian Ocean from November 2018 to April 2019.

The identification results show that the composition of the results shows that the target species is 59% and the Bycatch is 41%. The target species are dominated by *Thunnus alalunga* which reaches 836, then *Thunnus obesus* 73, *Thunnus maccoyii* 34, and *Thunnus albacares* 21. Whereas the bycatch group was dominated by *Lepidocybium*

flavobrunneum 498, *Scomberomorus* 43. Other types of fish, including large fish such as *Istiophoridae rafinesque* 13, *Istiompax indica* 1, and *Xiphias gladius* 1, are also caught only in very small quantities. Data analysis also showed 103 *Centrophorus squamosus* in the bycatch group.

In Figure 2 it can be seen that the distribution of catch composition in the target species of predominant catch is the type of *Thunnus alalunga*. In other types of tuna relatively small percentage. The data distribution gives an indication that the setting of the tuna longline fishing gear that is used places the hook on *Thunnus alalunga* swimming layer which prefers depth compared to the type of *Thunnus obesus* or *Thunnus albacares*. Laying deeper hooks can also be suspected from the capture of a number of *Thunnus maccoyii* which are quite numerous.

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 are caught with a very large percentage. If a ratio of dominant fish is caught in the target species group and the bycatch group will show a ratio close to the percentage of the two groups.

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

Hook Rate

According to Bahtiar et al (2013) the value of the hook rate from December to April in 2005 to 2010 was 0.13. Comparison between results and literature is not too significant, that is equal to 0.09. The range of catch rates in the period of capture ranged from 0.03 to 0.46. The catch rate values appear to be relatively small size in November and March. The overall distribution of capture rate can be seen and compared as shown in Figure 3 below.

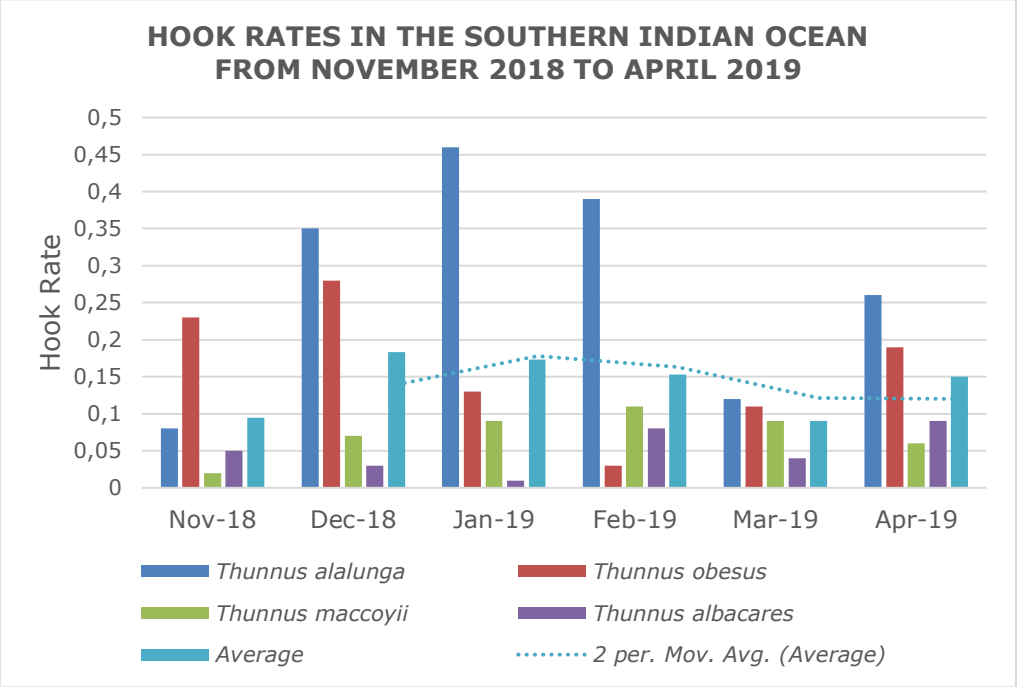

Figure 3. Distribution of tuna longline hook rates in the Indian Ocean from November 2018 to April 2019.

The distribution of the catch rate during the arrest took place showing the peak value of the catch rate was in January which was dominated by *Thunnus alalunga* catch. The analysis shows that there is a pattern of distribution of the catch rate that forms a normal distribution with the peak being in January. The distribution also shows that a good catch rate is found in three consecutive months, namely December, January and February.

Analysis of the moving average shows that the average catch rate forms a peak and it is assumed that the catch rate will rise again after April. The distribution of the value of the catch rate is small in March but the distribution is relatively the same for each type of 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 peak catching occurring in January. It can show in Figure 4.

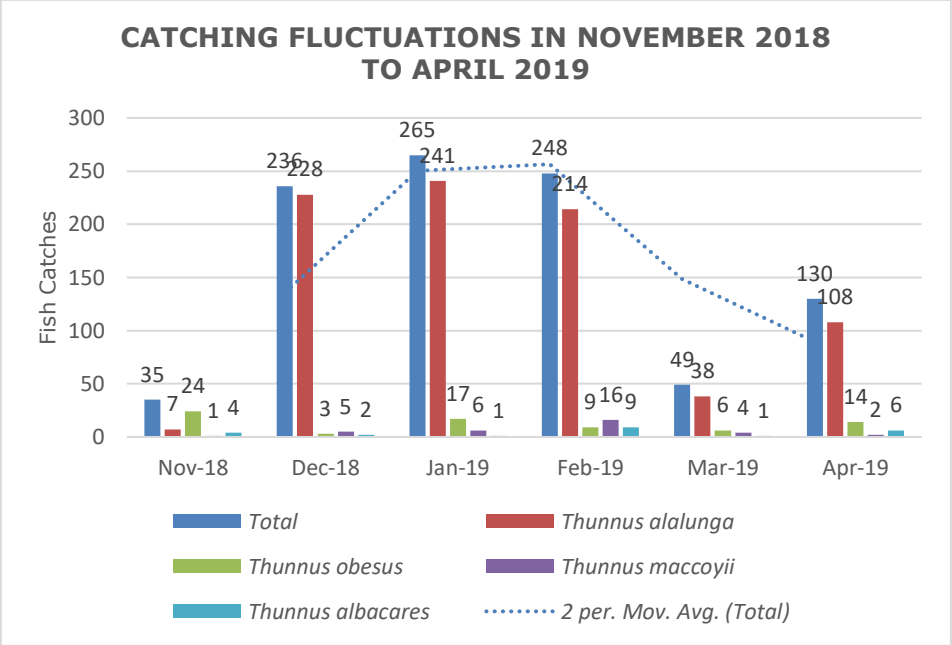

Figure 4: Catching fluctuation

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 *Thunnus alalunga* species. This indication can be shown from the number of catches this month 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 category for tuna longline fishing gear is various types of large size tuna. In this study the target species is tuna species as shown in the figure 5.

Figure 5. *Thunnus alalunga*, *Thunnus albacares*, *Thunnus obesus*, *Thunnus maccoyii*

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. It be presented in table 3 below.

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

Or we can show it in figure 6 below.

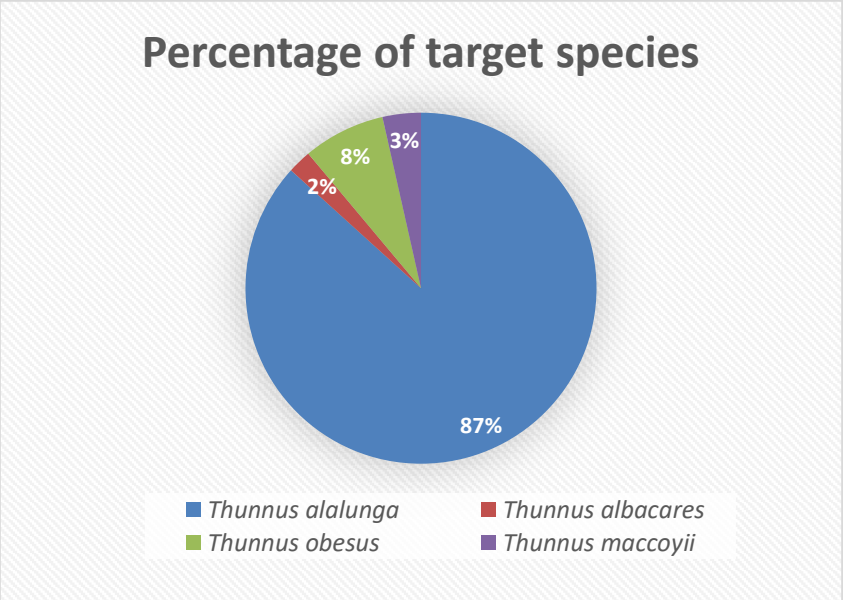

Figure 6. Percentage of target Species

CONCLUSIONS

The conclusion reached is that the ratio of the target species to the bycatch from this observation are 59% to 39% with the catches dominated by albacore *(Thunnus alalunga)* in the target species group and Escolar fish *(Lepidocybium flavobrunneum)* in the bycatch.

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.

Suggestions to make the same observations with one year so that you can get an overview of the information on all the parameters above in a complete cycle of seasons in Indonesia.

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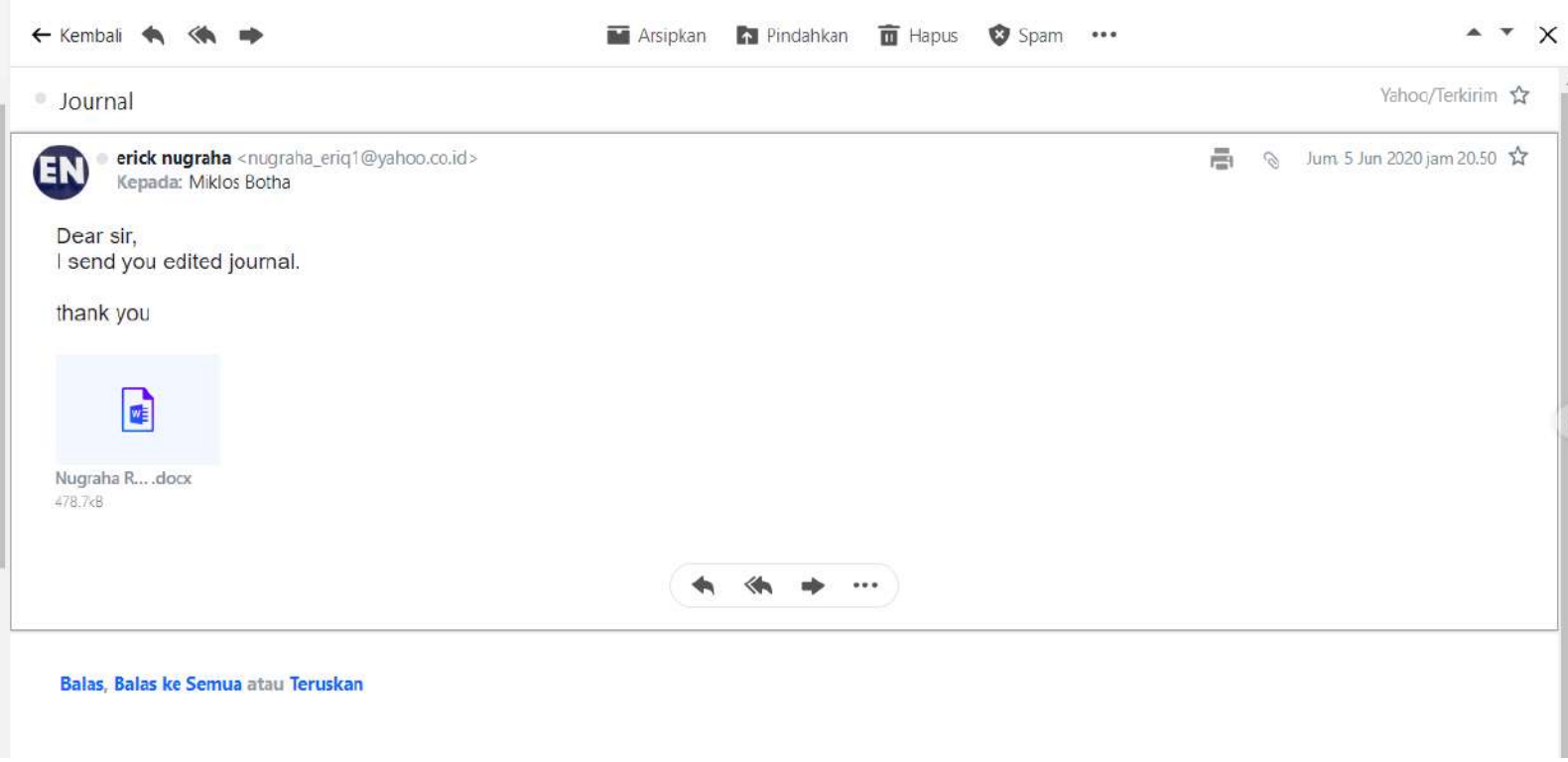
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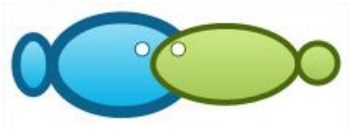

Composition of target species, bycatch, hook rate and fluctuation for longline tuna fishing in the Eastern Indian Ocean, Indonesia

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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^{0}00"–22^{0}00"S and 100^{0}00"–112^{0}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 Albacore (*Thunnus alalunga)* whereas the bycatch fish group was dominated by Escolar (*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 Albacore (*Thunnus alalunga*) which is deeper than of Bigeye (*Thunnus obesus)* and Yellow fin (*Thunnus albacares)*.
Key Words: tuna longline, ~~Bycatch~~ Tuna Season, Catch Composition, ~~hook rate.~~ Tuna Distribution.

Introduction. Indonesia is currently the largest producer of tuna in the Indian Ocean (Novianto et al 2019). In 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). 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 (2020) 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 2020).

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

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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 along 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*
Mackerel	*Scomberomorus commerson*
Escolar	*Lepidocybium flavobrunneum*
Swordfish	*Xiphias gladius*
Leafscale gulper shark	*Centrophorus squamosus*

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Commented [A9]: Leafscale gulper shark https://www.fishbase.se/summary/Centrophorus-squamosus.html

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 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.

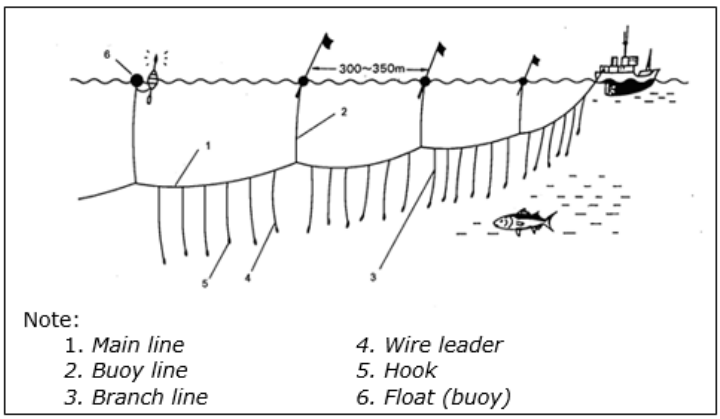

Figure 1. Long line (PPKP 2015).

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.

Target species and bycatch. The number of catches obtained during fishing operations ~~took place~~ are 1,714 fishes 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
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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 ~~that the setting of the tuna longline fishing gear placed the hooks on the *T. alalunga* swimming layer, which prefers depth compared to *T. obesus* or *T. albacares*. Laying deeper hooks can also be suspected from the capture of a number of *T. maccoyii* which are quite numerous.~~ that the most Higher catch is *T. alalunga* as a target species, but also caught with the second highest number of *T. macoyii* 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 is a large size catch of 103 *Centrophorus squamosus* species included in the bycatch type.

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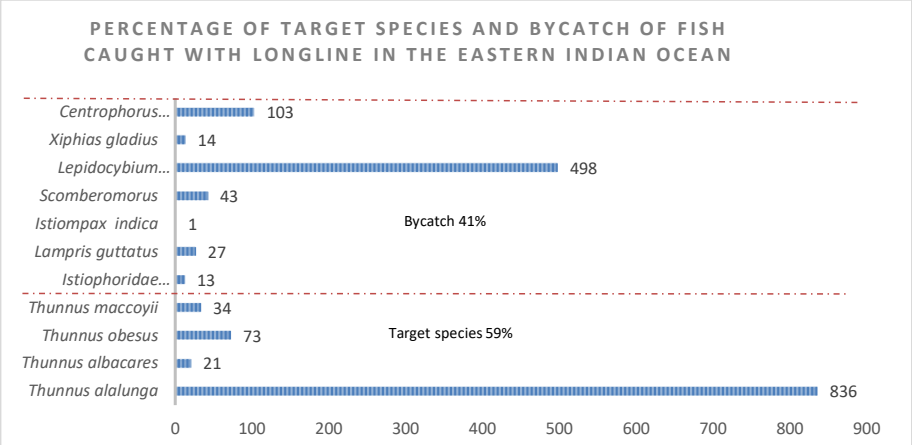

Figure 2. Percentage of target species and by catch of fish caught with tuna longline in the Eastern Indian Ocean from November 2018 to April 2019.

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. ~~Comparison~~ Hook Rate Ratio between results and literature is not too significant, the difference of rate ~~that is equal~~ to 0.09. The range of ~~catch rates~~ Hook rate in the period of capture ranged from 0.03 to 0.46. The ~~catch rates~~ Hook rate values appeared to be relatively small sized in November and March. The overall distribution of ~~catch rates~~ Hook rate is presented in Figure 3.

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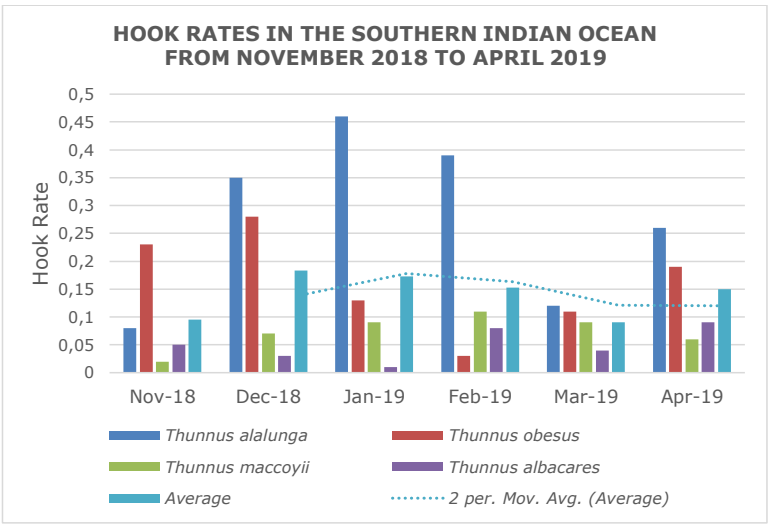

Figure 3. Distribution of tuna longline hook rates in the Indian Ocean from November 2018 to April 2019.

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

Commented [A18]: Hook rate or catch rate? Please clarify!

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good ~~catch rates~~ Hook rate was found in three consecutive months, namely December, January and February.

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

Commented [A21]: Hook rate or catch rate? Please clarify!

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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).

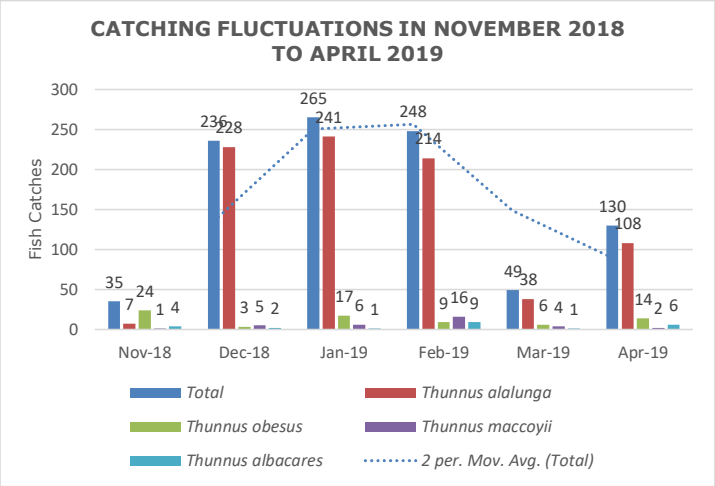
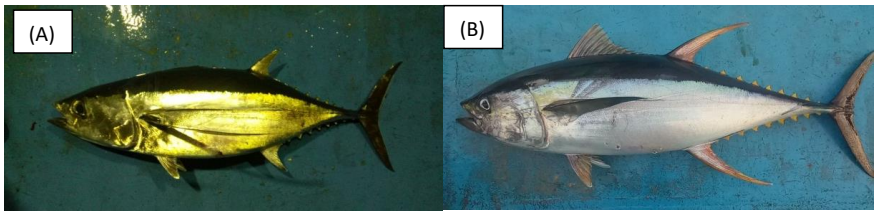


Figure 4. Catching fluctuation.

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.



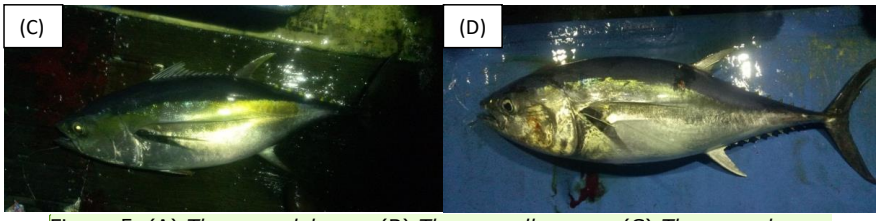


Figure 5. (A) *Thunnus alalunga*, (B) *Thunnus albacares*, (C) *Thunnus obesus*, (D) *Thunnus maccoyii*. (original)

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If the pictures were taken by the authors than please specify "original".
Thank you!

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).

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.

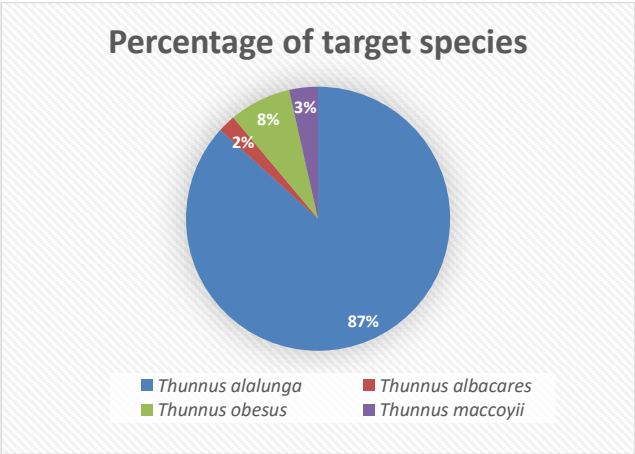

Figure 6. Percentage of target species.

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.

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Received: xxxxx.Accepted: xxxxx.Published online: xxxxx.

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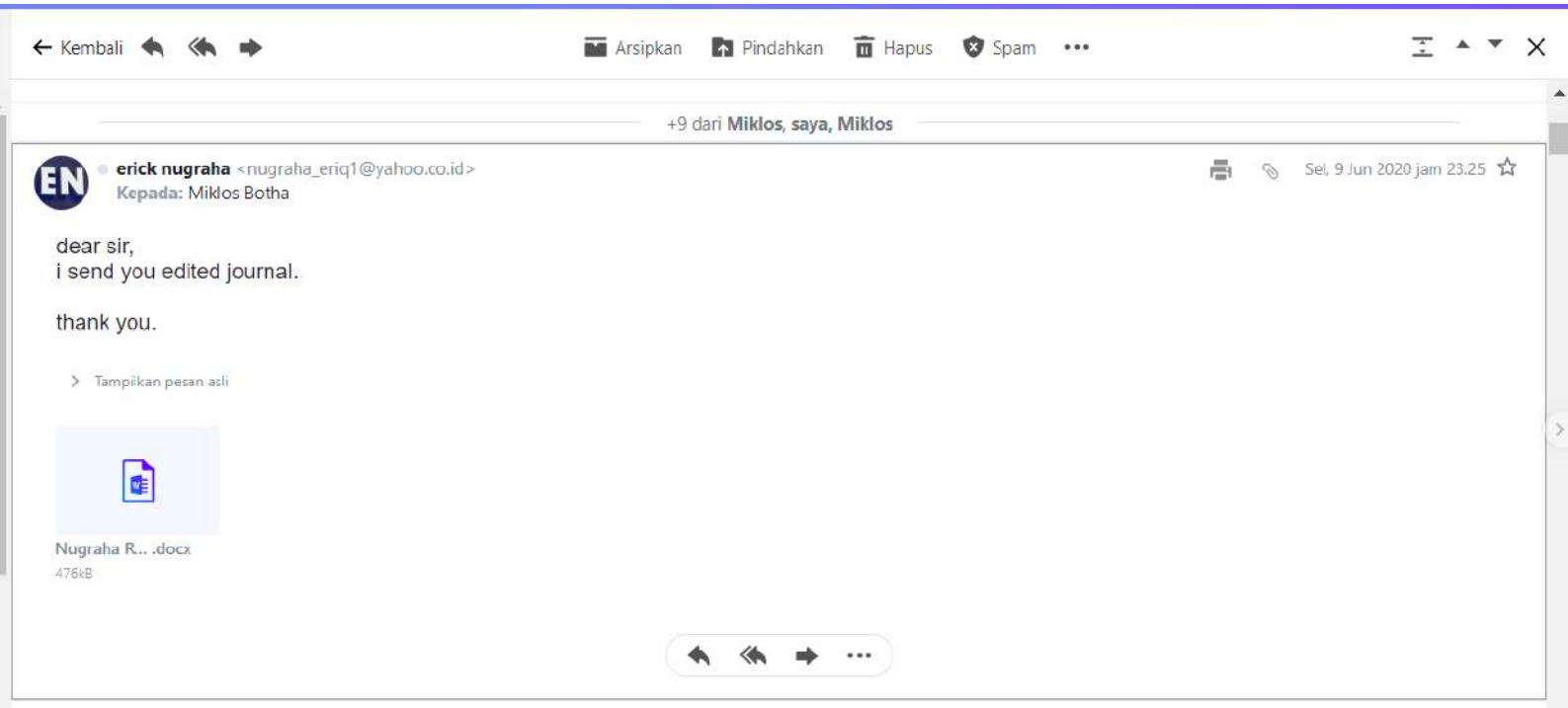
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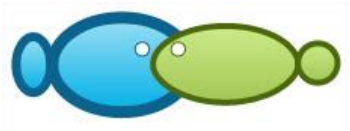

Composition of target species, bycatch, hook rate and fluctuation for longline tuna fishing in the Eastern Indian Ocean, Indonesia

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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^{0}00"–22^{0}00"S and 100^{0}00"–112^{0}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). In 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). 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 (2020) 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 2020).

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 along observation

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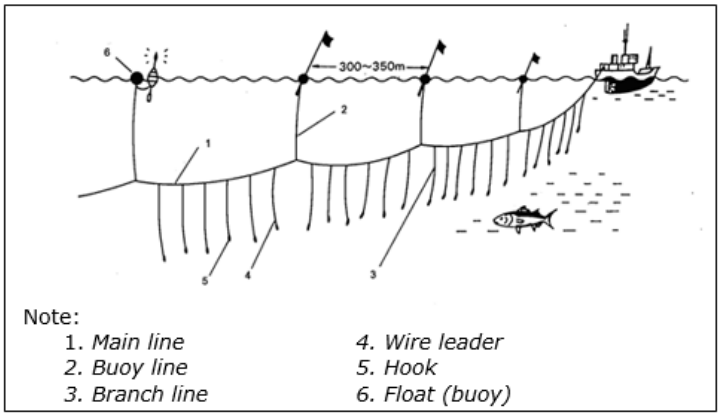

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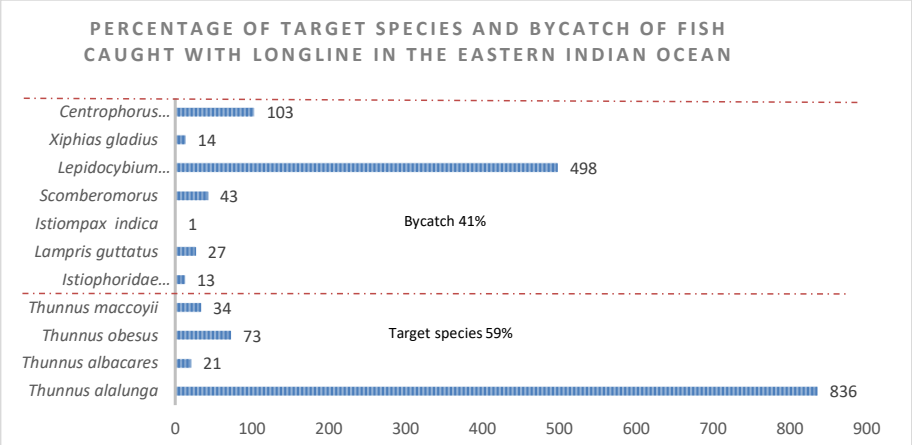

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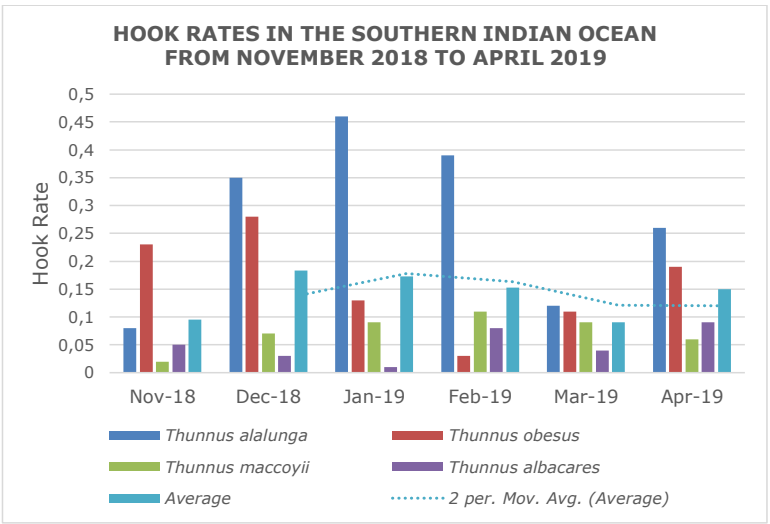

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Analysis of the moving average shows that the average hook rate forms a peak and it is assumed that the hook rate will rise again after April. The distribution of the hook rate value is small in March but the distribution is relatively the same for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

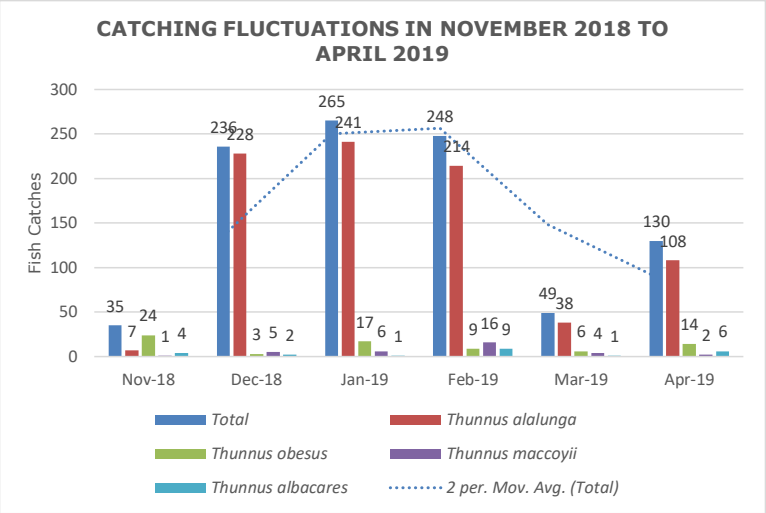

Figure 4. Catching fluctuation.

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).

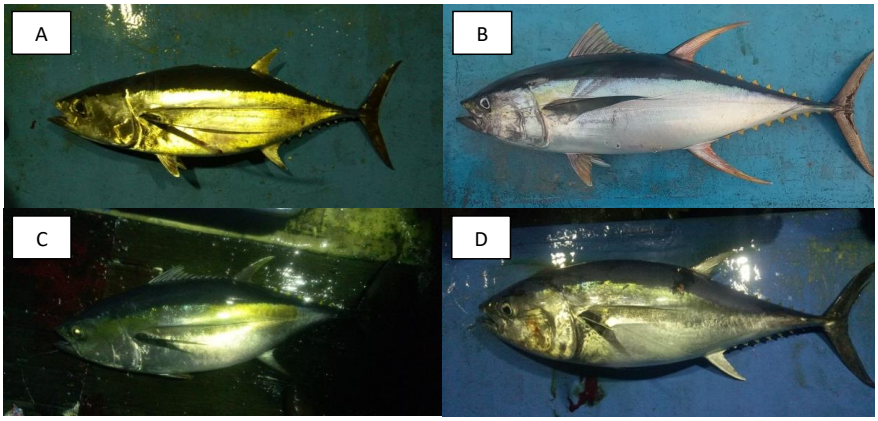

Figure 5. *Thunnus alalunga*, *Thunnus albacares*, *Thunnus obesus*, *Thunnus maccoyii* (original).

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.

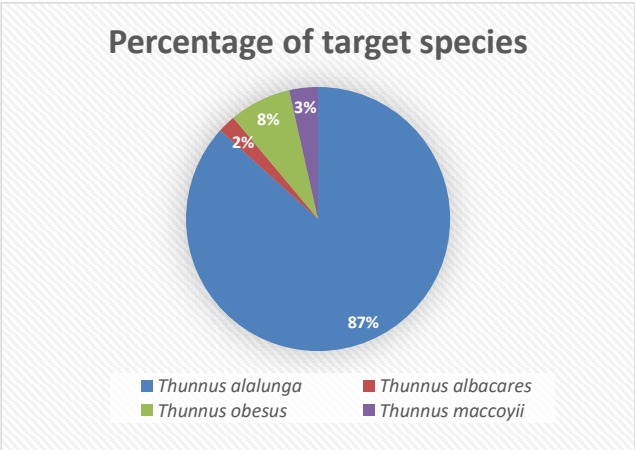

Figure 6. Percentage of target species.

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.

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