Submission Journal 2

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Kepada: Miklos Botha

Sen, 24 Feb 2020 jam 10.53

Dear Mr. Botha

I send you manuscript journal with tittle
"Financial analysis of purse seine fisheries in Natuna waters, Indonesia"

Thank you

best regards.

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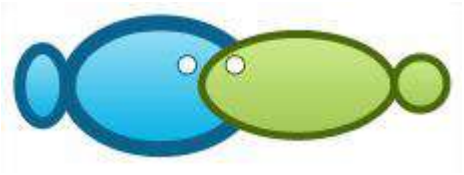

Financial analysis of purse seine fisheries in Natuna waters, Indonesia

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Abstract. Purse seine is a fishing gear that made from sheets of webbing, which are generally rectangular (Nainggolan 2007). Fisheries production in Batam City has increased in the last two years, where the purse seine is the dominant fishing gear used in Natuna waters. Thus, it is necessary to know how far the purse seine fishing activity can still be carried out properly. The purpose of analyzing the financial aspects of a business project feasibility study is to determine the investment plan through the calculation of expected costs and benefits, by comparing expenses and revenues, such as the availability of funds, capital costs, the project's ability to repay the funds within the allotted time and assess whether the project will continue to develop. (Kasmir and Jakfar, 2008). This research was carried out from November 1, 2017 to March 6, 2018. Sampling was done by observing all of the purse seine operations. Data were taken from primary data and secondary data. Data were analyzed using financial analysis The results of this study indicate that purse seine fisheries in Batam meet the proper requirements to be continued Financial analysis results are as follows: Operating profit: USD 71,204.56. Analysis of revenue and cost balance: 1.16 Value $\frac{R}{C}$ > means profitable, Payback period: 1 year 1.2 month, the investment capital can be returned. Return of investment: 90.62%.
Keywords: financial feasibility, Natuna Sea, fisheries, purse seine

Introduction. Indonesia is a country that has a very wide sea area, about 2/3 of the country's territory is ocean. (Nugraha E and Mulyono M, 2017). Indonesia's fisheries resources are ours without any interference from other countries (Sahabu, 2015). According to Limbong (2013) said that the utilization of marine resources needs to be limited by controlling the amount of fishing effort and/or catches in order to avoid excessive effort, excessive capital investment or excess labor. Utilization of resources without control tends to be followed by a decrease in resources (stock), a decrease in catches per unit of effort (CPUE), as well as the depletion of the benefits obtained. The efficiency of a resource utilization arrangement can be achieved by catching up to the level appropriate to the level needed to obtain an optimal catch.

According to Nainggolan (2007) said that Purse seine is a fishing device made from sheets of webbing, which are generally rectangular. There are also those who classify them based on the type of fish they are fishing for so that they are known as small pelagic purse seine and large pelagic purse seine (Sudirman and Mallawa, 2012). In tropical and sub-tropical waters, fish often gather in large numbers naturally, these fish are subject to capture using purse seine (Surur, 2010). Determination of the fishing ground can be expected from the waters condition that is the habitat of a species (Nugraha E., et al 2020).

Indonesia's total fishery production in 2014 was 11.06 million tons with a total value of IDR. 126 trillion. This figure was contributed by the capture fisheries and

aquaculture sectors respectively 5.86 million tons and 5.20 million tons. In 2014, the export volume of fishery products was 802 thousand tons with a value of USD 2.6 billion (Sub Directorate of Data and Capture Fisheries Statistics, 2014).

According to Kasmir and Jakfar (2008), the purpose of analyzing the financial aspects of a business project feasibility study is to determine the investment plan through the calculation of expected costs and benefits, by comparing expenses and revenues, such as the availability of funds, capital costs, the ability of the project to pay back these funds within the allotted time and assess whether the project will continue to grow.

According to Widodo (2005). Types of production costs and calculations can be divided into two. Short term production costs and long term costs. Analysis of business income aims to determine the magnitude of profits derived from a business activity carried out (Febrianto 2008). This analysis (Reveneu-Cost Ratio) aims to determine the extent of the benefits derived from business activities during a certain period. Revenue cost analysis is carried out to find out how far each value of revenue is benefited. The most profitable business activities have the biggest R/C.

Febrianto (2008) said that payback period (PP) is the period required to recoup investment expenditure (initial cash investment) using cash flow. The calculation of ROI is carried out to find out the amount of profit gained compared to the amount of profit obtained compared to the amount of investment invested (Hutajulu et al, 2019).

Material and Method

The financial analysis method is used to analyze data obtained at MV. Sumber Jadi belongs to Hasil Laut Sejati co.ltd, especially data relating to operational costs and the sale of fish catches.

Data analysis related to financial aspects as follows:

1. Business Revenue Analysis is an analysis that aims to find out the magnitude of profits derived from a business activity carried out (Djamin 1984). The calculation of operating income is done by using the equation, like the following formula:

$$\boldsymbol{\pi = TR - TC}$$

Note :
π = profit
TR = total revenue
TC = total cost
With criteria:
- If TR > TC, business activities have benefit
- If TR < TC, business activities do not benefit or loss benefit
- If TR = TC, business activities are at the break-even point or the business are nothing profit or loss profit.

2. Reveneu-Cost Ratio Analysis is an analysis that aims to determine the extent of the benefits derived from business activities during a certain period (Sugiarto et al 2002). Revenue-cost analysis is carried out to find out how far each value of revenue is benefited. The most profitable business activities have the biggest R/C. The calculation uses the following equation:

$$\frac{\boldsymbol{R}}{\boldsymbol{C}} = \frac{\boldsymbol{TR}}{\boldsymbol{TC}}$$

Note:
$\frac{R}{C}$ = Business activities
TR = Total revenue
TC = Total cost
With criteria:
- If R / C> 1, business activities benefit.

- If R / C <1, business activities approach a loss.
- If R / C = 1, business activities are nothing profit or loss profit

3. Payback Period (PP) is the period required to recoup investment expenditure (initial cash investment) using cash flow. (Umar 2003). The formula used is:

$$PP = \frac{Investment\ Value}{Profit}\ X\ 1\ \text{Year}$$

4. Return of Investment (ROI) is the ability of a business to generate profits. The calculation of ROI is carried out to find out the amount of profit gained compared to the amount of profit obtained compared to the amount of investment invested (Hutajulu, et al 2019). Formula used:

$$ROI = \frac{Profit}{Investment}\ X\ 100\%$$

With criteria:
> 25 % : Good
15 – 25 % : Fair
5 – 15 : bad
< 5 % : Worse

Result.

The purse seine ship that used in this study is MV. Sumber Jadi belongs to Hasil Laut Sejati, Co. Ltd as shown in Figure 1 below.

Gambar 1. Kapal Purse seine

Production

Total Catches for 3 trips were 92,191 kg. Details of fish species and fish weight can be seen in Table 1.

Table 1

Catches for 3 trips

No.	*Common Name*	*Scientific Name*	*Total catch per 3 trip (kg)*	*Percentage (%)*
1	*Scad*	*Decapterus spp*	72,295	78
2	*Yellowtail scad*	*Selaroides leptolepis*	8,863	9
3	*Auxis thazard*	*Euthynnus affinis*	2,748	3
4	*Scad*	*Selar crumenophtslmus*	2,682	3
5	*Island mackerel*	*Rastrelliger brachysoma*	2,551	3

6	*Bali sardinella*	*Sardinella lemuru*	1,549	2
7	*Squid*	*Loligo*	1,503	2
	Total Catching		*92,191*	*100*

The production of fish caught from November 4, 2017 to January 30, 2018 obtained as much as 92,191 kg. The catches obtained are: *Decapterus spp* 72,295 kg, *Selaroides leptolepis* 8,693 kg, *Euthynnus affinis* 2,748 kg, *Selar crumenophtslmus* 2,682 kg, *Rastrelliger brachysoma* 2,551 kg, *Sardinella lemuru* 1,549 kg, *Loligo* 1,509 kg. Figure of catch composition diagram for 3 trips can be seen in Figure 2.

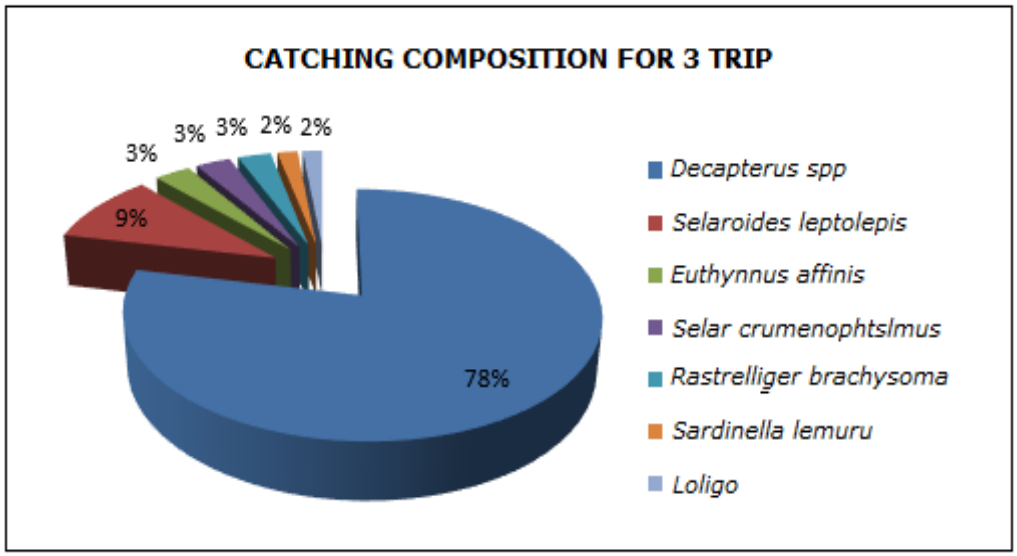

Figure 2. Catch composition for 3 trips.

While the catches in each trip have different catches, the table above explains that the catch does not always remain in each month due to season and weather factors. catch season is recorded in Table 2 and Figure 3.

Table 2

Total catch per trip

No.	Trip	Jumlah (kg)
1.	Trip I	40,951
2.	Trip II	29,720
3.	Trip III	21,520

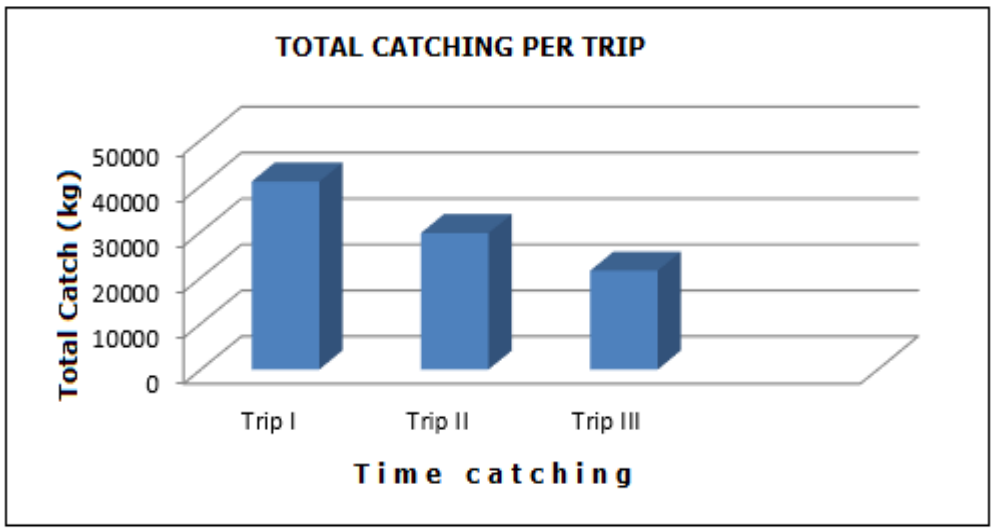

Figure 3. Graph of catches per trip.

In Figure 3, it can be concluded that the catch per trip is uneven. From the first trip to the third trip the catch has decreased. In November it got quite a lot of results because the number of settings was more, and the weather was good, while in December the number of settings was also less because the weather had started to be less good, in January the number of settings was getting lower and the weather was getting worse with accompanied by strong waves.

Marketing and Sales Results

The marketing and sale of catched fish is accommodated by companies that are stored in cold storage. And will be sold when fish prices start high or when consumers increase, for the highest selling prices companies usually sell it to the local market for the purchase price from the company to the ship. The number of fish caught during 3 trips can be seen in Table 3.

Table 3

The sale of fish catches for 3 trips.

No	Species	Price (USD)	Weight (kg)	Total (USD)
1	*Decapterus spp*	1.43	72,295	103,381.85
2	*Selaroides leptolepis*	2.14	8,863	18,966.82
3	*Euthynnus affinis*	1.43	2,748	3,929.64
4	*Selar crumenophtslmus*	1.43	2,682	3,835.26
5	*Rastrelliger brachysoma*	2.14	2,551	5,459.14
6	*Sardinella lemuru*	1.07	1,549	1,657.43
7	*Loligo*	2.14	1,503	3,216.42
	Total Hasil		**92,191**	**140,446.56**

Total catches sold as a whole during 3 trips get a yield of USD 140,446.56, catches during 2017 can be assumed with a total yield for 3 trips divided by 3 then multiplied by a year (10 Trips) with a result of USD 468,155.2.

Investation

Investment is a cost that is required to meet the infrastructure or supporting facilities in the initial stages of a business. Investment is also a fixed cost in the form of depreciation and maintenance costs. The bigger the fishing boat, the greater the investment value and the depreciation.

The capital that must be owned by a fishing company is in one fishing boat and its equipment, as well as fishing gear, and also its engine. In one fishing boat unit amounting to USD 78,571. Details of the investment value are listed in Table 8.

Table 8

Investment Cost

No	*Investation type*	*Unit*	*Price (USD)*	*Economic age*	*Value (USD)*
1	Fishing boat	1	42.857	8	42.857
2	Purse seine gear	1	28.571	3	28.571
3	Main engine	1	2.857	4	2.857
4	Auxillary engine	2	2.143	4	4.286
Amount Investation					*78.571*

Fixed cost

Fixed costs are costs derived from several factors, namely based on depreciation costs, maintenance costs, document fees and tax costs. Depreciation costs are calculated from the length of the object can be used or the feasibility and economic life of the object and the acquisition value and the residual value of the object.

Based on the depreciation calculation, the amount of depreciation costs consisting of ships, ring trawl nets and generator engines is USD 15,000 per year.

Maintenance costs are costs incurred for ship maintenance, netting maintenance, engine maintenance, dock & overhead while the ship is still operating, as well as details of maintenance costs are listed in Table 4.

Table 4

Fixed costs Table

No.	Cost	Per Trip (Rp)	1 Year (USD)
1	Cost of depreciation	1,500	15,000
2	Maintenance costs	257.14	2,571.4
3	Tax costs	372.33	3,723.3
4	Dock & Overhead	714.28	7,142.8
	amount	2,843.75	28,437.5

Variable cost

Operating costs

In the fishing operations activities require some equipment that must be available, to meet these needs the company spent a fee of USD 274,882.1.

Table 5

Variable cost

No	*Item of goods*	*Vol.*	*Unit*	*Price (USD)*	*Amount (USD)*	*Amount per Trip (USD)*
1	Fresh water	15,000	Littre/m^3	1.43	21,428.57	64,285.71
2	Gasoline	140	Littre	0.50	70.00	210.00
3	Rice	15	sack	17.86	267.86	803.57
4	Seasoning	2	Pack	3.57	7.14	21.43
5	Ice	2,000	kg	0.11	214.29	642.86
6	Salt	3	Pack	5.00	15.00	45.00
7	LPG Gas	2	tube	14.64	29.29	87.86
8	Sugar	3	sack	33.57	100.71	302.14
9	Kitchen goods				68.57	205.71
10	Deck & engine parts				107.14	321.42
11	Coffee	10	Pack	0.71	7.14	21.43

12	Fried oil	100	Littre	0.86	85.71	257.14
13	Medicines				7.14	21.42
14	Liquid oil	200	Littre	2.14	428.57	1,285.71
15	Fuel oil	10,000	Littre	0.46	4,642.86	13,928.57
16	Tea	1	Pack	8.21	8.21	24.64
	Total cost				***27,488.21***	***82,464.62***
	Total cost per 1 year (USD)					***274,882.1***

Labor costs

The results of work on the ship are calculated by profit sharing per trip, also based on position and length of service to the company. The amount of the premium depends on the catch, while for the salary system, it is calculated to be 20% of the sales proceeds while 80% for the company. The following results of the distribution of salaries per trip are : 20 % X USD 468,155.2 = 93,631.04.

Total cost

The total cost of fishing operations for one year incurred an overall cost of USD 396,950.64. With the breakdown of fixed costs 28,437.5, in these costs there are maintenance costs, which are incurred annually, and salary costs. For variable costs USD 368,513.14. the details of these costs are listed in Table 6.

Table 6

1 year total cost

No.	*Cost Type*	*1 Trip (Rp)*	*1 year (USD)*
	(A) Fixed cost		
1	Cost of depreciation	1,500	15,000
2	Maintenance costs	257.14	2,571.4
3	Tax costs	372.33	3,723.3
4	Dock & Overhead	714.28	7,142.8
	Amount (A)	*2,843.75*	*28,437.5*
	(B) Variable		
4	Operational cost	27,488.21	274,882.1
5	Salary	9,363.1	93,631.04
	Amount (B)	*34,615.71*	368,513.14
	Total Cost (A+B)		396,950.64

Discussion.

Business Revenue Analysis

Analysis of operating income aims to find out the magnitude of the benefits derived from the fishing. The calculation of operating income is done by using the equation.

$$\boldsymbol{\pi = TR - TC}$$

Note :

π = Profit

TR = Total revenue

TC = Total cost

π = 468,155.2 – 396,950.64

π = 71,204.56

The data is released in the operation for 10 trips (1 year), where in the calculation of the results of these operations there are already levies and taxes so that business profits are obtained after tax.

Analysis of Revenue and Cost Balance

Revenue-Cost Ratio analysis This analysis aims to determine the extent of the benefits derived from fishing business activities during a certain period. Done to find out how far each rupiah value of costs used in the most profitable business activities has the largest $\frac{R}{C}$. The calculation uses the following formula:

$$\frac{\boldsymbol{R}}{\boldsymbol{C}} = \frac{\boldsymbol{TR}}{\boldsymbol{TC}}$$

$\frac{R}{C}$ = Business activities
TR = Total revenue
TC = Total cost

$$\frac{R}{C} = \frac{468{,}155.2}{396{,}950.64}$$

= 1.18

R / C> 1 mean is business activities benefit
Value of $\frac{R}{C}$ > can be interpreted that fishing using MV. Sumber Jadi as financially viable sources.

Payback Period (PP)

Payback period is a comparison between the value of investment with profits multiplied by 1 year. Payback period is useful to find out how long the business can return the investment. Fast return on investment, as a good indicator of the company.

$$\boldsymbol{PP = \frac{Investment\ Value}{P\ r\ o\ f\ i\ t}\ X\ 1\ year}$$

$$PP = \frac{78.571}{71{,}204.56}\ X\ 1\ year$$

PP = 1,10 are same with 1 year 1.2 month
It can be interpreted that the capital will return for 12 months, very profitable.

Return Of Investment (ROI)

Return of investment is the ratio between profit and investment value multiplied by 100%. ROI is used to determine the benefits obtained in every rupiah of investment. ROI from a small pelagic fishing business unit using trawl is obtained in the following manner:

$$\boldsymbol{ROI = \frac{P\ r\ o\ f\ i\ t}{Investment}\ X\ 100\%}$$

$$ROI = \frac{71{,}204.56}{78.571}\ X\ 100\%$$

ROI = 90.62%.

ROI in fishing using the ring trawl can return 90.62% capital. Twice a year.

Conclusions.

This study can be concluded as follows:

1. Financial analysis obtained the following results:
   1) Operating profit: USD 71,204.56
   2) Balance and revenue analysis: 1.16. Value $\frac{R}{C}$ > 1 means beneficial.
   3) *Payback period*: 1 year 1.2 month the investment capital can be returned.
   4) Comparison of profits with investment value (*return of investment*): 90.62%

So it can be concluded that the operation of purse seine on MV. Sumber Jadi are viable sources.

Acknowledgement. We wish to thank to boat owner, master and crews MV. Sumber Jadi, who gave their contribution and determination to this observe.

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Received: Januari 2020. Accepted: xxxx 2020. Published online: xxxxxxx.

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Porcine Research www.porc.bioflux.com.ro Porc Res
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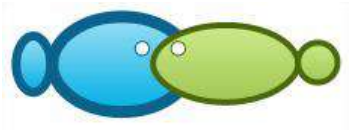

Financial analysis of purse seine fisheries in Natuna waters, Indonesia

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Abstract. Purse seine is a fishing gear made from webbing sheets, which are generally rectangular (Nainggolan 2007). Fisheries production in Batam City has increased in the last two years, where the purse seine is the dominant fishing gear used in Natuna waters. Thus, it is necessary to know how far the purse seine fishing activity can still be carried out properly. The purpose of analyzing the financial aspects of a business project feasibility study is to determine the investment plan through the calculation of expected costs and benefits, by comparing expenses and revenues, such as the availability of funds, capital costs, the project's ability to repay the funds within the allotted time and assess whether the project will continue to develop. (Kasmir and Jakfar, 2008). This research was carried out from November 1, 2017 to March 6, 2018. Sampling was done by observing all of the purse seine operations. Data were taken from primary data and secondary data. Data were analyzed using financial analysis. The results of the present study indicate that purse seine fisheries in Batam meet proper requirements to be continued. Financial analysis results are as follows: Operating profit: 71,204.56 USD. Analysis of revenue and cost balance: 1.16 Value $\frac{R}{C}$ > means profitable, Payback period: 1 year 1.2 month, the investment capital can be returned. Return of investment: 90.62%.
Key Words: financial feasibility, Natuna Sea, fisheries, purse seine.

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Commented [A2]: According to the international standards in scientific writing it is desirable to display 5 key words which do not appears in the title. This will increase findings via key words and implicit citations.

Introduction. Indonesia is a country that has a very wide sea area, about 2/3 of the country's territory is ocean (Nugraha & Mulyono 2017). Indonesia's fisheries resources are ours without any interference from other countries (Sahabu 2015). According to Limbong (2013), the utilization of marine resources needs to be limited by controlling the amount of fishing effort and/or catches in order to avoid excessive effort, excessive capital investment or excess labor. Utilization of resources without control tends to be followed by a decrease in resources (stock), a decrease in catches per unit of effort (CPUE), as well as the depletion of the benefits obtained. The efficiency of a resource utilization arrangement can be achieved by catching up to the level appropriate to the level needed to obtain an optimal catch.

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According to Nainggolan (2007), purse seine is a fishing device made from webbing sheets, which are generally rectangular. There are also those who classify them based on the type of fish they are fishing for so that they are known as small pelagic purse seine and large pelagic purse seine (Sudirman & Mallawa 2012). In tropical and sub-tropical waters, fish often gather in large numbers naturally, these fish are subject to capture using purse seine (Surur 2010). Determination of the fishing ground can be expected from the waters condition that is the habitat of a species (Nugraha et al 2020).

Indonesia's total fishery production in 2014 was 11.06 million tons with a total value of IDR. 126 trillion. This figure was contributed by the capture fisheries and aquaculture sectors respectively 5.86 million tons and 5.20 million tons. In 2014, the

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export volume of fishery products was 802 thousand tons with a value of 2.6 billion USD (Sub Directorate of Data and Capture Fisheries Statistics 2014).

According to Kasmir & Jakfar (2008), the purpose of analyzing the financial aspects of a business project feasibility study is to determine the investment plan through the calculation of expected costs and benefits, by comparing expenses and revenues, such as the availability of funds, capital costs, the ability of the project to pay back these funds within the allotted time and assess whether the project will continue to grow.

According to Widodo (2005), types of production costs and calculations can be divided into two: short term production costs and long term costs. Analysis of business income aims to determine the magnitude of profits derived from a business activity carried out (Febrianto 2008). This analysis (Reveneu-Cost Ratio) aims to determine the extent of the benefits derived from business activities during a certain period. Revenue cost analysis is carried out to find out how far each value of revenue is benefited. The most profitable business activities have the biggest R/C.

Febrianto (2008) stated that payback period (PP) is the period required to recoup investment expenditure (initial cash investment) using cash flow. The calculation of ROI is carried out to find out the amount of profit gained compared to the amount of profit obtained compared to the amount of investment (Hutajulu et al 2019).

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Material and Method. The financial analysis method was used to analyze data obtained at MV. Sumber Jadi belongs to Hasil Laut Sejati co.ltd, especially data relating to operational costs and the sale of fish catches.

Data analysis related to financial aspects are as follows:

1. Business Revenue Analysis is an analysis that aims to find out the magnitude of profits derived from a business activity carried out (Djamin 1984). The calculation of operating income is done by using the equation:

$$\boldsymbol{\pi = TR - TC}$$

Where:
π = profit
TR = total revenue
TC = total cost
With criteria:
- If TR > TC, business activities have benefit
- If TR < TC, business activities do not benefit or loss benefit
- If TR = TC, business activities are at the break-even point or the business has no profit or loss profit.

2. Reveneu-Cost Ratio Analysis is an analysis that aims to determine the extent of the benefits derived from business activities during a certain period (Sugiarto et al 2002). Revenue-cost analysis is carried out to find out how far each value of revenue is benefited. The most profitable business activities have the biggest R/C. The calculation uses the following equation:

$$\frac{\boldsymbol{R}}{\boldsymbol{C}} = \frac{\boldsymbol{TR}}{\boldsymbol{TC}}$$

Where:
$\frac{R}{C}$ = Business activities
TR = Total revenue
TC = Total cost
With criteria:
- If R / C> 1, business activities benefit
- If R / C <1, business activities approach a loss
- If R / C = 1, business activities has no profit or loss profit

3. Payback Period (PP) is the period required to recoup investment expenditure (initial cash investment) using cash flow (Umar 2003). The formula used is:

$$PP = \frac{Investment\ Value}{Profit}\ X\ 1\ \text{Year}$$

4. Return of Investment (ROI) is the ability of a business to generate profits. The calculation of ROI is performed to find out the amount of profit gained compared to the amount of profit obtained compared to the amount of investment (Hutajulu et al 2019). Formula used:

$$ROI = \frac{Profit}{Investment}\ X\ 100\%$$

With criteria:
> 25 % : Good
15 – 25 % : Fair
5 – 15 : bad
< 5 % : Worse

Results. The purse seine ship used in the present study was MV. Sumber Jadi belongs to Hasil Laut Sejati, Co. Ltd as shown in Figure 1.

Figure 1. Kapal Purse seine (original).

Production. Total catches for 3 trips were 92,191 kg. Details of fish species and fish weight are presented in Table 1.

Table 1

Catches for three trips

No.	*Common Name*	*Scientific Name*	*Total catch per 3 trips (kg)*	*Percentage (%)*
1	*Scad*	*Decapterus* spp.	72,295	78
2	*Yellowtail scad*	*Selaroides leptolepis*	8,863	9
3	*Auxis thazard*	*Euthynnus affinis*	2,748	3
4	*Scad*	*Selar crumenophtslmus*	2,682	3
5	*Island mackerel*	*Rastrelliger brachysoma*	2,551	3
6	*Bali sardinella*	*Sardinella lemuru*	1,549	2
7	*Squid*	*Loligo*	1,503	2
Total catching			92,191	100

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https://www.fishbase.se/summary/Selaroides-leptolepis.html

Commented [A11]: Auxis thazard is the scientific name of Frigate tuna
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Commented [A12]: Bigeye scad
https://www.fishbase.se/summary/Selar-crumenophthalmus.html

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https://www.fishbase.se/summary/Selar-crumenophthalmus.html

Commented [A14]: Short mackerel
https://www.fishbase.se/summary/Rastrelliger-brachysoma.html

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Fish catchment production from 4 November 2017 to 30 January 2018 was 92,191 kg. The catchment comprised: *Decapterus* spp. 72,295 kg, *Selaroides leptolepis* 8,693 kg, *Euthynnus affinis* 2,748 kg, *Selar crumenophtslmus* 2,682 kg, *Rastrelliger brachysoma* 2,551 kg, *Sardinella lemuru* 1,549 kg, *Loligo* 1,509 kg. Graphical representation of catch composition for three trips is displayed in Figure 2.

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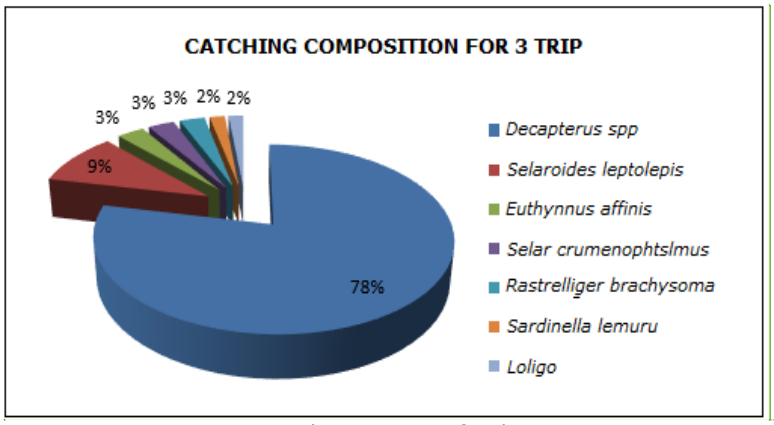

Figure 2. Catch composition for three trips.

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While the catches in each trip have different catches, the table above explains that the catch does not always remain in each month due to season and weather factors. Catching season is recorded in Table 2 and Figure 3.

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Table 2

Total catch per trip

No.	Trip	Jumlah (kg)
1.	Trip I	40,951
2.	Trip II	29,720
3.	Trip III	21,520

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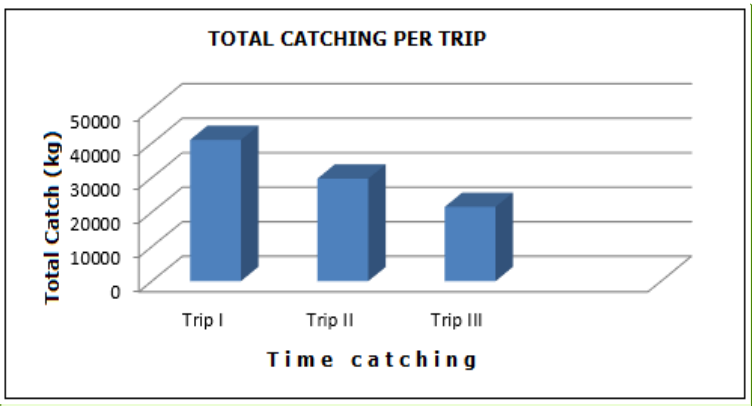

Figure 3. Graphical representation of catches per trip.

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Time catching would sound more appropriate as **Temporal distribution**.

From Figure 3, it can be concluded that the catch per trip is uneven. From the first trip to the third trip the catch has decreased. In November it got quite results results due to the high number of settings and favorable weather conditions, while in December the number of settings decreased due to the unfavorable weather conditions, in January the number of settings decreased even more and the weather conditions also turned to worse accompanied by strong waves.

Marketing and sales results. The marketing and sale of catched fish is performed by companies that have cold storage facilities and the merchandise will be sold when fish prices rise or when consumers demand increase. For the highest selling prices companies usually sell fish to the local market for the purchase price from the catching company. The amount of fish caught during three trips can be seen in Table 3.

Table 3

The fish catches capitalization for three trips

No	Species	Price (USD)	Weight (kg)	Total (USD)
1	*Decapterus spp*	1.43	72,295	103,381.85
2	*Selaroides leptolepis*	2.14	8,863	18,966.82
3	*Euthynnus affinis*	1.43	2,748	3,929.64
4	*Selar crumenophtslmus*	1.43	2,682	3,835.26
5	*Rastrelliger brachysoma*	2.14	2,551	5,459.14
6	*Sardinella lemuru*	1.07	1,549	1,657.43
7	*Loligo*	2.14	1,503	3,216.42
	Total	-	**92,191**	**140,446.56**

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Total catches sold as a whole during three trips get a yield of 140,446.56 USD, catches during 2017 can be assumed with a total yield for three trips divided by 3 then multiplied by a year (10 Trips) with a result of 468,155.2 USD.

Investation. Investment is a cost that is required to meet the infrastructure or supporting facilities in the initial stages of a business. Investment is also a fixed cost in the form of depreciation and maintenance costs. Bigger is the fishing boat, greater is the investment value and the depreciation.

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The capital that must be owned by a fishing company is in one fishing boat and its equipment, as well as fishing gear, and also its engine. One fishing boat unit amounting to 78,571 USD. Details of the investment value are listed in Table 8.

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Table 8

Investment Cost

No	*Investation type*	*Unit*	*Price (USD)*	*Economic age*	*Value (USD)*
1	Fishing boat	1	42.857	8	42.857
2	Purse seine gear	1	28.571	3	28.571
3	Main engine	1	2.857	4	2.857
4	Auxillary engine	2	2.143	4	4.286
	Investment amount				78.571

Fixed cost. Fixed costs are costs derived from several factors, namely based on depreciation, maintenance, document fees and taxes. Depreciation costs are calculated according to the shelf life of the economic goods or accoding to its feasibility and economic life of the object and the acquisition value and the residual value of the object.

Based on the depreciation calculation, the amount of depreciation costs consisting of ships, ring trawl nets and generator engines which is 15,000 USD year^{-1}.

Maintenance costs are costs incurred for ship maintenance, netting maintenance, engine maintenance, dock and overhead while the ship is still operating. Details of maintenance costs are listed in Table 4.

Table 4

Fixed costs

No.	Cost	Per Trip (Rp)	1 Year (USD)
1	Cost of depreciation	1,500	15,000
2	Maintenance costs	257.14	2,571.4
3	Tax costs	372.33	3,723.3
4	Dock & Overhead	714.28	7,142.8
	Total	2,843.75	28,437.5

Variable cost

Operating costs. Fishing operation activities require specific equipment that must be available, to meet these needs the company spent 274,882.1 USD, as it is detalied in Table 5.

Table 5

Variable cost

No	*Item of goods*	*Vol.*	*Unit*	*Price (USD)*	*Amount (USD)*	*Amount per Trip (USD)*
1	Fresh water	15,000	Littre/m^3	1.43	21,428.57	64,285.71
2	Gasoline	140	L	0.50	70.00	210.00
3	Rice	15	sack	17.86	267.86	803.57
4	Seasoning	2	Pack	3.57	7.14	21.43
5	Ice	2,000	kg	0.11	214.29	642.86
6	Salt	3	Pack	5.00	15.00	45.00
7	LPG Gas	2	tube	14.64	29.29	87.86
8	Sugar	3	sack	33.57	100.71	302.14
9	Kitchen goods				68.57	205.71
10	Deck & engine parts				107.14	321.42
11	Coffee	10	Pack	0.71	7.14	21.43
12	Fried oil	100	L	0.86	85.71	257.14
13	Medicines				7.14	21.42
14	Liquid oil	200	L	2.14	428.57	1,285.71
15	Fuel oil	10,000	L	0.46	4,642.86	13,928.57
16	Tea	1	Pack	8.21	8.21	24.64
Total cost					***27,488.21***	***82,464.62***
Total cost per 1 year (USD)						***274,882.1***

Labor costs. The results of work on the ship are calculated by profit sharing per trip, also based on position and length of service to the company. The amount of the premium depends on the catch, while for the salary system, it is calculated to be 20% of the sales proceeds while 80% for the company. The following results of the distribution of salaries per trip were evidenced: 468,155.2 USD x 20%= 93,631.04.

Total costs. The total cost of fishing operations for one year amounted an overall of 396,950.64 USD. With the breakdown of fixed costs of 28,437.5 USD, in these costs are included the maintenance costs, which are incurred annually, and salary costs. The variable costs amounted 368,513.14 USD; the details of these costs are listed in Table 6.

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Table 6

One year total costs

No.	*Cost Type*	*1 Trip (Rp)*	*1 year (USD)*
	(A) Fixed cost		
1	Cost of depreciation	1,500	15,000
2	Maintenance costs	257.14	2,571.4
3	Taxes	372.33	3,723.3
4	Dock & Overhead	714.28	7,142.8
	Total (A)	*2,843.75*	*28,437.5*
	(B) Variable		
4	Operational cost	27,488.21	274,882.1
5	Salary	9,363.1	93,631.04
	Total (B)	*34,615.71*	368,513.14
	Total costs (A+B)	-	396,950.64

Discussion

Business revenue analysis. Analysis of operating income aims to find out the magnitude of the benefits derived from the fishing. The calculation of operating income was performed by using the equation:

$$\boldsymbol{\pi = TR - TC}$$

Where:

π = Profit

TR = Total revenue

TC = Total costs

π = 468,155.2 – 396,950.64

π = 71,204.56

The data considers operation for 10 trips (1 year), where in the calculation of the results levies and taxes are already included so that business profits are obtained after taxes deduction.

Analysis of revenue and cost balance. Revenue-cost ratio analysis aims to determine the extent of the benefits derived from fishing business activities during a certain period. It is performed to find out how far each rupiah value of costs used in the most profitable business activities has the highest $\frac{R}{C}$. The calculation used the following formula:

$$\boldsymbol{\frac{R}{C} = \frac{TR}{TC}}$$

$\frac{R}{C}$ = Business activities

TR = Total revenue

TC = Total cost

$\frac{R}{C} = \frac{468,155.2}{396,950.64}$ = 1.18

R/C > 1 means that business activities are beneficial

Value of $\frac{R}{C}$ > can be interpreted that fishing using MV. Sumber Jadi as financially viable sources.

Payback period (PP). Payback period is a comparison between the investment value and profits multiplied by 1 year. Payback period is useful to find out in what time the business can return the investment. Fast return of investment is a good indicator of the company.

$$\boldsymbol{PP = \frac{Investment\ Value}{Profit}\ X\ 1\ year}$$

$PP = \frac{78.571}{71{,}204.56}\ X\ 1\ year$

PP = 1,10 are same with 1 year 1.2 month

It can be interpreted that the capital will return in 12 months (very profitable).

Return of investment (ROI). Return of investment is the ratio between profit and investment value multiplied by 100. ROI is used to determine the benefits obtained in every rupiah of investment. ROI from a small pelagic fishing business unit using trawl was obtained in the following manner:

$$\boldsymbol{ROI = \frac{Profit}{Investment}\ X\ 100}$$

$ROI = \frac{71{,}204.56}{78.571}\ X\ 100$

ROI = 90.62%.

ROI in fishing using the ring trawl can return 90.62% capital; twice a year.

Conclusions. Acording to the obtained results, the present study, concerning the financial analysis, concluded the followings:

1) Operating profit: 71,204.56 USD.
2) Balance and revenue analysis: 1.16. Value $\frac{R}{C}$ > 1, means beneficial.
3) Payback period: in 1 year and 1.2 month the invested capital can be returned.
4) Return of investment: 90.62%.

So it can be concluded that the operation of purse seine on MV. Sumber Jadi is a viable source.

Acknowledgements. We would like to thank to boat owner, master and crews MV. Sumber Jadi, for their contribution and determination during the present study.

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Received: Januari 2020. Accepted: xxxx 2020. Published online: xxxxxxx.
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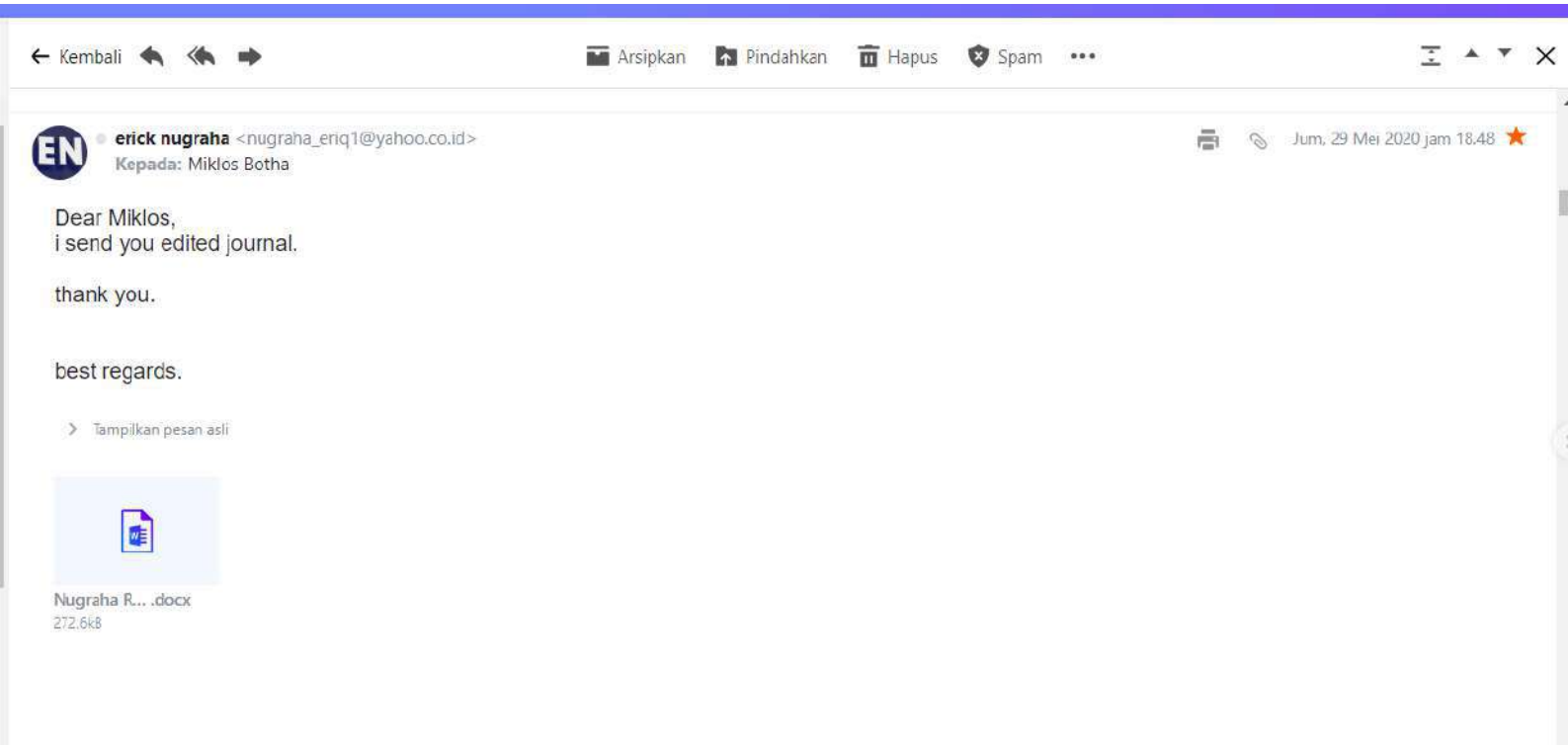
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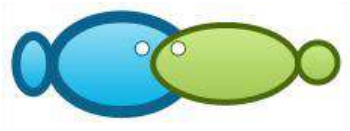

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Abstract. Purse seine is a fishing gear made from webbing sheets, which are generally rectangular. Fisheries production in Batam City has increased in the last two years, where the purse seine is the dominant fishing gear used in Natuna waters. Thus, it is necessary to know how far the purse seine fishing activity can still be carried out properly. The purpose of analyzing the financial aspects of a business project feasibility study is to determine the investment plan through the calculation of expected costs and benefits, by comparing expenses and revenues, such as the availability of funds, capital costs, the project's ability to repay the funds within the allotted time and assess whether the project will continue to develop. This research was carried out from November 1, 2017 to March 6, 2018. Sampling was done by observing all of the purse seine operations. Data were taken from primary data and secondary data. Data were analyzed using financial analysis. The results of the present study indicate that purse seine fisheries in Batam meet proper requirements to be continued. Financial analysis results are as follows: Operating profit: 71,204.56 USD. Analysis of revenue and cost balance: 1.16 Value $\frac{R}{C}$ > means profitable, Payback period: 1 year 1.2 month, the investment capital can be returned. Return of investment: 90.62%.
Key Words: financial feasibility, Natuna Sea, Catch Composition. Purse Seine Ships

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Introduction. Indonesia is a country that has a very wide sea area, about 2/3 of the country's territory is ocean (Nugraha & Mulyono 2017). Indonesia's fisheries resources are ours without any interference from other countries (Sahabu at al 2015). According to Limbong at al (2013), the utilization of marine resources needs to be limited by controlling the amount of fishing effort and/or catches in order to avoid excessive effort, excessive capital investment or excess labor. Utilization of resources without control tends to be followed by a decrease in resources (stock), a decrease in catches per unit of effort (CPUE), as well as the depletion of the benefits obtained. The efficiency of a resource utilization arrangement can be achieved by catching up to the level appropriate to the level needed to obtain an optimal catch.

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According to Nainggolan (2007), purse seine is a fishing device made from webbing sheets, which are generally rectangular. There are also those who classify them based on the type of fish they are fishing for so that they are known as small pelagic purse seine and large pelagic purse seine (Sudirman & Mallawa 2012). In tropical and sub-tropical waters, fish often gather in large numbers naturally, these fish are subject to capture using purse seine (Surur 2010). Determination of the fishing ground can be expected from the waters condition that is the habitat of a species (Nugraha et al 2020).

Indonesia's total fishery production in 2014 was 11.06 million tons with a total value of ~~IDR. 126 trillion~~ USD 9 billion. This figure was contributed by the capture fisheries and aquaculture sectors respectively 5.86 million tons and 5.20 million tons. In 2014, the

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export volume of fishery products was 802 thousand tons with a value of 2.6 billion USD (Sub Directorate of Data and Capture Fisheries Statistics 2014).

According to Kasmir & Jakfar (2008), the purpose of analyzing the financial aspects of a business project feasibility study is to determine the investment plan through the calculation of expected costs and benefits, by comparing expenses and revenues, such as the availability of funds, capital costs, the ability of the project to pay back these funds within the allotted time and assess whether the project will continue to grow.

According to Widodo et al (2005), types of production costs and calculations can be divided into two: short term production costs and long term costs. Analysis of business income aims to determine the magnitude of profits derived from a business activity carried out (Febrianto 2008). This analysis (Reveneu-Cost Ratio) aims to determine the extent of the benefits derived from business activities during a certain period. Revenue cost analysis is carried out to find out how far each value of revenue is benefited. The most profitable business activities have the biggest Revenue-Cost Ratio (R/C).

Febrianto (2008) stated that payback period (PP) is the period required to recoup investment expenditure (initial cash investment) using cash flow. The calculation of Return of Investment (ROI) is carried out to find out the amount of profit gained compared to the amount of profit obtained compared to the amount of investment (Hutajulu et al 2019).

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Material and Method. The financial analysis method was used to analyze data obtained at MV. Sumber Jadi belongs to Hasil Laut Sejati co.ltd, especially data relating to operational costs and the sale of fish catches.

Data analysis related to financial aspects are as follows:

1. Business Revenue Analysis is an analysis that aims to find out the magnitude of profits derived from a business activity carried out (Djamin 1984). The calculation of operating income is done by using the equation:

$$\boldsymbol{\pi = TR - TC}$$

Where:
π = profit
TR = total revenue
TC = total cost
With criteria:
- If TR > TC, business activities have benefit
- If TR < TC, business activities do not benefit or loss benefit
- If TR = TC, business activities are at the break-even point or the business has no profit or loss profit.

2. Reveneu-Cost Ratio Analysis is an analysis that aims to determine the extent of the benefits derived from business activities during a certain period (Sugiarto et al 2002). Revenue-cost analysis is carried out to find out how far each value of revenue is benefited. The most profitable business activities have the biggest R/C. The calculation uses the following equation:

$$\frac{\boldsymbol{R}}{\boldsymbol{C}} = \frac{\boldsymbol{TR}}{\boldsymbol{TC}}$$

Where:
$\frac{R}{C}$ = Business activities
TR = Total revenue
TC = Total cost
With criteria:
- If R / C> 1, business activities benefit
- If R / C <1, business activities approach a loss
- If R / C = 1, business activities has no profit or loss profit

3. Payback Period (PP) is the period required to recoup investment expenditure (initial cash investment) using cash flow (Umar 2003). The formula used is:

$$PP = \frac{Investment\ Value}{Profit}\ X\ 1\ \text{Year}$$

4. Return of Investment (ROI) is the ability of a business to generate profits. The calculation of ROI is performed to find out the amount of profit gained compared to the amount of profit obtained compared to the amount of investment (Hutajulu et al 2019). Formula used:

$$ROI = \frac{Profit}{Investment}\ X\ 100\%$$

With criteria:
> 25 % : Good
15 – 25 % : Fair
5 – 15 : bad
< 5 % : Worse

Results. The purse seine ship used in the present study was MV. Sumber Jadi belongs to Hasil Laut Sejati, Co. Ltd as shown in Figure 1.

Figure 1. ~~Kapal Purse seine (original).~~ The purse seine boat

Production. Total catches for 3 trips were 92,191 kg. Details of fish species and fish weight are presented in Table 1.

Table 1

Catches for three trips

No.	*Common Name*	*Scientific Name*	*Total catch per 3 trips (kg)*	*Percentage (%)*
1	*Scad*	*Decapterus* spp.	72,295	78
2	~~*Yellowtail*~~ *Yellowstripe scad*	*Selaroides leptolepis*	8,863	9
3	~~*Auxis thazard*~~ *Mackerels*	*Euthynnus affinis*	2,748	3
4	*Bigeye Scad*	~~*Selar crumenophtslmus*~~ *Selar crumenophthalmus*	2,682	3
5	~~*Island*~~ *Short mackerel*	*Rastrelliger brachysoma*	2,551	3
6	*Bali sardinella*	*Sardinella lemuru*	1,549	2

Commented [A14]: Yellowstripe scad
https://www.fishbase.se/summary/Selaroides-leptolepis.html

Commented [A15]: Auxis thazard is the scientific name of Frigate tuna
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https://www.fishbase.se/summary/Selar-crumenophthalmus.html

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https://www.fishbase.se/summary/Selar-crumenophthalmus.html

Commented [A18]: Short mackerel
https://www.fishbase.se/summary/Rastrelliger-brachysoma.html

7	*Squid*	*Loligo sp.*	1,503	2
	Total catching		92,191	100

Fish catchment production from 4 November 2017 to 30 January 2018 was 92,191 kg. The catchment comprised: *Decapterus* spp. 72,295 kg, *Selaroides leptolepis* 8,693 kg, *Euthynnus affinis* 2,748 kg, ~~*Selar crumenophtslmus*~~ *Selar crumenophthalmus* 2,682 kg, *Rastrelliger brachysoma* 2,551 kg, *Sardinella lemuru* 1,549 kg, *Loligo sp.* 1,509 kg. Graphical representation of catch composition for three trips is displayed in Figure 2.

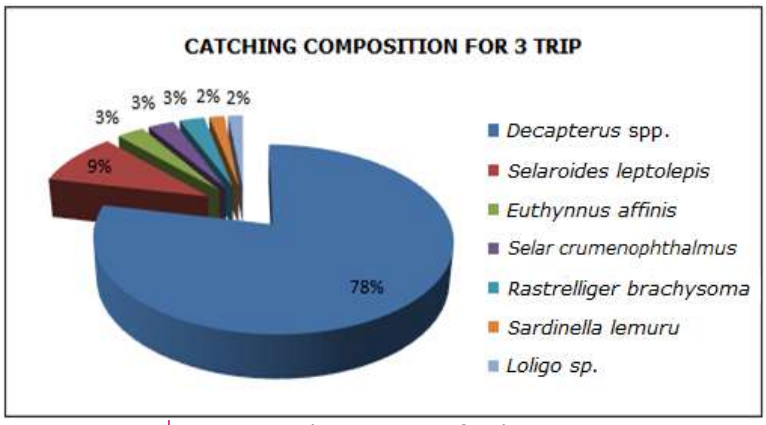

Figure 2. Catch composition for three trips.

While the catches in each trip have different compositon, the table 2 explains that catches are not similar in each month due to season and weather factors. Catches composition per trip is recorded in Table 2 and Figure 3.

Table 2

Total catch per trip

No.	Trip	~~Jumlah~~ Amount (kg)
1.	Trip I	40,951
2.	Trip II	29,720
3.	Trip III	21,520

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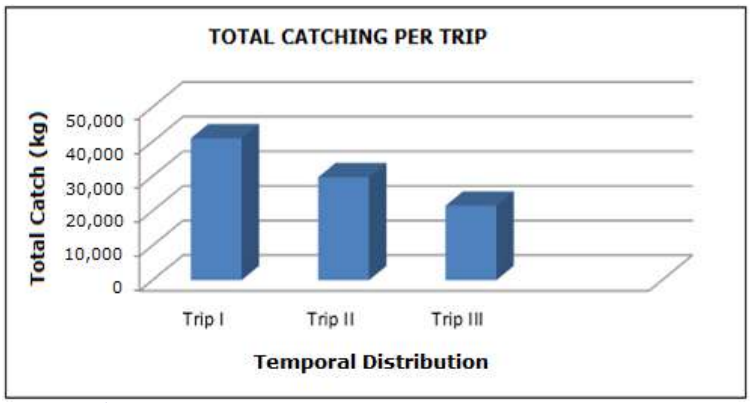

Figure 3. Graphical representation of catches per trip.

From Figure 3, it can be concluded that the catch per trip is uneven. From the first trip to the third trip the catch has decreased. In November it got quite results results due to the high number of settings and favorable weather conditions, while in December the number of settings decreased due to the unfavorable weather conditions, in January the number of settings decreased even more and the weather conditions also turned to worse accompanied by strong waves.

Marketing and sales results. The marketing and sale of catched fish is performed by companies that have cold storage facilities and the merchandise will be sold when fish prices rise or when consumers demand increase. For the highest selling prices companies usually sell fish to the local market for the purchase price from the catching company. The amount of fish caught during three trips can be seen in Table 3.

Table 3

The fish catches capitalization for three trips

No	Species	Price/kg (USD)	Weight (kg)	Total (USD)
1	*Decapterus spp*	1.43	72,295	103,381.85
2	*Selaroides leptolepis*	2.14	8,863	18,966.82
3	*Euthynnus affinis*	1.43	2,748	3,929.64
4	~~*Selar crumenophtslmus*~~ *Selar crumenophthalmus*	1.43	2,682	3,835.26
5	*Rastrelliger brachysoma*	2.14	2,551	5,459.14
6	*Sardinella lemuru*	1.07	1,549	1,657.43
7	*Loligo sp.*	2.14	1,503	3,216.42
	Total	-	**92,191**	**140,446.56**

Total catches sold as a whole during three trips get a yield of 140,446.56 USD, catches during 2017 can be assumed with a total yield for three trips divided by 3 then multiplied by a year (10 Trips) with a result of 468,155.2 USD.

~~***Investation***~~ ***Investment***. Investment is a cost that is required to meet the infrastructure or supporting facilities in the initial stages of a business. Investment is also a fixed cost in the form of depreciation and maintenance costs. Bigger is the fishing boat, greater is the investment value and the depreciation.

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Time catching would sound more appropriate as **Temporal distribution**.

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The capital that must be owned by a fishing company is in one fishing boat and its equipment, as well as fishing gear, and also its engine. One fishing boat unit amounting to 78,571 USD. Details of the investment value are listed in Table 8.

Table 8

Investment Cost

No	~~Investation~~ Investment type	Unit	Price (USD)	Economic age	Value (USD)
1	Fishing boat	1	42,857	8	42,857
2	Purse seine gear	1	28,571	3	28,571
3	Main engine	1	2,857	4	2,857
4	Auxillary engine	2	2,143	4	4,286
Investment amount					78,571

Fixed cost. Fixed costs are costs derived from several factors, namely based on depreciation, maintenance, document fees and taxes. Depreciation costs are calculated according to the shelf life of the economic goods or accoding to its feasibility and economic life of the object and the acquisition value and the residual value of the object.

Based on the depreciation calculation, the amount of depreciation costs consisting of ships, ring trawl nets and generator engines which is 15,000 USD year^{-1}.

Maintenance costs are costs incurred for ship maintenance, netting maintenance, engine maintenance, dock and overhead while the ship is still operating. Details of maintenance costs are listed in Table 4.

Table 4

Fixed costs

No.	Cost	Per Trip (Rp)	1 Year (USD)
1	Cost of depreciation	1,500	15,000
2	Maintenance costs	257.14	2,571.4
3	Tax costs	372.33	3,723.3
4	Dock & Overhead	714.28	7,142.8
	Total	2,843.75	28,437.5

Variable cost

Operating costs. Fishing operation activities require specific equipment that must be available, to meet these needs the company spent 274,882.1 USD, as it is detalied in Table 5.

Table 5

~~Variable cost~~ Operating cost

No	Item of goods	Vol.	Unit	Price per unit (USD)	Amount per Trip (USD)	Amount per 3 Trip (USD)
1	Fuel Oil	15,000	L	1.43	21,428.57	64,285.71
2	Gasoline	140	L	0.50	70.00	210.00
3	Rice	15	sack	17.86	267.86	803.57
4	Seasoning	2	Pack	3.57	7.14	21.43
5	Ice	2,000	kg	0.11	214.29	642.86
6	Salt	3	Pack	5.00	15.00	45.00
7	LPG Gas	2	tube	14.64	29.29	87.86
8	Sugar	3	sack	33.57	100.71	302.14
9	Kitchen goods				68.57	205.71
10	Deck & engine parts				107.14	321.42
11	Coffee	10	Pack	0.71	7.14	21.43

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12	Fried oil	100	L	0.86	85.71	257.14
13	Medicines				7.14	21.42
14	Liquid oil	200	L	2.14	428.57	1,285.71
15	Fresh water	40,000	L	0.11	4,642.86	13,928.57
16	Tea	1	Pack	8.21	8.21	24.64
	Total cost				***27,488.21***	***82,464.62***
	Total cost per 1 year (USD)					***274,882.1***

Labor costs. The results of work on the ship are calculated by profit sharing per trip, also based on position and length of service to the company. The amount of the premium depends on the catch, while for the salary system, it is calculated to be 20% of the sales proceeds while 80% for the company. The following results of the distribution of salaries per trip were evidenced: 468,155.2 USD x 20%= 93,631.04.

Total costs. The total cost of fishing operations for one year amounted an overall of 396,950.64 USD. With the breakdown of fixed costs of 28,437.5 USD, in these costs are included the maintenance costs, which are incurred annually, and salary costs. The variable costs amounted 368,513.14 USD; the details of these costs are listed in Table 6.

Table 6

One year total costs

No.	*Cost Type*	*1 Trip (Rp)*	*1 year (USD)*
	(A) Fixed cost		
1	Cost of depreciation	1,500	15,000
2	Maintenance costs	257.14	2,571.4
3	Taxes	372.33	3,723.3
4	Dock & Overhead	714.28	7,142.8
	Total (A)	*2,843.75*	*28,437.5*
	(B) Variable		
4	Operational cost	27,488.21	274,882.1
5	~~Salary~~ Labor cost	9,363.1	93,631.04
	Total (B)	*34,615.71*	368,513.14
	Total costs (A+B)	-	396,950.64

Discussion

Business revenue analysis. Analysis of operating income aims to find out the magnitude of the benefits derived from the fishing. The calculation of operating income was performed by using the equation:

$$\boldsymbol{\pi = TR - TC}$$

Where:

π = Profit

TR = Total revenue

TC = Total costs

π = 468,155.2 – 396,950.64

π = 71,204.56

The data considers operation for 10 trips (1 year), where in the calculation of the results levies and taxes are already included so that business profits are obtained after taxes deduction.

Analysis of revenue and cost balance. Revenue-cost ratio analysis aims to determine the extent of the benefits derived from fishing business activities during a certain period. It is performed to find out how far each rupiah value of costs used in the most profitable business activities has the highest $\frac{R}{C}$. The calculation used the following formula:

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$$\frac{R}{C} = \frac{TR}{TC}$$

$\frac{R}{C}$ = Business activities
TR = Total revenue
TC = Total cost

$\frac{R}{C} = \frac{468,155.2}{396,950.64}$ = 1.18

R/C > 1 means that business activities are beneficial
Value of $\frac{R}{C}$ > can be interpreted that fishing using MV. Sumber Jadi as financially viable sources.

Payback period (PP). Payback period is a comparison between the investment value and profits multiplied by 1 year. Payback period is useful to find out in what time the business can return the investment. Fast return of investment is a good indicator of the company.

$$PP = \frac{Investment\ Value}{Profit}\ X\ 1\ year$$

$PP = \frac{78.571}{71,204.56}\ X\ 1\ year$
PP = 1.10 are same with 1 year 1.2 month
It can be interpreted that the capital will return in 12 months (very profitable).

Return of investment (ROI). Return of investment is the ratio between profit and investment value multiplied by 100. ROI is used to determine the benefits obtained in every rupiah of investment. ROI from a small pelagic fishing business unit using trawl was obtained in the following manner:

$$ROI = \frac{Profit}{Investment}\ X\ 100$$

$ROI = \frac{71,204.56}{78.571}\ X\ 100$
ROI = 90.62%.
ROI in fishing using the ring trawl can return 90.62% capital; twice a year.

Conclusions. Acording to the obtained results, the present study, concerning the financial analysis, concluded the followings:

1) Operating profit: 71,204.56 USD.
2) Balance and revenue analysis: 1.16. Value $\frac{R}{C}$ > 1, means beneficial.
3) Payback period: in 1 year and 1.2 month the invested capital can be returned.
4) Return of investment: 90.62%.

So it can be concluded that the operation of purse seine on MV. Sumber Jadi is a viable source.

Acknowledgements. We would like to thank to boat owner, master and crews MV. Sumber Jadi, for their contribution and determination during the present study.

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Received: Januari 2020. Accepted: xxxx 2020. Published online: xxxxxxx.
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Kembali Arsipkan Pindahkan Hapus Spam •••

Miklos Botha <miklosbotha@yahoo.com>
Kepada: erick nugraha

Sen, 1 Jun 2020 jam 16.03

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Please note: Always operate corrections/additions (or deletions) in the manuscript we sent to you (already edited version) highlighted with a bright color (for easy identification). We never work on manuscript you send back, just identifying the corrections and operate them on our document (to avoid any undesirable accidental operations like changed page set up, or anything else - otherwise the editor have to start all the work from the beginning, and we cannot ask editors to re-check every manuscript word by word to identify unmarked modifications).
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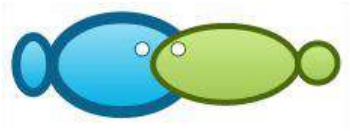

Composition of target species, bycatch, hook rate and fluctuation for longline tuna fishing in the Eastern Indian Ocean, Indonesia

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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 *Thunnus alalunga* which is deeper than of *Thunnus obesus* and *Thunnus albacares*.
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, 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 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 (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

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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*
Escolar	*Lepidocybium flavobrunneum*
Swordfish	*Xiphias gladius*
Shark	*Centrophorus squamosus*

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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.

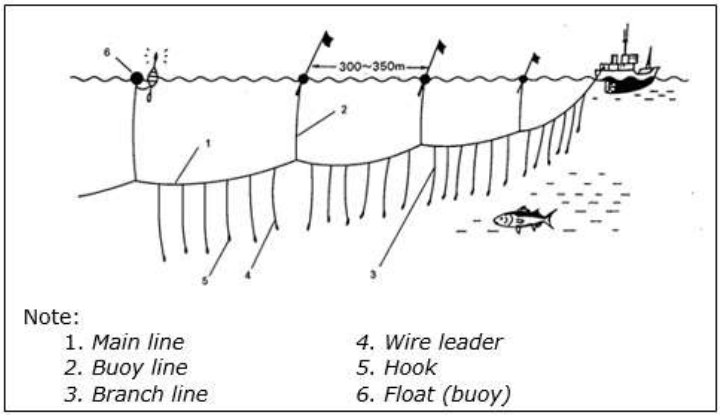

Figure 1. Long line (PPKP 2015).

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 and Discussion

Target species and bycatch. The number of catches obtained during fishing operations took place 1,714 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	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. The target species were 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 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.

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. 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.

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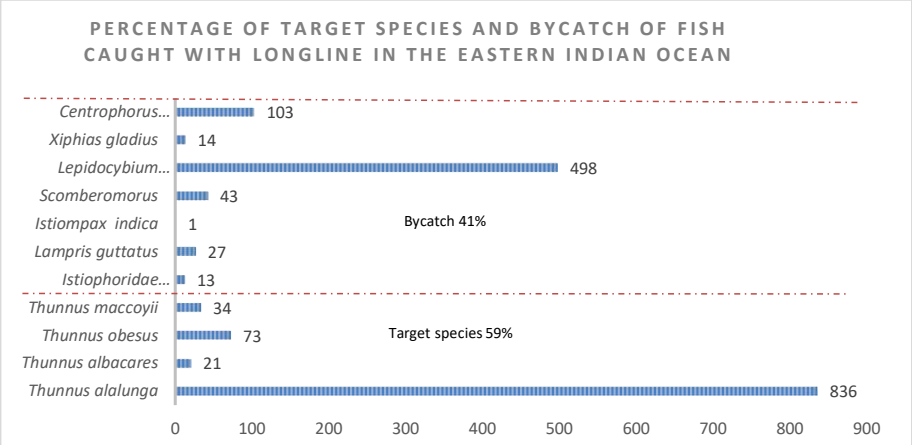

Figure 2. Percentage of target species and by catch of fish caught with tuna longline in the Eastern Indian Ocean from November 2018 to April 2019.

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 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 appeared to be relatively small sized in November and March. The overall distribution of capture rate is presented in Figure 3.

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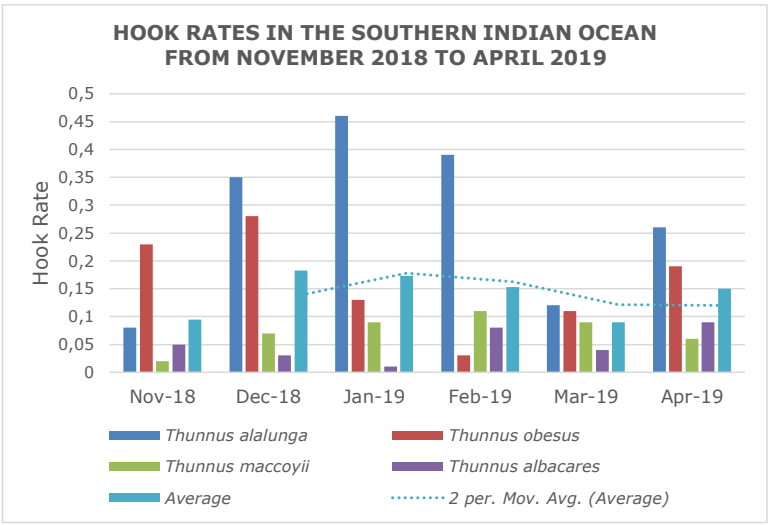

Figure 3. Distribution of tuna longline hook rates in the Indian Ocean from November 2018 to April 2019.

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

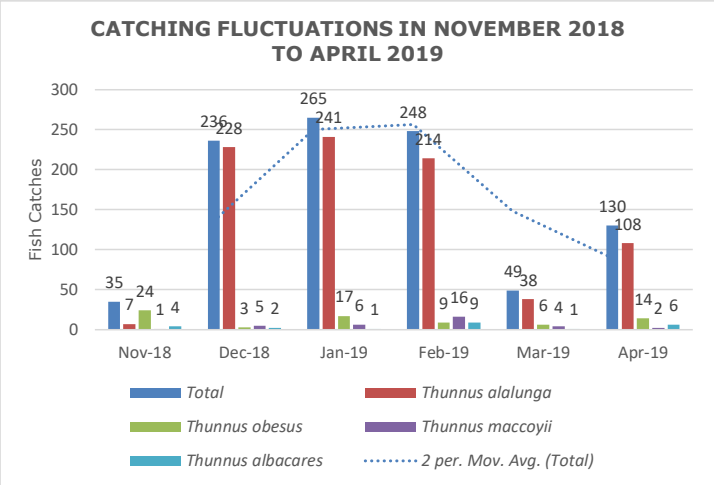

Figure 4. Catching fluctuation.

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.

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

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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.

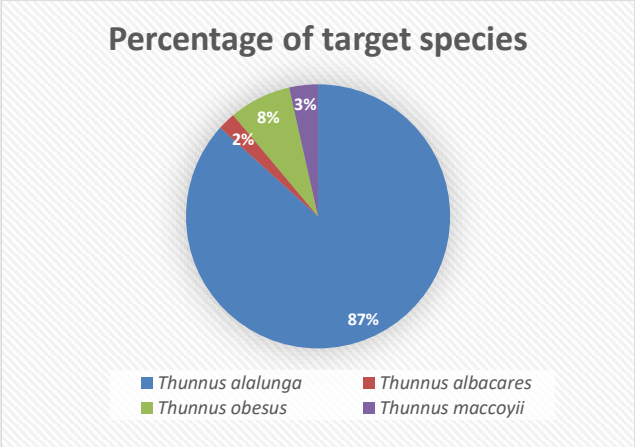

Figure 6. Percentage of target species.

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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