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Comparative analysis of income between fishing businesses with bottom longlines and floating traps in Sanga-Sanga Sub-District

Sudewi¹, Helminuddin^{2*}, Fitriyana², Said Abdusysyaid²

¹Student of Fisheries Science Magister, Fisheries and Marine Faculty, Mulawarman University, Indonesia.

²Lecturer of Fisheries Science Magister, Fisheries and Marine Faculty, Mulawarman University, Indonesia.

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ABSTRACT

The fishing business in Sanga-Sanga Sub-district is carried out by fishermen who use different fishing gear such as basic longline and floating bubu. This study aimed to analyze the income from the fishing business by basic longline fishermen and floating bubu and whether there is a real difference between the income of basic longline fishermen and floating bubu. Based on the analysis result, it was known that the average income of fishermen who use basic longlines was Rp 46,579,291.67/year while fishermen who use floating bubu is Rp 9,963,200.00/year. The statistical analysis results of the unpaired two-sample t-test showed that the calculated t value was 5.905 greater than the t table value of 2.447 and had a significance value of the t test which was smaller than 0.05. This meant that there was a significant difference in income between basic longline fishermen and floating bubu fishermen.

Introduction

Indonesia's marine resources are one of the important development assets and have a very large opportunity to be used as a source of economic growth. Maryanto *et al.* (2022) stated that the fisheries sector in East Kalimantan is considered not to have played a role in regional development. However, the Mahakam Delta fisheries production reaches 20% of the total fisheries production of East Kalimantan Province, so it can be said that the fisheries sector in the region has played an important role in the province's economic growth (Sugiharto, 2021).

Data from the Central Statistics Agency of Kutai Kartanegara Regency shows that there has been an increase in the amount of fish catch production from 2020 by 75,784 tons to 99,123 tons in 2023 (BPS Kutai Kartanegara Regency, 2024). This increase in production has still not been able to reduce the percentage of poor people in Kutai Kartanegara Regency. This can be seen from the percentage of poor people in Kutai Kartanegara Regency in 2020 of 7.31% which increased to 7.61% in 2023 (BPS Kutai Kartanegara Regency, 2024). Syahma, (2016)

revealed that fishermen are one of the community groups that are still plagued by poverty. Based on this, various efforts are needed to improve the welfare of the community and fishermen in particular.

One of the efforts to utilize sustainable fishery resources is to use environmentally friendly fishing gear (Yuliana & Fitriyana, 2023). Bubu fishing gear is classified as environmentally friendly fishing gear for catches due to its high selectivity (Pratama *et al.*, 2012). In addition, Rahmat & Yahya (2019) also stated that bottom Rawai is an environmentally friendly fishing gear because its catch is selective in terms of fish size.

The main target of national development in general and Sanga-sanga District in particular concerns the welfare of the community (Kutai Kartanegara Central Statistics Agency, 2023). The profession of fishermen is still often associated with the status of poor people, especially traditional fishermen, who are stereotyped as weak, stupid, inefficient, and unable to plan for the future (Cahyona & Nadjib, 2014; Velentina, 2018).

* Corresponding author.

Email address: h.belminuddin@fpik.unmul.ac.id

Fishermen in Sanga-Sanga District use various types of fishing gear such as bottom longlines, floating traps, nets (gillnets), cast nets, fishing rods and rakang. The capture fisheries business has obstacles and problems such as bad weather, peak season, and lean fish season making this business unable to operate, resulting in uncertain income (Caesari *et al.*, 2023). This phenomenon also occurs in Sanga-Sanga District, which causes people to prefer working in companies rather than doing fishing businesses that produce uncertain results. There are also many fishermen whose main job is as company employees and they only work as fishermen when they are not working. In order for the fishing business to be profitable, it is necessary to calculate the costs such as determining the costs and allocating them for the fishing business appropriately (Waileruny *et al.*, 2022). Based on the Regulation of the Minister of Marine Affairs and Fisheries No. 18 of 2021, bottom longlines and floating traps are passive fishing gear and are included in the category of permitted fishing gear. The fishing business using bottom longlines and floating traps in Sanga-Sanga District has never been studied whether it is financially profitable. This study aimed to analyze the income from the fishing business by basic longline fishermen and floating bubu and whether there is a real difference between the income of basic longline fishermen and floating bubu.

Materials and Methods

Location and time of research

The research location chosen in this study is in Sanga-Sanga District, Kutai Kartanegara Regency (Figure 1). The duration of the study is 4 months starting from June 2024 to September 2024.

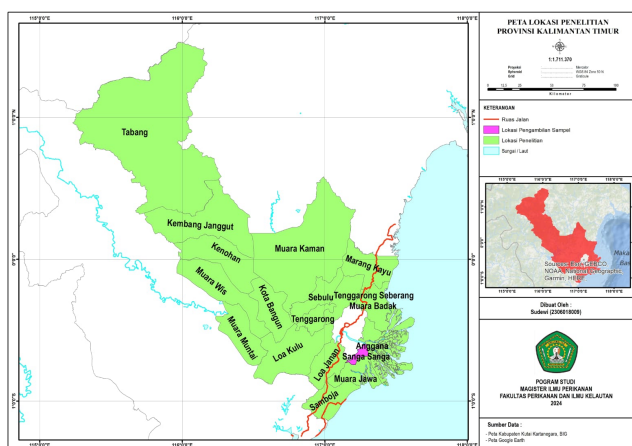


Figure 1. Research Location

Sampling Method

The sampling method used in this study is purposive sampling. Purposive sampling is a

sampling determination technique with certain considerations or special selection (Siyoto & Sodik, 2015). Sampling was carried out with the following criteria:

1. Making fishing business as their main job.
2. Active fishermen who carry out fishing business using 1 type of fishing gear, namely bottom longline or floating trap.
3. Have worked as bottom longline or floating trap fishermen for at least 5 years.
4. Fishermen who have joined a fisheries institution (group).

The population members at the research location who use bottom longline are 119 and floating traps are 49 people, but in reality many fishermen use several types of fishing gear and seasonal fishermen (fishermen who carry out fishing business only when they are not working in their main job) so that they are not included in the research respondent criteria. The number of respondents who have met the above criteria is 12 people consisting of 6 bottom longline fishermen and 6 floating trap fishermen.

Data analysis

The economic value of fishermen's businesses from fishing businesses can be determined by analyzing the costs, revenues and income of fishermen. Referring to the basic formula from (Rangkuti, 2012), economic value analysis can be done with the formula:

1. Cost Analysis

$$TC = TFC + TVC$$

Description:

TC (Total Cost) = Total cost (IDR/Year)

TFC (Total Fixed Cost) = Total fixed cost (IDR/Year)

TVC (Total Variable Cost) = Total variable cost (IDR/Year)

2. Revenue and Profit

Revenue is the result of calculating the selling price multiplied by the amount of production (Helminuddin *et al.*, 2024).

$$TR = P \times Q$$

Description:

TR (Total Revenue) = Total revenue (IDR/Year)

P (Price) = Price (IDR/kg)

Q (Quantity) = Amount of production (kg)

Helminuddin *et al.* (2024) states that income or profit is the result of total revenue minus total costs. Profit can be determined using the following formula.

$$\pi = TR - TC$$

Description:

π = net profit (IDR/Year)

TR (Total Revenue) = Total revenue (IDR/Year)

TC (Total Cost) = Total cost (IDR/Year)

The financial differences of fishing efforts using bottom longline and floating traps were tested using statistical analysis of the t-test. The t-test used was the t-test of two independent samples, to test whether there was a difference in the average between 2 (two) groups of unpaired data. In this case, the average of 2 (two) groups of bottom longline and floating trap fishing units. Data Interpretation ($\alpha = 5\%$) and ($t_{table} = 2.447$):

Sig < 0.05 and t count > t table, then there is a difference

Sig > 0.05 and t count < t table, then there is no difference

Results

Overview of the research site

Sanga-Sanga District is an area crossed by the Mahakam River which is usually used by the community for fishing, fish farming, water transportation and other activities. Fishing businesses in Sanga-Sanga District have existed for a long time. This location is quite strategic for fishing because it is on the banks of the Mahakam River and close to the river mouth. Fishing efforts in this location are usually carried out by fishermen who use several types of fishing gear by adjusting the season and water conditions. The fishing gear used by fishermen in Sanga-Sanga District are floating traps, bottom longlines, gillnets, cast nets, fishing rods and rakang with catch commodities such as giant prawns, tiger prawns, spotted prawns, crabs, pomfret, mullet, red snapper, white snapper and other types of fish.

Investment cost

Investment costs of bottom longlines incurred include the cost of purchasing bottom longlines fishing gears, boat, machine, coolboxes, gillnets and flashlights (Table 1).

Table 1. Investment Costs of Bottom Longlines.

No.	Tools	Unit	Investment Cost	
1	Bottom Longlines	4	IDR	2.165.000,00
2	Boat	1	IDR	12.333.333,33
3	Machine	1	IDR	7.083.333,33
4	Cool box	1	IDR	1.400.000,00
5	Gillnet	4	IDR	932.500,00
6	Flashlight	6	IDR	310.000,00
Jumlah			IDR	24.224.166,67

Source: Primary data processed, 2024.

Investment costs of floating trap incurred include floating trap (floating bubu), boat, machine and coolbox (Table 2).

Table 2. Investment Costs of Floating Trap.

No.	Tools	Unit	Investment Cost	
1	Floating Bubu	255	IDR	3.900.000,00
2	Boat	1	IDR	3.966.666,67
3	Machine	1	IDR	6.033.333,33
4	Cool box	1	IDR	1.100.000,00
Jumlah			IDR	15.000.000,00

Source: Primary data processed, 2024.

Bottom longline fishermen and floating traps have different investment cost components because the fishing method involves different amounts of cost components on supporting fishing gear and flashlights. Bottom longline fishermen make fishing trips for 3 to 4 days so they need flashlights as lighting equipment, while fishermen with floating traps do not need them because they do not carry out the fishing process at night.

Operational and maintenance cost

Operational costs are costs incurred during fishing business activities during a year. The operational costs borne by the respondents are sourced from their respective capital. Operational costs are divided into two categories:

1. Fixed costs

These are expense whose amounts remain constant, even when the quantity of desired products changes. The fishing effort carried out by bottom longline fishermen incurs fixed costs, including ship maintenance costs such as oil and fiber paint, fishing gear maintenance costs such as fishing hooks and equipment replacement costs with a period of 1-10 years. The fixed costs that must be borne by respondents from the 1st to the 10th year are IDR 66,330,000.00 to IDR 142,090,000.00 per year with the average fixed cost is IDR 2.702.500,00/Year (Table 3).

Table 3. Fixed Costs of Bottom Longlines.

No	Uraian	Quantity	Unit	Cost (IDR/Year)
1	Paint	13	Unit	1.076.500,00
2	Patch Fiber	2	Can	646.666,67
3	Oil	13	Liter	519.333,33
4	Pak Kop	2	Unit	180.000,00
5	Fish Hook	4	Pack	280.000,00
Jumlah				2.702.500,00

Source: Primary data processed, 2024.

Fishing efforts carried out by floating trap fishermen incur fixed costs, including ship maintenance costs

such as oil and fiber paint, fishing gear maintenance costs such as wire and nets and equipment replacement costs with a period of 1-5 years. The fixed costs that must be borne by respondents from the 1st to the 5th year are IDR 32,120,000.00 to IDR 47,100,000.00 per year with the average fixed cost IDR 1.803.000,00 (Table 4).

Table 4. Fixed Costs of Floating Trap.

No	Uraian	Quantity	Unit	Cost (IDR/Year)
1	Paint	2	Unit	280.000,00
2	Patch Fiber	0,2	Can	50.000,00
3	Oil	8	Liter	449.000,00
4	Rope	2	Unit	30.000,00
5	Duck Tape	2	Unit	74.000,00
6	Net	2	Unit	60.000,00
7	Wire	2	Unit	140.000,00
Jumlah				1.083.000,00

Source: Primary data processed, 2024.

2. Variable Costs

Variable costs are costs that are not fixed and can change based on the amount of production desired. These variable costs of bottom longlines include consumption costs, cigarette, fuel, bait, and other costs (Table 5). The variable costs incurred by respondents of bottom longline fishermen from years 1-10 ranged from IDR 263,950,000 to IDR 674,100,000.

Table 5. Variable Costs of Bottom Longlines.

No.	Uraian	Quantity	Unit	Cost (IDR/Year)
1	Consumption	4	Times	6.670.000,00
2	Fuel	36	Liter	25.250.000,00
3	Ice	4	Unit	3.380.000,00
4	Cigarette	2	Pcs	5.660.000,00
5	Battery	1	Unit	310.000,00
6	Bait	9	Kg	6.540.000,00
Jumlah				47.810.000,00

Source: Primary data processed, 2024.

These variable costs of bottom longlines include consumption costs, fuel, ice, cigarette and bait (Table 6). The variable costs incurred by floating trap fishermen from years 1-5 ranged from IDR 76,200,000 to IDR 96,800,000.

Table 6. Variable Costs of Floating Traps.

No.	Uraian	Quantity	Unit	Cost (IDR/Year)
1	Consumption	1	Times	2.933.333,33
2	Fuel	8	Liter	8.060.000,00
3	Ice	2	Unit	293.333,33
4	Cigarette	1	Pcs	1.320.000,00
6	Bait	18	Kg	5.200.000,00

Jumlah	17.806.666,67
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Source: Primary data processed, 2024.

Revenue and Profit

Income is obtained from the sale of catches multiplied by the selling price. The average annual income obtained by bottom longlines fishermen is IDR 103,110,916.67/year. Profit/benefit is the difference between the total income (TR) and the total cost (TC) of fishery products. The average profit obtained by respondents per year is IDR 46,579,291.67 (Table 7).

Table 7. Profit Average of Bottom Longlines.

Description	Rata-Rata (IDR/Year)
Total Revenue (TR)	IDR 103.110.916,67
Total Cost (TC)	IDR 56.531.625,00
Profit (π)	IDR 46.579.291,67

Source: Primary data processed, 2024.

The average annual income earned by floating trap fishermen is IDR 34.888.333,33/year and the average profit earned per year is IDR 9.963.200,00 (Table 8).

Table 8. Profit Average of Floating Traps.

Description	Rata-Rata (IDR/Year)
Total Revenue (TR)	IDR 34.888.333,33
Total Cost (TC)	IDR 24.925.133,33
Profit (π)	IDR 9.963.200,00

Source: Primary data processed, 2024.

Income Comparative Analysis

Based on the average annual income data of each fisherman, a data normality test is carried out to see whether the data is normally distributed. If the amount of data is quite large and the distribution is not 100% normal (not perfectly normal), then the conclusions drawn are likely to be wrong (Usmadi, 2020).

Table 9. Normality Data Test.

Nelayan		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pendapatan	Rawai Dasar	.175	6	.200 [*]	.979	6	.948
	Bubu Apung	.317	6	.060	.844	6	.142

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: Primary data processed, 2024.

Based on the results of the normality data test above, it is known that the significance value of both types of fishing gear from the Kolmogorov-Smirnov and Shapiro-Wilk analysis is greater than 0.05. This means that the data is normally distributed. Based on these data, a statistical analysis of the unpaired two-sample t test was carried out.

Independent Samples T-test can be used to analyze the difference in income between two types

of fishing efforts with different fishing gear (Parahita et al., 2016).

Table 10. The Result of t-test Analysis.

Pendapatar Nelayan	F	Sig.	t	df	Sig. (2-tailed)
EV assumed	6.966	.025	5.905	10	.000
EV not assumed			5.905	5.177	.002

Source: Primary data processed, 2024.

Discussion

Small-scale fishing businesses dominate fishing businesses in Sanga-Sanga District. This can be seen from the size of the boats used by fishermen, which are dominated by small boats, namely 1 to 4 GT. Generally, fishermen in this district catch fish individually because the size of the boat used is quite small. Fishermen who use bottom longline fishing gear and floating traps usually assemble their own fishing gear. This is done so that they can adjust to the conditions of the waters around them and to save costs. If the fishing gear is damaged, fishermen can usually repair their own fishing gear to reduce unexpected expenses. Fishermen carry out fishing activities using boats with dompeng engines to get to the fishing location.

1. Bottom Longline

Bottom longline is a fishing gear that is classified as environmentally friendly because its catch is selective in terms of size. This fishing gear consists of a main rope, branch line, hook, buoy and sinker. The main rope and branch line are made of nylon monofilament number 3, the hook is made of stainless steel number 7 measuring (height x width) 6.3 x 2.5 cm. The buoy is made of styrofoam measuring (length x width x height) 30 x 30 x 30 cm with a marker in the form of a torn cloth shaped like a flag and a sinker using 2 anchors made of 1.5 kg iron building rods placed at the end of the longline.

The bottom longline fishing fleet that is developing in Sanga-Sanga District is a type of motorboat made of wood with a ship weight of 1-2 GT. The number of operating days ranges from 1 - 4 days per trip depending on weather conditions and catch results. Longline fishing can be operated both during the day and at night. At night, it can be done up to two settings, but during the day usually only one setting. The catch of this fishing gear is usually in the form of *Pangasius sp.*, *Lutjanidae sp.*, *Caranx papuensis*, *Eleutheronema tetradactylum*, and other types of fish.

2. Floating Trap

Floating Trap (bubu apung in Indonesia) is also called a fish trap and is classified as a passive fishing gear. Passive fishing gear tends to be disruptive depending on the size of the hook and fishing rod used except for bagan (Burhanuddin et al., 2013). The construction of the basic bubu is divided into 2 parts, namely the frame and the mouth. The mouth is designed in such a way that fish that enter the trap cannot get out. The floating bubu fishing boat in Sanga-Sanga District is a type of boat made of wood with an outboard engine and has a ship weight of around 1 GT. The bubu used by fishermen in Sanga-Sanga District is made of bamboo and is made directly by the fishermen. The catch of this fishing gear is usually in the form of prawns of various sizes and *Myastus nemerus*.

Investment cost

Bottom longline and floating trap fishermen have different investment cost components because the fishing method involves different amounts of cost components for supporting and sending fishing gear. Bottom longline fishermen make fishing trips for 3 to 4 days so they need flashlights as lighting equipment, while fishermen with floating traps do not need them because they do not carry out the fishing process at night. The amount of investment costs for bottom longline fishermen is greater than for floating trap fishermen. The average investment cost for bottom longline fishermen is IDR 24,224,166.67/respondent, while for floating trap fishermen it is IDR 15,000,000.00/respondent.

Operational and maintenance cost fixed cost

Bottom longline and floating trap fishermen have different types of cost components for fishing gear maintenance. In the type of bottom longline fishing gear, they spend money on purchasing fishing hooks for fishing gear maintenance, while in the type of floating trap fishing gear, they spend money on purchasing duct tape, rope, nets and wire. Engine maintenance for bottom longline fishermen requires components of oil costs and replacement of the kop pack, while floating trap fishermen only need oil. This is due to the difference in the use of ship engines for fishing in bottom longline fishermen. Bottom longline fishermen catch in areas that are further away and require more time compared to floating trap fishermen whose fishing locations are closer.

Variable cost

Bottom longline and floating trap fishermen have similarities in variable cost components such as

consumption costs, gasoline, ice cubes and cigarettes, but for bottom longline fishermen there are additional expenses in the form of batteries because they use flashlights in their business activities. Another difference lies in the amount of each cost incurred by the cost component. This results in the variable cost component for bottom longline fishermen being greater than the variable cost expenditure for floating trap fishermen.

Revenue and profit

The average income of bottom longline fishermen per year is IDR 103,110,916.67/year, while floating trap fishermen earn IDR 34,888,333.33/year. Fishermen used bottom longlines and floating trap had differences average annual incomes because of there are differences in the quantity and type of catch. Gross income or revenue is greatly influenced by the catch and selling price on the market (Hastuti *et al.*, 2013). Siskawati *et al.* (2016) added that the difference in income was caused by differences in the amount of catch received by fishermen.

Fishermen who use bottom longline fishing gear have a higher revenue and profit than fishermen who use floating trap fishing gear. Fishing efforts using these two tools can cover the operational costs incurred. Fishermen in Sanga-Sanga District who use bottom longline fishing gear have an average profit of IDR 46,579,291.67/year, while fishermen who use floating trap fishing gear only have an average profit of IDR 9,963,200.00/year.

T-test Analysis

Based on the results of the unpaired two-sample t-test, it can be seen that the calculated t value is 5.905, which is greater than the t-table value of 2.447, and the results of this test are strengthened by the significance value of the t-test which is less than 0.05. This means a significant income difference exists between bottom longline fishermen and floating trap fishermen.

Conclusion

Based on the results of research conducted in Sanga-Sanga District, Kutai Kartanegara Regency, it is known that:

1. The average income of fishermen using bottom longlines is Rp 46,579,291.67/year, while fishermen using floating traps is Rp 9,963,200.00/year. Based on this, it can be seen that fishermen using bottom longlines have a higher income than fishermen using floating traps.

2. The results of the statistical analysis of the unpaired two-sample t-test show that the calculated t-value is 5.905, which is greater than the t-table value of 2.447 and has a significance value of the t-test which is less than 0.05. This means a significant income difference exists between bottom longline fishermen and floating trap fishermen.

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