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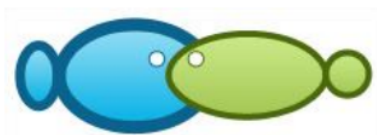
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Financial analysis of coral trout *Plectropomus leopardus* using handline fishing gear in Sarappo Island, Pangkep Regency, South Sulawesi

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Abstract. The aim of this study was to determine the current state of coral trout *Plectropomus leopardus* yields and its financial contribution to Sarappo Island waters of Pangkep Regency, South Sulawesi, Indonesia. This study was carried out from January to December 2017. Handline fishing techniques were used to acquire the fish sample. The number of each yield and costs were recorded for data collection. The total cost profit, Break-Even Point (BEP) and Profitability Index (PI) were used for data analysis. A total of 765 fish were caught from 235 fishing trips. The average initial capital investment for fishing operations was IDR 9,931,880, and the total cost was IDR 25,843,963. In addition, the average annual income was IDR 57,443,100, with an average net profit of about IDR 31,599,140. The BEP was a selling 345 fish at IDR 33,743 each, and the R/C ratio was 2.2.

Key Words: handline fishing gear, grouper, financial, capital investment, peak season, Pangkep.

Introduction. An increase of grouper fish world demand has also caused an increase of grouper fish domestic productions in Indonesia (Ahmad et al 2018). In 2015, the total yield for grouper fish reached 520,404 tonnes, an increase from 18 to 30% per year (BPS 2017). According to Chan (2000) and Tadjuddah et al (2012), 50% of the total exports of live grouper fish were from Hong Kong and 20% of the international market was supplied by Indonesia. Consequently, wild capture of juvenile groupers fish also influences the wild stock of grouper fish commodity as well as a stock of coral trout *Plectropomus leopardus* in South Sulawesi (Made et al 2017).

South Sulawesi is one of Indonesia's provinces that contribute approximately 22,709 tonnes of domestic productions of grouper fish in 2015. Approximately 50% of live grouper for domestic and international consumption derived from the Spermonde Islands, South Sulawesi (Suncoko 2013) which makes Spermonde Island the largest live grouper fishery producer in Indonesia. Consequently, wild grouper fishing leads to overfishing (Sadovy & Vincent 2002; Tadjuddah et al 2012) and the use of unsustainable fishing methods, such as cyanide use, can cause a further decline for wild grouper fish (Johannes & Riepen 1995).

According to the International Union for the Conservation of Nature and Natural Resources (IUCN) in 2006, coral trout was categorized as a threatened species and is included in a red list of threatened species (Sadovy et al 2018). The market price of coral trout is very expensive making it a sought after commodity. The availability of wild coral trout can be preserved with sustainable fishing management. Therefore, this study is aimed to determine the current state of coral trout fishing and its financial aspects.

Material and Method. The present study was carried out from January to December 2017 in the Sarappo Lompo Island, Pangkep Regency, Spermonde Islands, Indonesia. The research strategy used for data collection was based on Berg (1991) and Nugroho & Sulistiono's (2017) methods. A total of 25 fishermen (5% of the 437 individuals) from the local community of Sarappo Island were chosen as respondents during the study period.

The data that was descriptively and quantitatively analyzed, and included social and economic conditions of the local fishermen through various stages of the variables in the study with the following descriptions:

- a. Total cost was evaluated according to Nicholson & Snyder (2009):

$$TC = TFC + TVC$$

where: TC = total cost (IDR);

TFC = total fixed cost (IDR);

TVC = total variable cost (IDR).

- b. The profit of fishing rod business was calculated according to Budiman et al (2014):

$$\pi = TR - TC$$

where: π = profit (IDR);

TR = total revenue (IDR);

TC = total cost (IDR).

- c. Analysis of break even point (BEP) according to Prawirasentoso (2001) as follows:

$$BEP \text{ (Unit)} = \frac{BTp}{\frac{Py}{\text{Unit}} - \frac{BV}{\text{Unit}}}$$

$$BEP \text{ (IDR)} = \frac{BTp}{1 - \frac{BV}{Py}}$$

where: BTp = fixed cost (IDR per production);

BV = variable cost (IDR per production);

Py = fish price (IDR per kg).

- d. R/C ratio or profit ability index (PI) according to Umar (2003) as follows:

$$PI = \frac{\text{PV of cash flow}}{\text{Initial cash flow}}$$

where: PI = profit ability index (IDR);

PV = profit variable (IDR).

Decision criteria: feasible if $PI > 1$; not feasible if $PI < 1$.

Results and Discussion

Coral trout production. In the study, a total of 765 fish in a total of 235 trips were captured. Nonetheless, the coral trouts that were fished showed fluctuation (Figure 1). The number of fish that was caught was affected by the technical and environmental factors. The technical factors could be the fishing method, size of their fishing boats, technology, experiences, and knowledge. Meanwhile, the environmental factors might have been caused by the season, weather, waves, and fish behavior.

In addition, the highest fishing activity occurred from December to April during the rainy season. In this circumstances, the coral trout is more likely to spend time at a water depth of 25-30 meters and the water's wave pattern temporarily took place during capture activity compared to the dry season (May to November). During the dry season, the weather tends to be calm but the intensity of the water waves are high during the fishing activity due to strong winds blowing intensively. Based on the observation, the peak season of coral trouts occurred during the rainy season (December to April). Nonetheless, the weather is now unpredictable due to the effect of global warming leading to climate change in some fishing grounds. This condition caused problems for

local fishermen to adapt to environmental changes. The traditional fishermen adapt to the fishing activity based on the weather or season, but not according to monthly fishing.

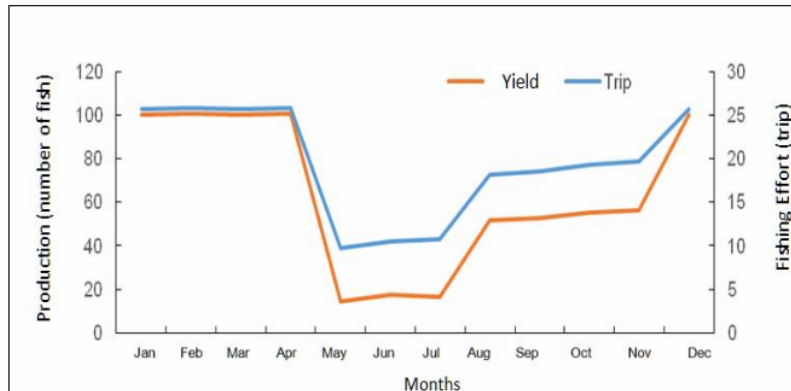


Figure 1. The production of coral trout using handline fishing obtained from the coast by the local fishermen from Sarappo Lompo Island 2017.

Fishing production and fishing efforts based on fishing seasons. Based on the interviews with the local fishermen, the handline fishing technique was commonly used for fishing coral trout around Sarappo Lompo Island. Fishing season affects the number of fish in the local fish landings and fish merchants (Figure 2).

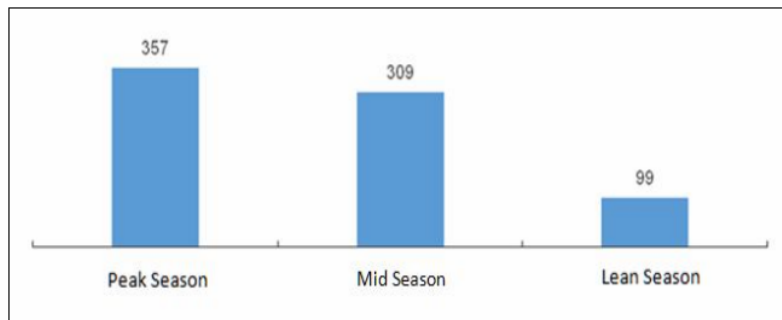


Figure 2. The fishing production of coral trout (number of fish) based on the fishing seasons categorized at the fish landing of Sarappo Lompo Island, Spermonde Waters, Pangkep Regency.

Figure 2 shows a total of 765 fish in different fishing seasons that were recorded during the study period, consisting of 3 different fishing periods. A total of 357 fish were captured during the peak season from August to October, 309 fish in mid-season from March to July, and 99 fish in the lean season between December and January.

Figure 3 shows the average number of trips for each season. At 97 trips in the peak season, 89 trips in the yield season, and 49 trips in the lean season. The total fishing trip based on the fishing season reached 235 trips. The difference between the total amount of fishing trips of each season was caused by environmental factors such as strong waves and bad weather. The condition in the fishing ground hampered the fishing operations.

Figure 4 illustrates the average fishing productivity of each fishing trip with the peak season at an average of four fish per trip, three fish each trip in the yield season, and two fish per trip in the lean season. The data shows the average fishing productivity using the handline technique from each trip of the fishing operation.

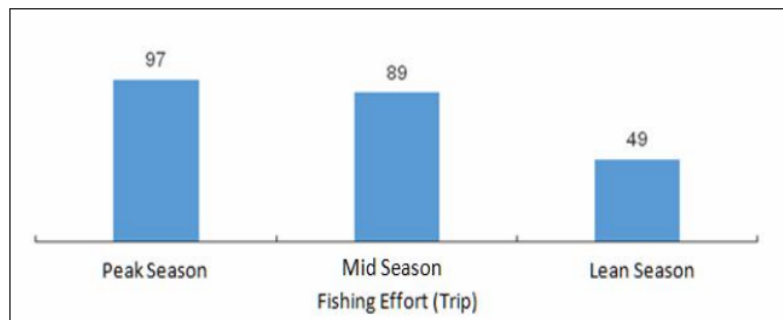


Figure 3. Fishing effort based on fishing seasons in Sarappo Island, Spermonde Island, Pangkep Regency.

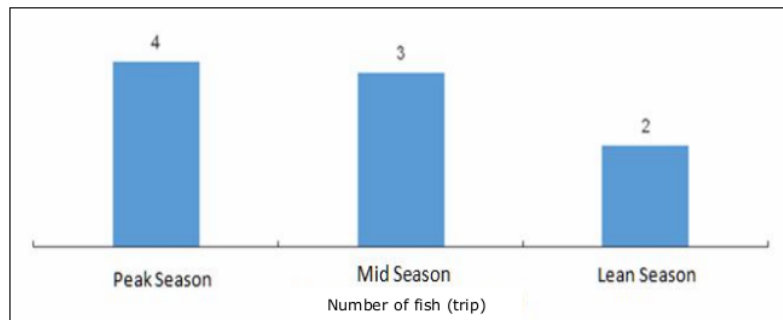


Figure 4. Fishing productivity based on fishing trips between each season conducted at the fish landing of Sarappo Lompo Island Waters in the Pangkep Regency.

Economic aspects

Capital investment. According to Budiman et al (2014), capital is an important factor in business to earn the maximum profit with minimum operational costs. In this study, the business capital for fishing coral trout consisted of several investments such as providing fishing ships, fishing gear, and ship engines. The scale of the business also plays a role in the amount of capital needed. The amount of capital needed by the local fishermen during the study period can be seen in Table 1.

Table 1
The average capital investment for handline fishing gear for local fishermen of the Sarappo Lompo Island in the Pangkep Regency

No	Details	Value (IDR)
1	Minimum	9,030,000
2	Maximum	13,535,000
	Average	11,282,500

Source: Research finding, 2017.

The amount of initial investment by the fishermen groups in Sarappo Lompo Island ranged from IDR 9,030,000 to IDR 13,535,000. However, the average investment was IDR. 11,282,500. The structure of the investment was obtained from different groups of fishermen. The following data shows the total amount of investment from eight groups of fishermen with group A investing IDR 9,030,000, group B invested IDR 9,931,000, group C invested IDR 9,932,000, group D invested IDR 10,883,000, group E invested IDR 10,884,000, group F invested IDR 11,735,000, group G invested IDR 11,736,000, and

group H invested IDR 12,637,000. The data was collected from different fishermen at the same time. The high tier of investment costs for the fishermen ranged from IDR 11,736,000 to IDR 12,637,000 and the lowest investment costs ranged between IDR 12,638,000 and IDR 13,535,000. The difference in investment costs is caused by the size of the ship, the brand of the engine, fishing gear, and the year of purchase. Yanuartoro et al (2013) stated that the investment costs are different from a fishing business owner to another. Furthermore, Budiman et al (2014) claimed that the year of buying the equipment and second-hand equipment leads to differences in total investment for each fishermen group. Moreover, the price of new goods is certainly more expensive than the price of second-hand goods.

Fixed costs. The fixed costs for operating fishing businesses in Sarappo Island are depreciation and maintenance costs. Depreciation costs are reserve funds used for replacing old fishing assets, thus allowing the continuation of the fishing activities (Panayotou 1985; Utomo et al 2013). Meanwhile, the maintenance costs are from occurrences within the business, such as changing the fishing rods. Fixed costs are always calculated as long as the business is still running. The fixed costs, according to the fishermen in Sarappo Lompo Island, included depreciation costs, engine maintenance, ship maintenance, and fishing gear with an average total cost of IDR 2,736,080 a year. The details of the average costs can be seen in Table 2.

Table 2

Average fixed costs for coral trout fishing activities in Sarappo Lompo Island
using handline fishing gear

No	Fixed cost	Average of fixed cost (IDR) per year
1	<i>Depreciation cost</i>	
	Ship cost	1,472,000
	Main machine cost	708,000
2	<i>Maintenance cost</i>	
	Ship (paint)	449,000
	Fishing gear	47,080
	Machine	60,000
	Total	2,736,080

Source: Research finding, 2017.

The fishing boats and propulsion engines may be operated for 5 years. The total expenditure for depreciation expense was IDR 2,180,000 with details of the average boat cost per year amounting to IDR 1,472,000 and the main engine cost per year was IDR 708,000. Whereas the average annual maintenance expenditure was at IDR 556,080 per year with the details of the components consisting of fishing boat maintenance and services (IDR 449,000 per year), the maintenance cost for fishing gear was IDR. 47,000 per year and the engine maintenance cost was IDR. 60,000.

The depreciation costs for each boat and the ship engine for fishing coral trout ranged from IDR 1,200,000 to IDR 1,712,000 and fishing grouper fish costs ranged from IDR 1,200,000 to IDR 1,370,000. However, the highest range of fixed depreciation costs for fishing boats ranged from IDR 1,542,000 to IDR 1,712,000, and the lowest ranged from IDR 1,371,000 to IDR 1,541,000.

In addition, the fixed costs structure for local fishermen's fishing boat of Sarappo Lompo Island per year ranged from IDR 400,000 to IDR 1,122,000. However, the highest range of fixed depreciation costs for the fishing boat machine ranged from IDR 641,000 to IDR 881,000 and the lowest ranged from IDR 882,000 to IDR 1,122,000.

Furthermore, the range of maintenance costs per year ranged from IDR 230,000 to IDR 764,000 with initial investments from IDR 230,000 to IDR 550,000. However, the highest range of fishermen's boat maintenance costs ranged from IDR 551,000 to IDR 764,000, while the lowest ranged from IDR 230,000 to IDR 336,000.

Non-fixed costs. Non-fixed costs (variable costs) are costs that vary according to changes in production levels such as operational costs. This type of costs consists of fishermen's supplies, fuel, and logistics during their fishing operations. The amount of the average operational costs spent by the fishermen was IDR 23,107,880. The details of the average non-fixed costs are seen in Table 3.

Table 3

Average non-fixed costs for leopard coral trout fishing activities in Sarappo Lompo Island using handline fishing gear

<i>Non fixed cost (operational cost)</i>	<i>The average non fixed cost (IDR) per year</i>
Fuel	14,128,400
Oil	36,840
Food	8,942,640
Total	23,107,880

Source: Research finding, 2017.

The structure of non-fixed costs for coral trout ranged from IDR 14,137,000 to IDR 30,041,000. However, the highest range of operational costs ranged from IDR 20,499,000 to IDR 23,679,000, and the lowest ranged from IDR 14,137,000 to IDR 20,499,000.

The difference in the non-fixed costs is caused by the difference of the fishing grounds locations and how much fuel to reach the various coral trout fishing grounds. Budiman et al (2014) stated that the size of the operational costs is influenced by the distance of fishing ground, the frequency of fishing, the length of fishing days, and the amount of production.

Total costs. Wismanigrum et al (2013) stated that the total cost is the total amount of fixed costs and non-fixed costs. Fixed costs are derived from the depreciation costs while the non-fixed costs are derived from the total operating costs and maintenance costs. The total cost of the coral trout fishing business using fishing rods in Spermonde Pangkep Regency was IDR 25,843,960 (Table 4).

Table 4

Average total costs for coral trout fishing activities in Sarappo Lompo Island using handline fishing gear

<i>Details</i>	<i>Cost (IDR) per year</i>
Fixed cost	2,736,080
Non fixed cost	23,107,880
Total cost	25,843,960

Source: Research finding, 2017.

Income. Income is the value of money earned from the sale of fish which is affected by the number of fish caught and the market prices. The income data is in Table 5.

Based on the Table 5, the unit price of coral trout at wholesale and local markets was IDR 75,000. The average income in the peak season reached IDR 26,775,000, midseason was IDR 23,175,000, and the lean season was IDR 7,425,000 with an average annual income of IDR 57,375,000. The income of handline fishermen is influenced by the fishing season when the season can affect the number of catches due to different amounts of trips and the weather. Wasahua & Lukman (2016) stated that the income of local fishermen relies on the number of catches and the selling value of fish per kg in the same season.

Table 5

Average annual income for coral trout fishing activities in Sarappo Lompo Island using handline fishing gear

No	Type of income	Average production (fish)	Price (IDR/unit)	Total (IDR)
1	Income of peak season	357	75,000	26,775,000
2	Income of yield season	309	75,000	23,175,000
3	Income of lean season	99	75,000	7,425,000
4	Annual income per year	765	75,000	57,375,000
5	Annual income per trip	3	75,000	225,000
6	Minimum per year			54,648,750
7	Maximum per year			60,108,750
8	Average per year			57,443,100

Source: Research finding, 2017.

Profit. Ningsih et al (2013) and Budiman et al (2014) stated that larger profits can be achieved by reducing operational costs. Details of fishing business profits can be seen in Table 6.

Table 6

Average annual profit per year fom coral trout fishing activities in Sarappo Lompo Island using handline fishing gear

No	Information	Total per year (IDR)
1	Annual income per year	57,443,100
2	Total cost	25,843,960
3	Non-fixed cost	23,107,880
	Gross profit (average annual income per year-non fixed cost)	34,335,220
	Net profit (average annual income per year-total cost)	31,599,140

Source: Research finding, 2017.

Financial analysis

Break Event Point (BEP). BEP is a condition that describes the business profits obtained equal to the capital. In other words, business conditions experience profits or financial losses. According to Sunyoto & Danang (2013) and Suhardi (2016) the analysis of break-even point is an analytical technique that is shown to produce information and by focusing on determining a situation where the volume of activity does not generate profits but also does not experience losses. Handline fishing in Sarappo Lompo Island was reviewed based on selling price (BEP price) and production volume (production BEP).

BEP price. The average number of fish production was 765 fish and the total cost was IDR 25,843,960. To reach the BEP, the minimum fish selling price must be IDR 33,743 for each fish. However, the market price of coral trout was IDR 75,000. Therefore, it can be concluded that the price of coral trout was higher than BEP prices, meaning that the coral trout business is worth for further expansion. Analysis of the BEP from using handline fishing of coral trout in the Sarappo Lompo Island is as follows:

$$\begin{aligned}
 \text{BEP (price)} &= \text{total cost} / \text{annual cost production} \\
 &= 25,843,960 / 765 \\
 &= \text{IDR } 33,782
 \end{aligned}$$

In order to achieve the BEP in a year, a total of 345 fish is needed to be sold in the market. Meanwhile, coral trout production can be produced in different seasons; the peak season at an average of 357 fish, mid-season at 309 fish, and the lean season at around 99 fish. The average production was 3 fish per trip and an amount of 765 fish in a

year. Thus, it can be concluded that the total production of coral trout sold for a year is higher than BEP for production.

Analysis of BEP production for handline fishing coral trout in Sarappo Lompo Island is as follows:

$$\begin{aligned}\text{BEP (production)} &= \text{total cost} / \text{price of product per unit} \\ &= \text{IDR } 25,843,960 / \text{IDR } 75,000 \\ &= 345\end{aligned}$$

R/C (revenue cost) ratio. R/C (revenue / cost) ratio is the ratio between total revenues and total costs incurred. For more details about the results of the R/C ratio, analysis of annual production can be seen below:

Analysis of R/C ratio for fishing coral trout in Sarappo Lompo Island in Spermonde, Pangkep Regency is as follows:

$$\begin{aligned}\text{R/C} &= \text{income} / \text{total cost} \\ &= \text{IDR } 57,443,100 / \text{IDR } 25,843,960 \\ &= 2.2\end{aligned}$$

The calculation shows the amount of total cost equals 1 to 2.2 times of profit. Therefore, this fishing business is feasible and profitable.

Conclusions. The average fish production for coral trout of fishermen in the Sarappo Island per year was 765 fish with a total trip 235 times. Based on the BEP analysis, the minimum selling price is IDR 33,782 and a total of 345 fish and R/C ratio 2.2. Therefore, handline fishing for coral trout in Sarappo island waters is feasible and profitable.

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