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Financial Aspects of Small-Scale Fisheries in Bulukumba Regency, Indonesia

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ABSTRACT

The aim of this study was to evaluate the financial aspects of small-scale handline fisheries in Ekatiro Suburb, Bontotiro District, Bulukumba Regency. Financial analysis aspects included the break-even point (BEP), return to owner (RTO), return to labour (RTL), return on investment (ROI), payback period (PP) and benefit-cost ratio (BC ratio). Known locally as *la didi* (Konjo, Bira dialect), yellowfin tuna (*Thunnus albacore*) in the *opo'* size class (≥ 10 kg) contributed most to catch volume (number of fish and weight) and fetched the highest price, followed by small yellowfin tuna (*kalaholong* size class, <10 kg) (local), and bigeye tuna (*Thunnus obesus*), local name *sabau*. Yellowfin tuna in *opo'* and *kalaholong* size classes were mostly caught during the east monsoon, followed by the east-to-west transition period and west monsoon, with very few fish caught during the transition from west to east monsoon. BEP, ROI, PP and BC ratio values show poor financial performance, indicating a need to improve fishing unit business management. Although the RTO and RTL values show profitable performance, the calculations for these two parameters ignore fixed costs, investment, and annual depreciation.

INTRODUCTION

Indonesia is an archipelagic nation with a territory comprised of around 70% territorial waters and only around 30% land area, and therefore has substantial marine and fisheries resources **(Tortora & Agnelli, 2021; Ariansyah, 2023)**. These resources have long been exploited by fishers across the nation, most of whom are classified as small-scale fishers, a phenomenon typical of developing countries **(Chuenpagdee & Jentoft, 2018; Halim *et al*., 2018; Warren & Teenbergen, 2021)**. Several fish stocks and fishing grounds in Indonesian waters have been overexploited or are already fully exploited,

while a few are still exploited at suboptimal levels **(Napitupulu *et al*., 2022)**. Large or industrial-scale fisheries, small-scale fisheries, and (to a lesser extent) recreational fisheries have all contributed to this situation **(McCluskey *et al*., 2008)**.

South Sulawesi Province has jurisdiction over marine and fisheries resources in several seas, including part of the Flores Sea **(Baso *et al*., 2022)**. Small-scale fishermen have been operating quite intensively in this area, using various fishing gears and targeting a variety of fishes. Tunas are one of South Sulawesi's principle fisheries exports, with the majority caught in these waters. This region of the Flores Sea links the Java Sea to the west, the Maluku Sea to the east and the Gulf of Bone to the north, and it is indirectly connected with the Pacific Ocean with fishing ground characteristics including deep waters, making it suitable as tuna habitat.

The fishing grounds of tuna handline fishers living in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, South Sulawesi, Indonesia are situated in the Flores Sea. With more and more fishing gears and fishing techniques being used in these fishing grounds, methods and techniques of catching are growing and the distance of fishing grounds is getting farther, it is a shadow of the unhealthy performance of capture fisheries in real conditions in the field. In addition, most small-scale fishing activities are still carried out by fishers working on their own, with very few receiving assistance from the various relevant stakeholders. The roles that these stakeholders can play will be necessary to find solutions to the problems of fishing communities, in particular access to business capital. This is because of the complex linkages and capacity for mutual influence between the fishery business sector as a system or subsystem and other fields of endeavour. Some fisheries commodities, such as the yellowfin tuna which is the main catch of the Ekatiro fishermen in this study, are export products that fetch relatively high prices compared to most fishery products. The main tuna export destinations are the United States, Japan, and China, with many other countries as current or potential markets.

Even though handline tuna fishing has become the main livelihood for many people living in this area, to date there has been little research on the financial viability of this type of fishing gear, despite the importance of financial aspects in evaluating fisheries performance. Therefore, the purpose of this study was to conduct research to assess the financial viability of small-scale tuna handline fishing in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, Indonesia. The specific aims were to examine the financial aspects of this fishery by analysing several business parameters: the break-even point (BEP), return to owner (RTO), return on labour (RTL), return on investment (ROI), payback period (PP) and benefit cost ratio (BC ratio). These parameters will indicate whether the business performance is viable and can continue to be run as it is now, or whether it is not financially viable, and the management needs to be improved.

MATERIALS AND METHODS

1. Research Site and Time

This study was conducted in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, South Sulawesi Province, Indonesia (Figure 1). The study sites were villages in Ekatiro Suburb that serve as fishing bases for small-scale capture fisheries. The fieldwork took place from July 2020 to June 2021.

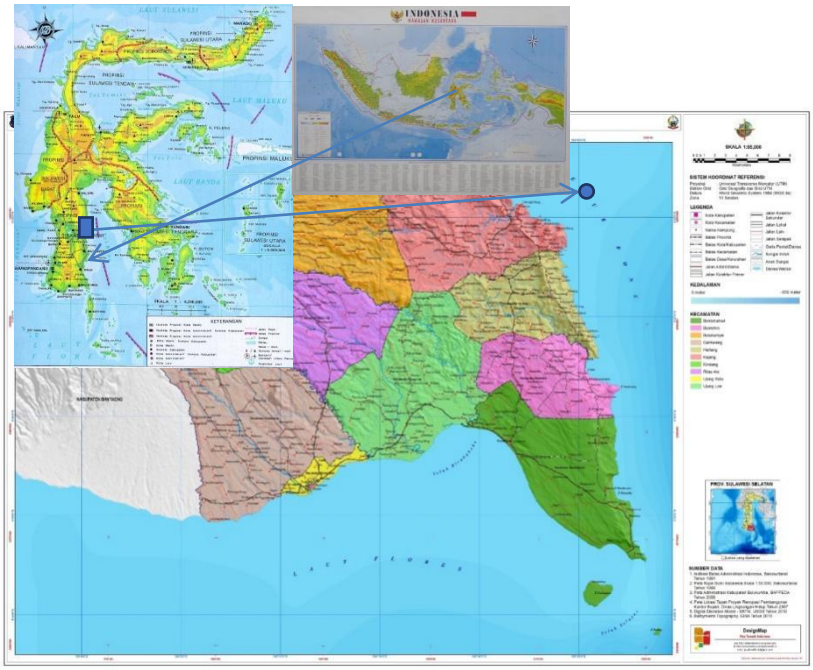

Fig. 1. Map showing the study site in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, South Sulawesi Province, Indonesia

2. Research Method

This study used descriptive qualitative methods **(Hambry, 2002; Engle & Neira, 2005; Salia, 2008; Ebata *et al*., 2012; Sreekanth *et al*., 2017; Adi *et al*., 2019; Akbar & Permana, 2022; Siaila & Rumerung, 2022;)**. The focus of this study was the financial viability of the small-scale tuna handline fishing businesses at the study site. In order to evaluate the financial viability, the variables measured included gross income as well as fixed and variable costs. The operational costs of fishing were measured directly and through the use of questionnaires. Data in income from the sale of the catch were obtained from fishing log books maintained by the fishers as a condition of their fishing licenses. Financial analysis followed several references**: Engle & Neira (2005), Rusmiyati (2015)**, **Adi *et al.* (2019)** and **Agusliana *et al.* (2019)** for Break Even Point (BEP); **Hermawan (2006)** for RTO (Return to owner) and RTL (Return to Labour); **Hermawan (2006)** and **Akbarsyah & Permana (2022)** for ROI (Return on Investment); **Hermawan (2006), Rusmiyati (2015)**, **Adi *et al*. (2019)** and **Akbarsyah & Permana**

(2022) for PP (Payback Period); **Hermawan (2006), Rusmiyati (2015), Adi *et al*. (2019)** and **Akbarsyah & Permana (2022)** for BC ratio (benefit cost ratio).

2.1. Data Collection

According to **Sudirman (2020)**, purposive sampling is a sampling technique based on specific considerations with the aim of obtaining primary data that are representative of the population to be sampled. The definition of a sampling unit in this study was one tuna handline fishing business. All units were very similar in terms of the number of vessels, vessel size, instruments and equipment, fishing gear and fishing aids, number of crew members, etc. Purposive sampling was used to select the sample studied, based on the assumption that the small-scale tuna handline fishing units operating from Ekatiro were homogenous.

The data needed for the financial analysis were collected from a sample of one fishing unit which was comprised of three fishing vessels with 4-6 crew members on each vessel. The questionnaire respondents were fishers, including the owner of the three-vessel unit (locally called *ponggawa*) and the crew (locally called *sawi*; in Indonesian, *anak buah kapal*, acronym ABK), who were asked questions regarding income (including the profit-sharing model used) and expenditure, as well as other relevant information. Data on the fish caught and sold as well as fuel consumption were taken from the log book of each fishing vessel. Detailed data on fixed and variable costs were obtained from the vessel owner using the questionnaire.

Data collected by previous studies mostly consisted of estimates made over a discontinuous time-line. In this study, direct measurements were made for a full year, covering all four seasons (west monsoon, west to east transition period, east monsoon, and east to west transition period). With such a data measurement model, it was considered that the data obtained should reflect the reality on the ground. The data collection was designed to enable analysis of the relationships between fishing operations, fuel consumption, weather conditions, and catch volume. In addition to the questionnaires, data were obtained through field surveys of the vessels, from the mandatory fishing logbooks maintained by each vessel. Data on seasonal weather patterns (east and west monsoons and two transition periods) were also collected for this analysis. In addition to the primary data, secondary data were obtained from the scientific literature as well as so-called grey literature (unpublished research reports and other data from relevant institutions). In order to assess the financial aspects of small-scale fisheries, the data obtained from all these sources were analysed together.

3. Data Analysis

3.1. Financial Analysis

Financial Analysis of the small-scale tuna hand fishery included the following parameters:

1. Break Even Point (BEP): the break-even point is the point at which total cost and total revenue are equal, meaning there is no loss or gain, and was calculated using the

following equation **(Engle & Neira, 2005; Rusmiyati, 2015; Adi *et al*., 2019; Agusliana *et al*., 2019)**:

$$\text{BEP (IDR)} = \frac{\text{Fixed costs}}{\text{(Revenue per Unit – Variable Cost per Unit)}}$$

$$\text{BEP (kg)} = \frac{\text{Fixed costs x production volume}}{\text{(Sales income – Variable costs)}}$$

2. Return to Owner (RTO): this is the net benefit received by the owner and was calculated using the following equation **(Hermawan, 2006)**:

$$\text{RTO} = \text{Income} - \text{Total Costs}$$

3. Return to Labour (RTL) is the benefit received by each crew member from the fishing operations and was calculated using the following equation **(Hermawan, 2006)**:

$$\text{RTL} = \frac{w \cdot (\text{Income} - \text{Operational costs})}{\text{Number of crew}}$$

where:

w = profit-sharing proportion

4. Return on Investment (ROI): this parameter represents the monetary value of an investment versus its cost; the ROI and was calculated based on the benefit received by the owner using the following equation **(Hermawan, 2006; Akbarsyah & Permana, 2022)**:

$$\text{ROI} = \frac{\text{Benefit}}{\text{Investment}}$$

5. Payback Period (PP): this is the length of time it takes to recover the cost of an investment or the length of time an investor needs to reach a breakeven point and was calculated based on the annual benefit received by the owner using the following equation **(Hermawan, 2006; Rusmiyati, 2015; Adi *et al*., 2019; Akbarsyah & Permana, 2022)**:

$$\text{PP} = \frac{\text{Investment}}{\text{Annual Benefit}}$$

6. Benefit Cost Ratio (B/C): this parameter indicates the relationship between the relative costs and benefits of a current or proposed enterprise and can be expressed in monetary or qualitative terms. According to **Hermawan (2006)**, **Rusmiyati (2015), Adi *et al.* (2019)** and **Akbarsyah & Permana (2022)**, the B/C ratio is an investment criteria commonly used to compare, measure and estimate the profitability of fishing businesses. Values over one indicate a profit, while if the ratio is less than one, the business has not yet made a profit and needs improvement to survive. In other words,

the smaller the value, the more likely the company is to suffer losses. The B/C ratio was calculated using the following equation:

$$\text{B/C (IDR)} = \frac{\text{Income from sales}}{\text{Production capital}}$$

RESULTS AND DISCUSSION

1. Fluctuations in Production Volume and Prices

The main commodity targeted by the hand line fisheries at the study site was yellowfin tuna (*Thunnus albacares*), called *madidihang* in Indonesian and *la didi* in the local Konjo language (Bira dialect). Based on the fishing vessel log book data, this species was caught all year round (Table 1). The size-class locally called *opo*' (≥ 10 kg per fish) was mostly caught during the east monsoon (July and August) and the transition period from east to west (September, October, and November). During the west monsoon (December, January and February) and the transition from west to east (April, May and June), relatively few fish were caught.

Table 1. Production volume and fish prices in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, during the study period (July 2020-June 2021)

N0	Fish Species	Month	Production		Value (IDR)
			Number of fish	Weight (kg)	
1	Yellowfin tuna (*Thunnus albacares*), *opo'* size	July	20	840	22,680,000
		August	40	1588	42,722,000
		September	40	1270	34,150,000
		October	21	625	16,725,000
		November	31	975	26,125,000
		January	22	1400	40,600,000
		April	9	305.5	8,859,500
	Total (I)		**183**	**7,004**	**191,861,500**
2	Bigeye tuna (*Thunnus obesus*)	August	1	38.5	1,039,500
		April	3	167	4,843,000
	Total (II)		**4**	**205.5**	**5,882,500**
3	Yellowfin fin tuna (*Thunnus albacares*), *kalaholong* size	July	124	323	4,845,000
		August	289	723	10,845,000
		September	80	150	2,550,000
		October	250	700	11,900,000
		December	300	900	16,200,000
	Total (III)		**1043**	**2,796**	**46,340,000**
	Total (I) + (II) + (III)		**1230**	**10,005**	**244,084,000**

Interviews with fishermen indicated that the main fishing season began during the transition season from west to east and continued into the east to west transition period. March is not included in Table 1 because there were no data recorded by the fishermen in the logbooks for this month. During the west monsoon (December, January and February) and the transition from west to east (April, May and June), relatively few fish were caught.

August was the month with the highest yellowfin tuna catch volume (1,588 kg, 40 fish, and sales income IDR 42,722,000). Catch volume was lowest in April, with a volume of 305.5 kg or 9 fish and a sales value of IDR. 8,859,500.

Other types of tuna are also caught in this region, in particular bigeye tuna (Thunnus obesus), with the Indonesian name of *tuna mata besar* and local name of *sabau*. However, the catch volume was quite low compared to yellowfin tuna, and bigeye tuna were only caught in August during the east monsoon and April during the west to east transition period. In August just one fish weighing around 38.5 kg was caught and it was sold for IDR 1,039,500, while in April three fish were caught with a total weight of 167 kg and a sales value of IDR 4,843,000.

Small yellowfin tuna in the size-class locally called *kalaholong* (< 10 kg per fish) were also caught, especially in December during the west monsoon (300 fish with a total weight of 900kg and sales value of IDR 16,200,000). Table 1 shows that this class of yellowfin tuna dominated the catch in terms of the number of fish; however, because of their small size they represent a smaller proportion of the catch volume by weight than the larger yellowfin tuna in the *opo'* class or the bigeye tuna. Based on the fishing vessel logbooks, the catch volume for these small tuna was lowest in September (150 kg from 60 fish and a sales value of IDR 2,550,000). Similar to the case of yellowfin tuna in the *opo'* size class, Table 1 also shows that relatively few *kalaholong* size yellowfin tuna were caught by fishermen during the west monsoon, with the largest catch during the east monsoon followed by the east to west transition period.

The transition season from west to east is a low season for the tuna fishermen, with fish only caught in April. In other words, the most productive fishing trips tend to be those during the east monsoon and the transition from east to west monsoon. The number of fish caught is influenced by the suitability of the type of fishing gear used, the characteristics of the fishing ground and fish abundance at that time **(Nomura & Yamazaki, 1977; Brandt, 1984; Duxbury & Duxbury, 1993)**. Trends in the type of fishing gear (purse seines, bait boats, longlines and longlines) and the type of target catch have evolved dynamically over the period 1950-2000 **(Miyake *et al*., 2004)**. A study by **Okemwa *et al*. (2023)** found that trolling lines, purse seines and handlines were the most common tuna fishing gear used by the vessels they sampled (approximately 52%, 18% and 12%, respectively); the most productive gear was purse seines (mean catch volume 547 kg/trip) and the least productive were handlines (mean catch volume 12.6 kg/trip).

The lack of bigeye tuna catch obtained by fishermen, which in turn affects the value of the catch, indicates that the Flores Sea is not a good fishing area for this fish species. With respect to oceanographic factors, bluefin tuna catches are generally highest in anticyclone eddies, while the highest catches of yellowfin and bigeye tuna are in cyclonic eddies and swordfish are mostly found in areas outside of cyclones **(Hsu *et al*., 2015)**. During El Nino episodes, the part of the water column favoured by bigeye tuna flows from the western region of the Tropical Pacific Ocean (TPO) while to the east the flow is compressed, tending to promote migration of bigeye tuna from east to west; whereas, during La Nina episodes, conditions preferred by yellowfin tuna tend to experience longitudinal shifts, resulting in northwards migration of this species **(Hsueh-Jung *et al*., 2001)**.

Tuna are divided by size and sold as tuna (> 20 kg) or baby tuna (< 20 kg). Tuna weighing at least 20 kg each meet the standard size limit for export, although exporters still consider fish in the 15-20 kg weight range. When fisherman come to sell their catch, collectors also buy the *opo'* size class (>10 kg) for sale to export traders in the Makassar Industrial Area (KIMA) in Makassar City, while the *kalaholong* size is only for domestic consumption. The size of tuna that can be exported depends on buyer demand. In Makassar there are several dozen tuna exporting companies competing with one another, with the main goal of exporting to America, Japan, China and other countries. Makassar is the gateway for tuna exports from eastern Indonesia and for tuna exports abroad via Jakarta or Surabaya depending on the buyer. While for export purposes, baby tuna comprises fish weighing 20 kg or less **(Hermawan, 2012)**, according to FishBase, the Global Database of Fish **(Froese & Pauly, 2022)**, yellowfin tuna reach maturity on average at a fork length (FL) of 103 cm and can reach FL 239 cm, although maturity can occur in the range FL 78-158 cm.

Yellowfin tuna sell for much higher prices than skipjack tuna. Apart from their smaller size and lower price, skipjack tuna are also commonly consumed within Indonesia, both fresh and processed (smoked, tinned, etc). According to **Agus (2018, 2019)**, skipjack tuna caught with pole and line and purse seine gears in Ternate are often landed at Bitung or Manado to be canned, while other methods of processing are often carried out locally, especially the production of smoked fish (local name *ikan fufu*), fish snacks such as crisps and crackers, and fish jerky (local/Indonesian name *abon*). Like other fisheries export commodities (e.g. sea cucumbers and live groupers), the trade routes often start from the fishermen, going through small and medium-sized traders/middlemen before reaching the exporting company **(Akamine, 2005; Agus & Sudirman, 2005)**.

2. Fixed costs

Fixed costs are costs required to manage a business unit within a certain time or cycle **(Engle & Neira, 2005; Salia, 2008; Adi *et al*., 2019)**. In this study, the fixed costs or investment costs are the costs that are incurred by any fisherman wanting to set up or

work in a tuna fishing business unit. Table 2 shows that this investment includes 3 basic components: fishing vessel and machinery, fish aggregating devices (FADs), and fishing gear. The mean costs were approximately IDR 148,33 million for the vessel and machinery, IDR 12 million for FADs and IDR 5,33 million for fishing equipment, giving a mean initial total outlay of IDR 165,67 million. On average, vessels and engines last for around 20 years, FADs have an average life of 7 years and handline fishing gear lasts for about a month. The size of the ship used is around ≤ 10 GT (so it is still categorized as small scale). FADs are operated in tuna fishing areas in the Flores Sea, usually fisherman owners (*punggawa*) have several vessels in their fishing business unit and in one fishing trip use 2-3 FAD units. These are generally FADs belonging to the *punggawa* or to a relative (as in the case of the sampled unit), or sometimes to another local FAD owner.

Table 2. Mean fixed costs for tuna hand line fishing vessels in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, South Sulawesi, Indonesia

No	Cost Component	Unit	Mean Fixed Cost
1	Vessel and machinery	IDR	148,333,333
2	Fish aggregating devices (FADs)	IDR	12,000,000
3	Fishing gear	IDR	5,333,333
Total mean initial investment per vessel		IDR	165,666,667

3. Variable Costs

Variable costs are business costs incurred during a certain time or cycle that that can vary between time periods or cycles **(Engle & Neira, 2005; Salia, 2008; Adi *et al*., 2019)**. In this study the period was one financial year, from July 2020 to June 2021. The main components of variable costs incurred in operating the hand line fishing business are the supplies needed by the crew (food, cigarettes, etc) and fuel. The fishing trips for this type of fishing vessel and gear generally last around 2 weeks or more with a crew of around 3-4 people. Fuel is needed to power the engine to and from the fishing ground and for operations during fishing. These costs were calculated for a year of fishing operations, and for each season (west and east monsoons, and the transition periods), as shown in Table 3. Supplies were the largest component of variable expenditure for hand line fishing operations.

Table 3. Variable costs for tuna hand line fishing units in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, South Sulawesi, Indonesia over a period of one year (July 2020-June 2021)

No	Cost Component	Unit	Mean Variable Cost
1	Supplies (food, cigarettes, etc)	IDR	20,333,333
2	Fuel	IDR	12,023,833
	Total	IDR	32,357,167

4. Financial Analysis

Fishing business capital is the capital used to establish a business or during one business cycle **(Adi *et al*., 2019; Mohu *et al*. (2019)**. The business capital (investment), sales proceeds (income), profits and depreciation are shown in Table 4 and the financial analysis in Table 5.

Table 4. Mean investment, income, profit and depreciation for tuna hand line fishing units in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, South Sulawesi, Indonesia over a period of one year (July 2020-June 2021)

No	Cost Component	Unit	Mean Variable Cost
1	Investment	IDR	198,023,833
2	Income from Sales	IDR	81,361,833
3	Profit	IDR	15,870,833
4	Depreciation	IDR	33,133,333

Table 5. Financial analysis for tuna hand line fishing units in Ekatiro Suburb, Bontotiro District, Bulukumba Regency, South Sulawesi, Indonesia over a period of one year (July 2020-June 2021)

No	Cost Component	Unit	Mean Variable Cost
1	a. Break-even point (BEP)	IDR	275,056,727
	b. Break-even point (BEP)	kg	33,824
2	Return to owner (RTO)	IDR	49,004,167
3	Return to labour (RTL)	IDR	5,067,649
4	Return on Investment (ROI)	%	0.0801
5	Payback Period (PP)	IDR/100 IDR invested	12.4772
6	Benefit Cost Ratio (B/C)		0.4109

Business capital is the sum of fixed costs and variable costs. Sales proceeds (annual income) were obtained from the sale of yellowfin and bigeye tuna. Profits were calculated as income minus depreciation and variable costs **(Infofish, 2011)**. Depreciation is the loss in value of the investment components (vessels and machinery, FADs and fishing gear) over one year, and was calculated separately for each investment component based on its life expectancy. For comparison, according to **Namikawa *et al*. (2021)**, individual fishing businesses engaged in aquaculture generate around 8 million yen, while those involved in coastal fishing yield an average of about 2 million yen .

Based on the data in Table 5, the break-even point (BEP) was around IDR 275 million or around 33.8 tonnes. These figures represent the production value or production volume in the hand line fishing business at which there is no profit or loss; in other words, the minimum values to avoid making a loss **(Engle & Neira, 2005; Agusliana *et al*., 2019)**.

The revenue sharing model used allocated one part to the ship owner, 3 parts to the engine owner, 1 part to the FAD owner and 1 part to each crew member. Typically, the owner will receive the ship, engine and FAD parts, although the FAD part may go to another FAD owner depending on the FAD(s) used. Return to owner (RTO) or income earned by the owner was just over IDR 49 million, while wages earned by the crew (ABK) (return to labour, RTL) were just over IDR 5 million. The values in Table 5 show the calculation of the average income for tuna hand-line vessels with an average of 1-2 FADs used during each fishing trip and 3-4 crew members. Based on the South Sulawesi regional minimum wage (UMR) of IDR 3 million/month, the wages received by hand line fishing crew members in Ekatiro Suburb were above the UMR. **Silveira *et al*. (2019)** found that in the Iguaíba Community, Maranhão, the profit sharing model was 50% for boat owners and 50% shared between the fishermen; the financial situation of the people in this region was relatively poor, as they only depended on small-scale fisheries, agriculture and other productive activities. In Japan, fishermen's salaries are much lower than those of workers in most other industries according to the Ministry of Agriculture, Forestry and Fisheries **(Li *et al*., 2021)**. In Brazil, fishermen's monthly incomes range from US$ 566.78 to US$ 1,466.87 and the contribution of fishing to family income range from 50.60% (employees) to 78.25% (entrepreneurs) **(Peixer & Neto, 2020)**. The RTO and RTL indicate that the small-scale tuna handline fishing fleet in the study area is generating a substantial amount of income for the people involved, thereby contributing to cashflow in the local community and supporting the local economy.

Return on investment (ROI) is the profit obtained by the owner of the fishing unit for a given amount of money invested over a certain period of time. The ROI enables the investor (in this case the owner) to measure his or her ability to recoup or repay the capital invested. The ROI is determined by the following:

- The owner's ability to generate profits,
- The ability of the business actors to return capital, and

- The use of outside capital to enlarge the company

The ROI value obtained in this study was 0.08 or 8% (Table 5). This figure means that a profit of IDR 8 will be generated for each IDR 100 of capital invested. Small-scale fisheries in Nusawiru had an ROI of 1.37 and were considered viable and sustainable **(Akbarsyah & Permana, 2022)**.

The payback period (PP) was around 12.48 years, which can be considered as a very long payback period. **Hermawan (2006)** states that PP is calculated to find out how long it will take to recoup the investment from the benefits (income) received by the owner. The shorter the payback period, the more feasible the proposed business project will be, and for making business decisions the PP is commonly compared to a maximum time period that has been set. The rate of return on business capital is generally categorized as fast if the PP is <3 years, medium if the PP is 3-5 years, and slow if the PP is > 5 years **(Zuraidah & Jaliadi, 2018; Akbarsyah & Permana, 2022)**.

Financial analyses often set B/C ratio > 1 as a criterion for considering that the business is generating sufficient profits to be feasible to run; if B/C ratio = 1, the business has no profit and no loss (break-even); if B/C ratio < 1, the business is suffering losses and is not viable **(Hermawan, 2012; Andella *et al*., 2021)**. The benefit cost ratio (B/C ratio) was approximately 0.41, indicating the tuna hand line fishing business is running at a loss, so that improvements are needed. Profits are made when total costs are less than the total revenue obtained **(Wahyuningrum, 2012)**. According to **Picaulima *et al*. (2022)**, the B/C ratio of a small-scale floating lift-net fishery was 5.0 which showed that it was economically viable.

The financial analysis based on the BEP, ROI, PP and BC ratio show poor performance, and a need for improved management. Even though the RTO and RTL values show profit to the individuals involved, these calculations ignore the fixed costs (investment) and annual depreciation. A financial analysis of data from a Fisheries Cooperative (Zenggyoren) in Japan **(Ariji & Matsui, 2021)** also showed that the fishing cooperative was poorly managed, with low labour productivity, and that labour costs bore little relation to the results. They concluded that to overcome this problem, a management guide was needed to review business models and personnel and management systems in line with changes in the management environment. However, it is also important to consider that fishermen who are not diligent and do not pay due care and attention with regards to filling out the catch log book can also skew the analysis and cause the parameters mentioned above to indicate detrimental performance if some of the catch production data is not recorded.

CONCLUSION

The fisheries commodity contributing the most to production in terms of volume (kg) and sales value was yellowfin tuna (*Thunnus albacares*), called *la didi* in the local language, in the *opo'* size-class (≥ 10 kg), followed by smaller yellowfin tuna in the

kalaholong size class (<10 kg), with bigeye tuna (*Thunnus obesus*), locally called *sabau*, contributing the least. However, the *kalaholong* yellowfin tuna contributed the most to production in terms of the number of fish caught, followed by *opo'* yellowfin tuna and bigeye tuna contributed the least. Yellowfin tuna in both *opo'* and *kalaholong* size-classes were mostly caught during the east monsoon, followed by the east-west transition period, then the west monsoon, with very few caught during the west-east transition period. The financial analysis parameters (BEP, ROI, PP and BC) indicated poor and deleterious financial performance, requiring improvements in fishing unit management, despite RTO and RTL values indicating profitable performance; however, the way these two parameters are calculated ignores fixed costs or investment and annual depreciation. To further investigate the problems face by small-scale fisheries, both in general and tuna handline fisheries in particular, the relevant institutions need basic data at daily, monthly and yearly time-scales and with specific scope, at local or settlement, village, district, regency, provincial and national scales.

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