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Research Article

Technical Aspects and cost-benefit of Fishing Business Using Purse Seine Fishing Gear at Ternate Fishing Port

Mutmainnah[1], Fikri Rizky Malik[2], Irsad Senen[3], Yuliana[4], Khamsiah A[5]*, Surahman[6], Hikmat[7], Mukminati[8], Edwarsyah[9]

[1,2,3,4,5,6]*Faculty of Fisheries and Science, Khairun University*

[7]*BRPL KKP, the Ministry of Fisheries and Marine Affairs*

[8]*Muhammadiyah University of Makassar*

[9]*Faculty of Fisheries and Marine, Teuku Umar University*

***Corresponding Author:** Khamsiah A, Faculty of Fisheries and Science, Khairun University, Jl. Yusuf Abdurrahman Kampus Gambesi, Ternate, North Maluku, Indonesia.

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Abstract

This study examines the development of the purse seine fishing business at Bastiong Fisheries Port in Ternate City regarding technical and cost-benefit aspects. Estimation of the level of business financial feasibility is analyzed using the Net Present Value (NPV) method, the Internal Rate of Return (IRR) method, and the Benefit Cost Ratio (B/C Ratio). The six fleets are KM. Lentera (1), KM. Nurwahidah (2), KM. Pratama Putra (3), KM. Ratu Rosari (4), KM. Salam Mesra (5), and KM. Qausar (6). The NPV, IRR, and B/C Ratio of each fleet are NPV 2,297,326,836 per year, a B/C Ratio 6 .6 per year, and an IRR of 52% per year for (1); the NPV value of 998,260,353 per year, B/C Ratio 3.5 per year, and an IRR of 49% per year for (2), the NPV value of 660,687,454 per year, B/C Ratio 2.6 per year, and IRR 50% per year for (3), the NPV value of 996,129,191 per year, B/C Ratio 3.5 per year, and IRR 35% per year for (4), the NPV value of 2,892,195,498 per year, a B/C ratio of 10.6 per year, and an IRR of 50% per year for (5). Number (6) has an NPV value of 809,122,892 per year, a B/C ratio of 3.5 per year, and an IRR of 56% per year, respectively.

Keywords: purse seine; fishing business; NPV; IRR; B/C Ratio

Introduction

Pelagic fish in Indonesian waters reaches 3.2 million tons or 51.62% of the total existing marine fishery potential resources. The resources include the large pelagic fishes (1.65 million tons), small pelagic fishes (3.6 million tons), demersal fishes (1.36 million tons), reef fishes (145 thousand tons), Penaeid shrimps (94.8 thousand tons), lobsters (4.8 thousand tons), and squids (28.25 thousand tons). Due to the availability and the easy way to catch, small pelagic fish is the type of most cultivated fish by small-scale fisheries. The development of small-scale pelagic fishery in Indonesia generally consists of many fish resources, including Selar (*Selaroides leptolepis*), Sunglir (*Elagastis bipinnulatus),* Anchovies (*Stolephorus indicus*), Japuh (*Dussumieria spp*), Tembang (*Sadinella fimbriata*), Lemuru (*Sardinella Longiceps*), Siro (*Amblygaster sirm*), and Schrombroid groups such as Bloating (*Rastrellinger spp*) (DKP Pekalongan 2012). Many studies have been carried out on technical aspects and cost-benefit analysis partially, but comprehensive research on purse seines in North Maluku based on the number of samples with purse seine objects is still limited. Therefore, it is necessary to provide baseline data related to the cost benefit analysis aspects for better future fishery management. The study objective is to describe the technical aspects and benefits of small-scale pelagic fisheries using the Purse Seine fishing gear in the Ternate Waters.

Methods

This research was conducted in April 2015 at Bastiong Fisheries Port (called PPN), Ternate City, in North Maluku Province. The survey method was used by participating in fishing operations and conducting structured interviews using a questionnaire instrument.

The samples taken were six units of purse seine vessels with different gross tonnage (GT) weights (Determining the number of 35% samples of the 17 units of purse seine vessels operating at PPN Bastiong) (PPN Bastiong, 2015). The data collected consisted of primary data and secondary data. Some of the analyses used in this study are as follows:

NPV (Net Present Value)

Net Present Value (NPV) is an analysis that considers the difference between the Present of Benefits and the Present Value of costs (Mutmainnah, 2014). Net Present Value (NPV) is the difference between investment and the present value of net cash receipts in the future (Umar, 2003). So, NPV is the estimated cash flow in the future adjusted for today. The NPV formula is as follows:

$$NPV = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+i)^t}$$

The assessment criteria are as follows: NPV > 0, the project is accepted, and NPV < 0, the project is rejected.

IRR (Internal Rate of Return)

The Internal Rate of Return (IRR) is the discount rate i which makes the NPV of the project equal to zero (Mutmainnah, 2014). IRR is an indicator used to determine the efficiency of a project. This method is used to find the interest rate that equates to the present value of expected future cash flows. IRR can be calculated using below equation:

$$\text{IRR} = \text{i}^{+} \frac{\text{NPV}^{+}}{\text{NPV}^{-} - \text{NPV}} (\text{i}^{+} - \text{i}^{-})$$

If the IRR is found > the specified rate of return, then the investment is accepted. And if the IRR < the fixed rate of return, the investment is rejected. This IRR is directly proportional to the NPV, so if the Present Value is low, the IRR must be lowered, and if the Present Value is too high, we must increase the IRR.

Benefit Cost Ratio (B/C Ratio)

In project management, the B/C Ratio is generally used for cost-benefit analysis. The benefit-Cost Ratio is a general indicator of investment/project profitability. This method offers a good indication of the buffer between benefits and costs. The formula is as follows:

$$Net\ \text{B/C} = \frac{\sum_{t=0}^{t=n} \text{NPV Positif}}{\sum_{t=0}^{t=n} \text{NPV Negatif}}$$

The lower the B/C, the higher the excess interest costs compared to the benefits. For all projects, it is not advisable to pursue negative value investments, except for projects implementing regulatory/legal requirements.

Result and Discussion

General description of sampling sites

Bastiong Fishing Port (PPN) was built on 10.06 Ha of land with an existing land area of 4 Ha and a development land area of 6.06 Ha. It is located at the coordinates of 00° 46' 0.36" North Latitude and 127° 22' 41' 10" East Longitude, precisely in Ternate City, North Maluku Province (VAT Ternate 2012 *in* Abubakar, 2014). The existence of PPN Ternate is a part of the Task Implementation Unit of the Ministry of Maritime Affairs and Fisheries. The establishment is expected to be able to accommodate the interests of port service users (investors, fishermen, intermediaries, and communities around the port) through the provision of facilities and infrastructure to increase the productivity of fishermen/fisheries entrepreneurs, which in turn will improve the welfare of the community.

Technical aspects

The technical aspect is one aspect that determines the success of fishing activities. There are several technical aspects observed in this study as follows:

a. Construction of purse seine fishing gear.
b. Construction of purse seine boats and engines of purse seine boats.
c. Fishing methods.
d. Duration of the fishing trip.
e. Fishing aids.
f. Area and fishing season.
g. Type and handling of fishing catch.
h. Ship crew.
i. Fishing gear operation techniques.

The results of the technical aspects above are explained below:

Purse seine fishing gear

The fishing gear used in this study was purse seine which has a rectangular shape with a pocket located on the middle side of the net. The net consists of wings, body, and codend with a length ranging from 300-400 m, a width of 60-75 m with a length of rope for overhead lines ranging from 300-400 m, 300-400 m for the bottom line, 300-400 m buoy line. m, ballast ropes 300-400 m, and draw-strings ranging from 600-760 m.

Specifications regarding the size and material of the purse seine used are demonstrated in Table 1.

Vessel name	*Gear section*	*Size*	*Material*	*Unit*	*Description*	*Amount*
KM. Lentera	Net Left and right wings Ship body	330x60 meter	PA multifilament PA multifilament	Meter 1.5 inch	Net Mesh	Unit
	Codend		PA multifilament	2 inches	Mesh	
	Lifebuoy		PA multifilament	1.5 inch	Mesh	
	Ballast		Ball-shaped cork	3.5 cm	Width	2.764
	Rings		Lead	5 cm	Length	6.70
	Rigging		Copper	3 cm	Width	70
	Top iris	330 m	Polyethylene	10 mm	Length	
	Bottom iris	330 m	Polyethylene	8 mm	Length	
	Float rope	330 m	Polyethylene	10 mm	Length	
	Weight rope	330 m	Polyethylene	8 mm	Length	
	Drawstring	600 m	Polyethylene	22 mm	Length	
KM. Nurwahidah	Net Left and right wings Ship body	325x65 m	PA multifilament PA multifilament	Meter 1.5 inch	Net Mesh	Unit
	Codend		PA multifilament	1.5 inch	Mesh	
	Lifebuoy		PA multifilament	1.5 inch	Mesh	
	Ballast		Ball-shaped cork	3.5 cm	Width	2740
	Rings		Lead	5 cm	Length	665
	Rigging		Copper	3 cm	Width	65
	Top iris	325 m	Polyethylene	10 mm	Length	
	Bottom iris	325 m	Polyethylene	8 mm	Length	
	Float rope	400 m	Polyethylene	10 mm	Length	
	Weight rope	400 m	Polyethylene	8 mm	Length	
	Drawstring	600 m	Polyethylene	22 mm	Length	
KM Pratama Putra	Net Left and right wings Ship body	400x70 m	PA multifilament PA multifilament	Meter 1.5 inch	Net Mesh	Unit
	Codend		PA multifilament	2 inches	Mesh	
	Lifebuoy		PA multifilament	1 inch	Mesh	
	Ballast		Ball-shaped cork	3.5 cm	Width	2900
	Rings		Lead	5 cm	Length	687
	Rigging		Copper	3 cm	Width	100
	Top iris	400 m	Polyethylene	10 mm	Length	
	Bottom iris	400 m	Polyethylene	8 mm	Length	
	Float rope	400 m	Polyethylene	10 mm	Length	
	Weight rope	400 m	Polyethylene	8 mm	Length	
	Drawstring	750 m	Polyethylene	22 mm	Length	

KM. Ratu Rosari	Net Left and right wings Ship body Codend Lifebuoy Ballast Rings Rigging Top iris Bottom iris Float rope Weight rope Drawstring	300x700 m 300 m 300 m 300 m 300 m 600 m	PA multifilament PA multifilament PA multifilament PA multifilament Ball-shaped cork Lead Copper Polyethylene Polyethylene Polyethylene Polyethylene Polyethylene	Meter 1.5 inch 2 inches 1 inch 3.5 cm 4 cm 3 cm 10 mm 8 mm 10 mm 8 mm 22 mm	Net Mesh Mesh Mesh Width Length Width Length Length Length Length Length	Unit 2700 657 55
KM. Salam Mesra	Net Left and right wings Ship body Codend Lifebuoy Ballast Rings Rigging Top iris Bottom iris Float rope Weight rope Drawstring	350x65 m 350 m 350 m 350 m 350 m	PA multifilament PA multifilament PA multifilament PA multifilament Ball-shaped cork Lead Copper Polyethylene Polyethylene Polyethylene Polyethylene Polyethylene	Meter 1.5 inch 2 inches 1.5 inch 3.5 cm 5 cm 3 cm 10 mm 10 mm 10 mm 10 mm 22 mm	Net Mesh Mesh Mesh Width Length Width Length Length Length Length Length	Unit 2755 685 85
KM. Qausar	Net Left and right wings Ship body Codend Lifebuoy Ballast Rings Rigging Top iris Bottom iris Float rope Weight rope Drawstring	400x75 m 400 m 400 m 400 m 400 m 760 m	PA multifilament PA multifilament PA multifilament PA multifilament Ball-shaped cork Lead Copper Polyethylene Polyethylene Polyethylene Polyethylene Polyethylene	Meter 1.5 inch 2 inches 1 inch 3.5 cm 5 cm 3 cm 10 mm 10 mm 10 mm 10 mm 22 mm	Net Mesh Mesh Mesh Width Length Width Length Length Length Length Length	Unit 2900 687 100

Table 1: Specifications for purse seine fishing gear used in the research.

Floats are used to obtain good buoyancy, which is evenly spaced along the buoy lines with a distance between one buoy and another ranging from 15 cm - 30 cm (Yasmin, 2009). According to Fiqrin (2010), the equipment has each function. The float plays a vital role in lifting the body of the net so that it remains afloat when using fishing gear. Net is used as a barrier, and the ring is used to seal the bottom of the net under drawstring assisted. The circle functions as weight and keeps the fish from running to the bottom of the net when pulled.

Fishing Vessel

The purse seine vessel used in this study was made of *gofasa* wood (fitex cofasus), a type of teak that local people called *biti*, *bana* or *wolata* wood. The durability of boats made of this type of wood reaches 10-15 years. Ships operated using a single ship system (one boat system). Each has a length ranging from 12.5019.12 meters, a width of 3.00-4.86 meters, and a height of 0.75-1.50 meters. This ship is equipped with a roller machine that functions to pull the drawstring.

According to Christanti (2005), the boats used by purse seine fishermen are generally made of teak wood (*Tectona grandis*). Construction or design of ships with different sizes, engine power, and GT depending on the fishing gear. The durability of boats made of this type of wood reaches 15-20 years.

The propulsion engines used in this study were 4 of them using internal engines by the Mitsubishi brand with a power of 105-240 PK and two others using outboard motors by the Yamaha brand with a capacity of 120 and 160 PK. The engine used by the purse seine from 6 ships in the fishing operation is from two main engines, namely the internal engine and the outboard engine, which are used as propulsion on board the vessel. The roller auxiliary machine is used to pull the Yanmar brand drawstring, which has a strength of 15 PK. The parts of a purse seine can be seen in Table 2 below:

No.	***Vessel Name***	***Size of vessel***			***Machine***	
		P (m)	***L (m)***	***D (m)***	***Driving force (PK)***	***Gross tonnage (GT)***
1.	KM. Lentera	14.30	4.17	1.25	105	18
2.	KM. Nurwahidah	17.90	3.45	1.50	160	19
3.	KM. Pratama Putra	19.12	4.86	1.35	170	26
4.	KM. Ratu Rosari	19.12	4.86	1.35	240	28
5.	KM. Salam Mesra	16.75	3.00	0.75	160	6
6.	KM. Qausar	12.50	3.60	1.20	120	6

Table 2: Size and Parts of Purse Seine Vessel.

Fishing methods

The preparations strongly influence the success of fishing operations before heading to the fishing ground.

The preparations made are:

1. Preparation of fishing gear.
2. Preparation of fishing aids.
3. Labor preparation.
4. Preparation of supplies.

In carrying out fishing operations, the most decisive factor in fishing success is determining the fishing area as a place for many fishing operations (Yasmin, 2009). Before carrying out the process of purse seine fishing gear, it is necessary to prepare such things as fuel and food while at sea (Yasmin, 2009). The materials prepared can be seen in Table 3.

No.	Type of fuel	Prices per Litre (IDR)	Usage per trip (Litre)	Description
1.	Oil	30.000	5 – 50	
2.	Diesel	8000	100 – 800	Five days to a week
3.	Petrol	9000	20 – 100	
4.	Kerosene	5000	30 – 800	

Table 3: Types and prices of fuel.

The survey results from the fishing base to the fishing ground, fishing operations were started by using fishing aids in the form of electric lights and petromax totaling two pieces and FADs. After arriving at the fishing area, the boat is tied to FADs, and then an electric light aid is turned on and installed at the bow to illuminate FADs so that the fish gather. The step is suiting with Erfan's research (2008); fishing operations with purse seine fishing gear are carried out at night, requiring a light aid as a collector or attracting fish with positive phototactic properties during fishing operations. Three types of lamps are used: torch lights, electric lights, and petromax.

Duration of trips

The length of the fishing trip is five days to a week. Fishing time of one-week fishing is usually used by fishermen during the peak and regular seasons, while trips of up to five days are carried out during the lean season. The number of trips from operation in a month for the lean season is 2 - 3 trips/month, while in the peak season, it is four trips per month and for the regular season is 3 - 4 trips/month.

Fishing Aids

Fish Aggregating Device (FAD)

FADs are fishing aids that lure fish to assemble in a fishing area. Most fishing gear to catch pelagic fish uses FADs. According to Tampubolon (1983) in Yasmin (2009), installing FADs collects small fish so that large fish can approach the area around FADs. The study's results explained that fishermen's FADs were made of bamboo, buoys, rope, Styrofoam, iron, and cement, with a length of 3 m and a width of 2 m. The specifications for FADs and pictures of FADs can be seen in Table 4.

No.	Material	Size	Volume	Usage
1.	Bamboo	3 m	30 unit	As a floating raft
2.	Rope	22 mm	1 roll	As an anchor rope
3.	Styrofoam	2.5 cm	8 unit	As a life raft
4.	Aluminum	4 m	1 unit	As an anchor
5.	Cement	50 kg	1 sack	For anchor making

Table 4: FADs specification used in the research.

Lamp

Electric lights and petromax are used as auxiliary tools in fishing operations. There are two different methods, namely:

1. Electric lights are installed at the boat's bow to illuminate FADs so that fish gather around them.
2. Petromax lamps are installed on the left and right sides of FADs to illuminate FADs so that they can hold and attract the attention of a school of fish that will gather around FADs.

Area and Fishing season

The amount and type of fish caught in the fishing area is strongly influenced by the season and natural factors, namely the regular and lean seasons in March, April, September, and October. In the lean season, fishermen generally do not even carry out fishing operations, while in the peak and regular seasons, fishermen actively carry out fishing operations. So large that the sea is very wavy, which makes it challenging to carry out operational activities (Sudirman and Achmar. 2004). The number of purse seine catches during the peak season reached 894 – 953 basins, and during the peak season usually, went 392 basins – 442 basins. In the lean season, it only came 133 basins – 179 basins, sometimes even none. The amount of catch per basin consists of 70-75 kg; it depends on the size of the type of fish. More details can be seen in table 5.

No.	*Season*	*Month*	*The number of fishing catch (in bucket)*	*Prices (IDR per bucket)*
1.	Peak season	May – August	894 – 953	650.000
2.	Normal Season	March, April, September, October	392 – 442	850.000
3.	Lean season	November - February	133 – 179	1.400.000

Table 5: Season, number, and catching results.

Fish catching and handling

Fishing operations carried out using purse seine fishing gear resulted in catching various pelagic fish with different numbers of catches. The catches of the purse seine fishermen were little tunny (local: komo) (*Auxis thazard*), flying fish (local: Sorihi) (*Decapterus macrosoma*), flying fish (local: Tude) (*Decapterus russelli*), flying fish Bloated (local: mackerel) (*Rastrelliger brachysoma*), and other types of fish, for example, the Julung-Julung fish (local: Ngowaro) (*Hemirhamphus sp*) and Sunglir fish (local: Suru) (*Elagatis bipimulatus*). Fish handling on the boat is by giving ice cubes to keep the body condition of the fish from decomposing quickly. This handling is carried out when the catch is put into the fish holding hold so that the decrease in the quality of the catch can be minimized.

Ship crew

On average, purse seine vessels operating in North Maluku waters use a workforce of around 15-20 people. They consist of 1 captain, one convert, two mechanics, two cooks, and nine people – 14 arrests. The labor duties (ABK) can be seen in Table 6.

No.	*Position*	*Number of person*	*Task*
1.	Captain	1	Responsible for the safety of the ship and crew on board
2.	Convert	1	Managing all crew needs
3.	Mechanic	2	Responsible for the engine room, ship engines and engine damage
4.	Chef	2	Responsible for consumption on board
5.	Crew	14	Conducting fishing catch

Table 6: The main task of ship crew on the purse seine vessel.

Purse seine operation procedures

Net setting

The setting is done after the fish are thought to have been collected. Before setting, the electric light on the boat is turned off and replaced with a petromax lamp which is placed on a raft held by one of the fishermen. The ship slowly leaves the petromax lights on the raft the fishermen are waiting for to prepare to lower the nets. Next, they circle the traps around the petromax lights on the raft. The lowering of the net must pay attention to the direction of the current and wind relative to the ship's position. The setting time is about 5 minutes, after which hauling is carried out.

Net hauling

Hauling works when two ends of the net have met, then the net is pulled, and the drawstring or purse line is pulled using a drawstring machine (Takal Machine). The pulling of the drawstring was carried out until all the rings rose above the deck of the ship. At that time, the light man watched the kerosene lamps so they would not get caught in the net. Then the next step is to take the catch using a scoop.

Fish marketing

The catch obtained is directly marketed at the Bastiong Fishing port. The fish from catching fishermen is sold to wholesalers and basket traders who have become regular customers of this fishing business. The catch in the peak season is 894 basins – 953 basins with a selling price of Rp. 6,50,000, in the regular season 392 basins – 442 basins with a selling price of Rp. 8,50,000, and in the famine season, 133 basins – 179 basins with a selling price of Rp. 1,400,000, then from wholesalers and basket traders, they bring it to the market to be marketed or sold to consumers at uncertain prices.

Cost-Benefit analysis

Before conducting economic analysis, several variables must first be identified to support the intended study. These variables include:

Investment cost

Investment costs for all vessels consist of boats, fishing gear, main ship engines, crane engines, light engines, Alkon engines, anchors, box crates, 120-ampere batteries, petromax lamps, searchlights, masks, ht radios, gas extinguishers, compasses, flashlights, boat lights, cables, kitchen utensils, and cutlery. The total investment costs for all fleets can be seen in Table 7.

No.	*Name of vessel*	*Investment rate (IDR)*
1.	KM. Lentera	362,541,000
2.	KM. Nurwahidah	405,643,000
3.	KM. Pratama Putra	434,851,000
4.	KM. Ratu Rosari	506,522,000
5.	KM. Salam Mesra	326,597,000
6.	KM. Qausar	294,472,000

Table 7: Investment cost.

Table 9 above shows that the KM. Ratu Rosari fleet has the highest investment value, namely Rp. 506,522,000, the KM. Lentera fleet has an investment value of Rp. 362,541,000, the KM. Nurwahidah fleet has an investment value of Rp. 405,643,000, the KM. Pratama Putra fleet has an investment value of Rp. 434,851,000, KM. Salam Mesra's fleet has an investment value of Rp. 326,597,000, the KM Qausar fleet has an investment value of Rp. 294,472,000. The investment costs incurred by the KM. Ratu Rosari fleet is greater for procuring ship hulls, fishing gear, and main engines than other fleets worth Rp. 4,80,000,000, a KM. Lentera fleet with an investment value of Rp. 3.30 million, KM. Nurwahidah fleet with an investment value of Rp. 3,70,000,000 KM. Pratama Putra with an investment value of Rp. 4.05 million, KM. Salam Mesra fleet with an investment value of Rp. 300,000,000, and the KM. Qausar fleet with an investment value of Rp.

2,65,000,000. So, there is a difference in the investment value of the six fleet units. b.

Variable cost

Variable costs depend on the intensity of fishing efforts (trips). The more fishing effort is made, the higher the variable costs incurred, and conversely, if the fishing effort is reduced, the total variable costs will also decrease. Variable costs incurred for the operation of all ships can be seen in Table 8.

No.	*Name of vessel*	*Variable costs per year (IDR)*
1.	KM. Lentera	436,632,000
2.	KM. Nurwahidah	454,230,000
3.	KM. Pratama Putra	417,648,000
4.	KM. Ratu Losari	417,143,000
5.	KM. Salam Mesra	468,485,000
6.	KM. Qausar	458,165,000

Table 8: Total variable costs per year.

Table 10 explains that the KM. Salam Mesra fleet has the highest variable cost of Rp. 468,485,000/year, the KM. Lentera fleet has a variable cost of Rp. 436,632,000/year, the KM. Nurwahidah fleet has a variable cost of Rp. 454,230,000/ year, the KM. Pratama Putra fleet has a variable cost of Rp. 417,648,000/ year, the KM. Ratu Rosari fleet has variable Rp. 417,143,000/ year, the KM. Qausar fleet has a variable cost of Rp. 458,165,000/ year. The variable costs incurred by the KM. Salam Mesra fleet is greater for purchasing fuel, ice cubes, and consumption than other fleets worth Rp. 72,885,000 - 395,600,000, KM. Lentera fleet with a variable cost of Rp. 46,552,000 – 39,080,000, KM. Nurwahidah fleet with a variable cost of Rp. 54,630,000 – 399,600,000, KM. Pratama Putra fleet with a variable cost of Rp. 44,528,000 – 373,120,000, KM. Ratu Rosari fleet with a variable cost of IDR 52,503,000 – 364,640.00, KM. Qausar fleet with a variable cost of IDR 62,565,000 – 395,600,000.

Profit-sharing system

The profit-sharing system shares risks between ship owners, skippers, and fishermen. Profit sharing with fishermen and purse seine boat owners is the income minus the results of FAD owners and exploitation costs. This value is shared 50% with the owner and another 50% with 15-20 fishermen per month. This is in line with Mulyadi's research (2005); in the profit-sharing system, the share that is shared is income after deducting the exploitation costs incurred during operation plus the cost of selling the product, so here it includes fuel costs, ice, and food costs and retribution. Other costs that still have exploitation costs, such as repair costs, are the responsibility of the owner of the equipment and ship. In general, the net profit received by the ship's crew and the ship owner must be divided again by several ship's crew. d. Fixed costs are ongoing costs that fishermen must incur at a particular time. Fixed costs incurred by all vessels can be seen in Table 9.

No.	Name of vessel	Fixed costs per year (IDR)
1.	KM. Lentera	77,850,524
2.	KM. Nurwahidah	91,306,333
3.	KM. Pratama Putra	78,389,086
4.	KM. Ratu Losari	99,536,524
5.	KM. Salam Mesra	71,339,333
6.	KM. Qausar	68,747,667

Table 9: The total fixed costs.

Based on Table 11 above explains that the KM. The Ratu Rosari fleet has the highest fixed costs, IDR 99,536,524/year, the KM. Lentera fleet has a fixed cost of IDR 77,850,524/year, the KM. Nurwahidah fleet has a fixed cost of IDR 91,306,333/year, the KM. Pratama Putra fleet has a fixed cost of Rp. 78,389,086/year, the KM. Salam Mesra fleet and the KM have a fixed cost of IDR 71,339,333/year. Qausar fleet has a fixed cost of IDR 68,747,667/year. The highest fixed costs incurred by the KM. Ratu Rosari fleet is depreciation costs, maintenance costs, and administrative costs such as SIPI (fishing license), SIUP (fishing license), and payment of retribution, compared to other fleets worth Rp. 4,30,000 – 99,106,524 KM. Lantern fleet with a fixed cost of Rp. 4,60,000 – 77,390,524, the fleet of KM. Nurwahidah with a fixed fee of Rp. 450,000 – 90,856,333, KM. Pratama Putra fleet with a fixed cost of Rp. 440,000 – 77,949,086 KM. Salam Mesra fleet with a fixed fee of Rp. 430,000 – 83,225,667, KM. Qausar fleet with a fixed cost of Rp. 430,000 – 68,317,667, so there is a difference in the fixed costs of the six fleet units.

Total receipts

Total revenue is a function of total production and price, namely the production amount of each vessel multiplied by the average fish price within one year. The total receipts of each ship are shown in Table 10.

No.	Name of vessel	Receipt rate per year (IDR)
1.	KM. Lentera	1,203,205,000
2.	KM. Nurwahidah	1,180,500,000
3.	KM. Pratama Putra	1,172,450,000
4.	KM. Ratu Rosari	1,136,800,000
5.	KM. Salam Mesra	1,144,300,000
6.	KM. Qausar	1,134,100,000

Table 10: The total receipts per year for all purse seine fleets.

Table 12 explains that the KM. Lentera fleet has the highest total revenue of IDR 1,203,250,000/ year, the KM. Nurwahida fleet has a total revenue of IDR 1,180,500,000/year, the KM. Pratama Putra fleet has IDR 1,172,450,000/year, the KM. Ratu Rosari fleet has a total revenue of IDR 1,136,800,000/year, the KM. Salam Mesra fleet has a total revenue of IDR 1,144,300,000, and the KM. Qausar fleet has a total revenue of IDR 1,134,100,000/year. The total revenue generated by the KM. Lentera fleet is higher in the amount of catch production in peak, regular season, and lean seasons compared to other fleets with total revenue of IDR 1,203,250,000/year, KM. Nurwahida's fleet, with a total revenue IDR 1,180,500,000/year, KM. Pratama Putra fleet with IDR 1,172,450,000/year, KM. Ratu Rosari fleet with total revenue IDR 1,136,800,000/year, KM. Salam Mesra fleet with total revenue IDR 1,144,300,000, and KM. Qausar fleet with a total revenue of IDR 1,134,100,000/year.

Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit Cost Ratio (B/C Ratio)

NPV

Under Mutmainnah's research (2014), that NPV analysis is a method that considers the time value of money. This method uses a discount rate (discounted interest rate) which will affect the proceeds or flow of funds. The NPV value of each ship can be seen in Table 11.

No.	Name of vessel	NPV per year (IDR)
1.	KM. Lentera	924,605,992
2.	KM. Nurwahidah	1,003,399,125
3.	KM. Pratama Putra	1,104,325,263
4.	KM. Ratu Rosari	786,263,885
5.	KM. Salam Mesra	787,263,547
6.	KM. Qausar	798,908,686

Table 11: NPV of purse seine fleets.

Based on the calculation results, the KM. Pratama Putra fleet has the highest value, with revenue (benefit) deducted by costs (cost) divided by the interest rate (discount rate), so it has an NPV value of IDR 1,104,325,263/year, KM. Lentera fleet has a value NPV IDR 924,605,992/year and owns KM. Nurwahidah fleet NPV value of IDR 1,003,399,125/year, KM. Ratu Rosari fleet has an NPV value of IDR 786,263,885/year, KM. Salam Mesra fleet has an NPV value of IDR 787,263,547/year, KM. Qausar fleet has an NPV value of IDR 798,908,686/year. This business is feasible to run because the NPV value is positive. NPV analysis data, this business is viable. This is done because the NPV value is still positive; according to Mutmainnah's research (2014), the fishing effort is worth continuing if the NPV value is positive. b. IRR.

In the IRR method, the interest rate that will be calculated is the interest rate that will make the total present value of each discounted proceeds (interest rate discount) at that interest rate equal to the present value of cash outflows (project value). The IRR value of each ship can be seen in Table 12.

No.	*Name of vessel*	*IRR per year (IDR) in percentage*
1.	KM. Lentera	52
2.	KM. Nurwahidah	49
3.	KM. Pratama Putra	50
4.	KM. Ratu Rosari	35
5.	KM. Salam Mesra	50
6.	KM. Qausar	56

Table 12: IRR value for all fleets per year.

Based on the results of the IRR calculation, KM. Qausar fleet has the highest IRR value by knowing the discount rate, namely the first interest rate is added to the first NPV and divided by the second NPV, and then the double interest rate is reduced by the first interest rate so that the KM. Qausar fleet has an IRR value of 56%/year, KM. Lentera fleet has an IRR value of 52%/year, KM. Nurwahidah fleet has an IRR value of 49 %/year, KM. Pratama Putra fleet has an IRR value of 50 %/year, KM. Ratu Rosari fleet has an IRR value of 35 %/year, KM. Salam Mesra fleet has an IRR value of 50 %/year. The value of this interest rate is feasible, for the calculation results of all ships have different interest rate values and are still viable to run; according to Mutmainnah's research (2014), if the interest rate is above 0%, it indicates that the business is feasible to continue.

B/C Ratio

The B/C Ratio value of each ship can be seen in Table 13.

No.	*Name of vessel*	*B/C Ratio per year*
1.	KM. Lentera	2,6
2.	KM. Nurwahidah	2,5
3.	KM. Pratama Putra	2,5
4.	KM. Ratu Rosari	1,6
5.	KM. Salam Mesra	2,4
6.	KM. Qausar	2,7

The value of the B/C Ratio is the total revenue divided by the total costs and profits of the fisherman. Table 15 illustrates that the highest B/C ratio value is found in the KM. Qausar fleet, namely 2.7/year, the KM.

Lentera fleet with a B/C ratio value of 2.6/year, KM. Nurwahidah fleet with a B/C ratio of 2.5/year, KM. Pratama Putra fleet with a B/C ratio of 2.5/year, KM. Ratu Rosari fleet with a B/C ratio of 1.6/year, KM.

Salam Mesra fleet with a B/C ratio of 2.4/year, overall the business of all fleets is feasible because it has a B/C ratio value greater than one (>1). This follows Mutmainnah's research (2004) B/C Ratio is an indicator of business feasibility as seen from the comparison between production costs and total income generated. If the B/C Ratio is greater than 1 (>1), then the business is feasible to run, while if the B/C Ratio is less than one (<1), then the company is not possible. The benefit-cost ratio value of fishing business using purse seine fishing gear at Ternate Fishing Port has a B/C ratio of >1 and is feasible to run.

Conclusion

The purse seine is a fishing gear for small pelagic fish that fishermen generally operate in Ternate and North Maluku waters. Of the six purse seine vessels studied, KM. Ratu Rosari has the most prominent investment value, but KM owns the most significant annual revenue costs. Lentera. All in all, entire vessels are categorized as a worthy business because the B/C Ratio is more than 1.

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