Biotechnic and economic analysis of fish catching units in Larangan Coastal Fishing Port, Tegal District, Indonesia

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Abstract. The fishing units in the Larangan Coastal Fishing Port consist of boat seine net and mini purse seine. Fish caught from Tegal waters, Indonesia, are landed at the Larangan Fish Auction Place (PPP). The fish caught include: anchovy (*Stolephorus commerrsoni*), Javan anchovy (*Stolephorus* sp.), tembang fish (*Sardinella fimbriata*), mackerel (*Scomber scombrus*), pepetek fish (*Leiognathus* sp.), squid (*Loligo* sp.) and rebon shrimp (*Acetes japonicus*). The most productive fishing gear is the purse seine. This can be seen from the annual average production of 805.937 kg. The annual average production of boat seine net is only 135.590 kg per year. The productivity per trip of the purse seine tends to increase over time. The highest productivity value of 668 kg per trip was in 2019, and the lowest productivity value was 156 kg per trip in 2015. Meanwhile, the productivity per trip of the boat seine net fishing unit tends to decline. The highest productivity value was 108 kg per trip in 2015 and the lowest productivity value was in 2018, with 35 kg per trip. Based on the analysis of the biological and technical aspects with the scoring method, the results show that the purse seine is an appropriate technology to operate in the waters of Tegal Regency, Indonesia. Based on the financial analysis of the boat seine net at the Larangan Coastal Fishing Port, the net present value (NPV) is 6615.81 USD. The net benefit-cost ratio (B/C) is 2.23 the internal rate of return (IRR) is 38.83% and the payback period (PP) is 0.99 years, which means that the catch fishery business at Larangan Coastal Fishing Port is feasible to continue. The NPV value of the purse seine fishery business is 30877.13 USD. The B/C value is 2.36, the IRR is 38.92% and the PP is 1.09 years, which means that the purse seine fishery at Larangan Coastal Fishing Port is feasible to continue.

Key Words: financial feasibility analysis, Larangan Coastal Fishing Port, productivity.

Introduction. Tegal Regency is included in the province of Central Java, which is directly adjacent to the Java Sea to the north. The coastal area is located in the Kramat, Suradadi, and Warureja Districts, which are the centers of marine fisheries activities in each region (Dzikrurianti et al 2014). The marine fisheries sector is one of the economy driving factors in Tegal (Mulyani et al 2019), represented by the existence of two fishing ports, namely the Larangan Coastal Fishery Port and Suradadi (Surodadi) Fishing Port. Larangan Coastal Fishing Port is the largest fishing port located in Kramat District, with a fishery production in 2019 reaching 1050.52 tons (DKP Central Java Province 2020).

The fishing fleet based on the Larangan Coastal Fishing Port consists of small boats, around 3-10 GT. The fishing gear used by the fishermen of this area are boat seine nets and purse seines, with the main catch being anchovies and other small pelagic fish. Sutono et al (2016) stated that the production of anchovy in Tegal Regency in the 1999-2011 period showed an increasing trend, of 0.95 percent per year. The trend of increasing production was also followed by an increase in the number of fishing gears, both in the 1999-2011 and 2015-2019 periods, especially the number of boat seine nets and purse seine. However, an increase in the number of fishing units has the potential to reduce fishing productivity, posing a threat to business sustainability and fish resources sustainability.

The similarity of target catch between boat seine nets and purse seine based in the Larangan Coastal Fishing Port has the potential to cause competition for fish resources, especially for small pelagic fish. This study aims to analyze the conditions of the existing fishing business in terms of technical, biological, production, and feasibility aspects of fishing with purse seine and boat seine net fishing gears in Larangan Coastal Fishing Port, Tegal Regency, Indonesia. The research results are expected to provide input for the management of boat seine net fisheries and purse seines that are more efficient in the Larangan Coastal Fishing Port.

Material and Method

Time and place of research. The research was conducted at Larangan Coastal Fishing Port, Tegal District, Central Java (Figure 1), in April 2020 by conducting field observations and taking fisheries statistical data from 2015 to 2019. Data analysis was conducted at the Laboratory of Fishing Technology, Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University, Bogor, Indonesia.

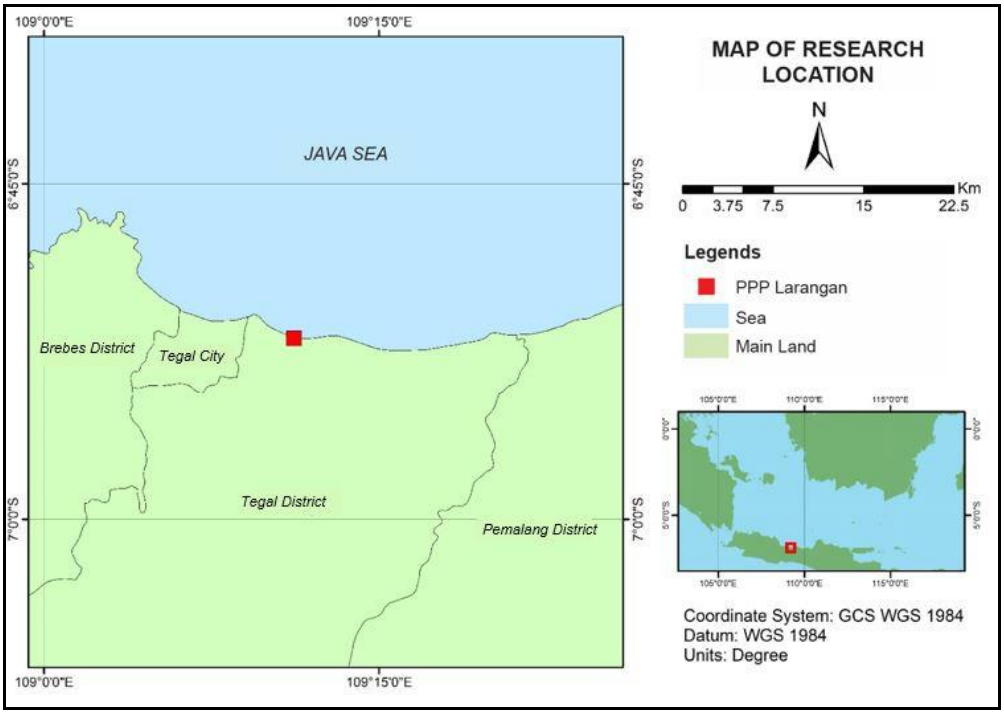

Figure 1. Study location in Larangan Coastal Fishing Port of Tegal Regency, Indonesia.

Data types and sources. The data collected in this study consisted of primary data obtained from interviews and field observations of fish landing activities at Larangan Coastal Fishing Port. Secondary data was collected in the form of fish production data from 2015 to 2019.

Analysis of fishing unit productivity. The Landing Per Unit Effort (LPUE) parameter is used to indicate the abundance of fish resources in an area. The LPUE value is obtained by calculating the catch reported and sold at the fishing port following existing conditions. According to Metri & Perez (2014), LPUE can usually describe the number of specimens or the weight of the catch, and the unit of effort. In general, the calculation of the LPUE value can be formulated as follows:

$LPUE_i = Landing_i / Trip_i$

Where: LPUE - Landing Per Unit Effort; Landing - total catch landed in the port by each boat per year; Trips - number of boat trips per year.

In addition to calculating the LPUE value, this study also analyzes the productivity value of the fishing unit, namely for boat seine net fishing gear and purse seine. The productivity value describes the catch of a fishing gear unit per certain unit effort. Fishing gear productivity is calculated using the following equation (Setyorini et al 2009):

Average productivity=(∑Production)/(∑Fishing effort)

Biological analysis. This analysis was carried out to see whether the fishing gear used is disturbing or damaging the biological resources of marine fisheries or not. The assessment of the biological aspects was carried out using the next parameters: length of time (months) of the fishing season, length of time (months) of the fishing trip, and the score of fishing gear selectivity. The scoring criteria for the selectivity of fishing technology are presented in Table 1.

Table 1

The interval for determining the selectivity of fishing technology

Value interval	*Description*
1-2	Not selective
3-4	Less selective
5-6	Quite selective
7-8	Selective
9-10	Very selective

Technical analysis. This analysis was conducted to determine whether or not a fishing gear is effective. The technical analysis is derived from the production of fishing gear per year, so that productivity can be seen. A fishing gear that has high productivity is effective in use. The criteria reviewed are: fishing gear operating method (score); operating range (miles); effect of the physical environment of the fishing area (score).

The scoring criteria for the method of operating the equipment is presented in Table 2.

Table 2

The interval for determining the criteria for fishing gear operating methods

Value interval	*Description*
1-2	Difficult
3-4	Somewhat difficult
5-6	Easy

The score of the criteria for the influence of the physical environment of the fishing area on the operation being analyzed was determined by observing the physical conditions of the aquatic environment. The score value interval is presented in Table 3.

Table 3

The interval for determining the effect of the physical environment on fishing grounds

Value interval	*Description*
1-2	Influential/bad
3-4	Quite influential/sufficiently good
5-6	Not influential/good

For the criteria for the fishing operation coverage, the assessment was carried out using interview data. The reach power increases proportionally with the distance from the

shore. Conversely, if the cruising range is limited, the catching operation range will be lower.

Business feasibility. The business feasibility analysis was used to provide information on whether it is financially feasible to use boat seine net and purse seine in Larangan Coastal Fishing Port or not. The method of testing the economic aspect is carried out by calculating the net present value, net benefit-cost ratio, and internal rate of return (Umar 2003).

The financial aspect is a key aspect of a feasibility study. Even if other aspects are considered feasible, if the financial aspects give inappropriate results, the project proposal will be rejected because it will not provide economic benefits (Haming et al 2003; Rustijarno 2007). The level of feasibility of a business with a project economic life of more than 5 years is included in the discounted criteria, so the net present value (NPV), internal rate of return (IRR), net benefit-cost ratio (B/C), and payback period (PP) are used as indicators. In this study, a financial analysis was carried out with the economic life of the project for 10 years, assuming that one of the investments has a useful life of 10 years. Business feasibility is also assessed by how much the business returns the investment. This can be determined by measuring the IRR value. IRR is the discount rate (DR) which results in a situation of an NPV equal to zero (Nurmalina et al 2010).

Net present value (NPV). This criterion is used to determine the benefits of the investment made for analytical activities. This figure is the total value of the net benefits and is expressed in US dollars. The equation used is as follows:

$$NPV = \sum_{i=1}^{N} \frac{(Bt - Ct)}{(1+j)^t}$$

Where: Bt - gross benefit in year t; Ct - gross cost in year t; N - economic life of the project; i - discount rate; t - project period. If NPV>0, the fishing business is feasible to be carried out, whereas if NPV<0, the fishing business is not feasible to be carry out. If NPV=0, the investment only provides the same level as the social opportunity cost of capital.

According to Listiana et al (2013), a business is feasible if the NPV value is positive. The higher the NPV of a business, the better the business and businesses that can increase profits, namely those that have a larger NPV.

Net benefit-cost ratio (Net B/C). This criterion is the result of comparing the net profit of a business with the total costs that have been incurred for the business. The equation is:

$$Net\ B/C = \frac{\sum \frac{(Bt - Ct)}{(1+i)^t},\ i = 0..N}{\sum \frac{(Ct - Bt)}{(1+i)^t},\ i = 1..N}$$

If net B/C>1, then the situation indicates that NPV>0, and this means that the effort is feasible to carry out, in other words, the project will generate profits. Conversely, if net B/C<1, this means that the NPV<0, thus indicating that the business is not feasible to carry out, or in other words, the project does not generate profits.

The net B/C ratio is the net benefit to the business that is generated against each unit of the business's losses. The net B/C ratio can be defined as the ratio between positive net benefits and negative net benefits (Nurmalina et al 2010).

Internal rate of return (IRR). The IRR value shows the rate of return on net investment in a business. Any net profits that are realized automatically are reinvested in

the following year and receive an interest rate for the remaining life of the project. The IRR formula is as follows:

$$IRR = i1 + \frac{NPV1}{NPV1 - NPV2}(i2 - i1)$$

If IRR>i (i representing the interest rate), the business is feasible. If IRR=i, the project is only able to return the investment without presenting a profit. If IRR <i, the business is not feasible because it will only suffer losses.

According to Wismaningrum et al (2013), if the IRR is greater than the discount factor, the business is feasible to continue; if it is the same as the discount factor, it can break even; and if it is lower than the discount factor, the project cannot be continued.

Payback period (PP). According to Kasmir (2009), the PP is a technique of assessing the investment return period of a project or business. The value of the PP can be calculated using the following formula:

Payback period = Investment/Profit

If the payback period value is less than 3 years, the return category is fast; if the payback period is 3 -5 years, the return category is moderate; if the payback period of more than 5 years is considered slow.

Results and Discussion

Fishing gear productivity. Production of fish landed in Larangan Coastal Fishing Port is dominated by purse seine catches. The catch landed at Larangan Coastal Fishing Port in the last 5 years has fluctuated for both fishing gears. The development of boat seine net and purse seine fish production from 2015 to 2019 is presented in Table 4.

Table 4

Fish production per fishing gear (kg) in Larangan Coastal Fishery Port in 2015-2019

Year	*Boat seine net (kg)*	*Purse seine (kg)*
2015	188851	591809
2016	143480	832731
2017	113309	793839
2018	125503	719109
2019	106809	1092195

Fish production from boat seine net fishing gear tends to decline every year. In 2015, the production of boat seine net fishing gear was 188.851 kg, while in 2019 the total production was only 106.809 kg. Meanwhile, purse seine fishing gear production is experiencing fluctuation every year. The highest production was obtained in 2019 amounting to 1092.195 kg. When viewed from the average production per year, purse seine is a fishing tool that is more productive than boat seine net. The average purse seine production volume is 805.937 kg, while the boat seine net is only 135.590 kg.

In Table 5, it can be seen that the number of trips using boat seine nets has fluctuated every year. The highest number of boat seine net trips occurred in 2018, with 3545 trips, while the lowest number of trips occurred in 2015, with 1746 trips. The number of purse seine fishing gear trips tends to decrease every year. The maximum number of trips was 3782 trips in 2015, while in 2019 the fishing effort decreased drastically to 1634 trips.

Table 5

Number of trips for boat seine net fishing gear and purse seine in Larangan Coastal Fishery Port, Indonesia

Year	*Boat seine net (trip)*	*Purse seine (trip)*
2015	1746	3782
2016	3150	3732
2017	2705	1576
2018	3545	1538
2019	2634	1634

The development of boat seine net and purse seine catching productivity from 2015-2019 can be seen in Table 6. Over these years, the boat seine net productivity has decreased. The lowest productivity occurred in 2018, with 35 kg per trip, while the highest productivity was obtained in 2015, with 108 kg per trip. The number of fishing trips did not have a positive effect on the amount of catch obtained in that year. This depends on the effectiveness of the boat seine net fishing gear in obtaining the catch, which is indicated by its productivity. Productivity is not only measured based on the amount of catch, but also on the number of fishing trips (Irian et al 2012).

Table 6

Productivity of boat seine net and purse seine (kg per trip) in Larangan Coastal Fishery Port, Indonesia, during 2015-2019

Year	*Boat seine net (kg per trip)*	*Purse seine (kg per trip)*
2015	108	156
2016	46	223
2017	42	504
2018	35	468
2019	41	668

Purse seine productivity tends to increase over time. The highest productivity value of 668 kg per trip occurred in 2019 and the lowest productivity value of 156 kg per trip was obtained in 2015. According to Wiyono (2010), large productivity values represent higher fish stocks. The same was stated by Saputra et al (2011), the catch per unit effort being an index of the abundance of fish stocks in waters.

Analysis of biological aspects. The assessment of the biological aspects of the boat seine net fishing gear and purse seine in Larangan Coastal Fishing Port can be seen in Table 7. Based on the criteria for the length of the fishing season, both fishing gears obtained first ranks because they have the same fishing season. The season for the fish which is the target of both fishing gears lasts for 12 months, so both of them have the first priority value.

Table 7

Value of each criterion in biological aspects and priority order of boat seine net fishing gear and purse seine in the Larangan Coastal Fishery Port

Fishing unit	*Criteria*					
	X1	*UP1*	*X2*	*UP2*	*X3*	*UP3*
Boat seine net	12	1	11	1	3	2
Purse seine	12	1	11	1	4	1

Note: X1 - length of fishing season (months); X2 - length of fishing trip (months); X3 - selectivity of fishing gear (score); UP - priority order.

In the criteria for the length of the fishing season, both fishing gears rank first because they have the same criteria value. Assessment of the fishing gear selectivity criteria

places the purse seine in the first priority. The results of the assessment of biological aspects as a whole were standardized using the value function, as presented in Table 8. Based on Table 8, the assessment of biological aspects places the purse seine as the first priority, because it has the highest value. This is because the purse seine has better selectivity than the boat seine net.

Table 8
Assessment of overall biological aspects with the value function of each main fishing unit in Larangan Coastal Fishing Port

Fishing unit	*Criteria*			*Σ*	*UP*
	X1	*UP1*	*X2*		
Boat seine net	1	1	0	2	2
Purse seine	1	1	1	3	1

Note: X1 - length of fishing season (months); X2 - length of fishing trip (months); X3 - selectivity of fishing gear (score); UP - priority order.

Technical aspects are related to the operation of fishing gear (whether the fishing gear is effective or not when operated). The criteria for the catchment operation coverage will more or less affect the technical aspects of the fishing gear operations. This is due to the relationship between the fishing area and the level of efficiency of the fishing unit.

The score for the influence of the physical environment of the fishing area on the operation of fishing gear is determined by taking into account the physical environmental conditions of the fishing area. The scoring for the method of operating the equipment in terms of whether it is easy or not to operate the fishing gear is presented in Table 9.

Table 9
Score of each criterion in technical aspects and priority order of each main fishing unit at Larangan Coastal Fishery Port, Indonesia

Fishing unit	*Criteria*					
	X1	*UP1*	*X2*	*UP2*	*X3*	*UP3*
Boat seine net	5	2	4	2	3	1
Purse seine	3	1	12	1	3	1

Note: X1 - fishing gear operating method (score); X2 - operating range (miles); X3 - effect of the physical environment of the fishing area (score); UP - priority order.

The assessment of the fishing gear operating method places the boat seine net as the first priority, and the purse seine the second. The assessment of the operational coverage places the purse seine as the top priority and the boat seine net in second place. Assessment of the effects of the physical environment of the fishing grounds places both fishing gears at first priority. Based on the assessment of the overall technical aspects using the value function, which includes the three criteria above, the results are as presented in Table 10.

Table 10
Assessment of technical aspects with value functions for boat seine net fishing gear and purse seine in Larangan Coastal Fishery Port, Indonesia

Fishing unit	*Criteria*			*Σ*	*UP*
	X1	*UP1*	*X2*		
Boat seine net	1	0	1	2	1
Purse seine	0	1	1	2	1

Note: X1 - fishing gear operating method (score); X2 - operating range (miles); X3 - effect of the physical environment of the fishing area (score); UP - priority order.

Based on the assessment of the overall technical aspects after being standardized using the value function, the two fishing gears rank first. The method of operating the boat seine net fishing gear is considered easy because it does not require much labor, its operation does not require complicated equipment, so that it can be operated by fishermen even without special skills. Meanwhile, the operation of a purse seine requires special equipment and skills, being more complex. The reach of the boat seine net fishing gear is close, around coastal waters or as far as 4 miles. The operating range of the purse seine fishing gear is higher. Based on these aspects, purse seine ranks first for operating coverage compared to boat seine net fishing gear.

Boat seine net financial analysis. The fishing business activity has a purpose, namely to obtain profit. The financial aspects of fishing using boat seine net include aspects of capital, income, expenditure, and profits. The investment required for the boat seine net fishing gear is around 3098.15 USD. The investment value is used for the procurement of boats, machinery, fishing gear and other equipment. The largest investment is for the purchase of a boat, which is approximately 2065.7 USD. According to Yanuartono et al (2011), the price of each unit in a fishing business differs from one owner to another. This is due to several factors, including a different purchase year, differences in the condition of the purchased capital goods (used goods or new goods), and other factors. Also, an increase in the yearly price for each component of the fishing business unit causes differences in investment costs.

Cost is a component of expenses that must be incurred. Capture fisheries business costs can be divided in fixed costs and variable costs (Warren et al 2009). The amount of average fixed costs that must be incurred in the boat seine net fishery business per year is 1101.71 USD. Depreciation is a reduction in the value of production factors caused by the production process (Meylinda 2017). The amount of the depreciation value for the investment component is 413.15 USD. The largest fixed cost that must be incurred in this business is the cost of maintaining the boat, which is 337.40 USD. Maintenance costs are oriented towards patching/repairing leaky parts, painting, docking, and others. Another fixed cost that must be incurred is the licensing fee. A business license is one of the obligations of boat owners in the capture fisheries business. The fee for licensing is 13.77 USD per year.

The average fishing operational cost per year is 3133.04 USD. The largest variable cost that must be incurred in this business is the cost of exploitation, which is 2410.03 USD. Exploitation costs consist of costs for fuel, lubricants, and ice. The average consumption cost in one year is 723.01 USD. The amount of this consumption cost is influenced by the length of fishing in one year.

Revenue is obtained from the sale of fish production, which is influenced by the number of fish obtained and the price when the fish are landed. The average income of boat seine net fishermen for one year is 10732.88 USD. In the fishing business, revenue is very uncertain, depending on the number of fish obtained. This is influenced by the fishing season and the condition of the fishing grounds, among other factors.

Profits are the main goal of a fishing effort carried out by fishermen. Profits are influenced by the income and costs incurred. Therefore, fishermen try to get the maximum amount of fish by keeping the costs down to a minimum to get maximum profit. According to Ningsih et al (2013), large profits can be obtained by reducing operational costs incurred. The net profit generated from the fishing business using boat seine net fishing gear in Tegal waters is around 3098.15 USD. The net profit value depends on the value of the catch minus the total fixed costs, variable costs, auction fees and profit sharing with the crew. Boat owners get 50% of the catch and the other 50% go to the fishermen who go to sea.

The average NPV value of the boat seine net capture fishery business is 6610.02 USD. The NPV value in the boat seine net fishery is positive, thus proving that this fishing business is feasible to continue. According to Soeharto (2002), a higher NPV of a business shows a better business and efforts that can increase profits.

The PP from fishing business with boat seine net fishing gear in Larangan Coastal Fishing Port is 0.99 years. This means that the investment costs that have been incurred

will return within 0.99 years. This business is feasible to run because the payback period for investment costs is faster than the life of the project, which is 10 years. The payback period for investment in the fishing business using boat seine net fishing gear is relatively fast. The rate of return on capital in a business is categorized as fast, if the payback period is less than 3 years. If the payback period is more than 3 years, but less than 5 years, it means that the rate of return is categorized as medium. However, if the payback period is more than 5 years, the rate of return is slow (Riyanto 1991). The details are presented in Table 11.

Table 11

Business analysis and investment analysis for the boat seine net fishing unit

I. Investment		
No	Description	Amount (USD)
1	Boat (10 years technical age)	2065.74
2	Main engines (10 years technical life)	413.15
3	Fishing gear (technical age 1 year)	516.43
4	Equipment (technical age 10 years)	68.86
	Total investment	3064.18
	II. Fixed cost	
1	Maintenance of boat	337.40
2	Machine maintenance	123.94
3	Maintenance of fishing gear	144.60
4	Maintenance equipment	68.86
5	Depreciation of boat	158.37
6	Depreciation of the main engine	75.74
8	Depreciation of fishing gear	144.60
9	License Fee	13.77
10	Other costs	34.43
	Total fixed costs	1101.71
	III. Variable cost	
1	Exploitation costs	2410.03
2	Logistics Costs	723.01
	Total Variable costs	3133.04
	Total cost	4234.75
	IV. Reception	
1	Production	10732.88
	Total acceptance	6498.13
	V. Profit sharing	
1	Ship's crew wages 50% of net income	3799.92
	Business analysis	
Criteria for Analysis	*Analysis Results*	*Decision*
Net profit	3098.15 USD	Profitable
Payback period	0.99 Year	Profitable
Net present value	6610.02 USD	Worth doing
Internal rate of return	38.83%	Worth doing
Net benefit-cost ratio	2.23	Worth doing

Note: investment analysis was conducted using an interest rate of 10%.

The IRR value for a 10% loan interest rate is 38.83%. This means that the internal benefits received by boat seine net are 38.83% per year. Based on the IRR values, the fishing business using boat seine net fishing gear could be feasible because the IRR is greater than a bank interest rate (10%). Referring to the IRR value, it can be said that fishermen can repay loans from banks because the benefits (38.83%) are greater than

the interest set by the bank (10%). According to Wismaningrum et al (2013), if the results of the IRR calculation are greater than the discount factor, the business is feasible to continue; if it is the same as the discount factor, it means that the principal returns; and if it is below the discount factor, the project cannot be continued.

The net B/C of boat seine net gear is 2.23. This means that the boat seine net business will provide a return of 2.23 times the investment cost. A business can be feasible if the net B/C ratio is more than one. This means that the fishing effort using the boat seine net fishing gear is feasible to continue.

Purse seine financial analysis. The investment capital required in a purse seine fishing business is 3064.18 USD. The price of a purse seine boat is 10328.68 USD. The main engine price is 1101.73 USD. The price of fishing gear is 4475.76 USD and other equipment is 103.29 USD.

The average fixed cost of operating a purse seine fishery business per year is 2310.19 USD, which consists of boat maintenance costs, fishing gear maintenance, engine maintenance, equipment maintenance, and business permits. The variable cost per year of fishing using a purse seine is 6306.74 USD. Variable costs consist of exploitation costs and consumption costs. Exploitation costs include costs for fuel, lubricants, and ice. The average consumption cost in one year is 4619.72 USD. The amount of this consumption cost is influenced by the length of fishing in one year. The size of the variable costs is influenced by the distance to the fishing ground, the frequency of fishing, and the amount of production. A farther fishing ground distance incurs a greater cost of supplies and fuel; a greater amount of production brings a greater cost of retribution.

According to Kisworo et al (2013), the value of income depends on the catch volume, the type and condition of the fish caught, and the price of fish on the market. The income earned comes from selling the catch. The size of the income is influenced by the amount of production and the price of the fish. A greater production and a higher price brings more income. The total average income obtained in the fishing business using purse seine in Larangan Coastal Fishing Port can be seen in Table 12.

The net profit generated from fishing with purse seine fishing gear is 14644.18 USD. The net profit value depends on the value of the catch minus the total fixed and variable costs, auction fees and profit sharing with the crew. Boat owners have 50% of the profit and 50% is for the fishermen.

According to Listiana et al (2013), a business is feasible if the NPV value is positive. A higher NPV value for a business shows a better business that can increase profits. The NPV value of fishing business using purse seine is 30840 USD, showing that at the end of a fishing business project using a purse seine, a profit of 30840 USD is generated. The NPV value of fishing business using purse seine is positive, showing that the fishing effort using purse seine is feasible to continue.

The IRR value of the fishing effort using purse seine is 38.92%. This value indicates that the IRR is greater than the discount factor, which means that the capture business using the purse seine is feasible to continue.

The NPV value of a fishing business using purse seine is 30840 USD, showing that at the end of a fishing business project it generates a profit of 30840 USD. The NPV value of fishing business using purse seine is positive, and the fishing effort using purse seine is feasible to continue.

The IRR value of fishing effort using purse seine is 38.92%. This value indicates that the IRR is greater than the discount factor, which means that the capture business using the purse seine is feasible to continue. The discount factor used in this study is 10%.

Table 12

Results of the business and investment analysis for purse seine catching units

I. Investment		
No	Description	Amount (USD)
1	Boat (10 years technical age)	10328.68
2	Main engines (10 years technical life)	1101.73
3	Fishing gear (technical age 1 year)	4475.76
4	Equipment (technical age 10 years)	103.29
	Total investment	16009.46
	II. Fixed cost	
1	Maintenance of boat	137.72
2	Machine maintenance	206.57
3	Maintenance of fishing gear	688.58
4	Maintenance equipment	6.89
5	Depreciation of boat	103.29
6	Depreciation of the main engine	619.72
8	Depreciation of fishing gear	482.01
9	License fee	13.77
10	Other costs	51.64
	Total fixed costs	2310.19
	III. Variable cost	
1	Exploitation costs	4619.72
2	Logistics Costs	1687.02
	Total Variable costs	6306.74
	Total cost	8616.93
	IV. Reception	
1	Production	57137.72
	Total acceptance	48520.79
	V. Profit sharing	
1	Ship's crew wages 50% of net income	17162.83
	Business analysis	
Criteria for Analysis	Analysis Results	Decision
Net profit	14644.18 USD	Profitable
Payback period	1.09 Year	Profitable
Net present value	30840 USD	Worth doing
Internal rate of return	38.92	Worth doing
Net benefit-cost ratio	2.36	Worth doing

Note: Investment analysis using an interest rate of 10%.

Conclusions. The most productive fishing gear is the purse seine with an average production of 805937 kg per year, while the production of boat seine net is 135590 kg per year. Purse seine fishing productivity tends to increase. The highest productivity value is found at 668 kg per trip. The productivity per trip of the fishing unit using boat seine net tends to decrease, with the highest productivity value being 108 kg per trip. Based on the analysis of the biological and technical aspects, the purse seine fishing gear is an appropriate technology to operate in the waters of Tegal Regency, Indonesia. Based on the financial analysis of the boat seine net and purse seine fisheries business in Larangan Coastal Fishing Port, both are feasible to continue. The B/C ratio for boat seine net fishing gear is lower (2.23) compared to purse seine gear (2.36).

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Conflict of Interest. The authors declare that there is no conflict of interest.

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