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STRATEGY OF GILL NET FISHING OPERATIONS FOR COASTAL FISHERIES MANAGEMENT IN BATANG REGENCY

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ABSTRACT

Batang Regency is located on the North Coast of Central Java, with geographical coordinates between 6°51'46" - 7°11'47" South Latitude and 109°40'19" - 110°03'06" East Longitude. This study aims to determine fisheries statistics, analyze business feasibility, and identify environmentally friendly fishing gear and strategies for managing fishing efforts. This research was conducted in the period of January – April 2023. The method used in this research is purposive sampling. In addition, the method of interviewing social respondents was used. Methods of data analysis using business feasibility analysis, descriptive analysis with a quantitative approach, and SWOT. The results of this study included: an increase in the number of fishing gear indicating the intensity of fishing trips and the number of catches; gill net capture fisheries business with financial analysis obtained a PP value of 0.67 and an NPV value of Rp. 178,467,972, - the Net B/C value obtained was 5 and the IRR value obtained was 117%; environmentally friendly fishing gear based on the Code of Conduct for Responsible Fisheries (CCRF) gets a score of 30 and shows that gill net fishing gear is classified as environmentally friendly fishing gear; and there are gill net fishing gear management strategies such as increasing fishing activities, stabilizing the price of fish caught, developing port facilities, fostering the use of business management fishing technology and diversifying catches in the utilization of natural resource potential.

Keywords: ***:*** gill net fishing gear, business feasibility, CCRF, management strategy.

INTRODUCTION

Capture fisheries, as a part of the fisheries economic sector, play an important role in national development; these roles include preparing protein food, obtaining foreign exchange earnings, and providing employment (Rahmantya, 2015). The role of the fisheries industry, especially the capture fisheries sector, is becoming increasingly important when the country's economic growth is encountering unfavorable conditions. However, in practice, individuals and the government are not giving the fisheries sector much attention thus far, despite the fact that if the sector is managed well, it can contribute more to national economic development and, in addition, benefit the Indonesian people, particularly the fishing community (Gumilang, A. P., & Susilawati, E., 2020). The North Coast of Central Java, one of which is Batang Regency, is a significant fishing region in Indonesia with great potential. According to the Central Statistics Agency (2021), Batang has a land area of 854,248.4 km², or 85,424.84 ha, with a coastline of 38,722 km and a width of 4 miles, so the sea area reaches 287,060 km². Most of the population of Batang Regency has a livelihood in the small-scale capture fisheries sector, which has significantly contributed to the economic and social conditions for the fishing community, and this has the potential to be developed in Batang Regency considering the potential of Batang Regency's fishery resources is quite high.

Based on Central Java capture fisheries data in 2020, Batang Regency contributed 14,159 tonnes of marine fisheries production with a production value of IDR 203,452,275.00. With the production and value of capture fisheries production, it has contributed to the district's GRDP (Gross Regional Domestic Product) contribution in 2020 of 23.09% to Central Java Province, with a GRDP growth rate of 2.36%. The magnitude of GRDP from the Regency shows that the fisheries sector in Batang Regency has a strategic role in the regional and national economies. In the capture fisheries sector in Batang Regency, there is very diverse fishing gear. There are 7 types of fishing gear used by fishermen in Batang Regency, they are gill net, *arad*, *cantrang*, *bubu*, purse seine, trammel net, and longline. Fishermen from Klidang Lor with fishing boats larger than 10 GT primarily utilize the various sections of fishing base areas, which include purse seine, long line, and *cantrang*, whereas fishermen from Roban, Celong, and Siklayu primarily employ *arad*, gill net, tremmel net, and *bubu* fishing gear. It indicates that the diversity of fishing gear can exploit fish resources on a large scale, and it requires good management to maintain the sustainability of these resources. Based on the data from Department of Marine Affairs, Fisheries, and Animal Husbandry (2021) in a period of seven consecutive years (2015–2021), the average gill net was the most used fishing gear after *arad* and *cantrang*, it is also other fishing gear, they are: gill net 184 units, *arad* 367 units, *cantrang* 224 units, 146 purse seine units, 135 trap nets, 102 trammel net units, and 19 longline units. According to Pramesthy et al. (2020) in his research. Kholis et al. (2018) stated that "some characteristics of gill net fishing latches are having webbing, the mesh size of the webbing is relatively small, webbing uses mini purse seine buoys, and gill nets do

not have specific target fish to catch". Gill net can be operated to catch fish with traditional, simple, or modern systems.

One of problems that occur in capture fisheries in Batang Regency is that most fishermen still use fishing gear that is not environmentally friendly or fishing gear that has been banned from operating, such as *Arad* and *Cantrang* fishing gear (Departement of Marine Affairs Fisheries, and Animal Husbandry, 2021). The main reason fishermen still use the *arad* fishing gear for fishing operations is because the quantity of fish caught is greater and it is more effective. In order to carry out sustainable capture fisheries management in the future, capture fisheries management in Batang Regency must focus on environmentally friendly capture fisheries that have existed so far in Batang Regency. According to data sourced from the Departement of Maritime Affairs, Fisheries and Animal Hubandry (2021) By using environmentally friendly fishing gear as advised by the Ministry of Maritime Affairs and Fisheries under KP Regulation Number 2 of 2015, fishermen in the coastal regions of Batang Regency have achieved progress toward sustainable fishing practices. Gill nets have taken the place of the Arad and Cantrang fishing gear during this shift. The shift to gill nets in Batang Regency has brought positive changes to the fishing industry. These nets are more selective, reducing bycatch and resulting in a higher proportion of the desired species in the catch. This benefits fishermen economically and provides higher-quality seafood, meeting consumer demands. Additionally, gill nets align with environmental guidelines, contributing to marine biodiversity conservation and healthier fishing grounds. While initial investment is needed, the long-term economic benefits, improved catch quality, and reduced environmental impact make this transition a sustainable and economically viable choice for Batang Regency's fishing industry. Despite its benefit, the use of gill net fishing gear still faces challenges, nevertheless. Gill net fishing equipment is currently frequently used as a backup method and is only used when the primary method is unworkable. It is essential to promote the complete integration of gill net fishing gear to guarantee the effectiveness of sustainable coastal fisheries management. This involves educating fishermen about the economic prospects and advancements associated with gill net usage, as well as solidifying gill nets as the primary fishing gear.

In response to the prevailing challenges in Batang Regency's coastal fisheries, a thorough investigation is imperative to delve into the strategies required for effective management of environmentally friendly fishing gear, specifically centered around the Gill net capture fisheries business. This research endeavors to enhance the feasibility of the Gill net capture fisheries sector for sustainable development, concurrently addressing the persisting fisheries issues within the region.

The study aims to provide insights into the forthcoming policies orchestrated by the Department of Maritime Affairs, Fisheries, and Animal Husbandry Office of Batang Regency. These policies will guide the development of fishing gear, constituting a pivotal facet for augmenting the income of local fishermen. A discerning understanding of these policies will enable informed decisions regarding the cultivation of appropriate strategies, primarily directed at fostering the growth of Gill net capture fisheries management. This is of paramount importance, especially in light of the prohibition and phasing out of non-environmentally friendly fishing gear. Furthermore, the study seeks to empower key stakeholders in environmentally friendly capture fisheries management by disseminating knowledge pertinent to the utilization of Gill net fishing gear. This knowledge-sharing initiative aims to instill heightened motivation among these stakeholders, inspiring them to engage in sustainable fisheries management practices through the utilization of Gill net fishing gear.

RESEARCH METHODS

This research was conducted using a descriptive methodology, which involved collecting data from surveys, field observations, interviews, and case studies.

Time and Location

This research was conducted in December 2022 in the coastal areas of Batang Regency, it includes Batang District, Tulis District, Kandeman District, Banyuputih District, Subah District, and Gringsing District.

Data Collection Method

The research data was taken from primary and secondary sources. Primary data collection was obtained by observing and interviewing several related parties, they are: 1) fishermen who use gill net fishing gear; 2) Employees of Maritime Affairs, Fisheries, and Animal Husbandry of Batang Regency; 3) Entrepreneurs; and 4) Ports and Fish Landing Points in the Coastal area of Batang Regency.

Data Analysis Method

The research data were analyzed using qualitative and quantitative methods. The aims of this study were to: (1) analyze descriptive statistics of fisheries; and (2) analyze the financial feasibility of the gill net fishing gear business. then also for research purposes to analyze the financial feasibility of fishing efforts using gill net fishing gear; (3) do the weighting through nine criteria for environmentally friendly fishing gear in accordance with CCRF (*Code of Conduct for Responsible Fisheries*) for the purpose of identifying the selectivity management of Gill net fishing gear; (4) use SWOT analysis for research purposes to formulate alternative strategies for sustainable capture fisheries management.

RESULT AND DISCUSSION

Overview of Batang Regency

Batang Regency is located on the North Coast of Central Java, with geographical coordinates between 6°51'46" - 7°11'47" South Latitude and 109°40'19" - 110°03'06" East Longitude. This area is about 100 km to the west of the provincial capital of Central Java (Anggraeni et al, 2018). Batang Regency occupies a significant geographic position as it is located along the main North Coast Java Island route that connects Jakarta and Surabaya. The Kendal Regency borders it to the east, Wonosobo Regency and Banjarnegara Regency to the south, Pekalongan City and Regency to the west, and the Java Sea to the north. These are just a few of the different features that make up its geographical limits. This territory is

divided into 15 sub-districts, which together have a sizable land area of 78,864.16 hectares. Notably, the maritime area covers over 287,060 square kilometers and has a 38.75-kilometer-long coastline. It is critical to recognize the many developmental orientations that are intrinsic to each of these unique areas within the boundaries of the regency due to the potential existence of each region in Batang Regency. The Batang Regency area consists of agricultural areas and non-agricultural areas. Subah District has the widest area, it is 8,352.17 hectares, with an agricultural area of 6,701.95 hectares and 1,650.22 hectares of non-agricultural land. As a coastal area, Batang Regency has various fishery resource potentials (Kurohman et al, 2018). Capture fisheries business activities are the main livelihood of most coastal communities and fishermen in Batang Regency (Ariadi et al, 2021). Figure 1 shows the location where data was collected in this study.

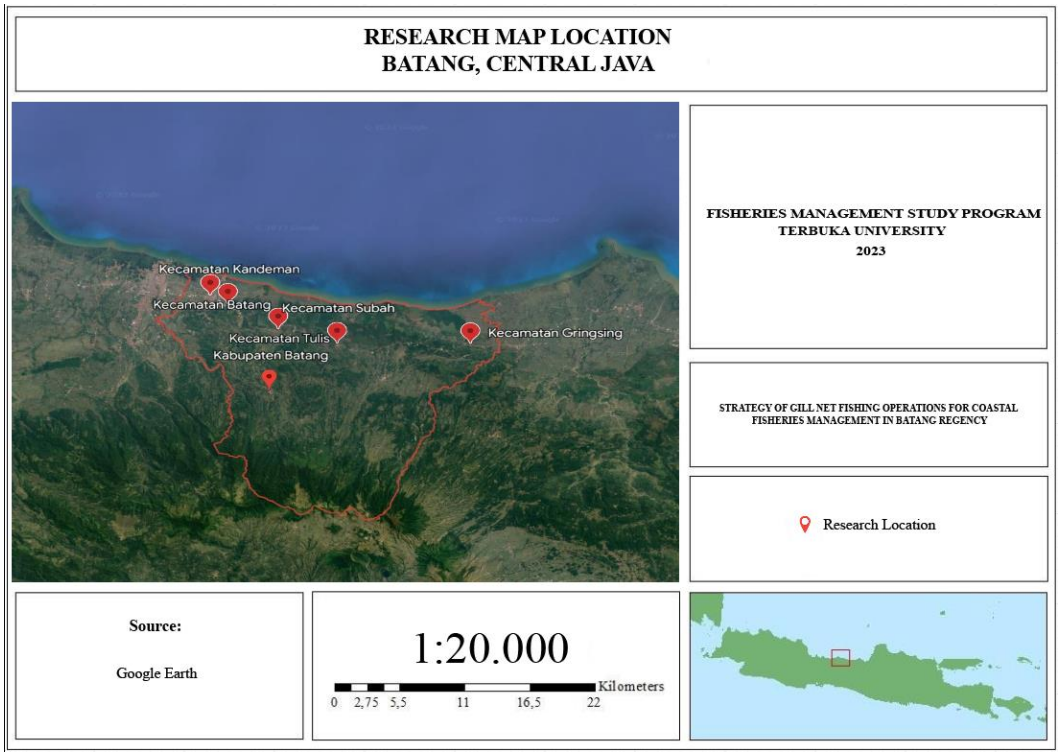

Figure 1. Map of Batang Regency

Capture Fisheries in Batang Regency

Batang Regency has six coastal districts, they are Kandeman District, Batang District, Subah District, Tulis District, Gringsing District, and Banyuputih District. Center for capture fisheries, which is marked by the presence of Fish Auction Places (FAP) spread over each fish landing center in each coastal district. The FAP is the center of fishing activities by migrant fishermen (andon) as well as local fishermen in Batang Regency. The five FAPs are (1) West Roban FAP in the Tulis District. (2) FAP Klidang Lor in Batang District (TPI Klidang Lor 1, 2 and 3). (3) FAP Siklayu in Gringsing District. (4) FAP Celong in Banyuputih District. (5) East Roban FAP in Subah District. Through all of their efforts, the five FAPs serve to represent the entirety of the catch fisheries in Batang Regency. FAP is essentially a piece of public infrastructure that users are responsible for maintaining and using properly in order to deliver the best possible service (Mardani et al., 2018). In terms of their fishing operations, the five FAPs in Batang Regency are largely comparable. Fish auctions, the sale and repair of fishing gear, outboard motors, motor boats, the purchase of caught fish, and other fishing-related businesses are all done by fishing communities at the five TPIs. The biggest FAP with capture fisheries activities in Batang Regency is FAP Klidang Lor which is in Batang District. It is due to the strategic location of FAP Klidang Lor at the berth and anchorage of fishing boats over 10 GT in size and supported by the adequate facilities and infrastructure of the Klidang Lor CFP fishing port (Coastal Fishery Port). FAP Klidang Lor is a capture fisheries center dominated by *Cantrang*/Dogol and Purse seine vessels with trips per day to months. While the other four FAPs, they are East Roban FAP, West Roban FAP, Siklayu TPI, and Celong TPI, they are capture fisheries centers for fishermen operating in fishing lanes I and II, it is fishermen who operate outboard motors under 10 GT using this type of fishing gear fish, for example *arad*, beach seine, drift gill net, trammel net, wadong/bubu, and longline.

Total Production and Production Value

The total production and production value of capture fisheries is the total production of fish landed at FAP in Batang Regency. Total production is the amount of fish expressed in tons while the production value is the amount of fish production expressed in units of rupiah. The total production and production value in Batang Regency are presented in Table 1.

Number of Fishing Gears in Batang Regency

Fishing gear is a type of equipment for fishing that fishermen use to capture fish when fishing. In Batang Regency, fishermen employ seven different types of fishing equipment: gill nets, trammel nets, traps, *cantrang*, *arad*, purse seine, and long lines. The number of fishing gear in Batang Regency is presented in Table 3 below.

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Gill net fishing gear is a "fishing gear that has a general rectangular shape with parts consisting of the body of the net, top line, bottom line, buoys and weights" (Kurohman, Faik, et al., 2018). The success of fishing on gill net fishing gear is influenced by several factors, it includes the influence of fishing season, the effect of placing fishing gear that blocks the fishing target, and the influence of weather Najisurya J. F, et al., (2018) states "the success rate of catching using gill net fishing gear is influenced by the activity of fish to get closer to the body of net to make physical contact with the net". If fish activity is low. So, the catch is also likely to be low, and vice versa.

Table 1. Total Production and Production Value of Capture Fisheries in Batang Regency

No	Year	Production Amount (Kw)	Production Value (000 Rp)
1	2015	257.290	124.137.594
2	2016	379.013	132.827.226
3	2017	301.377	156.529.311
4	2018	271.693	140.876.381
5	2019	313.914	162.768.571
6	2020	225.530	112.524.524
7	2021	240.702	149.463.904

Source: Indonesia Statistics, 2022

Table 2. Number of Marine Fishery Households in Batang Regency

Year	No Boat	Non-Motorized Boat	Outboard motors	Motor Ship	Amount
2015	-	-	602	50	652
2016	-	-	644	53	697
2017	15	-	658	62	720
2018	20	13	723	82	805
2019	10	-	723	82	805
2020	-	-	736	82	818
2021	10	12	771	50	821

Source: Indonesia Statistics, 2022

Table 3. Number of fishing gear in Batang Regency

Year	Type of Fishing Gear (Unit)						
	Gill net	Tremmel net	*Cantrang*	*Bubu*	*Arad*	Long line	Purse seine
2015	162	105	181	120	390	19	166
2016	170	106	250	125	388	21	174
2017	170	101	250	120	388	15	178
2018	190	101	245	145	360	19	130
2019	195	101	210	145	348	19	125
2020	195	101	210	145	348	19	125
2021	205	101	220	145	348	19	125

Source: Maritime Affairs and Fisheries Office of Batang Regency, 2022

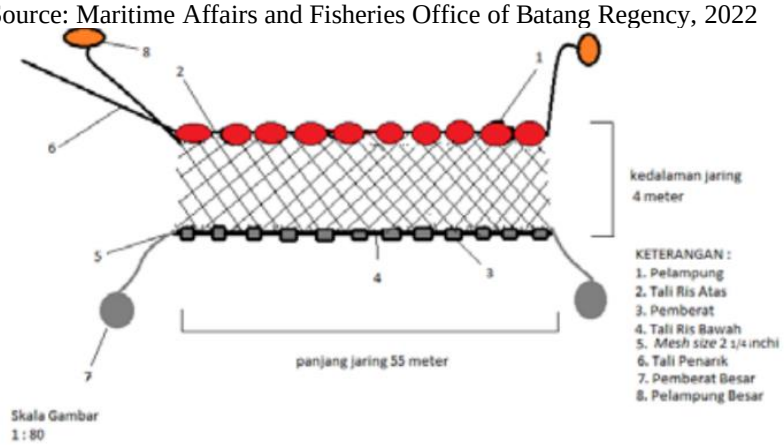

Figure 2. Gill net fishing gear in Batang District

Cost Analysis

Analysis of business feasibility costs for gill net fishing gear includes Total Costs, Variable Costs, and Fixed Costs. Cost is an important factor for determining the selling price of production and the cost of production. Ishak (2021) states that "Costs are cash or non-financial assets sacrificed for goods and services whose benefits are expected for the company in the present or in the future".

Fixed costs are costs that do not change or are not affected even though the volume of fishing activity changes. Fixed costs do not depend on the number of catches obtained. In fishing activities, costs included in fixed costs are maintenance costs and investment costs. Investment costs include the cost of purchasing fishing gear, ships, auxiliary equipment, and ship engines in fishing gear operations. The fixed costs incurred in fishing business activities using *Gil Net* fishing gear in the waters of Batang Regency can be seen in table 4 below.

Fixed costs, or total costs incurred by fishermen in fishing business activities with gill net fishing gear, are obtained from the total investment costs and maintenance costs. The total investment cost incurred to buy fishing gear, boats, main machinery, and auxiliary machinery amounted to IDR 50,000,000. The cost of investment will depreciate every year. The annual depreciation fee is obtained from the total purchase divided by the economic age or period of use of the item, so that the annual depreciation is obtained, which is IDR 12,011,905. The investment costs will also experience depreciation on each trip. Depreciation per trip is obtained from depreciation per year divided by the number of trips in a year. The number of trips in one year is 160 days, so the depreciation cost per trip is IDR 75,074.

In addition to investment costs, fishermen must also consider maintenance costs that must be incurred for the maintenance of fishing gear, vessels, main engines, and auxiliary engines. Maintenance costs can be obtained from the cost of one treatment multiplied by the period each year, so the value of maintenance costs per year is IDR 14,830,000, while the maintenance cost per trip is obtained from the maintenance fee per year divided by the number of trips in one year. The maintenance fee per trip is IDR 92,688. After knowing the investment costs and maintenance costs incurred, it can be seen that the fixed costs or total costs incurred in fishing activities with gill net fishing gear are IDR 167,762 for each trip.

Other costs incurred for operating fishing gear are variable costs. Variable costs are costs whose total changes in proportion to changes in the volume of activity. The higher the volume of activity, the higher of total variable costs and vice versa. Supplies are included in the type of variable costs. Supplies for gill net fishing gear in the form of diesel fuel, cigarettes, ice, food and auction distribution. Variable costs incurred in fishing business activities with gill net fishing gear in the waters of Batang Regency can be seen in table 5.

Table 4. Fixed Costs of Fishing Business with Gill net Fishing Gear

No	Kinds of Cost	Price (Rp)	Depreciation/yr (Rp)	Depreciation/trip (Rp)
1	Investment Cost			
	Catching instrument	7.000.000	7.000.000	43.750
	Boat	30.000.000	3.000.000	18.750
	Main Machine	6.500.000	928.571	5.804
	Auxiliary Machine	6.500.000	1.083.333	6.771
	Total investment	50.000.000	12.011.905	75.074
2	Maintenance costs			
	Catching instrument	2.350.000	2.000.000	12.500
	Boat	2.000.000	11.750.000	73.438
	Main Machine	260.000	780.000	4.875
	Auxiliary Machine	150000	300.000	1.875
	Total care	4.760.000	14.830.000	92.688
	Grand totals			167.762

Source: Research Results, 2022

Table 5. Fixed Costs of Fishing Business with Gill net Fishing Gear

No.	Types of Needs	Necessity	Price /item	cost/trip (IDR)
1	Diesel (liters)	15	6.900	103.500
2	Cigarettes (pack	2	20.000	40.000
3	Ice	4	5.000	20.000
4	Food	2	20.000	40.000
5	Auction fee	3%	558.284	16.749
	Total			**220.249**

Source: Research Results, 2022

Based on Table 5, it can be seen that the types of needs for going out to sea on gill net fishing gear are the costs of purchasing diesel fuel for fuel, ice for preserving catches, food, and cigarettes, it is also for auction fees. The need to go out to sea for 15 liters of diesel at a price per liter, it is IDR 6,900 and the total cost per trip of diesel is IDR 103,500. The need for smoking 2 packs costs IDR 20,000 per pack, and the total cost of cigarettes is IDR 40,000. The cost for 4 blocks of ice is Rp. 5,000 per block and the total cost for ice blocks is IDR 20,000. The total cost of food is IDR 40,000 for 2 meals. As for the auction levy, the total revenue is taken at 3%, with an income

value of IDR 558,284, an auction levy of IDR 16,749 is obtained.

The cost of going to sea is called variable costs. Variable costs incurred in gill net fishing business activities in the territorial waters of Batang Regency are IDR 220,249. These costs consist of purchase from diesel fuel, cigarettes, ice for preserving fish, food, and auction fees. The amount of operational costs incurred is influenced by the magnitude of required needs. The greater need, the greater cost, it is reinforced by Auralia, A. S., et al (2021) which states that "variable costs are costs incurred in variable amounts that can change each fishing operation; included in the variable costs in this *cantrang* fishing business are supplies, fees, and transportation services.

Total Cost

The total cost can be known from the total fixed costs and variable costs incurred on each trip. The total cost that must be spent on each trip by large fishermen is IDR 388,101. The total costs must be known in order to calculate the profit earned on gill net fishing gear operations. The value of total cost is influenced by the number of operational costs that must be incurred on each trip. The greater variable costs and fixed costs, the greater costs that must be incurred.

According to Juliana, L.M., Mudzakir, A.K., & Wijayanto, D. (2019), that "there are two kinds of costs, they are fixed costs and variable costs. Fixed costs are costs that are fixed for a certain period and do not depend on the level of production produced. Variable costs are costs that can change over a certain period of time depending on the level of production produced. In this case, it is the total cost that changes while the unit cost is fixed, for example, the cost of raw materials, the cost of piece labor, and the cost of auxiliary labor.

Receipt/Income Analysis

The income of gill net fishing gear fishermen in Batang Regency is divided into 3 seasons: famine season, ordinary season, and peak season. During the lean season, fishermen's income is IDR 205,000, which in this season is the smallest among the other 3 seasons. It is influenced by several factors, it includes the rainy season, high waves, and fishing intensity. Furthermore, the average income in the regular season is IDR 455,147, which in this season occurs from June to October. During the normal season, the income earned is greater than during the lean season. Income during the peak season averages IDR 1,014,706, because during the peak season fishermen usually get high-value catches such as Pomfret, White Snapper, Barracuda and Happy and the fishing intensity is higher. The average income of gill net fishermen is IDR 558,284 in one trip.

The income earned by fishermen generally varies from season to season. The famine season is a season when the catch is very small. Meanwhile, in the peak season, the catch is very large. It is rainforced by Nababan et al., (2020), which states that revenue is obtained through the sale of fish production, which depends on the amount of fish obtained and the price made when landed. In the fishing business, revenue is very uncertain, depending on the number of fish obtained (Tibrani, (2021). It depends on the condition of the waters of the fishing ground and the fishing season.

R/C Ratio analysis

R/C Ratio analysis is an analysis used to find out how far the results obtained through business activities in a certain time are profitable or not. The R/C ratio is derived from the proportion between total costs and total receipts. The calculation of the total income of IDR 558,284 divided by the total cost of IDR 388,010 yields the R/C Ratio obtained in gill net fishing business activities in the waters of Batang Regency of 1.4, meaning that the income received is greater than the costs incurred. The results of the analysis showed that the fishing activity effort received an R/C ratio of > 1, so that the activity was profitable and worthy of continuing. The R/C ratio is a comparison between total costs and total receipts. If the R/C ratio is getting bigger, the profit obtained is also greater.

Financial Aspect

The financial aspect is the benchmark for a feasibility study. It is stated even though other aspects are considered feasible. If the study of the financial aspects yields results that are not feasible, the project proposal is not accepted, which causes no economic benefits. In this study, a financial analysis was carried out with the economic life of the project within ten years, which assumes that one of the investments has a useful life of ten years.

Criteria for Environmentally Friendly Fishing Gear

The score weighting of gill net environmentally friendly fishing gear criteria in Batang Regency based on the results of this research questionnaire was adjusted according to the weighting criteria, namely the value 1-4 to determine the level of environmental friendliness of a fishing gear. Its weight is assessed according to 9 criteria for environmentally friendly fishing gear based on the provisions. The sample of respondents from fishermen using gill net fishing gear was 34 people spread from several areas in the Batang Regency area. The research results obtained on the gill net fishing gear management strategy, obtained the average value of each criterion for environmentally friendly fishing gear as follows.

In accordance with the nine criteria described in Table 6, it is found that the gill net fishing gear is environmentally friendly because the value of level from environmental friendliness of the gill net fishing gear is 30. According to Surbakti, J.A. & Sir, R. (2019), also explained that "the criteria for environmentally friendly fishing gear can be divided into four categories", namely the range of values that are very environmentally unfriendly get a value of 1–9, and not environmentally friendly get a value of 10–18. Eco-friendly gets a score of 19–27. Eco-friendly gets a score of 28–36. This is in line with research Isnaniah, et al. (2022), which stated "gill net fishing gear belongs to fishing gear that is environmentally friendly, does not damage habitats, is classified as safe for biodiversity, and is safe for biodiversity.".

An analysis of fishing gear is very necessary in carrying out tests because the fishing gear generally used by fishermen does not necessarily have a good level of environmental friendliness. Fishing gear that does not damage the aquatic environment (habitat or ecosystem of fish resources) and is

selective is environmentally friendly fishing gear (Surbakti, 2019). The characteristics of environmentally friendly fishing activities are that fish are caught uniformly, they do not catch protected species, and they are legal. A by-catch is a catch that is often thrown into the sea after being caught because it is less useful. Basically, gill net fishing gear is able to catch the main catch (*target catch*), it is fish, because the catch is dominated by the main catch (*target catch*), while the catch from gill net fishing gear is very little, which is not the main commodity of fishing. The *by catch* problem is the main problem in gill net fishing. The *by-catch* solution can be implemented through the use of by-catch, either for processed products, for self-consumption, or for resale. In accordance with the friendliness aspect of the resource habitat, the gilll nets that were tested tended to be friendly because there was no significant damage due to operating the tool (Rofiqo, et al, 2019). Then if other biota are stuck, thus the biota can be returned to the environment in good condition, it is due to the presence of 2 main factors, it is gill nets when operating do not reach the bottom of the water and gill nets are passive nets.

SWOT Matrix Analysis

According to Subaktilah et al,, (2018) stated that "systematic identification of various factors to formulate corporate strategy and policy makers". The analysis is based on logic that is able to optimize strengths and opportunities, but as a whole can minimize Weaknesses and Threats. At the strategic decision-making stage, it is always related to the development of the mission, goals and strategies of the stakeholders (strengths, weaknesses, opportunities and threats) in the current conditions. In accordance with the identification of known internal and external factors and the scoring of each factor, then the SWOT matrix is used to obtain alternative strategies that are suitable for internal and external factors in the development of superior commodities shown in table 7.

Table 6. Total Weighted Score and Average at each point Environmentally friendly Gill Net Fishing Gear in Batang District

No.	Criteria	Number of Respondents	Total Value Weights	Total Value Weights
1	Has high selectivity	34	85	2,5
2	Does not damage the habitat, dwelling and breeding of fish or other organisms	34	136	4
3	Does not harm fishermen	34	136	4
4	Produce good quality fish	34	102	3
5	The product does not harm the health of consumers	34	119	3,5
6	Minimum wasted catch	34	102	3
7	The fishing gear used must have a minimum impact on Biological Resources (biodiversity).	34	119	3,5
8	Do not catch species that are protected by law or endangered	34	102	3
9	Socially accepted	34	119	3,5
	Total Value Weighted Amount		1020	
	The average of the total criteria		30	

Source: Research Results, 2022

Table 7. SWOT Matrix Analysis

Internal factors / **External Factors**	**Strength (S)**	**Weakness (W)**
	S1. Good support from the central and regional governments in the form of training, outreach, or business assistance from the government **S2.** Availability of manpower who work as civil servants who are adequate and competent in the field of fisheries. (workforce with education levels of Senior High School, Diploma Degree, Bachelor degree and postgraduate degree) **S3.** There is a regional regulation in the field of fisheries that regulates the development of the fisheries sub-sector (Perda Kabupaten Batang No.3 of 2014) **S4.** Batang Regency has 1 Coastal Fishing Port (PPP) and 4 TPI, they are West Roban TPI, East Roban TPI, Celong FAP and Siklayu FAP which are active in fishing activities. **S5.** Proud to be a fisherman and skilled in fishing gear operation	**W1.** Facilities and infrastructure supporting the process of catching, handling, and distributing catches are inadequate. (Outside floors of TPI, MCK, buildings, damaged and shabby sewers) **W2.** Public awareness is still low in the management and utilization of fish resources **W3.** Not yet optimal facilities and infrastructure to support the fishing business. **W4.** Fishermen's education level is low, and human resource capacity is low. **W5.** Limited fishing area

OPPORTUNITY (O)	STRATEGY (SO)	STRATEGY (WO)
O1. There is a central regulation governing the fisheries sub-sector (Law Number 45 of 2009, KP Ministerial Regulation No. Per 71/Men/2016, KP Ministerial Regulation No Per. 58/Men/2021, and KP Ministerial Regulation No Per 59/Men /2021) **O2.** Prospects for fish selling prices are promising and market opportunities are available **O3.** Harmonious and safe socio-cultural conditions (with a crime rate of 2.7% compared to other cities/districts in Central Java province) **O4.** The development of small-scale capture fisheries **O5.** The potential for fish resources is abundant	**SO1**. Development of port facilities and fish auctions. **SO2**. Increasing small-scale fishing activities by developing environmentally friendly fishing gear **SO3**. Development of fishery business activities through optimizing business opportunities, services and promotions.	**WO1.** Optimization and development of infrastructure and facilities to meet fishing needs. **WO2.** Optimizing and evaluating the use of the APBD budget and eliminating budget discrepancies.
Threat (T)	**Strategy (ST)**	**Strategy (WT)**
T1. Uncertain natural conditions with daily rainfall of 11.16 days and average rainfall of 177.35 mm in 2020 **T2.** Fishing gear is not environmentally friendly. In 2019 there were 340 units of *cantrang* fishing gear and 406 *arad* fishing gear. **T3.** Status of catchment areas (WPP 712) that have been overfished with levels of exploitation of shrimp, red snapper, grouper and small pelagic fish with *overfishing* stock status **T4.** Lack of understanding in the use of technology in fishing **T5.** The form of processing catches is still traditional. Processing in the form of processed smoked, grilled and salted fish.	**ST1.** Increase oversight of law enforcement and strict sanctions against rule violators **ST2.** Improving the quality of human resources through training and coaching in the use of fishing technology, business management and diversification of catches in utilizing the potential of natural resources **ST3.** Price stability of fish caught using gill net fishing gear	**WT1.** Improving rehabilitation efforts and management development **WT2.** Modernization Development of fishing facilities, infrastructure and technology **WT3.** The need for an increase in environmentally friendly capture fisheries business. **WT4.** Develop procurement of environmentally friendly fishing gear and increase public awareness regarding the use of environmentally friendly fishing gear

Source: Research Results, 2022

Determination of *strategy priority*

Based on the data in table 7, it shows the selection of priority strategies for developing capture fisheries management strategies using gill net fishing gear in Batang Regency as follows:

1) Increasing small-scale fishing activities by developing environmentally friendly fishing gear. Based on the opportunities associated with this strategy, there is increasing fishing activities with environmentally friendly fishing gear so that the exploitation of natural resources can be well maintained, besides that the development of environmentally friendly fishing gear, it is expected to be a solution for effective fishing by fishermen. This opportunity can be optimized through fishing communities supported by local and central government who can regulate fishing gear that is more environmentally friendly, so that fishermen can abandon fishing gear that is prohibited by the government, and switch to fishing gear that is environmentally friendly and effective in catching.
2) Price stability of fish caught using gill net fishing gear. Based on the threats associated with the gill net fishing gear management strategy, one of which is the unstable price of fish caught due to uncertain natural conditions and the condition of overfishing fishing grounds, with the strength and support of the government, availability of manpower and local regulations that is expected to minimize the threats that hinder the development of

capture fisheries. To overcome the existing threats, it is necessary to stabilize the price of catches from gill net fishing gear at fish auctions or ports in Batang Regency. It also needs to be equipped with infrastructure such as cold storage to keep fish stocks and fish price stability.

3) Development of port facilities and fish auctions. Batang Regency has 1 type C fishing port, namely Klidang Lor PPP, and 4 Fish Landing Bases (PPI) or Fish Auction Places (TPI), namely West Roban TPI, East Roban TPI, Mangunsari FAP (Celong), and Siklayu TPI. The five ports are still active in carrying out fishing activities. However, the facilities at the port are still very limited and damaged. The development of facilities at fishing ports in Batang Regency needs to be carried out with the aim of increasing capture fishing activities. In addition, with adequate facilities, it will invite ships from other areas to enter the port in Batang Regency with the procedures that have been passed..
4) Improving the quality of human resources through training and coaching in the use of fishing technology, business management and diversification of catches in the utilization of natural resource potential. Based on the threat analysis on the gill net capture fisheries management strategy, there is the quality of human resources that do not understand and are adequate in carrying out fishing activities, it is appropriate from the coastal community in this case fishermen also know about sustainable fisheries so that natural resource control and upholding government regulations can be implemented optimally. Improving the ability of human resources can be done by utilizing coastal community groups to participate in supervising and enforcing the law in controlling the exploitation and management of fisheries and marine resources. Besides that, knowledge about business management and diversification of superior commodity fish needs to be carried out because superior commodity fish are not only sold in fresh form, superior commodity fish in Batang Regency are also sold in the form of processed products. The role of human resources in the government, both the central government and local government, will help fishermen know and learn about how to manage capture fisheries, the Maritime Affairs, Fisheries and Animal Husbandry Office of Batang Regency, which oversees the fishing community, is the foundation for developing the quality of coastal communities through the implemented programs. . therefore, it is necessary to have competent human resources to carry out programs, both outreach, counseling, or training to the community.
5) Development of fishery business activities through optimizing business opportunities, services and promotions. Development in the fishing business that is guided by environmentally friendly capture fisheries (sustainable fisheries), it has a big opportunity in the world of capture fisheries business. Business opportunities for coastal communities (fishermen) with the development of a measurable and environmentally friendly capture fisheries business will help restore their natural resources. The development of the capture fisheries business needs to be carried out to increase the selling value of commodity fish outside the region by creating business opportunities in the fisheries sector, improving services and expanding promotions.
6) Increasing supervision of law enforcement and strict sanctions for violators of regulations. Most fishermen in Batang Regency still use fishing gear that is not environmentally friendly and prohibited by the government through Maritime Fisheries Regulation No. 02 of 2015, such as *cantrang* and *arad* where the number of fishing gear is shown in the table. Supervision and law enforcement against the use of fishing gear that is not environmentally friendly or prohibited fishing gear aims to prevent damage to marine biodiversity, large-scale capture and capture of marine biota that are not yet suitable for catching due to the use of fishing gear that has low selectivity. In addition, law enforcement against the use of non-environmentally friendly fishing gear aims to maintain an abundance of superior commodity fish production every year. Efforts to improve supervision of the use of non-environmentally friendly fishing gear can be carried out by strictly enforcing regulations, and conducting socialization to fishing communities in Batang Regency about the impact of using non-environmentally friendly fishing gear. In addition, support from the government by encouraging people to use environmentally friendly fishing gear through socialization, field technical tests, and business management can be a program carried out by the government.
7) Optimization and development of infrastructure, it is also facilities to meet the needs of supporting fishing. Inadequate infrastructure and facilities lead to less optimal fishing activities in terms of catching, processing and distribution of catches. Optimization of facilities and infrastructure needs to be carried out, such as procurement of cold storage, repair of breakwater, jetties, docks, and other facilities that support fishing activities. In addition, dredging at the mouth of river is one of the hopes from the coastal community to carry out the program every year because the silting of river mouths, which often occurs, becomes an obstacle for ships to dock at ports or TPI, disrupting the cold chain in fishing activities.
8) Need to an increase in environmentally friendly capture fisheries businesses. The existence of government regulations regarding the prohibition of fishing gear that is applied to fishing communities, it has the potential to develop environmentally friendly fishing gear. The lack of effectiveness in catching rates using environmentally friendly fishing gear, such as gill nets, causes their use to not be optimal, and besides that, it causes this fishing gear to only become seasonal in coastal communities.
9) Develop the procurement of environmentally friendly fishing gear and increase public awareness about the use of environmentally friendly fishing gear. Another capture fisheries management strategy is a program to procure environmentally friendly fishing gear (gill net) to replace fishing gear banned by the government, such as *arad* and *cantrang*. The lack of public awareness about the use of fishing gear that damages the environment and is prohibited by the government through Permen KP Number 2 of 2015 must be understood together with the many outreach efforts to fishing communities that are useful for promoting awareness of the importance of making the best use of natural resource potential.

10) Development of modernization of fishing facilities, infrastructure, and technology. Modernization in the world of fishing, especially gill net fishing gear, needs to be carried out both in terms of fishing facilities, fishing supporting infrastructure, and technology applied in fishing. Fishing facilities both boats, fishing gear, main engines, and fishing auxiliary machines need to be developed. Fishing vessels must be equipped with a cool box, or hold as a place to store fish so that the cold chain is properly maintained. Gill net fishing gear as a fishing tool needs to be modified to maximize catch by adjusting the fishing season such as the demersal fishing season using bottom Gill nets while during the pelagic fish season using *surface* gill nets. Fishing infrastructure as a support for fishing, such as moorings for boats, fish auctions, ports, and breakwaters, must be further developed. Besides that, fishing technology is no less important for the development of gill net fisheries to support the fishing process, such as fish finders, Eco Sounders , and GPS.
11) Improving rehabilitation efforts and management development. Rehabilitation in the Gill net capture fisheries management strategy is focused on the threat of overfishing from its natural resources. The existence of program activities from the government to fishermen, such as the fish apartment program, will be very helpful for the development of fish resources. Besides that, the stocking of fish seeds (restocking) in the fish house area will become an ecosystem that will continue to develop to overcome overfishing that occurs in fishermen's fishing areas.
12) Optimizing and evaluating the use of the APBD budget and eliminating budget discrepancies. The use of regional budgets that have not been properly absorbed is an opportunity for fishermen to be able to propose programs in fishing development. One of them is requesting assistance from the regional government for the development of fishing. Programs from the government, such as the replacement of non-environmentally friendly fishing gear, have not been distributed evenly; therefore, it is necessary to optimize and evaluate the use of the budget and eliminate budget discrepancies so that the APBD can be used optimally.

CONCLUSION

Based on the results, it can be concluded that gill net capture fisheries are seen to be increasingly being used by fishermen in Batang Regency. Meanwhile, the Gill net capture fisheries business in Batang Regency is still profitable to implement. Environmentally friendly Gill net fishing gear based on *Code of Conduct for Responsible Fisheries (CCRF)* is classified as environmentally friendly fishing gear. The strategy chosen in the development of capture fisheries using Gill net fishing gear is based on the main priority strategy, they are increasing small-scale fishing activities by developing environmentally friendly fishing gear and stabilizing the price of fish caught using Gill net fishing gear. Development of port facilities and fish auctions and improving the quality of human resources through training. Guidance in the use of fishing technology, business management, and diversification of catches in the utilization of natural resource potential.

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