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Management of environmentally friendly fishing gears based on the code of conduct for responsible fisheries in Pidie District

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Abstract. Fishery management is all efforts that are integrated in laws and regulations in the field of fisheries to achieve sustainable productivity of aquatic biological resources. Fishery management activities in a water area with a high number productivity of fish resources have to pay attention to aspects that can support of goal the achievement of environmentally friendly and sustainable fisheries management. Pidie District is located in the east of Aceh which is directly opposite the Malacca Strait and has a high productivity of fish resources using various fishing gear. The purpose of this study was to determine the management strategy for environmentally friendly fishing gear based on the code of conduct for responsible fisheries (CCRF) in Pidie District. The data analysis method used in this research is descriptive, scoring, and SWOT analysis. The results, strategies used within environmentally friendly capture fisheries management are enhancement, monitoring, and law enforcement upon the un-selective fishing gears that tend to be destructive, optimize human resources in utilizing fish resources to environmentally friendly capture fisheries management in both of pre-production to post – production, improve the capacity of facilities and infrastructure in supporting environmentally friendly capture fisheries operations, monitor fisheries activities as well surrounding areas of port upon the pollution that harms environmental quality order, and socialization upon the used of environmentally friendly current technologies.

1. Introduction

Capture fisheries in Indonesia have a big role in world capture fisheries production. This is stated in the report [1] which states that Indonesia has contributed to world catch production by 7.19% (6.54 million tonnes) in 2016. Fishery products are one of the commodities that are traded internationally, which have a high selling value [2]. The total national fishery production in Indonesia until the fourth quarter of 2017 is 23.26 million tons, consisting of capture fisheries 6.04 million tons and aquaculture 17.22 tons [3]. Capture fisheries production is spread throughout the Indonesian marine fisheries area with an area of 5.8 million km² (archipelagic waters covering an area of 3.1 million km² and ZEE waters covering an area of 2.7 million km²) [4]. The prospect of fisheries and marine development in Indonesia has the opportunity to drive economic growth. This can be seen from the data on the growth



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in the gross domestic product value of the Indonesian fisheries sector which is always above the national gross domestic product value and the gross domestic product value in the agricultural sector [5]. The availability of great potential in the marine and fisheries sector can be a way for Indonesian people to prosper. To make it happen, it is necessary to manage fish resources that are environmentally friendly and sustainable [6].

Fisheries management plays a very important role in realizing sustainable fisheries, especially for important commodities [7]. Sustainable fish resource management does not prohibit fishing activities that are economic/commercial in nature, but the level of utilization does not exceed the carrying capacity of the ability to recover from fish resources (MSY), so that future generations will still have fish resource assets [8]. The management of the capture fisheries sector must be carried out in an environmentally friendly and sustainable manner so that the preservation of its resources is sustainable and there is no overfishing [9]. Fishery management is important to do to prevent over exploited and over capacity [10]. Currently, Indonesia's capture fisheries have experienced overfishing (Decree of the Minister of Marine Affairs and Fisheries NO. 47/2016), so it is a risk to its sustainability. This is due to the fact that current fishing is carried out by hunting brutally which results in not optimal utilization [11]. Therefore, it is necessary to develop capture fisheries that are environmentally friendly and sustainable [12].

The development of environmentally friendly and sustainable capture fisheries can be carried out by taking into account several aspects, namely economic, ecological, social and institutional aspects [13]. The main objective of developing environmentally friendly and sustainable capture fisheries is to improve the welfare of all people involved in the fisheries sector [14]. The fisheries development aspect greatly influences the management of capture fisheries that are environmentally friendly and sustainable. Such as the use of environmentally friendly fishing gear, using modern technology that is environmentally friendly and sustainable will not cause a decrease in fish resources and even become extinct. Therefore, this research was conducted with the aim of determining the management strategy for environmentally friendly fishing gear based on the code of conduct for responsible fisheries (CCRF) in Pidie District, by examining aspects of its development in order to improve fishermen's welfare by maintaining the sustainability of fisheries resources and environmental sustainability so that they can be used for the future.

2. Material and Method

2.1. Method of Collecting Data

This research was conducted in March 2019 and April - July 2020 in the waters of Pidie District. The data collected in this study consisted of primary data and secondary data. The population in this study is all types of fishing gear that operate in the waters of Pidie District. Sampling was done using probability sampling method. Probability sampling is a sampling technique that provides equal opportunities for each member of the population to be sampled [15]. In this study, 5 units of each fishing gear were sampled from each population (Table 1).

Table 1. Types of fishing gear and the number of sampling.

No	Type of fishing gear	Number of samples
1.	Longline	5 unit
2.	Handline	5 unit
3.	Gillnet	5 unit
4.	Modified beach seine	5 unit
5.	Purse seine	5 unit
6.	Beach seine	5 unit

2.2. Data Analysis Method

Analysis of environmentally friendly capture fisheries management strategies based on the code of conduct for responsible fisheries in Pidie District uses a SWOT analysis. SWOT analysis is a way of systematically identifying various factors in order to formulate a change strategy. This analysis is

based on logic that maximizes strengths and opportunities, but at the same time minimizes weakness and threats [16]. The SWOT matrix can illustrate how the external opportunities and threats faced by a company can be matched with internal weaknesses and strengths to produce four groups of possible alternative strategies.

The arrangement of the three matrices in the SWOT analysis can be weighted. The weighting stage used is as follows:

- 1) Compiling a list of factors that are considered important influences as internal factors and external factors for an environmentally friendly fishing gear management strategy based on the code of conduct for responsible fisheries in Pidie District.
- 2) Assessment of the weight of each internal strategic factor and external strategic factor. Weighting aims to quantify the internal and external factors that have been analyzed.
- 3) Give weight to each of the internal strategic factors and external strategy factors, starting from 1.00 (very important) to 0.00 (not important).

The weighting of each strategy factor will be ranked according to its importance. The factors included in the IFE and EFE matrices, the number of weighted values can range from 1.00 the lowest in 4.00 the highest and 2.5 as the average. A total weighted score that is far below 2.5 is a sign of a weak organization internally, while a total weighted value that is far above 2.5 indicates a strong organization position internally. Furthermore, it will be determined the preparation of several alternative strategies using the SWOT matrix.

This analysis matrix can clearly describe how the external opportunities and threats faced can be adjusted to the internal strengths and weaknesses of an environmentally friendly capture fisheries management. The resulting strategy is: S-O strategy that uses elements of strength to take advantage of opportunities. The S-T strategy uses the element of strength to overcome threats, the W-O strategy takes advantage of opportunities to minimize the element of weakness and the W-T strategy minimizes the element of catch weakness to avoid threats. The pattern of developing a capture fisheries management strategy described in this study is a combination of various factors of strengths, weaknesses, opportunities and threats. Therefore, an appropriate alternative strategy is made to be developed in environmentally friendly capture fisheries management based on the code of conduct for responsible fisheries in Pidie District.

3. Results and Discussion

Strategy for managing environmentally friendly fishing gear

A strategy for managing environmentally friendly fishing gear based on the code of conduct of responsible fisheries in Pidie District can be formed by knowing the factors related to the management of fishing gear, both internal and external factors. The description of the identification results of the components of the SWOT analysis obtained in Pidie District is described further.

Formulating an environmentally friendly fishing gear management strategy based on the code of conduct of responsible fisheries in Pidie District, needs to consider various factors that influence both internal and external factors. The identification of IFE and EFE in Pidie District has boundaries related to capture fisheries management in general. Before determining a development strategy, it is necessary to first know the internal factor evaluation and external factor evaluation then look for the score by multiplying the weight by the rating. The weight and rating values are determined from the results of interviews with respondents in the field. The total weight of internal factors and external factors is given a value of 1.00 with a comparison of the number of subtotals that are the most dominant and have a greater number of values. The rating value is determined based on the level that has the most influence on capture fisheries management based on the code of conduct of responsible fisheries in Pidie District.

Internal factors. Internal factors that become the strength element to develop a strategy for managing environmentally friendly fishing gear in Pidie District are divided into 8 elements. Internal factors that are an element of weakness in improving the management strategy for environmentally friendly fishing gear in Pidie District are divided into 7 elements. The total score for internal factor

evaluations was 3.24, consisting of strengths and weaknesses. On the internal factor, it can be seen that the element of strength is more dominant than the element of weakness which affects the management of environmentally friendly fishing gear in Pidie District. The total internal factor is 2.93, which means that the internal conditions of environmentally friendly fisheries management in Pidie District are dominated by the strengths that encourage the management of fishing gear. To simplify the translation of internal factors.

Faktor eksternal. External factors which become an element of opportunity to develop a strategy for managing environmentally friendly fishing gear are divided into 5 elements. External factors which become an element of opportunity to develop a strategy for managing environmentally friendly fishing gear are divided into 5 elements. The total score for External Factor Evaluations was 3.21, consisting of elements of opportunity and threat. From external factors, it can be seen that the element of opportunity is more dominant than the element of threat that affects the management of environmentally friendly fishing gear in Pidie District.

The value obtained from the external factor evaluation matrix is 3.21. The value of internal and external factors is far above the average of 2.5, which means that the conditions of fishing gear management in Pidie District have responded positively to the development of environmentally friendly fishing gear based on the code of conduct for responsible fisheries. The opportunities that exist have been able to be utilized to minimize existing weaknesses.

Based on the IFE matrix [17], the results of the internal factor evaluation matrix and the external factor evaluation matrix are in cell I, which is to maintain and maintain the existing strengths in Pidie District with the various opportunities they have to develop environmentally friendly fishing gear management based on code of conduct for responsible fisheries. The state of Pidie District fishing gear management in cell I indicates a development strategy through market expansion, adding and improving facilities as well as improving environmentally friendly technology. So that the level of fishing gear management strategy with the technical, environmental, and socio-economic aspects is in a fairly good category [16].

The SWOT matrix describes the strengths and weaknesses possessed by adjusting the opportunities and threats faced in the management of environmentally friendly fishing gear based on the code of conduct for responsible fisheries in Pidie District. The SWOT matrix can also recommend or describe strategic options that can be developed in environmentally friendly fishing gear management, especially in Pidie District through a combination of internal and external factors. These alternative strategies have been sorted based on priorities in the strategy for the management of environmentally friendly fishing gear based on the code of conduct for responsible fisheries in Pidie District. The complete SWOT matrix is presented in Table 6 below.

The W-O strategy is intended to use the elements of existing weaknesses and take advantage of opportunities. The number of very profitable capture fisheries business activities [18]. On the other hand, many penalties have been given to foreign fishermen who carry out illegal fishing in Aceh waters [19].

Tabel 2. Matriks SWOT.

Internal	Strengths (S)	Kelemahan (W)
	1. Has an institutional Panglima Laot	1. Fishermen education is relatively low
	2. Using fishing gear that has relatively high selectivity	2. Fishermen have not used modern technology
	3. Awareness of fishermen to produce high quality	3. The fuel station for fishermen is not functioning properly
	4. The use of fishing gear does not damage the environment	4. Fishing ports have not been used optimally
	5. Do not catch fish protected	5. Fish handling does not pay attention to quality
	6. The fishermen are still young and productive	

Eksternal	7. The fishing business is still very profitable	6. Lack of fisheries education to fishermen
	8. The high demand for fish	7. Do not have a representative fishing port
<u>Opportunity</u>	<u>S-O strategy</u>	<u>W-O Strategy</u>
1. Development of environmentally friendly fishing gear	1. Increased supervision of environmentally friendly fishing gear	1. Increase the capacity of capture fisheries facilities and infrastructure
2. Good market opportunities and distribution of caught fish	2. Guarantee the quality of the fish caught is better	2. Support the operation of environmentally friendly fishing gear
3. The existence of regulations and management zones for environmentally friendly capture fisheries	3. Imposing strict sanctions for fishermen using destructive fishing gear	3. Prohibit all forms of fishing gear that are not environmentally friendly
4. Development and construction of representative fishing ports	4. Development of a representative fishing port and not using a watershed as a fishing port location	
5. The growth of fishing units is getting higher	5. Provide guidance and training for fishermen	
<u>Threat</u>	<u>S-T Strategy</u>	<u>W-T Strategy</u>
1. Siltation of rivers as the entry point for ships to fishing ports	1. Improved monitoring of capture fisheries activities around river basins	1. Counseling to fishermen on the importance of technology in exploiting fish resources without neglecting the values of local wisdom
2. Flood disasters can occur at any time	2. Increasing the institutional capacity of Panglima Laôt as the adat laôt (local wisdom)	2. Integrated management to maintain and improve the function of aquatic ecosystems, especially in maintaining sustainable local wisdom values
3. Pollution around fishing ports and waters by community and fishermen activities	3. Increasing skilled human resources	3. Cooperation of various parties in the effort to combat IUU fishing
4. The use of destructive fishing gear by foreign fishermen	4. Development of fishing vessel and fishing gear that are efficient, effective and environmentally friendly	
5. The scarcity of subsidized fuel for fishermen		

The W-T strategy is intended to use the elements of weakness and minimize existing threats. Many threats from outside, easily affect the existing management. The main thing that must be done is socialization and guidance on the use of the latest and environmentally friendly technologies. Socialization is communication in external relations that must be considered. Communication between stakeholders is needed so that coordination occurs between related parties so that policies issued can produce output as expected or at least minimize imbalances due to errors due to lack of communication and coordination.

These alternatives are expected to be able to assist in realizing environmentally friendly capture fisheries management based on the code of conduct for responsible fisheries in Pidie District, so that it runs conducive and sustainable. This strategy was developed to optimize the synergy of capture fisheries management with environmentally friendly aspects in Pidie District. Factors that have a positive impact (strengths and opportunities) can be used to overcome existing weaknesses and threats, and even take advantage of these strengths and opportunities together to produce a better positive impact [16, 20].

Realizing this alternative strategy cannot be separated from the policies that have been set and must be adhered to by all stakeholders who play a role in a capture fisheries management activity in an area. Fisheries experts or fisheries offices are able to collaborate with fishermen in developing human resources by providing socialization and guidance on the latest technology in fishing to processing activities. Improving the quality of recording data on catches must be monitored in fishery activities. Fishermen are urged to be able to cooperate with institutions and organizations to make it easier for the government to collect data, provide subsidies so that all fishermen get an appropriate ration and do not escape the subsidy distribution. In addition, fishermen are able to make the best use of the facilities and infrastructure that have been provided to meet fishermen's needs. It is hoped that the handling of fish catches will be able to participate in all socialization and play an active role in innovation to develop high quality products with high selling prices. Fish traders must also be able to cooperate with the government in capitalizing and maintaining the quality of fish by means of laboratory quality testing of fish before trading so that it is safe for consumption.

4. Conclusion

The management strategy for environmentally friendly fishing gear based on the code of conduct for responsible fisheries in Pidie District is the improvement, supervision and law enforcement of fishing gear that is not selective and tends to damage, optimizing human resources in the use of fish resources for environmentally friendly capture fisheries management production to post-production, increasing the capacity of facilities and infrastructure that support environmentally friendly fishing operations, increasing monitoring of fishery activities and areas around the port for pollution that can damage environmental quality arrangements, and socialization in mentoring the use of the latest environmentally friendly technology, and port construction fisheries that are representative and do not use watersheds as port locations. Conduct training for fishermen

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