Resources Management Strategy For Mud Crabs (*Scylla* spp.) In Pemalang Regency

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Abstract. The aim of this research is to develop resources management strategies of mud crab (*Scylla* spp.) in Pemalang Regency. The method used is descriptive survey in a case study. This research used primary data and secondary data. Primary data were collected through field observations and in-depth interviews with key stakeholders. Secondary data were collected from related publications and documents issued by the competent institutions. SWOT Analysis was used to inventory the strengths, weaknesses, opportunities and threats. TOWS matrix was used to develop an alternative of resources management strategies. SWOT analysis was obtained by 6 alternative strategies that can be applied for optimization of fisheries development in Pemalang Regency. The strategies is the control of mud crab fishing gear, restricted size allowable in mud crab, control of mud crab fishing season, catch monitoring of mud crab, needs a management institutions which ensure the implementation of the regulation, and implementation for mud crab aquaculture. Each alternative strategy can be synergized to optimize the resources development in Pemalang Regency.

1. Introduction

Mangrove forest in Pemalang Regency is producing mud crab and has an area measuring 120.39 hectares of mangrove ecosystem to be used. In addition, the location is in coastal areas or boundaries to the Java Sea and can be utilized in the development of the fisheries sector especially in captured fisheries. The potential for sustainable (Maximum Sustainable Yield / MSY) fisheries resources in Indonesia is estimated at 6.4 million tons per year, whereas potential that can be exploited (allowable catch) of 80% of the MSY is 5.12 million tons per year [1]. The production of mud crab catches in Pemalang Regency in 2006 reached 11.89 tons [2].

There are 4 types of fishing gears to catch mud crab in Pemalang Regency and mud crabs have become a target catch or by catch. This research used two types of fishing gears; gill net and Badong (trap) because they are the dominant fishing gears. Rod and Cone were not analyzed because the limitations of the data sources and difficulty in identification, and because Ulujami sub district also provide a mangrove tour in which visitors can freely capture mud crab. The catches from this activity is difficult to identify as the fish are not directly captured by local fishermen.

In addition, mud crabs caught by fishermen generally measure less than 15 cm. Minister of Marine and Fishery (PERMEN-KP) Regulation No. 1 year 2015 states the prohibition of catching mud crab in spawning condition and carapace width of less than 15 cm. Therefore there needs to be a strategy to

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manage resources of mud crab in Pemalang Regency in a sustainable way so that resources and can provide high economic benefits for fishermen.

2. Method

The method used is descriptive survey in a case study. The aim of a descriptive study is to create descriptive, factual and accurate information of facts, and the relationship among the phenomena investigated. In other words, the survey method is to obtain facts and phenomena that exist and seek explanations of fact, either from social, economic, or political institutions in an area [3]. The case study is to select in depth cases only at a specific time and place, while the results do not necessarily apply to different times and places although the target object is the same [4].

2.1. Data Collection

This research used both primary and secondary data. Primary data were collected from field observations and in depth interviews with stakeholders. Respondents in this study include civil servants from the marine and fisheries department (two persons), employees of Asem Doyong fishing port (two persons), fisherman (two persons), fish traders (one person), and lecturer (one person). On the other hand, secondary data were collected from publications and documents issued by the competent authority.

2.2. SWOT Analysis

To gather information about mud crab management resources, we conducted an analysis of the strengths, weaknesses, opportunities, and threats (SWOT). A SWOT analysis is a simple and flexible tool, consisting of gathering opinions from a knowledgeable body of people familiar with a particular business or industry to help evaluate internal strengths and weaknesses, as well as external opportunities and threats.

Applications of SWOT to marine and fresh water fisheries have appeared in recent years in peer-reviewed journals [5-7] and government reports [8]. Recently, SWOT analysis was used to compare the strengths and weaknesses of alternative discard mitigation approaches to achieve mandates under the 2012 reform of the European Union's Common Fisheries Policy that bans future fishery discards [9].

Furthermore, researches using SWOT analysis to develop these strategies have been carried out by several researchers, both in terms of business strategies [10-16] and public policy strategies [17-21]. Some other research developed fisheries strategies using the TOWS matrix. In the TOWS matrix, there are four strategy types, i.e. SO strategy (integrating the strengths and opportunities), ST strategy (integrating the strengths and threats), WO (integrating the weaknesses and opportunities), and WT (integrating the weaknesses and threats).

3. Results and Discussion

3.1. Strengths

Ulujami Sub district is a coastal area or boundary to the Java Sea and can be utilized in the development of the fisheries sector. Its geographical condition supports fishing activities, thereby allowing the development of the fisheries sector, especially captured fisheries. Ulujami Sub district also has a mangrove ecosystem area measuring 120.39 hectares. The production of mud crab catches in Pemalang area in 2006 reached 11.89 tons [2]. This research made use of gill net and Badong (trap) because they are considered legal and not listed in the regulation the Minister of Marine and Fishery No. 2 of 2015 on the restriction of the use trawls and seine nets fishing gear at all fishery management areas in Indonesia.

Based on the aforementioned facts, several strengths that can be optimized for the resource management strategy of mud crab in Pemalang Regency are formulated. Some of these strengths are as follow:

1. The potential geography in Pemalang regency (Code: S1)
2. The availability of fisheries potential resource (Code: S2)
3. The fishing gears that are considered legal (Code: S3)

3.2. Weaknesses

There are many regulations regarding catching mud crab with the purpose of regulating these fishery activities. On the other hand, many fishermen do not understand those regulations because their implementation by the authorities in charge is not firm. Supervision and control of the stock resources especially mud crab needs to be done by the authorities so that the waters are not over-exploited. In addition, mangrove tour activities are a particular concern because mangrove tours allow visitors to freely capture mud crab. Yet another problem is the difficulty faced by fisherman to obtain capital from either banks or financial institution.

Based on those aforementioned facts, several weaknesses that can be optimized for the resource management strategy of mud crab in Pemalang regency are formulated. Some of these strengths are as follow:

1. Less attention to regulation implementation (Code: W1)
2. Less attention to supervision (Code: W2)
3. High cost of fishing operational (Code: W3)

3.3. Opportunities

Mud crab is one of the marine commodities with important economic values. Based on interviews with local fishermen, mud crab sold for high prices. Mud crab is of higher value than blue swimming crab when they are fresh. Despite having been harvested for a longer period than blue swimming crab, mud crab has better freshness level. Consumer demands for mud crab continue to increase. One of the policies in fishery in 2015 is to improve the prosperity of fishermen. This is in addition to the Regulation of the Minister of Marine and Fishery (PERMEN-KP) No. 1 year 2015 on prohibition of catching mud crab in spawning condition and carapace width of less than 15 cm, which is a good policy to preserve the habitat and maintain the stock of particular mud crab for sustainable fisheries.

Based on the aforementioned facts, several opportunities that can be optimized for the resource management strategy of mud crab in Pemalang regency are formulated. Some of these opportunities are as follow:

1. Increased income for mud crab fisherman (Code: O1)
2. Consumer demand vs increasing yield of mud crab (Code: O2)
3. The national fishery policy (Code: O3)

3.4. Threats

Based on interviews with local fishermen, mud crab production is already decreasing. CPUE value calculation that decreased in 2010 and 2015 were analyzed in this research. The market price is uncertain depending on the extent of mud crab supplies. This situation is detrimental to fishermen. At peak season prices are low and there is no guaranteed market price for mud crab.

Based on the aforementioned facts, several threats that can be optimized for the resource management strategy of mud crab in Pemalang regency are formulated. Some of these threats are as follow:

1. Reduced production of mud crab (Code : T1)
2. Less capital support (Code : T2)
3. No guaranteed market price for mud crab (Code : T3)

3.5. Alternative Strategies

Results of SWOT analysis can be used to develop an alternative strategy using the TOWS matrix. Alternative strategies can be divided into four groups, i.e. SO, ST, WO and WT in Table 1 and Table 2.

Table 1. Alternative Strategies for Mud Crab in Ulujami sub-district,Pemalang using the TOWS Matrix

IFAS	**Strength (S)** 1. Potential geography of Pemalang regency (Code: S1) 2. Available fisheries potential resource (Code: S2) 3. Legal fishing gears (Code: S3)	**Weakness (W)** 1. Less attention to regulation implementation (Code: W1) 2. Less attention to supervision (Code: W2) 3. High cost of fishing operational (Code: W3)
EFAS		
Opportunities (O) 1. Increased income for mud crab fishermen (Code: O1) 2. Consumer demand vs increased mud crab yields (Code: O2) 3. National policy on fishery (Code: O3)	Strategy SO 1. Control of mud crab fishing gears (S1, S2 , S3, O1 , O2, O3)	Strategy WO 1. Restricted allowable size of mud crab (W1, W2, O1, O2, O3)
Threats (T) 1. Reduced mud crab yields (Code: T1) 2. Less capital support (Code: T2) 3. No guaranteed market price for mud crab (Code : T3)	Strategy ST 1. Control of mud crab fishing season (S2, S3, T1, T3) 2. Catch monitoring of mud crab (S1, S2, S3, T1, T3)	Strategy WT 1. A management institution to ensure implementation of regulation (W1, W2, T1) 2. Implementation of mud crab aquaculture (W3, T2, T3)

Table 2. Review of Alternative Strategies for Mud Crab in Ulujami Sub district, Pemalang

No.	SO Alternative Strategy	Review
1.	Control of mud crab fishing gears	The purpose of control is to reduce incidence of unintentional catch of small-sized mud crab. The fishing gear should come with escape gaps, especially for badong (trap), so that small-sized mud crabs can run away and grow to their mature size for future consumption.
	Alternative Strategy	
2.	Restricted size of allowable mud crab	The size of mud crabs before mature or gonad is 10cm (Wijaya et al., 2010). Regulation of the Minister of Marine and Fishery (PERMEN-KP) No. 1 year 2015 prohibits the catching mud of crab in spawning condition and carapace width of less than 15 cm to ensure the sustainability of mud crab resource. The Solutions to Badong fishing gear is by designing the escape gap so that mud crab carapace with width of less than 6cm can get away from Badong. On the other hand, the gill net fishing gear needs to be used properly via proper communication with the local fishermen.
	ST Alternative Strategy	
3.	Control of mud crab fishing season	Based on the results of interviews with local fishermen, it is known that mud crab's peak season is from January to April, while its regular season is in May, July, Nov, and December, and the lean season is from August to October. In addition, April and June show mud crabs laying mature gonads [22].

		So, the alternative is that this is the close season for mud crab harvesting.
4.	Catch monitoring of mud crab	Research shows that mud crab catch in the peak season is abundant that some are discarded prior to selling them to traders as the handling proses is not proper. Hence, the alternative is to conduct socialization and counseling concerning the proper handling of mud crab catch. This will improve its selling value, which may include not only for consumption but also for soft-shelled crab farming (aquaculture).
	WT Alternative Strategy	
5.	A management institution that ensures implementation of regulation is required.	Management institution here is a group consisting of several elements of fishermen, fish traders, businessmen, and government officials for the supervision and control of regulation and the local wisdom that aims to manage mangrove crabs farming to be sustainable. One good example of this is the POKMASWAS (Community Supervising Group). Meetings among the entities here should be done regularly on a yearly basis for necessary reviews to be made.
6.	Implementation of mud crab aquaculture	Mud crabs size of less than 6 cm sis till worth selling for consumption. The Solution for this is to use this carapace for soft-shelled mud crab farming activities (aquaculture), so it will have a higher reselling value.

4.Conclusion

It can be inferred from the analyses above that there are 6 alternative strategies that can be applied for optimization of the resource management strategy in Pemalang regency. These strategies include controlling mud crab fishing gears, restricting mud crab size for consumption, controlling mud crab fishing season, monitoring mud crab catch, founding a management institution that ensures the implementation of the regulation, and implementing mud crab aquaculture.

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