



## Development Strategy of Mangrove Crabs (*Scylla* sp.) Cultivation in Gorontalo Province

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*Received 4 November 2019; Accepted 13 February 2020; Available online 31 Mei 2020*

### ABSTRACT

Mangrove crabs (*Scylla* sp.) are important economic fishery commodities that will be developed in Gorontalo Province. Mangrove crabs have large and prospective market opportunities in the domestic and foreign market. The mangrove crabs demand in this country is very high. Market demand for mangrove crabs has not been able to be fulfilled, because of the limited catch and the production of aquaculture which is still very minimal. The problem is how the development of mangrove crab cultivation will be applied in Gorontalo Province. The purpose of this research was to study and determine the development strategy of mangrove crab cultivation in Gorontalo Province in accordance with the potential and carrying capacity of the environment. The researched method was survey method with observational data collection and random sampling techniques. Data analysis was performed descriptively and SWOT analysis. Based on the SWOT analysis the strength (S) most influential on the development of mangrove crab culture in Gorontalo Province is government support and profitable business prospects (0.66), while the biggest weakness is the limited capital (0.54) and the low quality of human cultivation resources (0.48), and the biggest opportunity (O) is economic value (Very popular, because it is delicious and contains high nutritional value) (0.8), and threat (T) environmental degradation (0.8). Based on the quadrant of the analysis is in quadrant 1 (Growth Oriented Strategy).

**Keywords:** Development, Strategy, *Scylla* spp, Cultivation, Gorontalo Province

### ABSTRAK

Kepiting bakau (*Scylla* sp.) adalah komoditas perikanan ekonomi penting yang akan dikembangkan di Provinsi Gorontalo. Kepiting bakau memiliki peluang pasar yang besar dan prospektif di pasar domestik dan asing. Permintaan kepiting bakau di seluruh negeri sangat tinggi. Permintaan pasar untuk kepiting bakau belum dapat terpenuhi, karena terbatasnya tangkapan dan produksi akuakultur yang masih sangat minim. Masalahnya adalah bagaimana pengembangan budidaya kepiting bakau akan diterapkan di Provinsi Gorontalo. Tujuan dari penelitian ini adalah untuk mempelajari dan menentukan strategi pengembangan budidaya kepiting bakau di Provinsi Gorontalo sesuai dengan potensi dan daya dukung lingkungan. Metode penelitian adalah metode survei dengan pengumpulan data observasi dan teknik pengambilan sampel acak. Analisis data dilakukan secara deskriptif dan analisis SWOT. Berdasarkan analisis SWOT kekuatan (S) yang paling berpengaruh pada pengembangan budaya kepiting bakau di Provinsi Gorontalo adalah dukungan pemerintah dan prospek bisnis yang menguntungkan (0,66), sedangkan kelemahan terbesar adalah modal yang terbatas (0,54) dan kualitas manusia yang rendah. sumber daya budidaya (0,48), dan peluang terbesar (O) adalah nilai ekonomi (Sangat populer, karena enak dan mengandung nilai gizi tinggi) (0,8), dan ancaman (T) degradasi lingkungan (0,8). Berdasarkan kuadran analisisnya adalah pada kuadran 1 (Growth Oriented Strategy).

**Kata Kunci:** pengembangan, strategi, *Scylla* spp, budidaya, Provinsi Gorontalo

### 1. Introduction

The water Condition in Gorontalo Province is Very potential to be developed as a

cultivation areal. This province has an area that is suitable for aquaculture area of 15,675 hectares of land which consist of 5,000 hectares for the cultivation of marine and

10,675 hectares of Potential brackish cultivation (Department of Fisheries and Marine Resources of Gorontalo Province, 2017). The potential of existing brackish aquaculture cannot be utilized optimally. Brackish cultivation commodity diversification is an alternative in overcoming various problems of brackish cultivation. One of the brackish cultivation aquaculture commodities that needs to be developed is mangrove crab.

Djunaedi et al. (2015) stated that mangrove crabs are one of the fishery resources that have high economic value and potential to be cultivated. Mangrove crab market potential is not only domestic, but in international market is also quite large (Suprpto et al., 2014). Demand for mangrove crabs from various countries is very high: China, Japan, Hong Kong, South Korea, Thailand, Taiwan, Malaysia, and a number of countries in the European region and even US sea food restaurant entrepreneurs request mangrove crabs up to 450 tons every month (Putri et al., 2014). This demand has not yet been fulfilled due to the limited catch in the wild and very minimal aquaculture production. Suprpto et al. (2014) stated that in fulfilling the needs of mangrove crabs, most of them are still from the results of the capture in nature which is fluctuating or still uncertain. Further illustrated by Mardiana et al. (2015), fulfillment demand mostly mud crab ( $\pm 61.6\%$ ) still capture from the nature so that the continuity of production cannot be maintained, while only a small fraction ( $\pm 38.4\%$ ) of cultivation.

Increasing the number of human populations, economic needs and high consumer demand will cause pressure on mangrove crabs and their habitats so that there will be a decline in the population of mangrove crabs in the wild caused by the degradation of mangrove ecosystems and over-exploitation. This greatly affects the ecological status, biological status and economic value of mangrove crabs.

To comply consumer demand for mangrove crabs and maintain the sustainability of their habitat, it is necessary to develop a strategy for developing mangrove crab technology. The realization of an optimal mangrove crab cultivation strategy begins with the study of appropriate cultivation development. Until now there has been no research on the analysis of development strategies for mangrove crab cultivation and the formulation of concepts for the application of mangrove crab cultivation technology, it

needs to be developed in a systematic and sustainable way.

The problem to be investigated is how the development strategy of mangrove crab cultivation in accordance with the potential and carrying capacity of the environment in Gorontalo Province. The purpose of this research is to study and determine the development strategy of mangrove crab culture in Gorontalo Province in accordance with the potential and carrying capacity of the environment based on a SWOT analysis.

## 2. Materilas and Methods

### 2.1. Research Location

Gorontalo province is located between  $0^{\circ} 30' - 10^{\circ}$  North and  $121^{\circ} - 123^{\circ} 30'$  East with boundaries as follows: North side bordering to the Sulawesi Sea, the East with the province of North Sulawesi, South side borders with Tomini Bay, West side bordering Central Sulawesi Province, Gorontalo Province is  $12,215.45 \text{ km}^2$  or  $0.15\%$  of the Indonesia area. This research was conducted in Gorontalo Province consisting of North Gorontalo District, Pohuwato Regency and Boalemo Regency.

### 2.2. Data Sources and Research Instruments

Based on the source, the data needed in this research is primary data and secondary data. Primary data is information data obtained from the results of discussions and interviews with stakeholders. Primary data were obtained from interviews using the topic of data with key informants such as the fisheries business, business-related officials' mangroves crab cultivation in Gorontalo Province.

### 2.3. Research methods

The method used in this study is a survey method by observing data collection and random sampling techniques. Data analysis techniques include quantitative analysis (test the validity and reliability of the instrument) and qualitative descriptive analysis. Quantitative analysis is used to analyze the data from the calculation of the feasibility scoring and available statistical data. Whereas qualitative analysis is used to analyze non-parametric data and information which are descriptive.

The analysis method used in this research is descriptive analysis and SWOT analysis. SWOT analysis strategy for development of mangrove crab cultivation in Gorontalo grounded in logic to maximize

strength (*strength*) and opportunities (*opportunities*) that are owned and minimize your weaknesses (*weakness*) and threats (*threats*) facing. Analysis of internal SWOT variables based on the analysis proposed by Umar (2001) (Table 1).

### 3. Results and Discussion

#### 3.1. Potential and Opportunities for Development of Mangrove Crab Cultivation

Mangrove crabs (*Scylla* sp.) are one of the fisheries commodities in aquatic habitats beach, especially in mangrove forest areas. The area of mangrove forest as a mangrove crab habitat in Gorontalo Province covers an area of 17,204.84 hectares were shown in Table 2.

The area of mangrove land which is an opportunity to develop mangrove crabs in Gorontalo Province. Mangrove ecosystems are found in the southern and northern coastal areas of Gorontalo Province, on several small islands, on the shores of shallow bays, estuaries, and protected coastal areas such as in the estuaries of the Randangan River, Kwandang and Anggrek Gulf

Mangrove crab (*Scylla serrata* Forsskal, 1775) is one of the potential fisheries resources to be developed, has high economic value, contains important nutrients for health and the meat taste is good, so it is very popular with local and foreign consumers. Herliany and Zamdial (2015) stated that every 100 grams of fresh mangrove crab meat contains high nutritional value of 18.06 g protein, 1.08 g fat, 68.1 g water and 89 mg of calcium. Consumer demand for this commodity tends to increase from year to year, so the market opportunity for crab mangrove is wide open and prospective, both domestic and foreign markets. Mangrove crab market opportunities are wide open and prospective, both domestic and foreign markets. Domestic consumer demand for this commodity from year to year tends to increase, as well as export demand.

Suprpto et al. (2014) stated that fishery

exports showed the following developments in 2013 amounting to 1,258,179 tons while exports from 2014 to November amounted to 1,268,983 tons. Specifically, for crab exports in 2013 was 8.59 % while in 2014 it was 8.93 % of the total fishery exports, meaning it can be stated that crab exports from 2013 to 2014 increased by 3.97 %. To meet consumer demand, efforts are needed to produce mangrove crabs through aquaculture activities.

According to Risamasu et al. (2014), there are four types of crabs that are generally consumed, namely *S. serrata*, *S. tranquebarica*, *S. paramamosain*, *S. olivacea*. Type *S. serrata* is a kind of mud crabs are most popular as food and has a fairly expensive price. The crabs live in coastal waters, especially in forest areas mangrove.

Mangrove species found in Gorontalo Province areas such as *Avicennia alba*, *A. marina*, *Rhizophora apiculata*, *R. mucronata*, *R. stylosa*, *Bruguiera gymnorhiza*, *Ceriops* sp, *Xylocarpus* s. The diversity of mangrove species is quite high, this shows that conditions are still good and an opportunity for the development of mangrove crabs.

#### 3.2. Condition of Environmental Development in Mangrove Crab Cultivation

The business of mangrove crab cultivation in Gorontalo Province is still on an enlarged business scale or is still on the catching and collecting activities of fishermen and this cultivation business is still limited to certain people carried out by mangrove crab collector and fishermen.

The number of cultivators in Gorontalo Province is 28,349 people with the number of farmers who have grouped 8,625 people and the number of farmers who have not grouped 19,724 people.

Pohuwato Regency 1,725 people with 115 groups, Boalemo District 1,575 people with 105 groups, North Gorontalo Regency 1,380 people with 92 groups (Figure 1). The potential and level of utilization of brackish aquaculture in Gorontalo Province based on area (Ha) is 10,900 with a utilization rate of 4,536 Ha or 41.61%. The production of

**Table 1.** Analysis of Internal Variables

Score	Competitive Position
1.00 - 1.66	There is no hope (avoid)
1.67 - 2.33	The strength of competition is weak (weak)
2.34 - 3.00	Hold on (tenable)
3.01 - 3.67	Safe (favorable)
3.68 - 4.34	Strong (strong)
4.35 - 5.00	Excellent (dominant)

Source: Umar (2001)

**Table 2.** Extent of Mangrove Forests in Gorontalo Province

No	Area	Amount (Ha)
1	Pohuwato	11,395.40
2	Boalemo	1107.93
3	North Gorontalo	4,217.49
4	Gorontalo Regency	6.00
Total		17,204.84

Source: Subdin Marine and Coastal, DKP Gorontalo Province

**Table 3.** Internal Factor

Variable	Dimension	Indicator	Scale of Measurement				Weight Value
			1	2	3	4	
Internal factors	Strength aspect	Potential Land Cultivation	6				0.12
		Government Support	11				0.22
		The prospect of a cultivation business is profitable	10				0.2
	Weaknesses Aspect	The low quality of cultivation human resources	6				0.12
		Limited capital	9				0.18
		Low productivity of mangrove crabs	8				0.16
	Amount		50				1

Source: Analysis of Research Results

**Table 4.** Internal Strategy Factor Matrix (IFAS)

No	Internal factors	Weight	Rating	Score	Priority
STRENGTH					
1	Potential Land Cultivation	0.12	4	0.48	III
2	Government Support	0.22	3	0.66	I
3	The prospect of a cultivation business is profitable	0.2	3	0.6	II
Amount				1.74	
WEAKNESS					
1	The low quality of cultivation human resources	0.12	4	0.48	II
2	Limited capital	0.18	3	0.54	I
3	Low productivity of mangrove crabs	0.16	2	0.32	III
Amount				1.34	
Total Value		1		3.08	

Source: Analysis of Research Results

mangrove crabs has only reached 0.40 tons. Based on this data it is necessary to develop a cultivation strategy.

Based on Oldeman and Darmiyati classification, Gorontalo Province has an average of relatively dry climate. The driest region (E2 climate with an average of less than 3 months per year with more than 200 mm of rain) covers the entire south coast region. Meanwhile, relatively wetter regions (C1 and C2 climates, with 5 to 6 wet months per year) are found along the northern region of Gorontalo Province. The average temperature during the day in Gorontalo Province ranges from 30.9 - 34.0 °C and at night ranges from 20.8 - 24.4 °C. While the air humidity is relatively high with an average of 83 %. The maximum and minimum average temperatures are 31.8 °C and 23.0 °C (BPS Provinsi Gorontalo, 2017). The condition of the aquatic environment at the research site: temperature ranges from 27 - 34 °C. The content of

dissolved oxygen at the maintenance site varies between 5.5 - 7.7 ppm.

Measurement of pH around 7, 4 - 8 and levels of salinity between 29 - 30 ppt. According to Fujaya et al. (2011), water quality standards for mangrove crabs with a range: salinity 15-30 ppt, optimum DO > 5 ppm, temperature 25 - 35 °C, pH 6.8 - 8.2 alkalinity > 80 ppm, and turbidity > 30 mgL<sup>-1</sup>. Based on data from the measurement of water quality, it can be concluded that it is still within a reasonable range for the maintenance of mangrove crabs.

### 3.3. Strategic Environmental Analysis of Mangrove Crab Cultivation Development with SWOT

The development strategy of mangrove crab culture in Gorontalo Province is carried out by analyzing the factors of the strategy through SWOT analysis.

**Table 5.** External Factor

Variable	Dimension	Indicator	Scale of Measurement				Weight Value
			1	2	3	4	
Internal factors	Opportunity Aspect	Market demand is increasing				9	0.18
		The development of appropriate technology			7		0.14
		Economic Value (Very popular besides having good nutritional value)				10	0.2
	Threat Aspect	Environmental Degradation (mangrove areas)		7			0.14
		Crab population is declining	7				0.14
		Seed limitations Amount			10	50	0.2 1

Source: Analysis of Research Results

SWOT analysis is used to formulate concepts that will be applied for environmentally friendly of mangrove crab cultivation. This analysis is based on the assumption that an effective strategy will maximize strengths and opportunities, and minimize weaknesses and threats. Internal analysis includes an assessment of the strength factor (*strength*) which consists of the potential of cultivated land, government support, the prospects of a profitable aquaculture business and factor (weakness: the low quality of cultivation human resources, limited capital, low productivity of mangrove crabs).

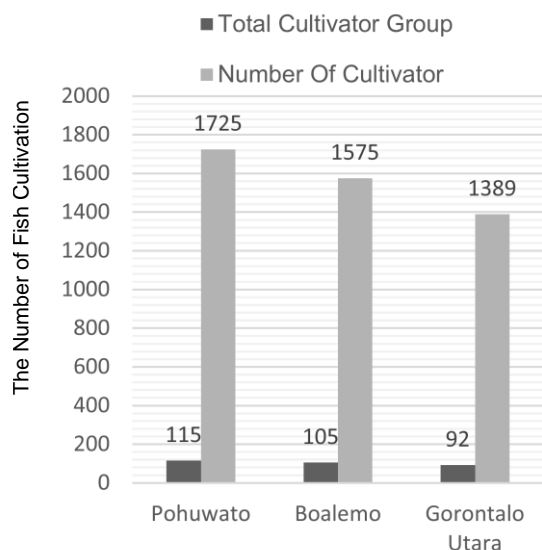
Based on the results of the analysis on the value of internal factor weights and internal strategy factor matrices (Table 3 and Table 4), the most influential strength (S) for the

development of mangrove crab culture in Gorontalo Province is government support with a score of 0.66 with the biggest weakness is limitations capital of 0.54. Total weighting score of internal variables (strengths and weaknesses) is 3.08. Based on the analysis of internal SWOT variables proposed by Umar (2001), the position of developing mangrove crabs in Gorontalo Province in the competition for strategic excellence is included in the criteria of value in the range of 3.01 - 3.67 which is in a position of safe competition (*favorable*), meaning that the Province Gorontalo is in safe condition in conducting mangrove crab activities. The position of developing mangrove crabs in Gorontalo Province in competition with a weighting score of 3.08 can be seen in analysis of internal & external variables table (Table 1).

**Table 6.** External Strategy Factor Matrix (EFAS)

Internal factors	Weight	Rating	Score	Priority
Opportunity				
Market demand is increasing	0.18	4	0.72	II
The development of appropriate technology	0.14	3	0.42	III
Economic Value (Very popular besides having good nutritional value)	0.2	4	0.8	I
Amount			1.94	
Threats				
Environmental Degradation (mangrove areas)	0.2	4	0.8	I
Crab population is declining	0.14	3	0.42	II
Seed limitations	0.14	4	0.42	III
Amount			1.64	
Total Value		1	3.58	

Source: Analysis of Research Result



**Figure 1.** The Number of Fish Cultivation in Gorontalo Province Data (Source: Gorontalo Province Fisheries and Maritime Affairs Office, 2017)

Analysis of external factors / External Strategic Factors Analysis Summary (EFAS), relating to the threats and opportunities of mangrove crab cultivation in Gorontalo Province. The determination of weights and ratings in the assessment of external strategy factors can be seen in the external strategy factor matrix (Tables 5 and 6)

**Table 7.** Alternative Value Ranking Strategies

No.	Alternative Strategies	Score	Total Score	Rank
1	SO ( <i>Strengths-Opportunities</i> )	1.74 + 1.94	3.68	1
2	ST ( <i>Strengths-Treats</i> )	1.74 + 1.64	3.38	2
3	WO ( <i>Weaknesses-Opportunities</i> )	1.34 + 1.94	3.28	3
4	WT ( <i>Weaknesses-Treats</i> )	1.34 + 1.64	2.98	4

Source: Analysis of Research Results



**Figure 2.** Quadrant Strategy for Mangrove Crab Cultivation Development in Gorontalo Province

Analysis of external covering chance factor (*Opportunity*) the market demand is increasing, the development of appropriate technology, economic value (highly popular besides having high nutritional value) and threats (*Threats*) that environmental degradation (mangrove areas), crab population declines, limitations the seed. Based on the external strategy factor matrix (EFAS), the biggest opportunity to determine the development of mangrove crab culture in Gorontalo Province is economic value (highly popular besides having high nutritional value) with a score of 0.8, while the biggest threat is environmental degradation (mangrove areas) almost 3.084,68 Ha in damaged conditions with a score of 0.8. The total weighted score / weighted value of opportunities is 1.94 and the threat is 1.64. Based on the results of the external variable matrix, the total factor value of the external strategy is 3.58. This business can be developed, with the level of threat caused by external factors still low, and has a high enough opportunity in terms of development.

### 3.4. Development Strategy Analysis of Mangrove Crab Cultivation in Gorontalo Province

The development strategy of mangrove crab culture in Gorontalo Province can be

**Table 8.** Alternative Strategies for Mangrove Crab Cultivation Development in Gorontalo Province

Internal Factor	Strength (S)	Weakness (W)
External Factor	<ol style="list-style-type: none"> <li>1. Potential Land Cultivation</li> <li>2. Government Support</li> <li>3. The prospect of a cultivation business is profitable</li> </ol>	<ol style="list-style-type: none"> <li>1. The low quality of cultivation human resources</li> <li>2. Limited capital</li> <li>3. Low productivity of mangrove crabs</li> </ol>
<b>Opportunities (O)</b>	<b>Strategy (SO)</b>	<b>Strategy (WO)</b>
<ol style="list-style-type: none"> <li>1. Market demand is increasing</li> <li>2. The development of appropriate technology</li> <li>3. Economic Value (Very popular besides having good nutritional value)</li> </ol>	<ol style="list-style-type: none"> <li>1. Extensification and intensification of mangrove crabs to meet market demand</li> <li>2. Government and all parties need support to be able to master and develop mangrove crab culture technology</li> <li>3. Increase the production of aquaculture that is more profitable because it has important economic value</li> </ol>	<ol style="list-style-type: none"> <li>1. Increasing professionalism, competence, quality of human resource cultivation through various training activities in order to master crab culture technology to increase production so that market demand is met</li> <li>2. Open access and strengthen capital to increase various technological activities appropriate for mangrove crab cultivation</li> <li>3. Carrying out various technical and non-technical efforts to increase the production of mangrove crabs with high economic value</li> </ol>
<b>Threat (T)</b>	<b>Strategy (ST)</b>	<b>Strategy (WT)</b>
<ol style="list-style-type: none"> <li>1. Environmental Degradation (mangrove areas)</li> <li>2. Crab population is declining</li> <li>3. Seed limitations</li> </ol>	<ol style="list-style-type: none"> <li>1. Protecting the environment of mangroves by utilizing the potential of cultivated land in an environmentally friendly manner</li> <li>2. Various programs, policies and government support are needed in developing eco-friendly cultivation technology to increase the population of mangrove crabs</li> <li>3. Provision of seeds through hatchery and development of crab hatchery technology to be able to increase the production of profitable cultivation</li> </ol>	<ol style="list-style-type: none"> <li>1. Preparing and improving human resources conducting mangrove crabs by considering environmental factors, the concept of <i>biosecurity, silvofishery and Best Management Practices (BMP)</i></li> <li>2. Make various efforts to strengthen capital, to increase the yield of aquaculture production</li> <li>3. Making hatcheries to provide quality crab seeds and innovating hatchery technologies so as to increase the productivity of mangrove crabs</li> </ol>

Source: Analysis of Research Results

analyzed by combining internal and external factors. Based on the weighting carried out, it can be seen the priority of the strategy based on the SWOT ranking based on the large number of scores from SO, ST, WO and WT. The first ranking alternative strategy for developing mangrove crab cultivation in Gorontalo Province is SO (*Strengths-Opportunities*) with a score of 3.68 (Table 7). SO strategy means creating a strategy using the strength (S) to take advantage of the opportunities (O) that exist in developing mangrove crab culture in Gorontalo Province.

Alternative Strategies for Mangrove Crab Cultivation Development in Gorontalo Province are obtained by combining external strategic factors (EFAS) with internal strategic factors (IFAS) into a summary analysis of strategic factors (SFAS). Alternative Strategies for Mangrove Crab Cultivation Development in Gorontalo Province are presented in Table 8. To determine the development strategy of

mangrove crab culture in Gorontalo Province, it can be analyzed based on the strategy quadrant stated by Rangkuti (2006). The SWOT matrix strategy quadrant can be seen in Figure 2. Based on Figure 2, it can be seen that the strategy for developing mangrove crabs in Gorontalo Province is in quadrant I position (Aggressive Strategy). According to Rangkuti (2006), quadrant 1 is a very good situation, because in Gorontalo Province can utilize the availability of strengths and opportunities for the development of mangrove crab culture. This aggressive strategy can be carried out through extensification and intensification of mangrove crab cultivation to fulfill market demand, the need for government support and all parties to be able to dominate and develop mangrove crab cultivation technology and increase the business of aquaculture production that is more profitable because it has important economic value.

#### 4. Conclusion

Based on the results of research on the development strategy of mangrove crab (*Scylla* spp) cultivation in Gorontalo Province, it can be concluded, analysis result of the internal factors is the strength of the most influence on the development of mangrove crab cultivation in Gorontalo that government support and biggest weakness the lack of capital, with the score weighting internal variables 3.08, in the position of a safe competition.

The results of the analysis of external factors are the greatest opportunities for the determination of the cultivation of mangrove crab in Gorontalo Province which high economic value because it is very popular besides tasty, also contains high nutritional value, while the biggest threat that environmental degradation (mangrove areas) with a total value factor external strategy 3,58 means this business can be developed.

Strategy cultivation of mangrove crab in Gorontalo Province in the position Strategy agresif that can take advantage of the strengths and opportunities that exist through the expansion and intensification of cultivation of mangrove crab to fulfill market demand, the need for support from the government and all parties to be able to master and develop cultivation technology mangrove crabs and increase cultivation business production which is more profitable because it has important economic value.

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