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Environmental characteristics of mangrove forest as a reference for development of mud Crab *Scylla serrata* cultivation: A case study in Mojo Village, Ulujami, Pemalang

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Abstract. Mud crab is one of the fisheries commodities that has a high economical value. Production of mud crab still depends on the wild stock for the seed, while the production from aquaculture sector has not been well established yet. Aquasilviculture is one of the options to develop aquaculture sector for this commodity in mangrove forest. This research aims to analyze and evaluate environment parameters that affected mud crab production in mangrove forest ecosystem at Mojo village, Ulujami, Pemalang. This research was conducted based on the survey method. The result from physical-chemistry analysis of the water in mud crab habitat showed that the most affecting factor in mud crab production was salinity. The production of mud crab tends to be high in salinity level between 21–25 g/L. From this result, site selection with stable water salinity should be considered for the development of mud crab aquasilviculture.

Keywords: aquasilviculture, environmental, mangrove forest, mud crab *Scylla serrata*

1. Introduction

One of fisheries commodity with high economic value in Indonesia is mud crab *Scylla serrata*. The current market price of this mud crab reaches Rp100,000 - Rp50,000/kg [1]. In addition, crab meat contains protein that is high enough for health. The protein content of mud crab meat is 65.72% and in eggs are 88.5% [2]. Based on this finding, mud crabs are products in demand because of its nutritional value by all circles both domestically and abroad. Demand for mud crabs has increased from year to year. Demand for crabs from US seafood restaurants reaches 450 tons every month.

The catch of mud crabs caught by fishermen is generally less than 15 cm in size. Regulation of Minister of Marine and Fisheries prohibits the capture of mud crabs under laying eggs conditions and those with carapace width less than 15 cm [3]. Therefore, something needs to do in order to utilize the seeds caught from nature with carapace width less than 15 cm. One of the activities that can be carried out is development of cultivation activities.

The cultivation of mud crabs that has been developed in Indonesia is the cultivation of enlarged and fattened soft-shell crabs. In addition, environmentally friendly cultivation is now starting to develop, namely cultivation activities that are based on natural habitat characteristics, so that they will produce



organic products. Environmentally friendly cultivation will increase the selling value of the products produced. An example in Babelan, Bekasi, West Java, every transaction of organic shrimp is required to have an additional fee of US\$1 per kilogram [4]. However, organic crab products in Indonesia are currently underdeveloped. For this reason, it is necessary to develop environmentally friendly mud crab cultivation through aquasilviculture activities so that it can produce organic crabs.

Aquasilviculture is a multi-purpose production system that enables fish cultivation in mangrove forest areas. It aims to create environmentally friendly cultivation techniques [5]. Mangrove forest ecosystems are a component of coastal ecosystems that have an important role, one of which is the natural habitat of mud crabs. The benefits of mangrove forests are spawning ground and nursery ground for mud crabs [6]. Therefore, the environment of mangrove forests indicates a suitable environment for the growth and survival of mud crabs.

One of the mangrove forests in Indonesia is mangrove forest in Mojo Village, Ulujami Sub-District, Pemalang District, Central Java. The area is a producer of mud crabs. Production of catches of mud crabs in Pemalang area in 2006 reached 11.89 tons [7]. Mangrove forest in Mojo Village, Ulujami is the largest mangrove forest in Pemalang District, with Ulujami Sub-District area of around 120.39 Ha, while the area of mangrove forest which became the location of this study is around 72 Ha [8].

Efforts to preserve mangrove forests must continue to be carried out to support the supply of mud crab seeds in the wild because the hatchery of mud crabs is not yet developed. Therefore, this research was conducted to obtain the basic data on the environmental characteristics of mangrove forests in Mojo Village, Ulujami Sub-District, Pemalang District, Central Java. The results of this study are expected to be used as a reference to support the development of environmentally friendly mud crab cultivation. This study aimed to analyze the effect of environmental characteristics of mangrove forests in Mojo Village, Ulujami, Pemalang, on the production of mud crabs from harvesting activities as a reference for the development of mud crab aquasilviculture.

2. Materials and Methods

This research was conducted in March – April 2015 in the mangrove forest ecosystem of Mojo Village, Ulujami Sub-District, Pemalang District, Central Java. The coordinates of the study location are 109°E17'30"-109°E40'30" and 06°52'30"S-07°S20'11"S.

2.1. Research procedure

2.1.1. Station determination. Locations of the research stations were determined after potential locations were surveyed. The location of the research station was determined based on the natural mangrove forest ecosystem and the area where mud crabs could be caught. Determination of the observation station in this study was based on the drawing of a line diagonally from the estuary of the Comal River. It aimed to obtain research stations with different environmental characteristics.

There are 3 stations that were used as the locations of this study (figure 1), namely:

- Station 1: Mangrove forest ecosystem located near the estuary.
- Station 2: Mangrove forest ecosystem located near the fishpond.
- Station 3: Mangrove forest ecosystems located near the sea, fishponds and lagoons.

The following is the locations of the research stations in the mangrove forest ecosystem of Mojo Village, Ulujami Sub-District, Pemalang District, Central Java.

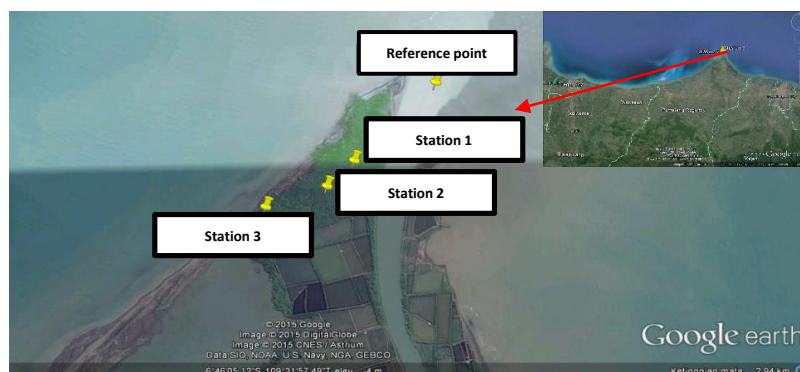


Figure 1. Location of the research station.

2.2. Collection of research data

Data collection was done by identification and survey method. The parameters that were measured, units, research method, and location are presented in table 1.

Table 1. Measured parameters, tools/methods, units, and location of measurements.

No	Parameter	Tools/Measurements methods	Unit	Location
1.	Physics-chemistry of water			
	Salinity	Hand refractometer ^a	g/L	In-situ
	Temperature	DO meter ^b	°C	In-situ
	pH	pH meter ^b	-	In-situ
	Dissolved Oxygen	DO meter ^b	mg/L	In-situ
	TAN	Phenate ^c method	mg/L	Ex-situ
	Nitrite	Sulfanilamide ^c method	mg/L	Ex-situ
	Nitrate	Bruchine ^c method	mg/L	Ex-situ
	Total organic matter	Oxydimetric ^c method	mg/L	Ex-situ
2.	Abundance and Type identification	Plankton net, microscope ^d	sel/m ³	Ex-situ
		Identification book ^{e,f}	ind/m ³	Ex-situ
3.	Mangrove vegetation			
	Type identification	Identification book ^g	-	In-situ
	Mangrove abundance	Observation plot 10 x 10 m ^h	ind/100 m ²	In-situ
4.	Litter abundance	Observation plot 1x1 m and digital scale ^h	g/m ²	Ex-situ
5.	Chemical substrate			
	Total organic matter	Gravimetric ^c method	%	Ex-situ
	Organic C	Walkley and Black ^c method	%	Ex-situ
6.	Microclimate condition			
	Light intensity	Luxmeter ⁱ	Lux	In-situ
	Air temperature	Luxmeter ⁱ	°C	In-situ
	Air humidity	Luxmeter ⁱ	%RH	In-situ
7.	Analysis of catches	Interview	-	In-situ

^a[9-17]

2.2.1. Water physicochemical analysis. Water sampling was performed by grab sampling method, which is a direct sampling to obtain an overview of the characteristics of water at the time of sampling [18]. Water-physicochemical measurements were carried out in-situ and ex-situ. The parameters analyzed in-Situ included temperature, salinity, pH, dissolved oxygen, while the parameters analyzed by ex-situ include TAN (total ammonia nitrogen), nitrite, nitrate, and total organic matter. Ex-Situ

measurements were carried out at the Aquaculture Environment Laboratory, Department of Aquaculture, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University.

2.2.2. Plankton analysis. Plankton analysis was carried out using book identification according to [13,14]. Identification of types and calculations of plankton abundance was carried out at the Bio Macro Laboratory, Department of Aquatic Resource Management, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University.

2.2.3. Mangrove vegetation analysis. Identification of mangrove species was carried out based on the identification book [15]. The measurement of mangrove abundance was performed by making a 10×10 m observation plot, then the number of mangrove trees was calculated according to the tree category (more than 10 cm in diameter) and the sapling category (diameter less than 10 cm).

2.2.4. Litter analysis. Litter abundance was calculated based on observation plots of 1×1 m at each research station, calculating litter weight in g/m^2 . Litter abundance measurements were carried out at the Aquaculture Environment Laboratory, Department of Aquaculture, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University.

2.2.5. Organic matter substrate analysis. Analysis of substrate organic matter was conducted ex-situ. The parameters measured were total organic matter and organic C. Measurements were made at the Fish Nutrition Laboratory, Department of Aquaculture, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University.

2.2.6. Microclimate condition analysis. Analysis of microclimate conditions at each research station was carried out in-situ using lux meter. The parameters that are measured were light intensity, air temperature, and air humidity.

2.2.7. Mud crab production analysis. Analysis of the production of mud crabs from fishing activities in Mojo Village, Ulujami, Pemalang was carried out by interview method. The interview method that was used is purposive sampling method, which is a sampling technique of data sources with certain considerations [19], for example by analyzing feed types and the number of crabs per unit location. The resource persons interviewed were five key informants who deeply understood the problems being studied, namely fishermen and collectors.

2.2.8. Data analysis. The data were analyzed descriptively, namely by presenting, compiling, and measuring the values of available data from a study, so that a clear and easily-understood picture could be obtained [20].

3. Results and Discussion

3.1. Results

3.1.1. Water Physicochemical Analysis. The results of measurements of physical chemistry of the water in the study location are shown in figure 2. Water physics parameters measured include salinity and temperature (figure 2). The salinity value at the research location shows that Station 1 had a salinity range between 5-10 g/L, and Station 2 had a salinity range between 5–20 g/L. The salinity value of Station 3 was in the range between 21–25g/L. The temperature values obtained between research stations fluctuated. The highest temperature range was found at Station 3, which was between 30–32°C, while the lowest temperature range was at Station 2, which was between 28.5–30.1°C.

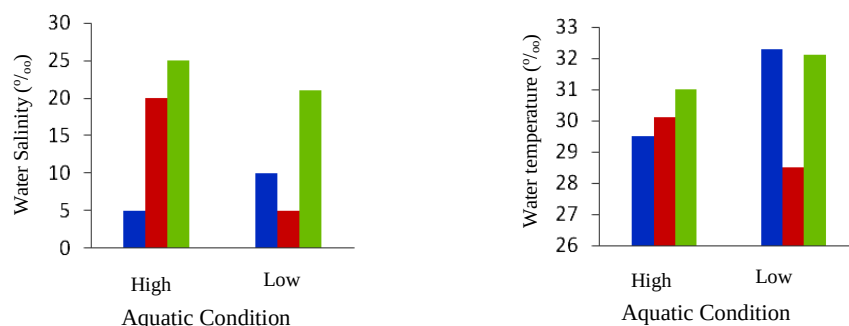


Figure 2. Graph of physical waters parameters of salinity and temperature in the research location. (■ Station 1 ■ Station 2 ■ Station 3)

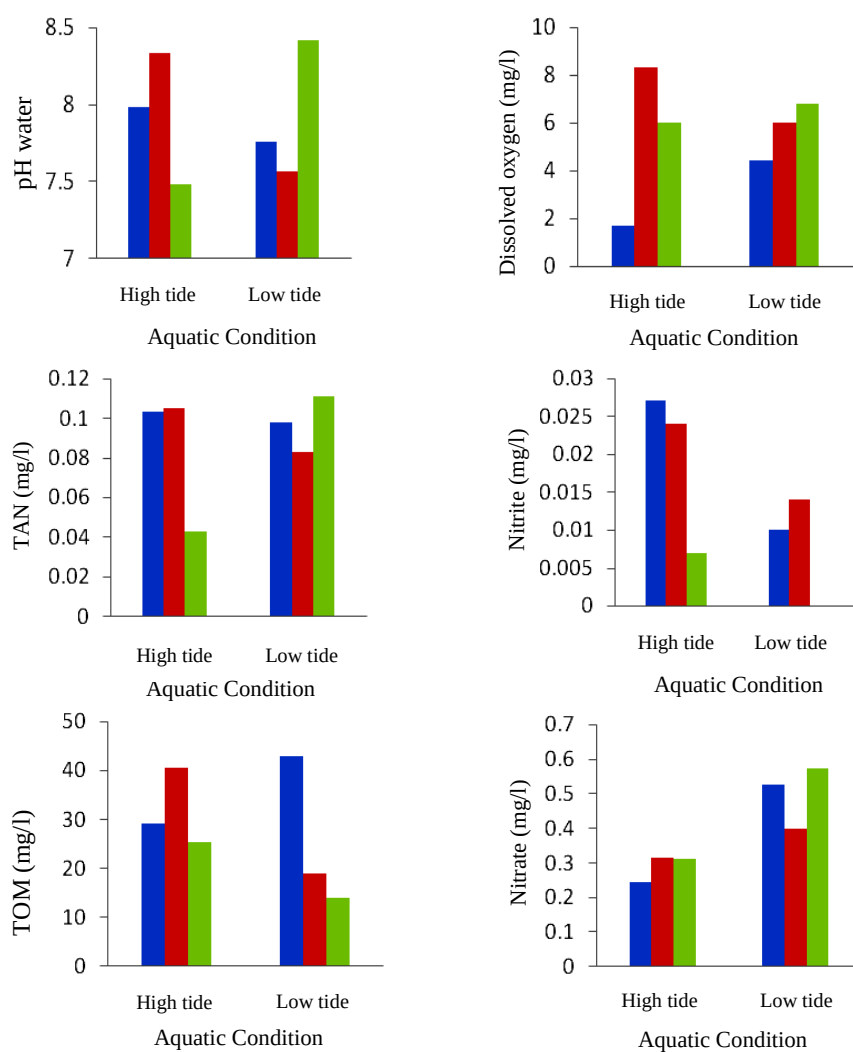


Figure 3. Graph of waters chemical parameters of pH, Dissolved oxygen, TAN, Nitrite, Nitrate, Total organic matter (TOM) (■ Station 1 ■ Station 2 ■ Station 3)

The results of the measurements of the chemical parameters of the waters at the study site obtained a fluctuating range at all stations (figure 3). The lowest pH value was at Station 3, with tidal waters at 7.48, and the highest was at Station 3 where tidal waters was at 8.42. The range of dissolved oxygen values at all stations ranged from 1.7 to 8.3 mg/L. The range of TAN values obtained was equal to 0.043–0.111 mg/L, and the range of nitrite values was obtained at 0.000–0.027 mg/L. Furthermore, the range of nitrate values obtained was 0.243–0.574 mg/L, and the range of total organic matter values was obtained at 13.90–42.98 mg/L.

3.1.2. Plankton analysis. The analysis of plankton in this study location is presented in table 3. The results of the plankton analysis showed that the highest abundance for plankton was found at Station 1, which was 969,864 cells/m³ with the type *Nitzschia* sp, while the other group was *Pelagothrix* sp.

Table 2. The dominant planktons and their abundance at the study site.

Station	Dominant Plankton	Plankton abundance (cell/m ³)
1	<i>Nitzschia</i> sp.	969.864
2	<i>Pelagothrix</i> sp.	27.629
3	<i>Pelagothrix</i> sp.	44.030

3.1.3. Mangrove vegetation analysis. Data on mangrove vegetation found at the study site were obtained from observation plots of 10×10 m presented in table 4. Based on observations made, the types of mangroves found in the study sites were *Avicennia marina* and *Rhizophora mucronata*. Most of the mangroves found are in the tree category.

Table 3. Mangrove vegetation at the study site.

Station	Types of mangrove	Information	Total (ind)	Density (ind/100 m ²)
1	<i>Avicennia marina</i>	Tree	7	35
	<i>Avicennia marina</i>	Tree	1	
	<i>Rhizophora mucronata</i>	Tree	27	
2	<i>Avicennia marina</i>	Tree	6	43
	<i>Avicennia marina</i>	Tree	1	
	<i>Rhizophora mucronata</i>	Tree	26	
	<i>Rhizophora mucronata</i>	Sapling	10	
3	<i>Avicennia marina</i>	Tree	7	64
	<i>Rhizophora mucronata</i>	Tree	50	
	<i>Rhizophora mucronata</i>	Sapling	7	

3.1.4. Litter analysis. Litter abundance at the study site is presented in table 5. The highest litter abundance was found at Station 3, which was 26.73 g/m², while the lowest litter abundance was at Station 1, which was 19.51 g/m².

Table 4. Litter abundance at the study site.

Station	Litter abundance (g/m ²)	Water content
1	19.51	82.27
2	22.86	80.59
3	26.73	78.64

3.1.5. Organic matter substrate analysis. The results of measurements of substrate organic matter at the study site are presented in table 6. Based on the results of measurements, the highest total organic matter on the substrate was found at Station 1, which was 72.82%, and the highest organic C was found at Station 3, which was 4.10%.

Table 5. Substrate organic matter; total organic matter and organic C.

Station	Total organic matter (%)	Organic C (%)
1	72.84	2.82
2	70.99	1.65
3	66.03	4.10

3.1.6. Microclimate conditions analysis. The microclimate conditions at the study sites are presented in table 7. Based on the results of measurements, the microclimate conditions in the mangrove forest ecosystem of Mojo Village, Ulujami Sub-District, Pemalang District, the obtained results of air temperature and air humidity parameters were not much different between research stations. Sampling took place during rainy season. The air temperature in the three research stations ranged from 31.3 to 34.3°C, air humidity ranged from 65.97% RH. While the lowest light intensity parameter was at Station 2, which was 1.128 lux, and the highest at Station 3 of 9.210 lux. Overall, the weather conditions at the three research stations both at high tide and low tide were in bright conditions.

Table 6. Results of microclimate measurements at the study site.

Station	Air Temperature (°C)		Humidity (% RH)		Light intensity (lux)		Weather	
	LT	HT	LT	HT	LT	HT	LT	HT
1	32.4	31.3	71.6	77.4	5,120	9,210	Sunny	Sunny
2	34.3	31.6	65.9	77.7	1,126	3,850	Sunny	Sunny
3	33.4	32.9	68.8	75.4	6,480	3,940	Sunny	Sunny

Remarks : LT = Low Tide; HT = High Tide

3.1.7. Mud crab production analysis. Figure 4 is a graph of the production of mud crabs from harvesting activities. The data was based on daily catches of fishermen at each study site in April 2014. Based on the results of interviews with fishermen, the highest production of mud crabs was found at Station 3 (figure 4). The production of mud crabs when the harvest season was high was equal to 4 kg/day, and when the harvest season was low was at 1.9 kg/day.

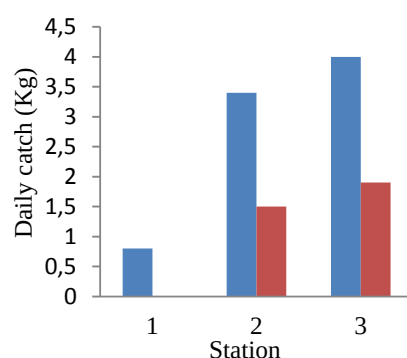


Figure 4. Production of mud crabs from harvesting activities according to the research station, ■ High catch (Des-May) ■ Low catch (Des-May).

Figure 5 is a graph of the production of mud crabs from harvesting activities per year (in 2014) obtained by fishermen in Mojo Village, Ulujami, Pemalang. The results of interviews with mud crab collectors in Mojo Village, Ulujami, Pemalang stated that the production of mud crabs per year in Mojo Village was 9.18 tons in the high season and 2.88 tons during the low season (figure 5).

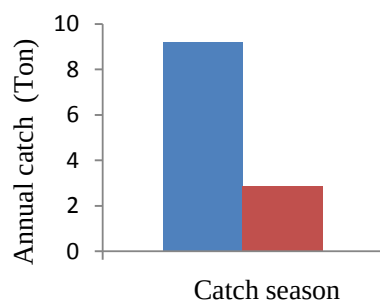


Figure 5. Production of mud crabs in Mojo Village, Ulujami, Pemalang in 2014 ■ High catch (Des-May), ■ Low catch (Des-May).

3.2. Discussion

Aquaculture is a production system that includes inputs, processes, and outputs [21]. One part of the production input in mud crab cultivation is natural resources. The environment of mangrove forests is a natural resource that indicates an environment that is suitable for mud crabs. The development of mud crab aquasilviculture can be done by analyzing the physicochemical waters, mangrove vegetation, and microclimates in the mangrove forest area. Based on the analysis of mud crab production from harvest, the highest daily catch was obtained at Station 3, which was equal to 4 kg in the high harvest season (December – May) and 1.9 kg in the low harvest season (June – October). The environmental characteristics at Station 3 are thought to be the suitable environmental characteristics for mud crabs.

The results of salinity measurements during the study ranged from 5–25 g/L. Station 1 had a low salinity range of 5–10 g/L. The salinity range at Station 2 ranged from 5–20 g/L. Station 3 had a high salinity range, which was 21–25 g/L. These results explain that the salinity in the waters of the mangrove forest has a wide range. Salinity in Malaysia's Tumpat mangrove forest obtained a range between 1.0–30.1 g/L [22]. Wide range of salinity is due to mangrove forests growing in intertidal areas. Mangrove forest defined as a tropical plant community that grows in intertidal or tidal areas [23]. The salinity range for mud crabs is 10–25 g/L [24]. [25] study sites are the appropriate range of salinity for mud crabs, especially at Station 3. This is because salinity at Station 3 tends to be stable near 25 g/L, so that catches in Station 3 area tend to be higher.

Besides salinity, another waters physical parameter measured in this study was temperature. The results of temperature measurements from the three research stations did not differ significantly. Overall, the temperature range obtained ranges from 28.5–32.3°C. The temperature range at Station 1 is 29.5–32.3°C. The temperature at Station 2 was in the range between 28.5–30.1°C. The highest temperature range is found at Station 3 which was 31–32.1°C. In general, an organism's growth rate will increase in line with the rising temperatures [26]. The growth of mud crabs is supported by water temperature because mud crabs are poikilotherm. Temperature will affect activity, appetite, oxygen consumption, and metabolic rate of mud crabs. The optimum temperature for mud crabs is 29°C [27]. The temperature that is good for the growth of mud crabs is 25–35°C, thus the temperature range at the research location is suitable for mud crabs, which ranged from 19.6–35.9°C [24]. This indicates the temperature range in the research site was in accordance with the temperature range in the mangrove forest ecosystem in general.

Furthermore, for the waters chemical parameters measured in this study were pH, dissolved oxygen, TAN (total ammonia nitrogen), nitrite, nitrate, and total organic matter. The range of pH values at all research stations was 7.57–8.42. The pH range is almost the same with the pH range for the maintenance of mud crabs in the Mtwapa Kenya pen culture mangrove according to [28], which ranged from 7.95 to 8.25. The results of pH measurements at Station 1 were 7.76–7.98. Station 2 had a pH range of 7.57–8.33. Furthermore, for pH at Station 3, the range was 7.58–8.42. The pH ranges obtained from 3 research stations were in accordance with the good pH range for mud crabs, which is 7.5–8.5 [24]. In addition, the optimum pH for the growth of mud crabs in aquaculture containers is 7 [29]. This shows that the

pH range in the mangrove forest of Mojo Village, Ulujami, Pemalang tends to be optimum for the growth of mud crabs.

The results of the measurement of the next chemical parameters of waters are dissolved oxygen. The value of dissolved oxygen at Station 1 tend to be low at 1.7–4.4 mg/L. This value is classified as low because Station 1 was located close to the river mouth. The coastal waters adjacent to the river mouth contain high organic matter originating from the land, flowed by the river. The highest average result of measurements of organic matter in the waters was found at Station 1, which was 36.02 mg/L. The low level of dissolved oxygen at Station 1 is thought to be because it is mostly used by microorganisms in breaking down organic matter. Slightly different from Station 1, the dissolved oxygen value at Station 2 tend to be high at 6–8.3 mg/L, while the dissolved oxygen value at Station 3 ranged from 6–6.8 mg/L. Oxygen content for seawater biota is >5 mg/L, thus the dissolved oxygen content in the study site is a safe range for mud crabs [31].

The range of TAN, nitrite and nitrate values in this study was not much different between research stations. TAN values obtained were ranged from 0.083 to 0.111 mg/L. TAN value in waters for seawater biota is 0.3 mg/L [31]. The results obtained at the study site still meet the TAN standard for mud crabs. The nitrite content obtained at the study site also tend to be low at 0.000–0.024 mg/L. This is because natural waters experienced continuous water changes due to tidal influences. Nitrites can interfere with the process of respiration in cultured organisms [32]. Nitrite in the blood of fish can react with hemoglobin to form methemoglobin. The methemoglobin cannot bind oxygen like hemoglobin, so that oxygen cannot be distributed throughout the body. High nitrite content can reduce the ability of blood to bind oxygen because nitrite can bind hemocyanin in the blood [32].

The nitrate content in the study site was found to be in the range of 0.243–0.504 mg (Appendix 6). The range of nitrates is included in waters with moderate fertility [33]. Nitrate content of <0.227 mg/L is classified as infertile waters, nitrate content of 0.227–1.129 mg/L is classified as waters with moderate fertility, and nitrate content of 1.130–11.250 mg/L is classified as waters with high fertility [33]. The nitrate content in mangrove waters ranged from 0.71–6.27 mg/L [34].

The results of measurement of total organic matter in the waters ranged from 13.90–42.98 mg/L. The highest total organic matter was found in Station 1 at low tide conditions which was 42.98 mg/L. Water with a total organic material of more than 26 mg/L are classified as fertile waters [35]. Total organic matter in these waters can be utilized by plankton. The highest plankton abundance was at Station 1, equal to 969,864 cells / m³. The dominant type of plankton found is *Nitzschia* sp. Organic materials in the other two locations were relatively lower and had a positive effect on crab production. In accordance with the research of [36], the genus found with the highest abundance in the Comal river estuary is *Nitzschia*. This was due to this genus has a broad distribution and is able to adapt to high environmental changes.

Another factor that plays an important role in the availability of mud crabs in their natural habitat is mangrove vegetation. Mangrove vegetation found in the mangrove forest of Mojo Village, Ulujami, Pemalang, was *Rhizophora mucronata* and *Avicenia marina* [37]. The mangrove forest in the research location was the result of replanting by the OISCA (Organization for Industrial Spiritual and Cultural Advancement) from 2000 to the present. The most planted type of mangrove is *Rhizophora mucronata*, while *Avicenia marina* mostly grows naturally. Most of the mangroves found are in the tree category, which is more than 10 cm in diameter. The highest abundance of mangrove trees is found at Station 3, which was 64 ind/100 m².

Most of the mangrove species found at Station 3 were 57 ind *Rhizophora mucronata*/100 m². This can be seen from the types of roots found in *Rhizophora mucronata*, namely the tap roots and aerial roots that grow from the lower branches [15]. These root types help mud crabs find food and also serve as a place of refuge from predators. Mangrove forests are occupied by a number of large mud crabs that make holes on soft substrates [30]. The mud crab hole serves as a refuge from predators, as a breeding

ground, and as an aid in finding food. Therefore, the highest catch is obtained at Station 3 because it is assumed that *Rhizophora mucronata* mangrove trees support the survival of mud crabs.

Mangrove trees produce litter which is a source of organic matter. Organic matter in the waters comes from various organisms originating from high-level plants and all suspended materials [38]. The highest litter abundance produced at Station 3 was 26.73 g/m². The total organic matter content on the substrate ranged from 66.03% to 72.84%. The range of these values is quite high when compared with the value of total organic matter in mangrove soils in Hooker Bay, San Andreas Island, Colombia, which is 22.89% [39]. One chemical component of organic matter that is often used as an indicator of the presence of organic matter in soil or sediments is organic C [40]. The highest measurement result for organic C was found at Station 3, which was 4.10%.

Litter will produce detritus which can be used directly by mud crabs as their natural feed. Regarding the behavior of mud crabs in foraging, mud crabs begin actively seeking for food at night and returning to immerse themselves in the morning [6]. Cases found at the study site showed that mud crabs did not only get natural food from within the mangrove forest, but from around the pond near the mangrove forest. In its growth stage, mud crabs consume a variety of foods, but tend to consume mollusks, crustaceans, and fish, compared to plants. The highest percentage of food found in the stomach of mud crabs was animal meat [41], so that it is suspected that mud crabs consume mollusks and crustaceans from the surrounding study sites. In general, the environmental characteristics in the mangrove forests of Mojo Village, Ulujami, Pemalang belong to an environment that is suitable for the development of mud crab aquasilviculture. Waters physicochemical parameters, mangrove vegetation, and natural food can affect the catch of mud crabs, but the dominant parameter is salinity. This is because the highest catches of mud crabs are found in locations with salinity approaching the iso-osmotic condition of the mud crab body. Mud crabs respond to several important environmental factors, such as temperature and salinity [24]. The temperature and salinity can constantly modify the metabolic functions in the body of mud crabs, such as breathing and excretion, so that they can maintain the condition of homeostasis. Salinity will affect the media osmolarity which is a determinant of the level of work of the osmotic mud crab. The level of osmotic work experienced by mud crabs is proportional to the difference in osmolarity between media and fluid in the body of mud crabs (hemolymph). Mud crabs will do greater osmotic work on media beyond the iso-osmotic range of their bodies, so that the energy needed for the osmoregulation process tends to be high, and the portion of energy for growth decreases. Based on [42], the highest level of osmotic work was produced on the medium of delivery of 15 g/L and the lowest at salinity of 25 g/L. This indicates that 25 g/L salinity is close to the iso-osmotic condition of the mud crab body.

Based on the results of interviews with fishermen, the highest catch of mud crabs is in the location of mangrove forests that are close to the sea, ponds, and lagoons, which was at Station 3. Harvesting mud crabs is carried out by means of fishing gear in the form of cadets. According to, the cadaver [43] used in Mojo Village had the highest percentage in harvesting mud crabs with *Scylla serrata* species, amounted to 97.8%. Mud crabs with *Scylla serrata* species are mud crab species which are very fond of water conditions with high salinity, compared to the other three species namely *S. paramamosain*, *S. tranquebarica*, and *S. olivacea* [24]. The results of the [44] study also state that mud crabs with *Scylla serrata* species are found in the front zone of mangrove forests and sea zones. This further confirms that salinity is an environmental parameter that affects the production of mud crabs from fishing activities.

4. Conclusion

Based on the results of this study, it can be concluded that the best environmental characteristics of mangrove forests in Mojo Village, Ulujami, Pemalang for aquaculture development are the characteristics found at Station 3, with the levels of salinity of 21–25 g/L, temperature of 31–32.1°C, pH of 7.48–8.42, dissolved oxygen of 6.0–6.8 mg/L, nitrite of 0–0.007 mg/L, nitrate of 0.313–0.574 mg/L, and total organic matter in waters of 13.90–25.28 mg/L. In addition, the abundance of mangroves was 64 ind/100 m² and the abundance of litter was 26.73 g/m². It can also be concluded that the most influential parameter on the production of mud crabs in Mojo Village, Ulujami, Pemalang is salinity.

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