The important value of mangrove crabs based on sediment conditions at the Asam-Asam river estuary of Tanah Laut regency

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Abstract. Mangrove scabs (Scylla) are organisms that have very high commodity values and are satisfied by many communities in Indonesia, including communities at the Estuary of Asam-Asam River. This research aimed to analyze the important value index of mangrove crabs based on sediment conditions at the Estuary of Asam-Asam River in Tanah Laut Regency. The method of this research was the descriptive method with the direct observation to the field for defining the five sampling points. We took mangrove crab samples three times at each sampling point with distinct periods. The three sampling points lay at the river estuaries and two sample points lay at the non-river estuaries (about 100 meters to 200 meters from the estuary). The results showed that two species of mangrove crabs were found at the region of the river estuaries were Scylla serrata with the Important Value was 133,33 dan Scylla paramamosain which the Important Value was 66,67. Important Value Indexes of these mangroves were high and indicated that these mangrove crabs could play large important ecologic roles in their communities. The mangrove crabs which be found were very little because the condition of the texture of sediments were clays and the contents of air hardness of water were high (smallest 50,8 mg/l) as well as Total Suspended Solid (smallest 55 mg/l) were a high concentration.

Keywords: Important value, mangrove crab, sediment.

1. Introduction

Mangrove crabs (Scylla) are one of the key species in balancing mangrove ecosystems. Mangrove crabs have very important roles as food resources which be liked by large communities. Mangrove crabs are founded largely for selling at the traditional markets. Mangrove crabs are one of the opportunities for fishery commodities that have little scale. These mangrove crabs have the height of an economic value because of the protein resource which is consumed by large communities [1]. Also, the mangrove crabs have a high export value. The export value of crabs reaches 409.82 USD from 2015 to 2017 [2].
Mangrove crabs are one of the animals which are in the estuary of the Asam-Asam River. These mangrove crabs enjoy the muddy swamp habitat that is grown by the mangrove forests [3]. Mangrove crabs which the habitat conditions of these, one of them is found in the estuary of Asam-Asam River.

According to early observation (2014) was known that a part of the mangrove forests in the area of the Estuary of Asam-Asam River experienced a land conversion to the pond lands. Siringoringo et al. [4] said that the conversion of the parts of the mangrove forests to pond lands could cause the degradation of habitat qualities so could bring about damage of breeding area and look for food area of the mangrove crabs. So, mangrove crab populations could reduce the number and possibility of the kind of their species.

The estuary of Asam-Asam River is one of the Rivers which its flow can be used by in this area and its around. This condition can cause degradation of water quality or sediment quality. Halang [5] reported that the texture values of the Estuary of Asam-Asam River were categorized nearby loam sandy. The sand texture was not suitable for living the mangrove crabs.

Water conditions at the Estuary of Asam-Asam River experienced the degradation of quality chemically. Heddy [6] reported that zinc concentration (Zn), hydrogen sulfide (H₂S), and iron (Fe) of water qualities passed the values of standard qualities according to the values of standard qualities of the Governor’s Decree of South Kalimantan in 1994. Merkristivita [7] said that the Estuary of Asam-Asam River especially at the parts of the mangrove plants which were the medium heights had a zinc content of 0.28 mg/l. This zinc content passed the standard quality requirement. Wibowo [8] reported that the part of vegetations at the estuary of Asam-Asam River contained the iron concentration (Fe) was 15.42 mg/kg. It passed the standard-quality requirement according to Dirjen POM of number 03725/SK/VII/1989.

We have been knowing that a part of the mangrove forest which lay at the edge of Asam-Asam River, especially the Estuary of Asam-Asam River, and its water quality has already experienced degradation. Those could result in an abundance of mangrove crabs. There was no information of the result studies about this condition. The new information about the density of mangrove forests related to mangrove crabs has never been researched especially at the estuary of the Asam-Asam River. So we need the study the important values of mangrove crabs and sediment contents. Next, the result of this study can become the basis for managing the preservation of living mangrove crabs.

2. Study Site and Methods
This research used a descriptive method. Sampling was done by observation, namely direct observation to the field. This research was located at the Asam-Asam River in the estuary of Asam-Asam Village, Tanah Laut Regency. The research procedure was done to observe the research area. Prepared tools and materials, established the five sampling points, that were: 1) In the estuary of Asam-Asam River on the high density of mangrove plants, 2) The part of Estuary of Asam-Asam River on the medium density of mangrove plants about 600 meters from the settlement of communities, 3) The part of the Estuary of Asam-Asam River at the condition of the rare mangrove plants, 4) The part of the Non-Estuary of Asam-Asam River (about 200 meters from the third sampling point) and 5) The part of the Non-Estuary of Asam-Asam River proximally 400 meters from the third sampling point). The location of the five sampling points can be seen in Figure 1 below, namely:

The technique used to catch mangrove crabs was to use a trap in the form of Rakkang. Cached the mangrove crabs by using Rakkang dan We used a special fish bait in this Rakkang. After that, mangrove crabs have observed their morphologies by using a wolf. Next, we measured the ecological conditions of mangrove crabs, which were: watercolor, water depth, turbidity, hardness, Total Suspended Solid (TSS), Iron (Fe), and Nitrite (NO₂). Then, we measured sediment contents (texture, C-Organic, pH (H₂O), pH (KCl), particle density, metals of Fe, Zn, Cu, As.
3. Results

3.1. The composition and Density of Mangrove Crabs

The composition of mangrove crabs that were found could be varied, according to the observed habitat. The composition of mangrove crabs in freshwater also could be different. River habitats could differ from pond habitats. The composition of mangrove crabs which were found at the estuary of Asam-Asam River was shown in Table 1 as follow:

**Table 1.** The composition of mangrove crabs which found at the estuary of Asam-Asam River.

| No | Species           | Number | Percentage (%) | Density (ind/area) |
|----|-------------------|--------|----------------|-------------------|
| 1  | *Scylla serrata*  | 2      | 66.67          | 0.004             |
| 2  | *Scylla paramamosain* | 1  | 33.33          | 0.002             |

The composition of mangrove crabs which were found at the Estuary of Asam-Asam River consisted of two species (Table 1) namely *Scylla serrata* and *Scylla paramamosain*. These species were in one class, which was Crustacea. The density of these species was low, namely 0.004 individual/area for *Scylla serrata* and 0.002 individual/area for *Scylla paramamosain*. The composition of the mangrove crabs which were found in this location could be seen in Figure 2.

**Figure 2.** The highest percentage of the mangrove crab was *Scylla serrata*, which was 66.67 % and the lowest percentage of mangrove crab was *Scylla paramamosain*, which was 33.33 %.
3.2. The Important Value Index of Mangrove Crabs

The Important Value Index of mangrove crabs also could differ on each habitat. One of the river habitats with another river habitat also could differ its condition so the important value of mangrove crabs could vary. The important value index of mangrove crabs that were found at the Estuary of Asam-Asam River could be seen in Table 2.

**Table 2.** Species of the mangrove crabs were found at the Estuary of Asam-Asam River while the 1st, 2nd, 3rd sampling days.

| Observation Days | Species name     | sampling points | Total | K (ind/area) | INP | H’  |
|------------------|------------------|-----------------|-------|--------------|-----|-----|
| I                | -                | 0 0 0 0 0       | 0     | 0            | 0   | 0   |
| II               | Scylla serrata   | 1 1 0 0 2       | 2     | 0.004        | 133.33 | 0.27 |
| III              | Scylla paramamosain | 0 1 0 0 1       | 1     | 0.002        | 66.67 | 0.37 |
|                  |                  | 3               | 0.006 | 200          | 0.64 |

The highest important value of mangrove crabs (Table 2) which was found on the second observation day was *Scylla serrata*, which was 133.33 and the lowest important value of mangrove crabs was *Scylla paramamosain*, namely 66.67. Besides that, the diversity of these mangrove crabs was low (H’ = 0.64).

3.3 Water and Sediment Quality of Asam-Asam River Estuarine

Some environmental parameters characterize water chemical parameters. Those parameters consisted of the physical, chemical, and biological parameters. The parameters of water quality at the estuary of Asam-Asam River which were observed should be seen in Table 3.

**Table 3.** Results of measurements of the physic-chemical quality parameters at the Asam-Asam River on the five sampling points.

| Parameters   | Units | Titik | Threshold of standard quality* |
|--------------|-------|-------|--------------------------------|
|              |       | 1     | 2     | 3     | 4     | 5     |
| Color        |       |       |       |       |       |       |
| Yellow-Brown |       |       |       |       |       |       |
| Yellow - Brown |     | 247.20 | 261.00 | 230.10 | 201.00 | 158  |
| Depth        | Cm    |       |       |       |       |       |
| Turbidity    | NTU   | 62.3  | 51.4  | 169   | 406   | 329  |
| Hardness CaCO3 | mg/L | 54.2  | 50.8  | 61.6  | 62.4  | 63.5  |
| TSS          | mg/L  | 66    | 55    | 115   | 254   | 197   |
| Iron (Fe)    | mg/L  | 0.23  | 0.17  | 0.46  | 0.37  | 0.56  |
| Nitrite (NO2)-N | mg/L | 0.0049 | 0.0009 | 0.0018 | 0.0067 | 0.0055 | 0.06 |

The results of measurements of physic-chemical parameters (Table 3) showed that parameters of turbidity, hardness, and TSS exceeded the threshold of standard quality. Whereas the parameter of nitrite was under the threshold of standard quality of the environment.

Furthermore, the sediments are the habitats for bottom animals' life, i.e. mangrove crabs. The sediment has some important main roles. Results of sediment measurements at the Estuarine Asam-Asam River were shown in Table 3.

The results of the research (Table 4) showed that the characters of sediments that were measured were texture and particle density. According to the triangle of texture based on USDA (Soil Survey Staff, 1990) was found that texture of the location of area 1 (estuary of the river) was categorized as clay class (6.73 % of sand, 26.10 % of dust, 67.18 of clay). The location texture of area 2 (Non-Estuary of River) was categorized close clay class (36.90 % of sand, 18.6 % of dust, 44.84 % of clay). The diagram of texture could be seen in Figure 3.
Table 4. The measurement of sediments at the estuary area and the non-estuary area of Asam-Asam River.

| Parameter | Units | Area | Description/ Criteria/BM |
|-----------|-------|------|---------------------------|
| Physics | | | |
| a. Texture | | | |
| Sand | % | 6.73 | 36.90 | Sampling 1 : Clay |
| Dust | % | 26.10 | 18.26 | Sampling 2 : close clay |
| Clay | % | 67.18 | 44.84 | |
| b. Particle Density | g/cm³ | 2.07 | 2.10 | |
| Chemicals | | | |
| C-Organik | % | 3.04 (T) | 7.73 (T) | 3.01-5 : High, 2.01-3 : Medium |
| pH (H₂O) | | 6.37 | 3.19 | |
| pH (KCl) | | 6.04 | 2.90 | |
| Iron (Fe) | mg/g | 9.33 | 9.82 | <17* mg/kg |
| Zinc (Zn) | mg/g | 0.008 | 0.02 | <0.09* mg/kg |
| Copper (Cu) | mg/g | 0.002 | 0.02 | |
| Arsen (As) | mg/g | <0.005 | <0.005 | |

Description: *) *Standard /BM: Classification of US-EPA in not polluted condition; R= low, S= Medium, T= High : Pusat Penelitian Tanah, 1995

Figure 3. Texture diagram of sediment at the estuary and non-estuary of Asam-Asam River.

The features of chemical sediments which were measured were C-Organic, pH (H₂O), pH (KCl), and some heavy metals. The C-Organic content at the Estuary was high category (3.04 %) and C-Organic content at the Non-Estuary (around 200 m – 400 m from the Estuary) was very high category (7.73). The pH (H₂O) content at the Estuary was close neutral whereas the pH (H₂O) at the Non-Estuary was very acid. Also, the heavy metal content of Fe was rather high so it was estimated to disturb the existence of mangrove crabs.

4. Discussion
4.1 The composition and density of mangrove crabs
The composition of mangrove crabs that were found was very little (only two species) and the density of these species was very low. These cases were guessed could be caused by the mangrove crabs couldn’t adapt to their habitats. Their habitats possibly couldn’t provide foods with were fix of them or their habitats possibility were polluted if we reviewed from their water qualities. We also could say that their habitats possibility were polluted if we reviewed from the side of sediment qualities. Besides that, we could say that the mangrove crabs were found the little because they were overfishing.
These species had low densities and diversities were supposed by overfishing toward mangrove crabs. Research about the frequency of catching mangrove crabs not ever be done at the Estuary of Asam-Asam River. However, communities at the Estuary of Asam-Asam River often catch the mangrove crabs according to the information of communities that live in this area. The mangrove crabs are often caught by communities because these mangrove crabs are one of the protein necessities in this area. As a result, probably many young mangrove crabs were caught before adults. So, the density and the diversity of mangrove crabs are more reduced in their number. Mirera [9] said that the exploitation of mangrove crabs increased in the last decade.

Furthermore, Tahmid et al. [1] said that the rate of catching for mangrove crab was over of exploitation (53.62%) which happened in Bintan Bay, Riau. Moreover, [4] added that the mangrove crab which was worthy caught was the mangrove crab had a size of carapace width was > 15 cm and spawned. This statement was supported by [10] that reductions in crab resources were caused by the degradation of mangrove plants and overfishing.

Another statement said that the pattern of distribution mainly appertained to characteristics of the physico-chemical environment [11,12]. The existence of mangrove vegetation even prepares the structure of habitat and food for mangrove crabs and establishes the structure of habitat from these crabs. Crab abundance varied among the tidal level of three habitats [12].

4.2 The important value index of mangrove crabs
The important values of the Scylla serrata and the Scylla paramamosain respectively were 133,33 and 66,67. The important values of those mangrove crabs were high. They indicated that the Scylla serrata and the Scylla paramamosain had the best of their adaptation processes on the sampling areas so they could play the important role in processing ecological balances. Both these species could adapt to their habitats. Their habitats contained source of food which was suitable for them, i.e., those habitats many contained the macrozoobenthos.

Other research showed that the compositions of macrozoobenthos which were found at the Estuary of Asam-Asam River were at least 53 kinds of species [5]. This statement was supported by [13] that natural foods of the mangrove crabs were macrozoobenthos. While the small size of Scylla serrata was Omnivorous, feeding probably plant material and small crabs. While the medium size and large size of S.serrata, were predominantly carnivores, feeding a variety of slow-moving invertebrates such as worms, crabs, and mollusks [14].

4.3 Water and sediment qualities at the estuary of Asam-Asam River
The low densities of mangrove crabs were caused by their habitats weren’t suitable or their habitats did not support their life. One of the habitats that weren’t suitable were the bad water qualities on all of the sampling points, especially the turbidities, the hardness, the Total Suspended Solids (TSS), and the Fe contents. These parameters were above the threshold of quality standards so these parameters could disturb mangrove crabs’ life.

Increasing TSS value and hardness will hamper the photosynthesis process by autotroph organisms and reduce the oxygen in the water. This caused an anoxic condition in the water [15]. Some factors which influenced TSS concentration, namely dryland farming, and shrubland, the population, location quotation (LQ) for dryland paddy field and soybean production, geographic population density, and area of settlement land [16].

Besides that, the sediment quality also defined the density and diversity of mangrove crabs. The sediment parameters which could influence the mangrove crabs were textures. The texture class which was found at the Estuary of Asam-Asam River were clay (river estuary) and close clay (river non-estuary) These sediment textures didn’t support mangrove crabs’ life. This statement was supported by [17] that the habitat for mangrove crabs were the sediments that contained loam sandy, sandy loam, and sandy-clay loam.

Variation of metal concentrations in water and sediments depends on the activities of human communities around the stream or the river. These activities are industries, mining, and urbanization.
The Cu and the Zn were within the range found by other authors, but they exceeded the maximum range of criteria. If communities often consumed food like the traditional food in Thai food, these metals become accumulated in the human body. As a result, these metals may be a potential health hazard for human consumers [18].

This corresponded with [13] stated that mangrove crabs were suitable with the habitat which had sandy loam sediment. [19] described that the dispersion of sediments, vegetation in the mangrove area, and crabs have strongly correlated with the present results. Thus, those findings were good to study in conjunction. Furthermore, they said that the characteristics of mangrove crabs were significantly correlated to vegetation types, weight /size, and abundance. Also, sediment characteristics were substantially distinct based on the vegetation type. Another statement [20] said that the oxidized layer-thickness varied base on burrow volume and sediment depth. Consequently, the effect of burrow varied significantly between distinct from fiddler crabs as an effect of distinct habitat characteristics, crab size, and sediment types. Next, [12] reported that the distribution and diversity of crabs (i.e., mangrove crabs) were significantly distinct among the tidal level and sites. Sediments that retained the content of water provided an appropriate condition for these crabs of burrows.

Besides that, some of the sediment contents in the water like iron (Fe) might cause serious disturbance to animals (i.e., mangrove crabs) when its content reached a high concentration. The high concentration of Fe on the cellular level might disrupt the membranes of cells and damage DNA. We have known that Fe was an essential mineral for growth, but it had a toxicity effect when added its concentration in excess. It could negatively affect aquatic biota [21].

5. Conclusion
a. The important value index of mangrove crabs at the Estuary of Asam-Asam River in Tanah Laut Regency were 133,33 for Scylla serrata and 66.67 for Scylla paramamosain.

b. Sediment texture at the Estuary of Asam-Asam River belong to clay class in the Estuary and close clay class in the Non-Estuary of Asam-Asam River

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