

Diversity of Crustaceans Family: Portunidae in East Coast Mangrove Forest Reserve Mendahara Resort Tanjung Jabung Timur

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Abstract – Crustacea, the largest subphylum in the Phylum Arthropoda, inhabits fresh and seawater. Their bodies are divided into three segments namely cephalo, thorax, and abdominal, or cephalothorax in some crustacean species and they breathe through gills. Crabs are one of the biota that can function as aquatic bioindicators in addition to making a major contribution to nutrient recycling. In the muddy parts of the mangrove forest, the decapod crustacean species Portunidae plays an important ecological function in the environment. This research aims to categorize the crustaceans of the Portunidae family in the East Coast Mangrove Forest Nature Reserve and calculate their dominance, uniformity, and diversity indices. The diversity, uniformity, and dominance index of the Crustacean Family Portunidae in the East Coast Mangrove Forest Reserve area was calculated in this quantitative descriptive research. Purposive sampling is a sampling approach used in survey methods used for sample collection. The results showed that the two different types of crustaceans collected for this study were *Thalamita crenata* (4125 individuals) and *Scylla olivacea* (a total 19 individuals). This research shows that in the East Coast Mangrove Forest Reserve area, *Thalamita crenata* is the most commonly found crustacean species in the Portunidae family. The overall dominance index is in the medium group, while the overall diversity and uniformity index is in the low group. The results of Principal Component Analysis (PCA) show that the environmental factor with the closest relationship and positive correlation between species diversity and uniformity and environmental parameters is salinity.

Keywords: Diversity, Portunidae, Mangrove

INTRODUCTION

Mangrove forests are tropical coastal ecosystems that are primarily defined by the abundance of various types of trees that are able to thrive in the tidal zone. The unique species of flora and fauna found here differentiate this forest from other forests (Ritohardoyo & Ardi, 2014). The mangrove forest ecosystem consists of various organisms that interact with their environment in the mangrove forest habitats, such as plants, animals, and bacteria. One way to view the mangrove environment is as a home for the animals and plants that live there. Due to the interaction of various interrelated factors that influence the growth and development of the mangrove ecosystem both internally and externally, this is very complex (Khairunnisa et al., 2020). One of the mangrove forests in

Jambi Province is the East Coast Mangrove Forest Nature Reserve.

Various types of crustaceans can be found living in the East Coast Mangrove Forest (HBPT) Nature Reserve (CA) which stretches along the east coast of Jambi. Administratively, it is located in two sub-districts, East Tanjung Jabung, and West Tanjung Jabung. The East Coast Mangrove Forest area functions as a Nature Reserve and is formally classified as a protected area. Its circumference is 109,331 kilometers and the total area is 4,126.60 hectares (BKSDA Jambi, 2003).

The order Decapoda is a taxon of arthropods that has up to fifteen thousand species. The term "Decapoda" means "ten", meaning this specific species has five pairs of legs (Waisaley et al., 2019). Three pairs of locomotor organs have transformed into the maxilla of the first thoracic segment. The five

pairs of thoracic locomotion organs listed below function as pereopods, or walking legs. The first limbs used for walking are often large and have pincers; these are called chelipeds (Hernawati et al, 2013). One of the animal families that can be found in mangrove forests is Portunidae. It is a member of the subphylum Crustacea and family Portunidae, subclass Malacostraca.

A type of decapod crustacean known as Portunidae is found in muddy parts of mangrove forests and plays an important ecological role in this environment. Members of the Portunidae family dig burrows for shelter and food. They also act as an oxygen aeration medium, which improves the quality of the forest floor by allowing oxygen to penetrate into the soil. In this way, the

mangrove forest substrate remains loose so that the root system of the constituent vegetation can grow and develop well in the substrate (Dewi et al., 2017).

Scientifically, we see the important ecological role of crustaceans in the area. Apart from that, this study can also be used as a step in making conservation policies in the East Coast Mangrove Forest Reserve.

MATERIALS AND METHODS

1. Location and Time of Research

This research is located in the East Coast Mangrove Forest Nature Reserve, East Tanjung Jabung, Jambi Province. This research was carried out in March-May 2023. The following is a map of the research locations presented in Figure 1.

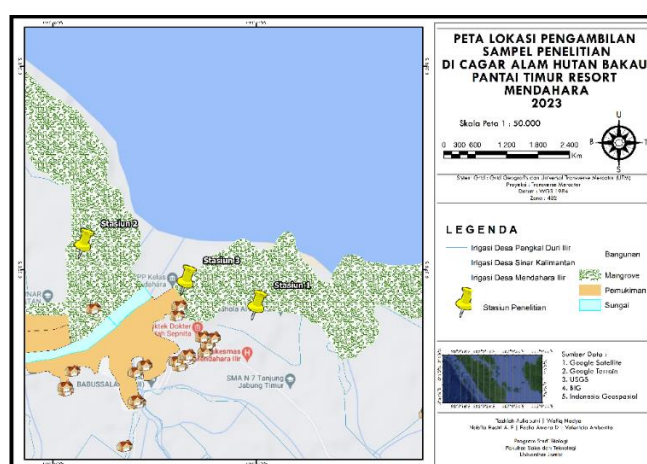


Figure 1. Determination of Sampling Points

Sampling of crabs along with measurements of environmental factors consisting of water quality conditions was carried out in the East Coast Mangrove Forest Nature Reserve area. Sampling starts from high tide conditions using a purposive sampling method.

2. Tools and Materials

The equipment used in this research included cell phones, sample containers, hanging labels, stationery, rakkang, spread nets, gloves, pH paper, thermometer, and a

refractometer. This study used crustacean samples from the portunidae family, along with 70% alcohol, 40% formalin, distilled water, and fish bait for sampling.

3. Method

This research is a quantitative descriptive study that calculates the diversity index, uniformity index, and dominance index of crustaceans belonging to the Portunidae family in the mangrove forest reserve area on the east coast. This research was carried out

in several stages, including data analysis, sample identification, sample preparation, and field sampling. Sampling was carried out at 3 stations with the aim of collecting samples obtained from several habitat types. Station I in Parit Odong with mangrove vegetation characteristics is near residential areas, Station II Sinar Kalimantan has mangrove vegetation near the shoreline and Station III is Syahbandar.

Crustacean samples that have been obtained from the field are identified. Observation of crustacean samples with identified characteristics such as carapace, claws, dactylus and abdomen. The data analyzed includes diversity, uniformity and dominance which is calculated using the following formula:

a. Diversity Index (H')

The Shannon-Wiener diversity index formula is as follows, the diversity index is used:

$$H' = -\sum p_i \ln p_i$$

Information :

H' = Shannon-Wiener diversity index

n_i = Number of species

N = Total number of individuals of all species

With criteria:

$H' < 1$ Low diversity

$H' = 1-3$ Medium diversity

$H' > 3$ High diversity

b. Index of Uniformity

The Krebs (1985) formula was used to calculate the homogeneity of crustacean species.

$$E = \frac{H'}{\ln S}$$

Information :

E = Uniformity index

H' = Diversity index

S = Number of species

With criteria:

$e < 0.4$: Low category

$0.4 < e < 0.6$: Medium category

$e > 0.6$: High category

c. Dominance Index

The dominance index is calculated using a formula based on Odum (1993).

$$C = \sum \left[\frac{n_i}{N} \right]^2$$

Information :

C = Dominance index

n_i = Number of individuals

N = Total individuals

With Criteria:

$0 < C < 0.5$ = No dominance

$0.5 < C < 1$ = There is dominance

RESULTS AND DISCUSSION

Mendahara Ilir Village is located in East Tanjung Jabung Regency, Jambi Province, on the east coast of Mendahara District. This area on the East Coast is a wildlife reserve that mostly consists of mangrove forests. Based on the requirements of having a large amount of vegetation and a diversity of plant and animal species, this area is declared a conservation area. The condition of the mangrove forest determines the division of the research location into three locations. Station I is located close to residential areas with mangrove vegetation which mostly consists of *Nypa fruticans* and *Avicennia* sp. The station coordinates are S-0, 9520163 E-103, 6850904. Station II is surrounded by mangrove vegetation consisting of *Avicennia* sp., *Nypa fruticans*, *Sonneratia* sp., and *Rhizophora* sp. It is located in the middle of the river. S -0.9440318 E 103, 6700295 are the coordinates. Station III is located near the sea and provides a transit route for shipping and fishing vessels. Mangrove vegetation, especially *Avicennia* sp., *Nypa fruticans*, and *Sonneratia* sp. to differentiate the location.

Station III coordinates S -0.9512865, E 103.6766998.

Mangrove vegetation and mud crabs have a relationship based on the mangrove crab's desire for mangrove vegetation with a strong root system that can anchor the mud substrate. The mangrove environment with *Rhizophora* plants is home to most of the mangrove crabs. In 2017, Dewi et al. conducted research that found that crabs thrive in the complex physical structure of mangrove vegetation, which is characterized by its branches extending downwards and supporting roots that are closely intertwined. Mangrove plant litter is broken down by bacteria and fungi, adding nutrient-rich organic matter to the mangrove forest. Portunidae and other aquatic species that live near mangrove forests will benefit from this.

The mangrove habitat is a very productive ecological zone because it is rich in nutrients and has ideal temperature, pH value, oxygen concentration, salinity and water turbulence. As a result, crustaceans consider this area to be an excellent habitat (Putriningtias et al., 2019). According to Dewi et al. (2017), mangrove forests offer Portunidae the best habitat for hiding. According to Serosero (2011), crabs live on coral islands, muddy sandy beaches and sandy beaches. They can swim up to 65 meters below the surface and down to about one meter above sea level.

1. Diversity of Crustacea (Family: Portunidae)

The worldwide family Portunidae consists of 15 genera, containing approximately 72

species. There are 10 genera with a total of 27 species recognized in Indonesia (and Malaysia). With at least 20 species, the *Charybdis* genus is the most numerous in terms of population size. Ten or more species are found in Indonesia. (Irwan and Soegianto, 2006).

a. *Scylla olivacea* (Kepiting Bakau)

Mud crabs are a type of crustacean known as an arthropod because of their hard exoskeleton. The Decapoda order is characterized by the presence of 10 legs, and five pairs of legs, including mud crabs. The fifth set of legs is flat and used for walking, while the first set of legs is pincer-shaped. The oval carapace of mud crabs in the genus *Scylla* is what sets them apart. There are nine spines on the longer side of the carapace, five on the left and five on the right, and four in the space between the eyes. The captured male mud crab had a carapace width of 11 cm. In 2019, Tiurlan et al. The most common range for male mud crabs was 10–10.7 cm, while the most common range for female mud crabs was 10.8–11.5 cm, consistent with the frequency distribution of mud crab carapace widths. Even though their size is still not very large, mangrove crabs are thought to have perfectly formed reproductive organs at that size.

Mangrove crabs are often found in brackish water habitats with muddy bottoms, usually around coastlines covered with mangrove forests. The mud crab population will eventually decrease due to degradation of its natural environment. (Wijaya, 2010).

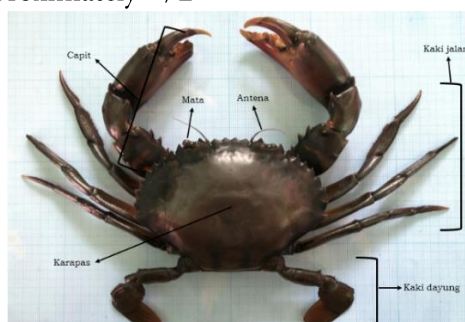


Figure 2. Morphology (*Scylla olivacea*)

d. *Thalamita crenata* (Rajungan Hijau)

Genus *Thalamita* adalah salah satu marga terbesar dalam anak suku Portunidae. Di kawasan Indo-Pasifik Barat telah ditemukan setidaknya 66 spesies. *Thalamita*

ditemukan di dasar laut bersubstrat batu karang, berpasir, berlumpur dan di kawasan bakau serta lamun (Luthfiyana dkk, 2021).



Figure 3. Morphology (*Thalamita crenata*)

The *Thalamita* genus shows geographic variation in body size between males and females due to factors such as habitat, genetics, gonadal maturity index, and food availability. The *Thalamita* genus includes small crustaceans. The carapace size of the captured *thalamita* specimens was 3 cm for males and 4.5 cm for females. With a smooth greenish carapace, a slightly rectangular body shape, the last set of legs are paddle-shaped,

with greenish walking legs, and pink claw tips, *Thalamita crenata* has a body width of 4-5 cm. (Putriningtias et al, 2014).

Based on the research results, the crustacean samples obtained consisted of 2 species, namely *Scylla olivacea* and *Thalamita crenata*. The number of crustacean species of the Potunidae family found in the East Coast Mangrove Forest Reserve area is listed in Table 1.

Table 1. Species and number of individual crabs caught at each research station

No.	Species	Family	Station			Quantity (Individual)
			I	II	III	
1.	<i>Scylla olivacea</i> (Herbst, 1796)	Portunidae	5	5	9	19
2.	<i>Thalamita crenata</i> (Rüppell, 1830)		1341	1335	1449	4125
	Jumlah		1346	1340	1458	4144

Based on the data in Table 1, *Thalamita crenata* is the most frequently found species among the species found at the three research stations. It can be concluded that the lunar phase had an impact on the feeding, migration or reproductive habits of crustaceans during the March to May sampling period when sea levels were at their

highest. During a month, the moon's phases undergo cyclical changes which then repeat throughout the year. The development, molting, and reproductive activity of decapod crustaceans are influenced by the lunar cycle, which in turn influences the number of crabs caught. Because these conditions influence the behavior of

crustaceans, the phases of the moon impact aquatic biota as a whole. Cannibalism is another factor limiting population expansion in these habitats, in addition to the impact of overfishing during certain lunar phases. Crabs will act cannibalally when they are hungry and have little food (Wiyono and Ihsan, 2015).

Where there are many mangrove trees and the land is often flooded with sea water, even at low tide, the portunidae species are most diverse. Due to the area's high topography and low forest density, resulting in reduced flooding at high tide and rapid seawater drainage at low tide, the family Portunidae shows less variation here. There are no portunidae species in the area because there are not many trees in the area, limiting the amount of nutrients available. (Dewi et al, 2017).

2. Diversity Index Value (H')

This research investigates the correlation between diversity and two main variables: species richness, which indicates the number of different species in a community, and species abundance, which indicates the proportional population size of a species. The number of species present, the support the food chain offers, the population size of each species, and environmental factors can all impact the value of species diversity.

The crustaceans of the family Portunidae found here have low diversity, according to the estimated diversity index (H') ($H' < 1 = \text{Low}$). The diversity index value is 0.031. The environment is negatively impacted by the presence of polluted stations and the narrow mangrove forests. A low diversity index indicates the dominance of one species with an uneven distribution, according to research by Hasanah et al. (2014).

3. Uniformity Index Value (E)

The uniformity index represents the balance of species composition in a community. Low uniformity index results indicate that the community is dominated by different crustacean species. A lower organism uniformity score indicates an irregular distribution of organisms among the various species, with a tendency for certain forms to dominate.

The results of calculating the homogeneity index (E) for each station show that it is included in the low group ($e < 0.4 = \text{Low}$). with a uniformity index value of 0.04. The unequal distribution of individuals and the dominance of species in this habitat is the cause of the low homogeneity index. A lower uniformity index score indicates a tendency for one species to dominate the population, indicates changes in numbers, and indicates that individuals within each species or genus are not all the same.

4. Dominance Index Value

The dominance index is a numerical number that ranges between 0 and 1. According to Odum (1993), a greater dominance index indicates the presence of a particular species, while a lower dominance index reflects the absence of a dominating species.

The dominance index calculation result of 0.990 is included in the low category. The more or less even distribution of individuals between species in all locations is the cause of the low dominance value. An unstable situation or the presence of a species that really dominates a station is indicated if the dominance index is close to 1. The most abundant species in the East Coast Mangrove Forest Area is *Thalamita crenata*. *Thalamita* tends to spread into deeper waters because it is thought to prefer environments with low salinity.

5. Environmental Parameters of Each Station

Environmental characteristics assessed in this study include temperature, pH, and salinity. The results of the study of environmental factors show that the temperature of the three locations is all in the range of 28°C. Observations made in the morning and evening were the cause of this happening. Warm temperatures increase the metabolic rate of aquatic animals, especially Portunidae, which increases the need for dissolved oxygen. High temperatures cause increased evaporation, which causes the substrate to dry out. This ultimately has an impact on decreasing the diversity of Portunidae species in mangrove forests as well as decreasing the abundance of Portunidae. This is because many Portunidae cannot tolerate temperatures that are too high (Dewi et al., 2017).

Because it influences the metabolism of aquatic species, sea water temperature is an important environmental factor that has a major impact on the survival and reproductive processes of these species. According to Pasingi (2012), rising water temperatures will have a significant impact on aquatic life, including disrupting crustacean reproduction.

The pH values of the three stations are as follows: station I has a pH of 6, station II has a pH of 7, and station III has a pH of 6. A pH of 6.5 to 7.5 is considered adequate water quality, while a pH of 7.5 to 8, 9 is considered good quality water. The pH range indicates that the water is clean and in good condition, according to research conducted in the East Coast Mangrove Forest Conservation Area (Abidin et al., 2022).

One measurable environmental aspect that impacts crab life is salinity. By increasing osmoregulation, the process of controlling the ratio of water to ions in their bodies, crustaceans can adapt to variations in salinity (Lantu, 2010).

Based on research findings, three stations—namely station I (10°), station II (16°), and station III (22°)—have salinity levels. Due to its strong osmoregulation, *Scylla* sp. Mangrove crabs can survive in low salinity conditions. According to Lasara et al. (2014), mud crabs have a high level of tolerance for salt levels in their habitat, which ranges from 2 to 40 parts per thousand (ppt). Certain crab species require the right amount of salt to survive and thrive. Osmoregulation may be triggered by a lack of salinity in the crab's habitat, which may inhibit its ability to grow. For crabs to survive, the recommended salinity range is 30-35 ‰. (Hutabarat & Evans, 2008).

6. Relationship of Environmental Physico-Chemical Parameters with Diversity and Evenness of Crustacean Types Family: Portunidae.

The relationship between environmental physico-chemical parameters in the East Coast Mangrove Forest Reserve area with the diversity and uniformity of crustacean species of the portunidae family was analyzed using Principal Component Analysis (PCA). This analysis will show the size of the influence of a parameter on the diversity and uniformity of crustacean types of the Portunidae family in the East Coast Mangrove Forest Nature Reserve area. Can be seen in figure 4.

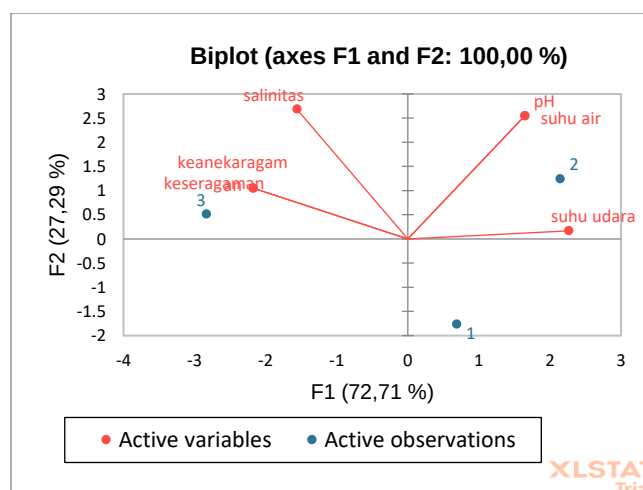


Figure 4. Graph of the relationship between environmental parameters and the diversity and uniformity of crustaceans of the Portunidae family.

Based on the results of the analysis carried out using Principal Component Analysis (PCA) which is presented in Figure 18, the factor with the closest and most positive correlation between species diversity and uniformity and environmental parameters is the salinity parameter. Salinity affects crustaceans at every stage of their life, but it is especially important when they are molting (Hill, 1976 in Rosmaniar, 2008). Between 10 and 30 parts per thousand (ppt), or brackish water, is the ideal salinity range for crabs. Crustaceans can adapt to fluctuations in salinity by increasing their osmoregulation, which involves regulating the balance of water and ions in their bodies. Gills are an important organ in the osmoregulation process of crustaceans according to research Lantu (2010).

CONCLUSIONS

1. Conclusion

Based on the research conducted, it produces the following conclusions:

- a. Crustaceans (Family: Portunidae) found in the East Coast Mangrove Forest Reserve area consist of 2 species, namely, *Scylla olivacea* and *Thalamita crenata*.
- b. The diversity index and uniformity index obtained as a whole for the station are in the low category, while the dominance index is included in the medium category. Results of measuring optimal water parameters for the life of crustacean biota.

2. Suggestion

Based on the research carried out, the following suggestions can be given:

- a. This research may serve as a complementary or comparative resource for future crustacean research.
- b. Further research can be carried out in the new lunar cycle so that the species obtained are maximized.

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