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Research Article

Study of the abundance and diversity of crustacea in the ecosystem mangrove forest of Ambon Island

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ABSTRACT

Crustaceans are very abundant in mangrove forest ecosystems and are still poorly documented. Therefore, this study aims to reveal the abundance and diversity of crustaceans in the mangrove forest ecosystem of Hutumuri Beach and Suli Beach, Ambon Island. Crustacean data collection was done by determining the plot using random sampling method. Determination of crustacean abundance using individual formulations per unit area or per unit volume, while crustacean diversity was calculated using the Shannon-Wiener equation. The crustaceans found in the mangrove forest ecosystem of the Hutumuri and Suli beaches were 56 individuals, consisting of 7 families and 11 species. The abundance of crustaceans in the mangrove forest ecosystem of the Hutumuri coast and the coast of Suli was 0.29 ind/m2 and 0.27 ind/m2, respectively. For the diversity of crustacean species in the mangrove forest ecosystem of the Hutumuri coast and the Suli coast, respectively, 1, 176807 in the medium category and 0.78526 in the low category.

Keywords: crustacea, mangrove forests, diversity, abundance

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INTRODUCTION

Mangrove forest is a typical forest type that grows in areas that are affected by tides, especially in coastal areas, lagoons, river estuaries that are flooded and free from inundation at low tide where the plant community is tolerant of salt levels (Sofian et al., 2019 ; Haumahu et al., 2018; Rahayu et al., 2017). This ecosystem forms a system consisting of organisms both plants and animals that interact with environmental factors that exist in the mangrove ecosystem (Rahayu et al., 2017). Mangrove ecosystems have an important role in coastal areas, namely 1) physically acting as a barrier to abrasion, sea waves, strong winds for land areas, controlling sea water intrusion, and building land through the sedimentation process, 2) ecologically acting as producers (providers). nutrients), spawning ground, nursery ground and feeding ground for various types of animals such as fish, shrimp, and crabs and 3) economically, mangroves can be used as firewood, paper materials, and construction materials (Putriningtias et al., 2019). As a specific ecosystem, mangroves have strong associations with the biota that live around them.

The existence of mangroves is very important for every biota in the ecosystem (Hogarth, 2007 & Pratiwi, 2007). Therefore, the mangrove ecosystem is often called a transitional ecosystem which has an important role in balancing the surrounding aquatic (marine) and terrestrial (terrestrial) ecosystems (Pratiwi, 2007). As a transitional area for the two ecosystems, mangroves have the characteristics of fauna that live in the environment, namely vertebrates such as amphibians, reptiles, aves and mammals, while the invertebrates that live in mangrove ecosystems are crustaceans and mollusks. The existence of these two phyla is the most conspicuous and abundant (Hogarth, 2007 & Pratiwi, 2007). The mangrove ecosystem has optimum temperature, light, pH, oxygen, salinity, rich in nutrients (organic matter content), sediment characteristics and calm water conditions. This fulfills the criteria for a suitable habitat for crustaceans (Pratiwi, 2007 & Checon et al., 2017). Crustaceans consisting of shrimp and crabs have an important role in the mangrove ecosystem and there are several species that have high economic value. In addition, there are several species identified as high protein sources, for example Panurilus spp., Scylla spp., and Portunus pelagic (Hamid & Wardiatno, 2018).

Several studies show that the diversity of crustacean species varies in all locations and in Maluku, research on crustacean diversity is rarely carried out, even though Maluku has waters that are rich in various kinds of marine life. Suli and Hutumuri beaches are the locations used for research on crustacean diversity. These two locations are rarely used for crustacean research, therefore, in this study, these two beaches were used to identify the diversity of crustaceans on both coasts. In addition, there are many biological aspects that become criteria for suitable habitats for crustaceans, namely abundant mangrove populations as a place of reproduction, rich in nutrients, calm water conditions, and others. The purpose of this study was to reveal the diversity and abundance of crustacean species on Hutumuri Beach, South Leitimur District, Ambon City, Maluku and on Suli Beach, Salahutu District, Central Maluku Regency, Maluku.

METHODS

This research is a descriptive study that describes the diversity and abundance of crustacean species in the Mangrove area, Hutumuri village, South Leitimur sub-district, Ambon city and Suli village, Salahutu sub-district, Central Maluku district in March 2020. Sampling was carried out at low tide (lowest low tide). The location for sampling is based on the availability of mangrove vegetation that represents the research area. Each location (station) consists of 3 plots. The plot was determined based on the random sampling method. In each sampling squared (10 x 10 m), crustaceans on the substrate surface were picked by hand (hand picking). The crustaceans contained in the hole were taken by digging a hole and using a trofol/shovel. Samples that can be cleaned with water to remove traces of sediment attached to the crustacean sample. Samples were anesthetized with 70% alcohol, then stored in jars and labeled for identification.

Crustacean abundance is calculated using the following equation:

$$\mathbf{N} = \frac{\mathbf{\Sigma ni}}{\mathbf{A}}$$

Explanation:

- **N** = Abundance of *crustacea* (ind/m^2)
- **Σni** = Number of individuals of type I (ind)
- **A** = Sampling box area (m^2)

The Diversity Index (H') of Crustaceans is determined by the equation of Shannon-Wiener (Krebs, 2016) :

$$\mathbf{H'} = -\sum_{\mathbf{i=1}}^{s} \mathbf{(pi)ln(pi)}$$

Explanation:

- H' : Diversity index Shannon-Wiener
- S : Number of species
- pi : The proportion of the number of individuals of type I to the total number of individuals
- pi : ni/N
- ni : Number of individuals type -i
- N : Number of individuals of all types

Table 1. The value of the diversity index benchmark (Indraswari et al., 2018)

Benchmark Value	Explanation
H' < 1,0	Low diversity, poor, very low productivity as an indication of heavy pressure and unstable ecosystem
1,0 < H' < 3,322	Moderate diversity, sufficient productivity, moderately balanced ecosystem conditions, moderate ecological pressure
H' > 3,322	High diversity, stable ecosystem stability, high productivity, resistant to ecological stress

RESULTS AND DISCUSSION

Based on the results of a comprehensive study at the location of the mangrove forest ecosystem, Hutumuri beach and Suli beach, 56 individuals were found consisting of 7 families and 11 species. In the coastal mangrove forest ecosystem of Hutumuri, 6 families, 8 species and 29 individuals were found. In the Suli coastal mangrove forest ecosystem, 2 families, 3 species and 27 individuals were found (Table 2).

Table 2. Types of crustaceans in the mangrove forest ecosystem of the Hutumuri coast and the Suli coast

Family	***Species***	**Number of Individuals**	
		Hutumuri	**Suli**
Grapsidae	*Metopograpsus frontalis*	-	2
Ocypodidae	*Austruca* (*Uca*) *perplexa*	-	11
	Gelasimus (*Uca*) *hesperiae*	-	14
	Paraleptuca (*Uca*) *boninensis*	1	-
	Tubuca (*Uca*) *dussumieri*	2	-
Penaeidae	*Penaeus* sp.	3	-
Pilumnidae	*Pilumnus vespertilio*	1	-
Porcellanidea	*Pterolisthes scabriculus*	1	-
Potamidae	*Geothelphusa cilan*	1	-
	Geothelphusa hesperiae	9	-
Xanthidae	*Etisus dentatus*	11	-
Number of Types		**8**	**3**
Number of Individuals		**29**	**27**

Crustacea families found in the coastal mangrove forest of Hutumuri were quite large compared to those found in the mangrove forest of the Suli coast. The species in the two research locations were also different, where the species in the Hutumuri coastal mangrove forest ecosystem did not exist in the Suli coastal mangrove forest ecosystem. This is because the mangrove forest ecosystem on the Hutumuri beach is still in good condition and there is no human-caused disturbance that can damage the mangrove forest ecosystem, therefore species diversity is found there. In the mangrove forest ecosystem on the Suli coast, the condition has been under pressure caused by the presence of garbage disposal and has become a place for community settlements. This greatly affects the existence of crustaceans so that the number of species and families found is not too many (Pratiwi, 2007). Overall diversity and abundance of crustaceans in the mangrove forest ecosystem of the Hutumuri coast and the coast of Suli have differences, especially for the abundance of certain species in the Ocypodidae, Potamidae and Xanthidae families. This situation is in line with the opinion of Odum (1993) that in a community that contains many species, some of which are pre-dominant groups. The number of species including pre-dominant decreases if an environment becomes extreme caused by environmental disturbances both physically, biologically and chemically (Pratiwi, 2002).

The crustaceans found in the mangrove forest ecosystem of Hutumuri village consisted of 8 species belonging to 6 families, namely Paraleptuca (Uca) boninensis and Tubuca (Uca) dussumieri (Ocypodidae), Penaeus sp. (Penaeidae), Pilumnus vespertilio (Pilumnidae), Pterolisthes scabriculus (Porcellanidae), Geothelphusa cilan and Gheothelphusa hesperiae (Potamidae) and Etisus dentatus (Xanthidae). Crustacean species that are most often found are species from the Xanthidae family, while the less common are species from the Pilumnidae and Porcellanidea families. The Xanthidae family has a species composition of 39% in the Hutumuri coastal mangrove forest ecosystem. The number of species from the Xanthidae family that were found was due to several factors, including the first factor, the crabs in the Xanthidae family have "lazy moving" behavior so that their roaming area is

limited (Wahyudi, 2013). The second factor, Xanthidae crabs are the dominant group in coral reef ecosystems and rock fragments (Pratiwi, 2012). The third factor is the possible influence of the sampling method (handpicking) used for sampling because the sampling process is carried out by taking sediment, so that crabs that have lazy behavior such as Xanthidae will be obtained more than crabs that are actively moving (Pratiwi, 2019). The types of crabs found in the mangrove forest ecosystem of Suli village consist of 3 species which are divided into 2 families, namely Austruca (Uca) perplexa and Gelasimus (Uca) hesperiae (Ocypodidae) and Metopograpsus frontalis (Grapsidae). The most common type of crustacean found is the type of crustacean in the Ocypodidae family, while the less common is the Grapsidae family.

Two species in the Ocypodidae family are crab species that live in holes when the tide is low and are found (dominant) in mangrove forest ecosystems (Suprayogi, 2014). This is because the habitat occupied is in accordance with the way of life of the crab and the availability of food in the form of abundant mangrove leaf litter, so this type of crab is the most abundant. This is because, the habitat occupied is in accordance with the way of life of the crabs and the availability of food in the form of abundant mangrove leaf litter, so that this type of crab is most often found (dominant) with a percentage of 93%. Two species in the family Ocypodidae dig holes and live in them to protect their bodies against high temperatures, because the water in the dug holes can help regulate body temperature through evaporation (Murniati, 2009). While the Grapsidae family has a composition of 7% for the location of the Suli village mangrove forest ecosystem. Crabs from this family are found in mangrove areas, however, not as many as Ocypodidae because Metopograpsus frontalis is a climbing species so it is difficult to find this species.

Crustacea abundance in the mangrove ecosystem of Hutumuri and Suli coasts

In general, the two study sites had relatively similar abundances of crustaceans because the differences were not too significant. The location of the mangrove forest ecosystem in Hutumuri village has a greater abundance than the location of the mangrove forest ecosystem in Suli village, which is 0.29 ind/m2 while the abundance of crustaceans in the mangrove forest ecosystem location in Suli village is 0.27 ind/m2. There are several factors that affect the abundance of crustaceans, namely, the availability of a high content of organic matter (food), organic matter serves to provide nutrients for the crustaceans that live in it. temperature, salinity, pH, and substrate type. If the required element values are below or above the threshold, the species will not be found in these waters (Redjeki et al., 2017).

Table 3. Crustacea abundance at the study site

Family	***Species***	**Number of Individuals**	
		Hutumuri	**Suli**
Grapsidae	*Metopograpsus frontalis*	-	0,02
Ocypodidae	*Austruca* (*Uca*) *perplexa*	-	0,11
	Gelasimus (*Uca*) *hesperiae*	-	0,14
	Paraleptuca (*Uca*) *boninensis*	0,01	-
	Tubuca (*Uca*) *dussumieri*	0,02	-
Penaeidae	*Penaeus* sp.	0,03	-
Pilumnidae	*Pilumnus vespertilio*	0,01	-
Porcellanidea	*Pterolisthes scabriculus*	0,01	-
Potamidae	*Geothelphusa cilan*	0,01	-
	Geothelphusa hesperiae	0,09	-
Xanthidae	*Etisus dentatus*	0,11	-
	Amount	**0,29**	**0,27**

Diversity of crustaceans in the mangrove ecosystem of Hutumuri coast and Suli coast

Based on the number of individual crustaceans from the two research locations, namely the mangrove forest ecosystem of Hutumuri village and Suli village, it shows that the number of individual crustaceans found in each location is different and the diversity index of the two locations is also different.

Table 4. Diversity of crustaceans in the mangrove forest ecosystem of the Hutumuri coast and the Suli coast

Family	***Species***	**Number of Individuals**	
		Hutumuri	**Suli**
Grapsidae	*Metopograpsus frontalis*	-	2
Ocypodidae	*Austruca* (*Uca*) *perplexa*	-	11
	Gelasimus (*Uca*) *hesperiae*	-	14

	Paraleptuca (*Uca*) *boninensis*	1	-
	Tubuca (*Uca*) *dussumieri*	2	-
Penaeidae	*Penaeus* sp.	3	-
Pilumnidae	*Pilumnus vespertilio*	1	-
Porcellanidea	*Pterolisthes scabriculus*	1	-
Potamidae	*Geothelphusa cilan*	1	-
	Geothelphusa hesperiae	9	-
Xanthidae	*Etisus dentatus*	11	-
	Number of Individuals	**29**	**27**
	Number of Species	**8**	**3**
	H'	**1,176807**	**0,78526**
	Σ H'	**1,96207**	

The diversity index (H') of the location of the mangrove forest ecosystem in Hutumuri village 1.176807 belongs to the medium category, which means that this location is in fairly stable environmental conditions, crustaceans live well in these environmental conditions. The concept of species diversity can be used to measure the ability of a community to keep itself stable (community stability), even though it gets disturbed. H' is in a fairly stable condition, the ecosystem is quite balanced and is under moderate ecological pressure (Handayani et al., 2016). The diversity index (H') at the location of the Suli coastal mangrove forest ecosystem, which is 0.78526, is included in the low category, it means that the Crustacean community is in an unstable condition. Not many species live in this location and there are dominant species such as Gelasimus (Uca) hesperiae and Austruca (Uca) perplexa). In addition to these types, other types are obtained but in very small quantities. This is related to the condition of the location which is close to community settlements and there is a lot of waste from the surrounding community. .

CONCLUSION

Based on the results of the study, the crustaceans found in the coastal mangrove forest ecosystem of Hutumuri and Suli coast consisted of 7 families with 11 species, namely Paraleptuca (Uca) boninensi, Tubuca (Uca) dussumieri, Austruca (Uca) perplexa and Gelasimus (Uca) hesperiae (Ocypodidae). Metopograpsus frontalis (Grapsidae), Penaeus sp. (Penaeidae), Pilumnus vespertilio (Pilumnidae), Pterolisthes scabriculus (Porcellanidae), Geothelphusa cilan and Gheothelphusa hesperiae (Potamidae) and Etisus dentatus (Xanthidae). In all, 56 individuals were identified. The abundance of the two locations is relatively similar, namely at the location of the coastal mangrove forest ecosystem of Hutumuri 0.29 ind/m2 and at the location of the coastal mangrove forest ecosystem of Suli 0.27 ind/m2, the abundance is influenced by tidal factors, food availability and environmental factors. The value of the diversity index (H') at the location of the mangrove forest ecosystem on the Hutumuri coast is 1.176807 with a medium category indicating moderate diversity, sufficient productivity, fairly balanced ecosystem conditions and moderate ecological pressure and at the location of the mangrove forest ecosystem in Suli village of 0, 78526 with low category with indications of low diversity, poor, very low productivity as an indication of heavy pressure and unstable ecosystem.

REFERENCES

Checon, H. H., & Costa, T. M. (2017). Fiddler crab (Crustacea: Ocypodidae) distribution and the relationship between habitat occupancy and mouth appendages. Marine Biology Research, 13(6), 618-629.

Hamid, W., & Wardiatno, Y. (2018). Diversity of decapod crustaceans in Lasongko Bay, South-East Sulawesi, Indonesia. Biodiversity Journal, vol. 9(3), p. 303-311.

Handayani, O. T., Ngabekti, S., & Martuti, N. K. T. (2016). Diversity of crustaceans in the mangrove ecosystem in the Tugurejo Village area, Semarang City. Life Science, 5(2), 100-107.

Haumahu, S., Uneputty, P. A., Tuapattinaja, M. A., & Rijoly, F. (2018). Biology of coastal and marine organisms. Alphabeta: Bandung.

Indraswari, I. G. A. D., Dirgayusa, I. G. N. P., & Faiqoh, E. (2018). Study of the abundance and diversity of crabs in mangrove forests and seagrass beds on the Mertasari coast. Journal of Marine and Aquatic Sciences, 4(1), p. 167-170.

Krebs, C. J., O'Donoghue, M., Taylor, S., Kenney, A. J., Hofer, E. J., & Boutin, S. (2016). Predicting white spruce cone crops in the boreal forests of the southern and central Yukon. Canadian Journal of Forest Research, 47(1), 47-52.

Murniati, D. C. (2009). Comparison of the cover area of the second maxiliped spoon toped setae in Uca spp, (Brachyura: Ocypodidae). Zoo Indonesia, 18(1), 1-8.
Odum EP. 1993. Basics of ecology. Translated by Tjahjono Samingan. Third Edition. Gadjah Mada University Press, Yogyakarta.
Pratiwi, R. (2002). Study of community structure and some biological aspects of crustacean macrobenthos in the mangrove community of Ajkwa Island and Kamora Island, Mimika Regency, Papua. Undergraduate Thesis in Marine Science, Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang
Pratiwi, R. (2007). Study of mangrove crabs in the Mahakam Delta, East Kalimantan. Oceanographic Research Center-LIPI, 12(2), 92-99.
Pratiwi, R. (2012). Types and distribution patterns of crustacean fauna in the seagrass beds of Tikus Island, Seribu Islands. Oldi, 38(1), 43-55.
Pratiwi, R. (2019). Tikus island brachyura crab, Thousand Islands. Biosphere Biosphere Scientific Magazine: A Scientific Journal, 36(1), 63-70.
Putriningtias, A., Faisal, T. M., Komariyah, S., Bahri, S., & Akbar, H. (2019). Diversity of crab species in the mangrove forest ecosystem of Kuala Langsa, Langsa City, Aceh. Journal of Tropical Biology, 19(1), 101-107.
Rahayu, S. M., Wiryanto., & Sunarto. (2017). Diversity of crustacean species in the mangrove area of Purworejo Regency, Central Java. Journal of Basic Science, 6(1), 57-65.
Redjeki, S., Arif, M., Hartati, R., & Pinandita, L. K. (2017). Density and distribution of crabs (Brachyura) in the mangrove forest ecosystem of Segara Anakan Cilacap. Journal of the Tropical Ocean, 20(2), 131-139.
Sofian, A., Kusmana, C,, Fauzi, A., & Rusdiana, O. (2019). Ecosystem services-based mangrove management strategies in Indonesia: A review. AACL Bioflux 12(1), 151-166.
Suprayogi, D., Siburian, J., & Hamidah, A. (2014). Diversity of violin crabs (Uca spp.) in Tungkal I village, Tanjung Jabung Barat. Biospecies, 7(1), 22-28.
Wahyudi, A. J. (2013). Poisonous crab. In: Hasdeo EH, Bisri SZ, Ningrum A, Ayuandari S, Kurnia F, Syamsurnarno MR, Heryani P & Premono Eds. Thousand Teachers Magazine, 29, 11-13