Mangrove and Gastropod Composition in Pemalang Mangrove Forest, Central Java Indonesia

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Abstract: Pemalang mangrove forest is one of the mangrove forests located in Central Java and suffered damage due to abrasion. Coastal abrasion can affect the composition of mangroves and gastropods. The research was conducted in the rainy season and aims to analyze the wealth, density, and distribution of gastropods. The sampling technique for mangroves and gastropods was purposive sampling techniques. The richness of gastropada species was found in 10 species of five families. The highest density of gastropod species at station 3 (SA3) was 6.33 ind/m^2 followed by station 2 (SA2) at 4.27 ind/m^2, and satasiun 1 (SA1) 3.87 ind/m^2. The distribution of gastropods in stations 1, 2, and 3 has uniform distribution pattern.
Keywords: composition, richness, density, distribution

Introduction

Mangrove forests are a typical type of vegetation, found in tropical and subtropical coastal areas that thrive on sloping coastal areas near river estuaries and beaches that are protected from waves. Mangroves can also live in habitats with suitable salinity and substrates (Tomlinson, 1986). Mangrove forests have various functions, including ecological functions as shoreline protection, preventing sea water intrusion, habitat, foraging areas, nursery and enlargement, spawning grounds for various aquatic biota (Bengen, 2002). Mangrove forests also have a function as carbon storage and can reduce carbon dioxide gas (Bouillon *et al*., 2003).

Gastropods have an important role in the structure and function of the mangrove ecosystem. Gastropods connect primary detritus at the bottom of the food web with consumers at higher tropic levels. Benthic organisms have limited mobility, so that gastropods are very sensitive to local disturbances and cannot avoid water and sediment conditions that are decreasing in quality. Gastropods that are sensitive to environmental chemistry and physics conditions make gastropods a good bioindicator of mangrove environment (Skilleter, 1996). Gastropods are one type of invertebrates that are abundant in mangrove ecosystems. The distribution of Gastropod species is influenced by several factors, including light, salinity level, substrate type, and tides. In general, the species richness pattern of Gastropods follows the species richness of mangrove vegetation (Nagelkerken *et al*., 2008). One of the roles of gastropods is as a decomposer in the process of decomposition of litter and mineralization of organic matter, especially those of herbivores and detrivors (Suwondo *et al*., 2005). The function of mangrove forests is very important for the management and conservation of mangrove ecosystems (Nordhaus, 2007; Nordhaus *et al*., 2009).

The mangrove ecosystem in Central Java has various forms. Pemalang Mangrove Forest is one of the mangroves on the north coast bordering the Java Sea with relatively small waves. On the north coast, sediments from rivers and seas are deposited in certain protected locations and form tidal flats or mud flats (tidal mud flats settle in river estuaries to form embankments and sandbanks) which inhibit the entry of river water into the sea, thus forming lagoons. (Setyawan

and Winarno, 2006). The decline in mangrove diversity is influenced by changes in environmental conditions (Wintah, 2018).

Pemalang mangrove forest was damaged. Damage to the mangrove ecosystem that occurs continuously will experience changes in habitat which have an impact on the structure of the mangrove vegetation itself, including the structure of the associated biota community in the form of benthic invertebrates, including gastropods. Basically, the presence of gastropods has an influence on the flow of energy in the mangrove ecosystem.

Pemalang mangrove forest experiences habitat changes, directly or indirectly, which will result in changes in the structure of the vegetation community including its associated biota. Therefore, it is necessary to study the composition of mangroves and gastropods in the mangrove forests of Pemalang, Central Java.

Methods

Time and Location of Research

The research was conducted in Pemalang Mangrove Forest, Central Java during the dry season for four months, namely June, July, August, and September 2018.

Research Material

The materials used in the study were mangrove plants and associated biota in the form of gastropods found in Pemalang Mangrove Forest, Central Java.

Sampling Technique

The population in the study were all mangroves in Pemalang, Central Java. The sampling method of the mangrove population was taken using a purposive sampling method. The research location was divided into three stations which were determined based on good mangrove canopy cover at station one (SA1), moderate mangrove canopy cover at station two (SA 2), and damaged mangrove canopy cover at station three (SA 3). At each sampling point, data on mangrove and gastropods communities were taken using a plot sampling method (Mueller-Dumbois and Ellenberg, 1974) with the plotting procedure described in the sampling procedure section.

Sampling Procedure

Field sampling begins with the determination of the station points at the research location and at each station point 3 quadrants measuring 10m x 10m, 5m x 5m, 1m x 1m are made to measure the composition of mangroves and a 5m x 5m plot for measuring gastropod composition data. Mangrove vegetation samples obtained at the study site were identified using Tomlinson (1986), Kusmana *et al*. (2003), and Duke (2006). Gastropod samples were taken randomly in a quadrant of 10m x 10m with three repetitions. For each plot, it is taken in three ways, namely
1) making a 5m x 5m plot to get a sample above the sediment (Sasekumar, 1974) taking a sample of gastropods in the sediment by sticking the corer with a depth of 10 cm (Nordhaus *et al.* 2009). 3) take gastropods attached to the roots, leaves and trunks of mangrove trees. The gastropod samples obtained were then preserved using 70% alcohol. Gastropod samples obtained at the study site were identified in the laboratory using Dance (1974) and Dharma (1988).

Result

The composition of mangroves in Pemalang mangrove forest found 4 species from 2 families, namely Rhizophora stylosa, Rhizophora apiculata, Rhizophora mucronata, and Avicennia marina. Mangrove wealth is presented in table 1.1

Table 1.1 Mangrove richness

No	Familia	Spesies	Station		
			SA1	SA2	SA3
1	*Rhizophoraceae*	*Rhizophora stylosa*	+	+	-
		Rhizophora apiculata	+	+	-
		Rhizophora mucronata	-	-	+
2	*Avicenniaceae*	*Avicennia marina*	+	+	-
Total			3	3	1

Information;
SA1 = Station one SA2 = Station two SA3 = Station three

Four species of mangroves were found (tabei 1.1), namely *Rhizophora stylosa*, *Rhizophora apiculata*, *Rhizophora mucronata*, and *Avicennia marina*, including true mangroves (Tomlinson, 1986).

R. stylosa, *R. apiculata*, *R.mucronata*, and *A. marina* has high frequency, because it is found at stations one and two. The mangrove species *R. mucronata* were only found at station three.
R. apiculata and *R. mucronata* are the most common mangrove species. In terms of the conservation of mangrove species *R. apiculata* and *R. mucronata* have the status of "least consern" because of their declining population (Duke *et al*., 2010 and Kathiresan *et al.*, 2010). This is of particular concern for sustainable mangrove management.

Discussion

The mangrove composition can also be seen from the total number per station. The highest density value at station one. The tree density was 4633 individuals / ha, the sapling density was 5800 individuals / ha, while the mangrove density at the seedling level was 2500 individuals / ha. Mangrove density at station two was only found at the tree and sapling levels. The tree-level density was 3666 individuals / ha and sapling density was 5633 individuals / ha. Meanwhile, the mangrove density at station three was only found at the tree level, namely 3466 individuals / ha (Figure 1.1).

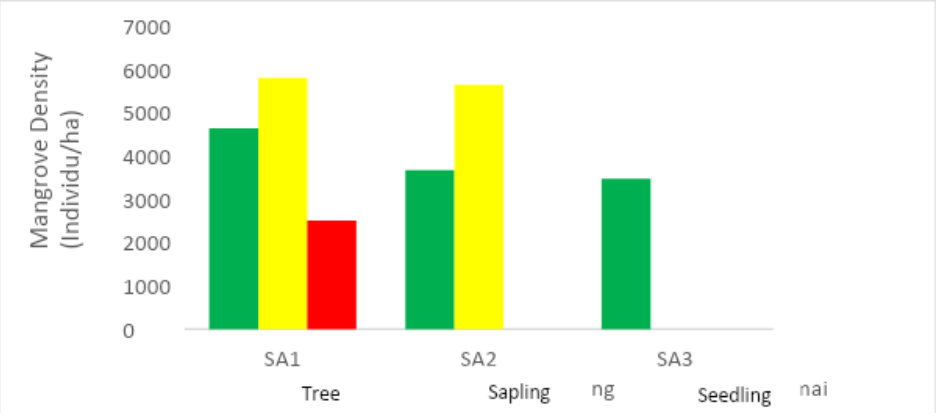

Figure 1.1. Mangrove density at each station

Station one is found at tree, sapling, and seedling levels. Station two is found at tree level and sapling. While station three is found only at tree level. Station 1 has the highest density of all stations due to environmental factors such as temperature, salinity, and soil pH which are still in good condition and the substrate is in good condition. While the substrate is sandy mud, the substrate is suitable for mangrove growth. This is in accordance with the opinion (Setyawan and Ulumuddin, 2012) that mangroves need silt as a substrate for growth in order to grow well and the presence of silt is an important factor. Mangroves are also able to live on beaches with sandy substrates (Noor *et al.*, 2006; Halidah, 2010).

Composition of Gastropods

The composition of gastropods in the Pemalang mangrove forest was found in 11 species from 5 families, namely *Assimenia brevicula, Cassidula angulifera, Cassidula nucleus, Cassidula aurisfelis, Cerithidea alata, Telescopium telescopium, Littoraria melanostoma, Littorina carinifera*, *Littorina scabra*, and *Neritina lineata* (table 1.2). .

Table 1.2. Gastropods Richness

No	Familia	Species	Station		
			SA1	SA2	SA3
1.	Assimineidae	*Assimenia brevicula*	+	+	-
2.	Ellobiidae	*Cassidula angulifera*	+	+	+
		Cassidula nucleus	+	+	+
		Cassidula aurisfelis	+	-	-
3.	Potamididae	*Cerithidea alata*	+	+	-
		Telescopium telescopium	-	-	+
4.	Littorinidae	*Littoraria melanostoma*	+	+	-
		Littorina carinifera	+	-	-
		Littorina scabra	+	-	-
5.	Neritidae	*Neritina violacea*	+	-	-
		Neritina lineata	+	-	-
Total Species			10	5	3

Information;
SA1 = Station one SA2 = Station two SA3 = Station three

Gastropods found in mangrove forests are included in the Prosobranchia subclasses. Some of the common families found are Littorinidae, Neritidae, Potamididae, Ellobiidae, and Assimineidae. Frith (1977) states that the dominant gastropod groups in mangrove forests are from the families Neritidae, Littorinidae, Potamididae, Muricidae, Onchinidae and Ellobidae. The families Ellobiidae and Potamididae were found at all stations, while the presence of the families Assimineidae, Littorinidae, and Neritidae was only found in certain stations. The station that has the most number of species is station 1, which is 10 species. The station that has the least number of species is station 3. The species that are often found at each station are Cassidula angulifera and Cassidula nucleus.

Budiman and Darnaedi (1982) state that the presence of high species of mollusks depends on their ability to adapt or have a wide environmental tolerance, such as dry resistance (Littorina, Brachiodontes and Crassostrea), species that can escape from high tide (Nerita and Littorina).

and water resistant type (Cerithidea). The gastropod density at each station is presented in (Figure 1.2)

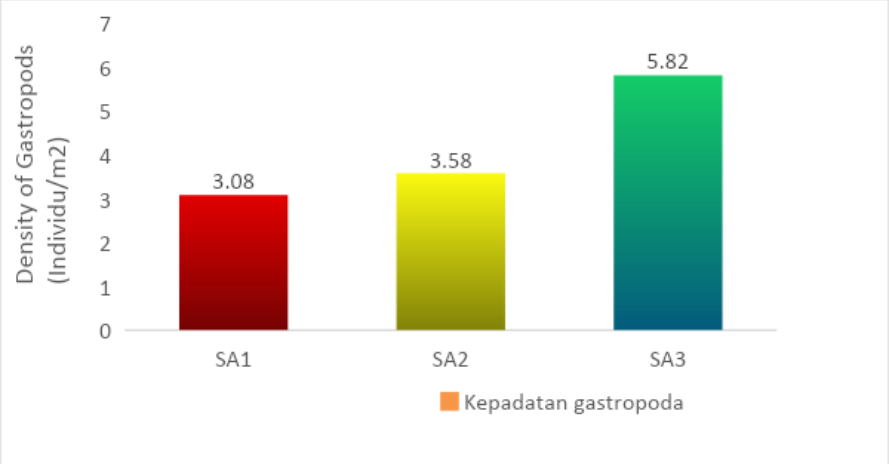

Figure 1.2. Gastropod density at each station

Gastropods composition can be seen from the total number of gastropod species per station. The highest gastropod density was at station three, followed by stations two and one. The density at station three is 5.82 individuals / m^2, at station two 3.58 individuals / m^2, at station one 3.08 individuals / m^2. The highest species density was found in *Cassidula nucleus* at 4.05 individuals / m^2. Meanwhile, the lowest total species density was *Littorina carinifera* and *Neritina lineata* at 0.1 individuals / m^2. Low species density due to poor environmental conditions. Odum (1971) states that the number of species can be reduced if an environment becomes extreme, namely experiencing environmental stresses, both physical, chemical and biological. The entry of both organic and inorganic waste as pollutants can also cause changes in environmental conditions which in turn change the habitat for several species. Species density is strongly influenced by the availability of foodstuffs, predation, and competition (Wintah *et al*., 2017).

Conclusion

The reduced mangrove composition has an effect on gastropod density. Station three has a mangrove density that has little effect on gastropod wealth, only three species of gastropods are found. On the other hand, the good mangrove composition at station one has a lot of gastropod properties, namely 11 species of gastropods.

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