Gastropod Diversity In The Tundung Musuh Mangrove Forest Conservation Area, Tasikmadu Village, Palang District, Tuban Regency

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Abstract

Gastropods are one of the Mollusca Phyla which play a very important role in maintaining the balance of the coastal ecology and as a general environmental bio-indicator in the mangrove ecosystem. If the number of Gastropod diversity is low, it can be ascertained that the mangrove forest ecosystem is disturbed. Likewise, if there is high gastropod diversity, it can be ascertained that the mangrove forest ecosystem is in a stable state. With this, it is necessary to conduct research with the aim of analyzing the diversity of Gastropods in the Tundung Musuh Mangrove Forest Conservation Area. This type of research is quantitative descriptive with observative methods. Based on observations, data obtained from 1,325 individual Gatropods consisting of 8 species from 4 families. With the following details: *Planaxis* sulcatus from the Planaxidae family, *Littorina scabra* and *Littorina littorea* from the Littorinidae family, *Terebralia sulcata*, *Terebralia palustris*, and *Cerithidea cingulata* from the Potamididae family. *Cerithium litteratum* and *Hemifusus ternatanus* from the family Certhidae. Based on the results of data analysis, the value of Gastropod species diversity was 1.92 which means moderate, the Gastropod uniformity value is 0.34 which means low, the Gastropod dominance index value is 0.1423 which means low. Based on this, it can be concluded that the Mangrove Forest Conservation Area is still not supportive for Gastropod habitat.
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Keyword: Gastropods Diversity, Tundung Musuh Coast, Concervation, Mangrove Forest.

1. Introduction

Gastropods are animals that belong to the Mollusca phylum and live in Mangrove Forests (Ernawati et al. 2019). Generally, gastropods that we often encounter have a spiral tube-shaped shell, an asymmetrical body shape, breathing using a girdle and an internal anatomy called a torson (Zoologi & Lipi 2013). Gastropods are one of the mollusks that are found in various substrates, this is because gastropods have a higher adaptability than other classes (Puryono & Suryanti 2019)(Adharyan Islamy & Hasan 2020). Gastropods also play an important role in maintaining the balance of coastal ecology as bioindicators of the environment and water quality as well as a source of food for other animals (Kakap & Kubu 2019). Gastropod class is generally known as snails or slugs, and belongs to the phylum Molluscs (Gastropoda et al.). Gastropods have a wide distribution and the ability to adapt to the environment is very diverse, such as living in land, freshwater, marine, sandy and muddy substrates (Cappenberg

2016)(Ernawati et al. 2019). Gastropods have the most diverse and largest species because they successfully occupy various kinds of habitats and ecosystems such as seagrass ecosystems, coral ecosystems and mangrove ecosystems (Di et al. 2019).

Mangrove forests are terrestrial vegetation of shrubs and trees that survive and adapt in extraordinary ways to salty conditions (Di et al. 2019). Mangrove forests are vegetation that can survive in brackish waters (Pendidikan & Indonesia 2016). Mangrove forests have abundant wealth ranging from types of flora and fauna (Bitar & Zibrowius 2020). Fauna that humans use as feed ingredients in mangrove forest areas include snails (gastropods) and clams (bivalves) (Pulau & Tengah 2018). Gastropod class adapts both in mangroves and brackish water ecosystems, if there is diversity and low numbers of individuals, it can be ascertained that the mangrove forest ecosystem is disturbed (Imamsyah et al. 2020).

The reduction in gastropods will reduce the decomposition process in the mangrove forest, which results in reduced sedimentation from gastropod consumption leftovers (Baderan et al. 2019). Gastropods can be bioindicators of mangrove forest damage, if the mangrove conditions are good, the diversity and number of individual gastropods is high, and vice versa (Baderan et al. 2019).

The Tundung Musuh Mangrove Forest Conservation Area is an area rich in natural resources, both flora and fauna, such as fish, shellfish and snails. The local people depend on the mangrove forest area for their livelihoods such as looking for shellfish, however the current condition of the Tundung Musuh mangrove forest is appalling (Adharyan Islamy & Hasan 2020) (1 , 2 , 3 1 2011). The decline in this condition is due to the activities of community members around the mangrove forest area (Kakap & Kubu 2019) (Di et al. 2019) (Imamsyah et al. 2020). Where community uses mangrove forests for forest allocation into residential land and as a garbage disposal site (Pendidikan & Indonesia 2016). The rampant exploitation of mangrove forests by humans has a negative impact on the ecosystem. mangroves, starting from the depletion of mangrove forests and the reduction of organisms that live in them, such as in the gastropod class (Rahayu et al. 2018) (Kelautan et al. 2015).

Damaged mangrove forests can no longer withstand the abrasion that occurs, if this continues, the Tundung Musuh Mangrove Forest Conservation Area will continue to be eroded by water and floods will occur at high tide (1 , 2 , 3 1 2011). Mangrove forests provide a major contribution to organic detritus which is very important as a food source for biota that live in the surrounding waters (Seminar et al. 2020). Gastropods in mangrove forests play an important role in the structure of the food chain, namely in the process of decomposition of litter and mineralization of organic matter, especially those that are herbivore (Sigi et al. 2013). In other words, Gastropods are positioned as chopper leaves into small pieces which will then be continued by the decomposition process by Gastropod microorganisms which are relatively fixed in their habitat because of their very limited movement (Susiana 2011). Gastropods usually live attached to roots, mangrove stems and to the soil surface (Sigi et al. 2013)(Di et al. 2019)(Rahmawati et al. 2015). Gastropod abundance and distribution is influenced by their environmental habitat, food availability, predation, and also competition. If the number of Gastropod diversity is low, it can be ascertained that the mangrove forest ecosystem is disturbed (Sarong & Dewiyanti 2017). Likewise, if there is high gastropod diversity, it can be ascertained that the mangrove forest ecosystem is in a stable state (Irma & Sofyatuddin 2011).

Based on the condition of the Tundung Musuh Mangrove Forest Conservation Area, where there are still many community activities, one of which is the allocation of forests to residential land as well as garbage dumps and disrupting the Gastropod ecosystem, a research was carried out on the diversity of Gastropod species in the Tundung Musuh mangrove forest ecosystem. This research is a preliminary research that has never been carried out on this ecosystem. The research objective was to analyze the diversity of gastropods in the Tundung Musuh Mangrove Forest Conservation Area, Tasikmadu Village, Palang District, Tuban Regency.

2. Research Methods

2.1 Types and Research Methods

This study used a descriptive method because this study describes the diversity of gastropods in the Tundung Musuh Mangrove Forest Conservation Area. The research method is carried out by observation with the aim of obtaining data or facts about the diversity of gastropods and the environmental conditions of the conservation area. This research was conducted in January 2021 which is located in Tasikmadu Village, Palang District, Tuban Regency with the coordinate point 6˚35'45 "S 112˚ 06'29" E, the location is presented in Fig 1.

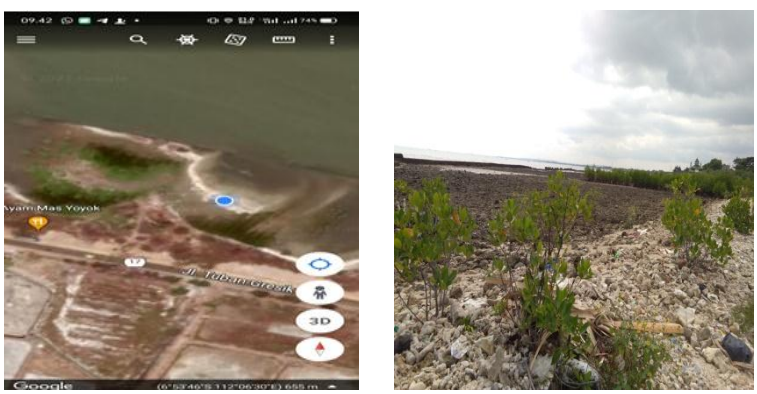


Fig 1. Research locations for the Tundung Musuh Mangrove Forest Conservation Area (Source: documentation on google maps of conservation areas, 2021).

2.2 Research Steps

The first stage in this research is field observation, this is done in orderknow the field conditions that will be used for research. Then the determination of the location that will be used as a research site is the Tundung Musuh conservation area in the village of Tasikmadu which has sandy mud soil characteristics. The tools used in this research include: 1) writing instruments; 2) Handbook of various Gastropods; 3) camera. The materials used in this study are various types of gastropods found in the Tundung Musuh Mangrove Forest Conservation Area.

2.3 Data Collection and Analysis Techniques

Data Collection Technique

The data collection technique used in this study is the observation technique, namely through direct observation in the field, in this case it is carried out directly in the Tundung Musuh Mangrove Forest Conservation Area which is located in the village of Tasikmadu. Observation of Gastropod types based on morphological characteristics. The data obtained after making observations are various types of Gastropods that live in the conservation area based on morphological characteristics. The research data were then identified using the Gastropod identification handbook from Simpson (Adharyan Islamy & Hasan 2020) (Badola et al. 2012).

Diversity Index Data Analysis

To find out the diversity of Gastropod species in the Tundung Musuh Mangrove Forest Conservation Area, Tasikmadu Village, Palang District, Tuban District, you can use the Shannon-Wienner species diversity index formula (Badola et al. 2012) in the diversity index showing the relationship between the number of species and the number of individuals that make up a community.

$$H' = -\sum_{i=1}^{S} \left(\frac{Ni}{N}\right) \ln \left(\frac{Ni}{N}\right) \quad (1)$$

Information :
H '= Shannon-Wienner diversity index.
Ni = Number of individuals of one kind.
N = total number.

Based on the species diversity index according to Shannon-Wienner is defined as follows:
a. The value of H '> 3 indicates that diversity is high.
b. The value of H '1 ≤ H' ≥ 3 indicates that diversity is moderate.
c. The value of H '<1 indicates that the diversity is little or low.

Analysis of Uniformity Index Data

To find out how much the distribution of the number of individual Gastropods of each type is similar, can use a uniformity index, namely by comparing the diversity index with its maximum value (Picardal & Dolorosa 2014). The more uniform the distribution of individuals between species, the more the balance of the ecosystem will be. The uniformity index is determined based on the following equation in:

$$(E = \frac{H'}{H'max} \text{ where } H'max = \ln S) \quad (2)$$

Information :
E: uniformity index
H ': diversity index
H'max: maximum diversity index
S: the number of types
The ranges for the uniformity index are as follows:
a. 0 <E ≤ 0.5: The ecosystem is under stress and uniformity is low

b. 0.5 <E ≤ 0.75: The ecosystem is in a less stable condition and moderate uniformity
c. 0.75 <E ≤ 1.0: The ecosystem is in a stable condition and high uniformity

Analysis of Dominance Index Data

To show that there are types of Gastropods that dominate in the Tundung Musuh Mangrove Forest Conservation Area in Tasikmadu Village. According to Odum, the status of the community condition can be determined using the dominance index. Where:

$$D = \sum_{i=1}^{S} \left[\frac{Ni}{N}\right]^2 \quad (3)$$

Information :
D: Simpson-dominance index
Ni: Number of individuals of type
N: The total number of individuals
S: Number of types

Dominance index range in (Kelautan et al. 2015) as follows:

a. 0 < C ≤ 0,5 : Low dominance (there are no species that dominate other species), the environmental conditions are stable, and there is no ecological pressure on the biota in the location
b. 0,5 < C ≤ 0,75 : Moderate dominance and fairly stable environmental conditions
c. 0,75 < C ≤ 1,0 : High dominance (there are species that dominate other species), environmental conditions are unstable, and there is an ecological pressure

3. Result and Discussion

3.1 Result

Based on the results of Gastropod identification found in the Tundung Musuh Mangrove Forest Conservation Area, Tasikmadu Village, Palang District, Tuban Regency, 1,325 individuals from 4 families were obtained. Gastropod diversity and the number can be seen in Table 1.

Table 1. Results of Gastropod Diversity Identification

No.	Family	Species	Number of Species
1.	Planaxidae	*Planaxis sulcatus*	210
2.	Littorinidae	*Littorina scabra*	150
		Littorina littorea	215
3.	Potamididae	*Terebralia sulcata*	275
		Terebralia palustris	175
		Cerithidea cingulate	130
4.	Certhidae	*Cerithium litteratum*	95
		Hemifusus ternatanus	75
		Total number	1.325

Gastropod diversity index is strongly influenced by the number of individuals and the number of Gastropod species. Diversity index for Gastropod species shows mixed results. Diversity index (H '), uniformity (E), and Gastropod dominance (D) for tree growth rates can be seen in Table 2.

Table 2. Data Analysis of Gastropod Diversity Index, Uniformity and Dominance

No.	Family	Species	Number of Species	H'	E	D
1.	Planaxidae	*Planaxis sulcatus*	210	0,29	0,05	0,0249
2.	Littorinidae	*Littorina scabra*	150	0,25	0,04	0,0128
		Littorina littorea	215	0,29	0,05	0,0263
3.	Potamididae	*Terebralia sulcata*	275	0,32	0,06	0,0430
		Terebralia palustris	175	0,26	0,05	0,0174
		Cerithidea cingulata.	130	0,19	0,03	0,0096
4,	Certhidae	*Cerithium litteratum*	95	0,18	0,03	0,0051
		Hemifusus ternatanus	75	0,14	0,03	0,0032
Total number			1.325	1,92	0,34	0,1423

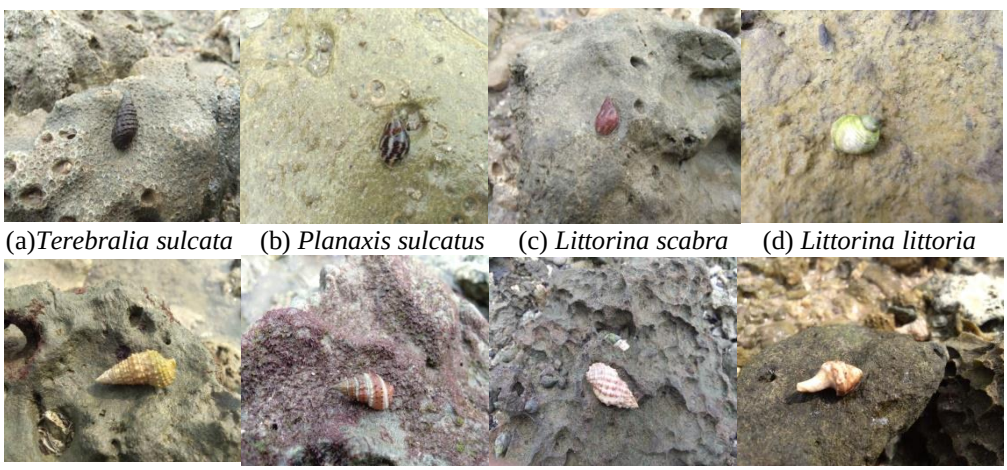
3.2. Discussion

The Tundung Musuh mangrove forest conservation area in the village of Tasikmadu has a diversity of Gastropods of 1,325 individuals consisting of 8 species of Gastropods from 4 families, namely *Planaxis sulcatus* from the Planaxidae family, *Littorina scabra* and *Littorina littorea* from the Littorinidae family, *Terebralia sulcata*, *Terebralia palustris* and *Cerithidea cingulata*, *Cerithium litteratum* and *Hemifusus ternatanus* from the family Certhidae. The results of observations about the diversity of Gastropods showed that the highest abundance of Gastropod species was Terebralia sulcata and the lowest was Hemifusus ternatanus. Terebralia sulcata is a type of Gastropod that has the largest number in mangrove forest conservation areas with 275 individuals, this is because this type of gastropod is the original inhabitant of mangrove forests and has a high tolerance for environmental changes due to physical factors outside the mangrove forest, so that these organisms can survive and thrive in mangrove forests (Irma et al. 2020).

Terebralia sulcata is one of the most important and most widespread types of Gastropods (Cappenberg et al. 2016). Its body has a diameter of 13-35mm with a dark to black shell color character and horizontal stripes (see Figure 2a) (Yolanda et al. 2015). *Planaxis sulcatus* is a type of Gastropod that has a slightly rounded body shape like a snail and has 2 body colors, namely white and brown (see Figure 2b) (Belhiouani et al. 2019). *Littorina scabra* is an epifauna gastropod that is native to mangrove ecosystems, where this species likes mud substrate or areas with large puddles with a reddish brown body (see Figure 2c) (Yolanda et al. 2015) (Ramanibai & Govindan 2017). *Littorina littoria* is a type of gastropod that has a white body color with a body diameter of 60-70 mm (see Figure 2d) (Kabir et al. 2014). *Terebralia palustris* is the largest mangrove gastropod, with a maximum shell length of 190 mm (see figure 2e)

(Modesta R. Maturbongs 2016). *Cerithidea cingulata* is a Gastropod species that has beautiful hues, including orange, white, gray and brown (see Figure 2f). *Cerithium litteratum* is a Gastropod species which has a dotted pattern on its body (see Figure 2g) (Picardal & Dolorosa 2014) (Wahyuni et al. 2016).

Whereas the species with the lowest abundance were *Hemifusus ternatanus*, *Hemifusus ternatanus* was a Gastropod species that had a shell that reached 70-270 mm in length (Zvonareva et al. 2015). The shell shape is slender, fusiform, with a high spire and long siphonal canals, but shows high geographic variation in sculpture and color (see figure 2h) (Moradi et al. 2019). The color is usually light brown, while the aperture is light cream to whitish. This species is very rare to find, this is because this species is a visitor gastropod, meaning that these gastropods are accidentally found in the mangrove ecosystem (Di et al. 2019)(Ira et al. 2015). So that this species is very minimal found in the Tundung Musuh mangrove forest conservation area.



(a)*Terebralia sulcata* (b) *Planaxis sulcatus* (c) *Littorina scabra* (d) *Littorina littoria*

(e) *Terebralia palustris* (f) *Cerithidea cingulate* (g) *Cerithium litteratum* (h)*Hemifusus ternatanus*

Fig 2. Gastropod diversity in the Tundung Musuh mangrove forest conservation area.

Table 1 shows that the types of Gastropods found consist of 4 species from 4 families, namely *Planaxis sulcatus* from the Planaxidae family, *Littorina scabra* and *Littorina littorea* from the Littorinidae family, *Terebralia sulcata*, *Terebralia palustris* and *Cerithidea cingulata* from the Potamididae family, *Cerithium litteratum* and *Hemifususus* family Certhidae. Potamididae is the most dominant family with the number of species, namely 350 individuals from the total number of existing Gastropods. This is because the Tundung Musuh mangrove forest area has a high tolerance for environmental changes.

Based on the diversity analysis data above, Gastropods in the mangrove forest conservation area of Tundung Musuh, Tasikmadu Village, Palang District, Tuban Regency show the number 1.92 indicating that the diversity of Gastropods there is moderate. However, the diversity index shows that the environmental conditions are less stable. Gastropod uniformity analysis data in the mangrove forest conservation area of Tundung Musuh, Tasikmadu Village, Palang District, Tuban Regency shows a number of 0.34 indicating that the uniformity of Gastropods there is low. This is

because the number of each Gastropod species is different (Silaen et al. 2013). The lower the uniformity index of a community means that the environmental conditions are increasingly unstable. The low uniformity value indicates that the community condition is in a depressed state (Arbi 2012). Gastropod dominance analysis data in the mangrove forest conservation area of Tundung Musuh, Tasikmadu Village, Palang District, Tuban Regency shows the number 0.1423 which indicates that the dominance of Gastropods in this location is low (Laraswati et al. 2020). This shows that the environment for gastropod growth is stable, there is no ecological pressure on the biota in these locations so that the gastropods can grow well (Mujiono 2016). From the three data generated regarding diversity, uniformity, and dominance, it can be concluded that the Tundung Musuh mangrove forest conservation area is still good enough for the growth of Gatropoda. The diversity of gastropods in the Tundung Musuh conservation area shows quite good results from the data that has been obtained. It can be seen that the Gastropods in the Tundung Musuh conservation area are still doing well for the time being (Adji & Haryono 2017).

4. Conclusion

Based on the results of research that has been carried out on the diversity of Gastropods in the Tundung Musuh Mangrove Forest Conservation Area, Tasikmadu Village, Palang District, Tuban Regency, there are 1,325 individual Gastropods consisting of 4 families. hich were found consisted of 8 species from 4 families, namely *Planaxis sulcatus* from the Planaxidae family, *Littorina scabra* and *Littorina littorea* from the Littorinidae family, *Terebralia sulcata*, *Terebralia palustris* and *Cerithidea cingulata* from the Potamididae family, *Cerithium litteratum* and *Hemifusus ternatanus* from the family Certhidae. Data on diversity, uniformity, and dominance of Gastropods in the Tundung Musuh Mangrove Forest Conservation Area, Tasikmadu Village, Palang District, Tuban Regency, shows that the diversity of Gastropods in the area is moderate, the level of uniformity is low, and the level of dominance is low. From the three data, it can be concluded that the area is stable. There is no striking dominance of any particular species and it is good enough for the growth of gastropods.

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