



# Habitat Degradation and Study of Macrozoobenthos Conditions in Homogeneous Mangrove Ecosystems

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**Abstract:** Habitat degradation that occurs in the mangrove ecosystem will have an impact on the presence of associated biota found in the ecosystem, including macrozoobenthos. If it continues, it will threaten the sustainability of macrozoobenthos resources which are characterized by decreasing abundance and it is not even impossible that one day they will become extinct. The purpose of this research is to analyze the species composition of macrozoobenthos and to analyze the composition of mangrove species. This research was conducted in the mangrove ecosystem of Naga Permai Beach, Gampong Lhok and Gampong Pulo, Kuala Pesisir District, Nagan Raya Regency, Aceh Province in December 2021. The research method was quadrat sampling. The results showed that the macrozoobenthos species found consisted of 2 phylum, 3 classes, 7 families with 16 species.

**Keywords:** Habitat degradation; Macrozoobenthos; Mangrove ecosystem

## Introduction

Macrozoobenthos are basic organisms that are relatively large in size more than 1 mm (Munandar et al., 2016). Macrozoobenthos is one of the aquatic organisms that live on the bottom of the waters, the movement is relatively slow and can live relatively long, so it has the ability to respond to water quality conditions (Zulkifli & Setiawan, 2011).

Macrozoobenthos has a habitat that is at the bottom of the waters, either sessile, creeping or digging holes. These organisms have an important role in food webs. The existence of macrozoobenthos is strongly influenced by changes in water quality and the substrate in which it lives (Ulfah et al., 2012). Generally found in mangrove areas from class Crustacea, Polychaeta, Bivalves and class Gastropods (Afkar et al., 2014). One of the habitats that contain macrozoobenthos is the mangrove ecosystem area of Naga Permai Beach, Kuala Pesisir District, Nagan Raya Regency.

Nagan Raya Regency is one of the regencies in Aceh Province which has various mangrove areas, including

those in Kuala Tadu Village, Tadu Raya District and in the Naga Permai Beach area, Lhok Gampong and Pulo Village, Kuala Pesisir District. This area is dominated by *Nypa fruticans*.

Mangrove ecosystems live various animal species whose lives depend on mangroves (Afif et al., 2014). Mangroves function as a spawning ground, nursery ground, and feeding ground for marine biota, one of which is macrozoobenthos (Maulud et al., 2017). Mangrove ecosystems provide enormous benefits to the environment in coastal areas, namely controlling coastal abrasion, preventing marine intrusion, improving water quality, increasing productivity of coastal waters, and as a habitat for the enlargement and protection of economically valuable biota in coastal waters and can improve the welfare of coastal communities.

The degradation that occurs in the mangrove ecosystem will have an impact on the presence of associated biota in the ecosystem, including macrozoobenthos. If it continues, it will threaten the sustainability of macrozoobenthos resources which are characterized by decreasing abundance and it is not

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even impossible that one day they will become extinct (Hasan in Pratiwi et al. 2021). Based on these problems, it is necessary to conduct research on the study of macrozoobenthos composition in the mangrove ecosystem area of Naga Pemas Beach, Kuala Pesisir District, Nagan Raya Regency, Aceh Province.

**Method**

*Place and Time of Research*

This research was conducted in the mangrove ecosystem of Naga Permai Beach, Gampong Lhok and Gampong Pulo, Kuala Pesisir District, Nagan Raya Regency, Aceh Province (Figure 1). Naga Permai Beach is a tourist attraction for local people and outside the region. This research was conducted in December 2021.

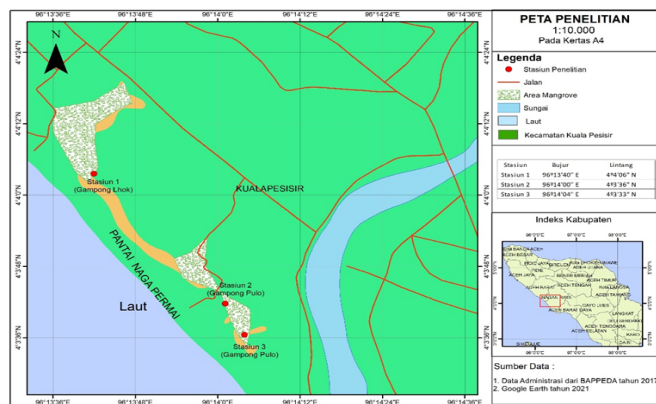


Figure 1. Research Site Map

*Approach and Type of Research*

The research approach used in this study is a quantitative approach, which is an approach that sums or collects data/facts that can be used in order to obtain certainty and accuracy in answers to research questions and a qualitative approach, namely a descriptive approach in the form of written/oral words and behaviors that observable (Mulyadi, 2011). The type of research used is included in the type of basic research that is carried out by research with the aim of describing.

*Data Collection Technique*

The mangrove area is divided into 3 locations, namely location 1 near settlements, location 2 near land and location 3 bordering the sea. Each station is laid out 1 line transect line consisting of 5 plots of squared plots which are placed zig-zag along the line transect. The determination of observation stations and sampling points was chosen based on the aspect of representativeness, so that it can describe the presence of macrozoobenthos in certain mangrove species as a whole at the sampling location. Each station consists of 5 sampling points and at one point consists of nine sampling times. Sampling was carried out five times for

mangrove data in one station and nine times for macrozoobenthos data collection in one station point.

Data collection for macrozoobenthos and mangroves used a survey method and a quadrat sampling (Figure 2). Data collection for macrozoobenthos and mangroves followed a line transect with a size of 100 m for macrozoobenthos species using a square plot measuring 1 mx 1 m (Afkar et al., 2014), while for mangrove species it was carried out in a plot with a size of 10 mx 10 m (Annisa et al. , 2017). Observations were limited to the types of macrozoobenthos and mangroves, the number of individuals and the number of species of both.

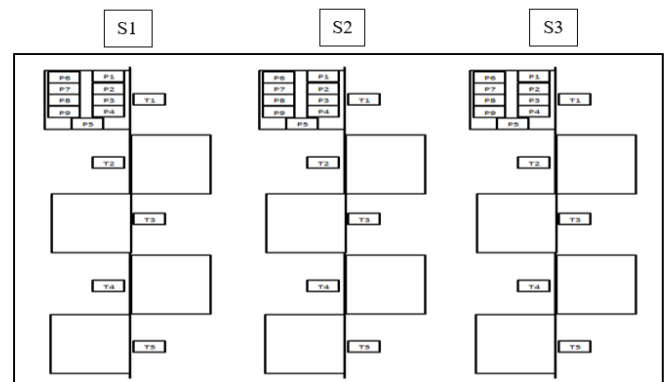


Figure 2. Quadrat Sampling Method (Faidiban, 2017)

Observations were made from points 0 to 100 m, with a width of 10 m to the left and 10 m to the right of the transect line, then measurements were made again at the next station. Observations were made by looking at the number of species and individuals of macrozoobenthos in mangroves. The sampling method is destructive and non-destructive. Measurements of the values of environmental conditions were carried out at each observation station including water pH, water temperature, and salinity. The type of substrate observed at each station was recorded.

*Analyzing of Data*

The composition of macrozoobenthos and mangroves was described according to the observation station including the type, morphology and number of macrozoobenthos found in various types of mangroves in the mangrove ecosystem area of Kuala Pesisir District. Determination of the composition of macrozoobenthos and mangroves using the equation (1) Hidayatullah & Pujiono, (2014); Susiana, (2015).

$$K = \frac{I}{N} \times 100 \% \tag{1}$$

Information:

- K = composition value
- I = number of species at station
- N = total species at station

If:  
 0 - 25% = very low  
 25 - 50% = low  
 50 - 75% = medium  
 > 75% = height

**Result and Discussion**

*Macrozoobenthos Species Composition*

The results of observations of macrozoobenthos species found during the study in the mangrove ecosystem area of Naga Permai Beach consisted of 2 phylum, 3 classes, 7 families with 16 species. Macrozoobenthos species found during the study can be seen in Table 1.

The dominant macrozoobenthos species found in the mangrove ecosystem of Naga Permai Beach are *Thiara scabra* and *Faunus ater*. This *Thiara scabra* has a length ranging from 1-3 cm, the shell type is elongated and spiny, the shell is yellowish with brown stripes on the main thread, has a pointed apex, tapered chiffon grooves. This species is commonly found in stagnant or flowing freshwater, with a muddy or sandy bottom substrate; up to an altitude of 1,400 m above sea level. Sometimes found in slightly brackish waters Mujiono et al., (2020); Sulphayrin, (2018). *Faunus ater* it lives by crawling on mangrove trunks and roots in low salinity waters. This is also in accordance with the statement Lok et al., (2011) stated that *Faunus ater* is generally found in brackish waters with low salinity. The abundance of *Faunus ater* is very good for people's lives, because people generally use this species for consumption. This is in accordance with the statement (Suarni, 2020) that *Faunus ater* is a source of animal food that contains high protein and nutritional value so that it is desirable for consumption.

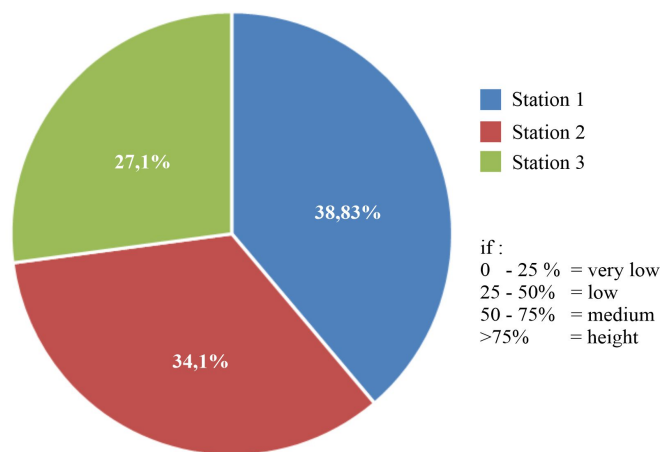
**Table 1.** Macrozoobenthos species found in the Naga Permai Beach Mangrove Ecosystem Area

Scientific Name	Station			Σ	(%)
	1	2	3		
<i>Stenomelania denisoniensis</i>	13	5	-	18	6.59
<i>Melanoides plicaria</i>	-	22	-	22	8.06
<i>Thiara Scabra</i>	33	16	7	56	20.51
<i>Mieniplotia scabra</i>	-	3	-	3	1.10
<i>Melanoides turbeculata</i>	14	-	19	33	12.09
<i>Neritina (vittina) natalensis</i>	-	10	4	14	5.13
<i>Vittina turrata</i>	-	11	3	14	5.13
<i>Vittina natalensis</i>	-	-	6	6	2.20
<i>Neripteron auriculatum</i>	3	-	-	3	1.10
<i>Clithon corona</i>	-	-	3	3	1.10
<i>Filopaludina sumatrensis</i>	15	7	8	30	10.99
<i>Faunus ater</i>	14	15	10	39	14.29
<i>Pila ampullacea</i>	5	-	4	9	3.30
<i>Geloina sp</i>	8	-	4	12	4.40
<i>Corbicula javanica</i>	-	-	6	6	2.20
<i>Parapenaepsis hardwickii</i>	1	4	-	5	1.83
<b>Total</b>				<b>273</b>	<b>100%</b>

The total number of species found was 273 individuals. The most species were found at station 1 with 106 individuals, station 2 with 93 individuals. The least number of species found at station 3 was 74 individuals. The density of macrozoobenthos during the study in the mangrove ecosystem area of Naga Permai Beach showed that the highest density was at station I and the lowest was at station III.

The large number of individual densities found at station I is due to the water substrate which is a loamy sand substrate and is a high seagrass ecosystem so that food supplies such as plankton and plants can be found at this station.

Based on Figure 3, it is known that the composition of macrozoobenthos at station 1 is 38.83% in the low category, the composition at station 2 is 34.1% in the low category, and the composition at station 3 is 27.1% in the low category. The low composition of macrozoobenthos at the location of data collection is influenced by environmental factors, where the condition of the water is high so that the discharge and water level are high so that it becomes the main obstacle during the data collection process in the field.



**Figure 3.** Percentage of Macrozoobenthos Species Composition in Each Research Station

This is in line with the statement Fuller, (1979) that the majority of macrozoobenthos prefer to live in mud to sand sediments. Besides having a good substrate for macrozoobenthos, the temperature at station I is 30°C with a salinity reaching 2.1 ppm and a water pH of 7.2 which is good for macrozoobenthos life. Next Odum, EP, (1993) stated that the main factors that determine the distribution of macrozoobenthos are aquatic substrates in the form of mud, clay, sand, gravel, stone, and each determines the composition of the macrozoobenthos species.

*Mangrove Species Composition*

The results showed that the mangrove ecosystem area of Naga Permai Beach was found as many as 10

species belonging to the true mangrove category, namely plants that grow in tidal areas and form pure stands. This type of mangrove rarely combines with land plants Mujiono et al., (2020); Ponder, WF et al., (2022). As in general mangrove forests in Indonesia, the composition of mangrove species on Naga Permai Beach is dominated by the *Rhizophoraceae* and *Arecaceae* families, this is presumably because the environmental conditions at the research site support the spread and growth of this family so that the adaptation process runs well.

The number of this species is very low compared to the total mangrove which is usually found in Aceh Province. The plants that make up the mangrove ecosystem consist of various species, including *Rhizophora apiculata*, *Rizophora mucrosa*, *Acanthus ilicopolium*, *Aegiceras corniculatum*, *Bruguiera gymnorrhiza* and *Nypa fructican* (Ali et al., 2020).

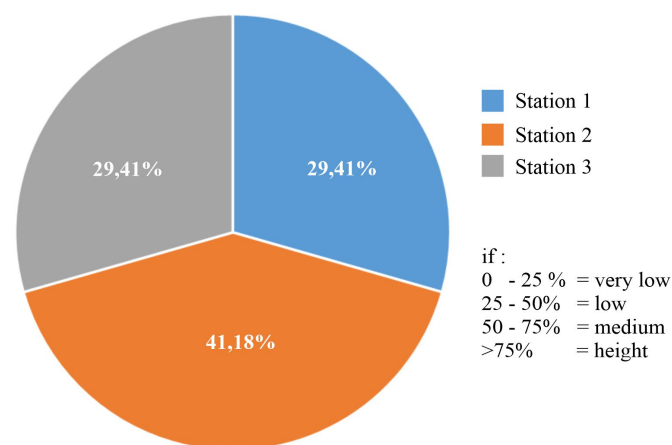
**Table 2.** Mangrove Species found in the Mangrove Ecosystem Area of Naga Permai Beach

S	Scientific Name	Local Name	Type Mangrove		Habitus		
			E	R	Tree	Bush	
1	<i>Nypa fructicans</i>	Nipah	E	-	T	-	
	<i>Acrostichum aureum</i>	Paku Laut	E	-	-	B	
	<i>Eclipta alba</i> L.	Urang-Aring	E	-	-	B	
	<i>Eichhornia crassipes</i>	Eceng Gondok	E	-	-	B	
	<i>Premna serratifolia</i>	Buas-buas	E	-	T	-	
	2	<i>Nypa fructicans</i>	Nipah	E	-	-	B
		<i>Rhizophora sp</i>	Bakau	E	-	T	-
		<i>Acrostichum aureum</i>	Paku Laut	E	-	-	B
		<i>Acrostichum speciosum</i>	Paku Laut	E	-	-	B
		<i>Fimbristylis littoralis</i>	Teki	E	-	-	B
<i>Eichhornia crassipes</i>		Eceng Gondok	E	-	-	B	
<i>Flacourtia rukam</i>		Rukam	E	-	T	-	
3	<i>Nypa fructicans</i>	Nipah	E	-	T	-	
	<i>Sonneratia alba</i>	Perepat	E	-	T	-	
	<i>Eichhornia crassipes</i>	Eceng Gondok	E	-	-	B	
	<i>Eclipta alba</i> L.	Urang-aring	E	-	-	B	
	<i>Fimbristylis littoralis</i>	Teki	E	-	-	B	

Information: S: station; E: Experience; R: Rehabilitation; T: Tree; B: Bush.

According to Wahab et al., (2020) species composition is the composition and number of species contained in a plant community, so there are three important keywords, namely species, composition and number. *Nypa fructicans* predominates in all growth phases. *Nypa fructicans* dominates at every growth because this species is superior in obtaining nutrients, light, and space to grow. *Nypa fructicans* is intolerant of fresh water for long periods, likes soil mixed with mud and sand, sometimes on coral rocks often found in coastal locations protected from wave action, also in estuaries and around offshore islands.

Based on Table 2, the mangrove species found in the mangrove ecosystem area of Naga Permai Beach are natural mangrove ecosystems. The population in the tree habitus is more dominant than the bush habitus. Estuary areas generally contain several species of mangrove which are a source of nutrients and organic matter which is a source of food for aquatic biota and macrozoobenthos in the vicinity. Ulfah et al., (2012) stated that the estuary ecosystem has a fairly high biodiversity, including macrozoobenthos that live in and on water sediments and relatively live in digging holes, creeping and sticking.



**Figure 4.** Percentage of Mangrove Species Composition in Naga Permai Coastal Area by Station

Based on Figure 4, it is known that the composition of mangroves at station 1 is 29.41% in the low category, the composition of mangroves at station 2 is 41.18% in the low category, and the composition of mangrove species at station 3 is 29.41% in the low category. One of the reasons for the low composition of mangrove species in the Naga Permai Coastal Area is that the area is dominated by *Nypa fructicans*.

The density or abundance of various species in an environment is different. If the environment changes, there may be a reduction in the number of individuals so that the rarest species are likely to be wiped out. The low abundance of the above species at each station is due to the low tolerance of these species to changes in the

conditions of the waters they inhabit Hartoto & Marwoto, (1986).

The composition of mangrove species in the mangrove ecosystem area of Naga Permai Beach is dominated by *Nypa fructicans*, this is presumably because the environmental conditions at the study site support the spread and growth of this species so that the adaptation process runs well. It is supported by (Heriyanto & Subiandono, 2016) who said that in the Alas Purwo National Park area, several mangrove species are very good at utilizing solar energy, nutrients/minerals and water as well as competitive characteristics so that they dominate other species Hidayatullah & Pujiono, (2014).

The condition of mangroves is basically influenced by the influence of tides, but in the mangrove forest area of Naga Permai Beach, young seawater enters the area. The adaptability of each species to environmental conditions causes differences in the composition of mangrove forests with distinctive boundaries. Mughofar et al., (2018) stated that this was one of the causes of the zoning conditions of mangrove vegetation that were not optimal and caused by the influence of soil conditions, salt content, duration of inundation and tidal currents. So that the conditions shown in the zoning pattern formed are not in accordance with the proper mangrove zoning.

## Conclusion

The composition of macrozoobenthos species associated with mangrove ecosystems in the mangrove ecosystem area of Naga Permai Beach, Kuala Pesisir District, Nagan Raya Regency, which consists of 2 phyla, 3 classes, 7 families with 16 species. The composition of mangrove species in the mangrove ecosystem area of Naga Permai Beach, Kuala Pesisir District, Nagan Raya Regency consists of 10 different species.

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