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Habitat function of seagrass ecosystem for megabentos diversity in Teluk Bakau, North Bintan, Indonesia

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Abstract. This paper examines about seagrass ecosystems as a habitat function of variety type of association biota. There are a lot of research about seagrass ecosystem in study area, including the seagrass itself, associated organism and also seagrass transplantation activities that have been carried out. Moreover, there have been research on anthropogenic disturbances towards the presence of seagrass ecosystems in Teluk Bakau Area. This is occur because the seagrass ecosystem in Teluk Bakau has habitat availability in accordance with various associated biota. The association biotas which found in seagrass habitats are generally from Megabenthos type which is very closely related to the presence of seagrasses as the habitat. From the 3 stations which have been taken based on the substrate heterogeneity, there found 6 species of seagrass such as *Enhalus acoroides* (Ea), *Thalassia hemprichii* (Th), *Cymodocea serrulata* (Cs), *Cymodocea rotundata* (Cr), *Syringodium isoetifolium* (Si), and *Halophila ovalis* (So), where these five types of seagrass are favourite food of Dugong. Besides, there also found megabenthos type as the association biota which consists of molluscs, echinoderms and crustaceans types. At station 1, there found 20 species, station 2 found 13 species and station 3 found 9 species. Nutrient degree in the substrate also determines the presence of various species associated of seagrass habitats in Teluk Bakau. The average of nitrate degree is 3.65 ppm where include in the medium category. Furthermore, the average of phosphate degree in the substrate of seagrass habitats is 2.06 ppm which include in the low category. Despite of it's important roles in shallow marine waters, not much credit was given to seagrass compared to coral reef and mangrove ecosystem. It was assessed indirectly in their role because of the existence of biota with economic values.

1. Introduction

Biota diversity in marine waters is currently in a crisis state [1]. Habitat in Marine ecosystem has occurred a frag, and one of them is seagrass ecosystem [2]. Seagrass ecosystem is one of the habitats for various marine biotas. Habitat fragmentation can occur due to several things, both naturally (the presence of wave and current movements), water turbulence [3] or due to anthropogenic activities [4, 5]; which has an impact on the reduced function of ecosystem services around shallow waters.

Seagrass ecosystem as a habitat provider for various marine biota [6, 7, 2]; both directly and indirectly, seagrass habitats play a major role in the provision of ecosystem services in shallow sea water; which will be very influential for the management of ecosystem services, where the role of the ecology of seagrass as habitat must be considered [5]. There are several types of seagrass in Teluk Bakau, where five types are the favourite foods of biota which included in the protected list, namely dugong [8]. In addition to dugongs that utilize the presence of seagrasses is the type of megabenthos



which makes seagrass as a habitat function [9]. This paper examine how much seagrass provides habitat space for a variety of megabenthos biota on the substrate heterogeneity.

2. Material and Methods

2.1. Study area

The research was conducted in July 2018 in Teluk Bakau area with further consideration from previous research [4]. The substrate in Teluk Bakau area is quite diverse, ranging from rocky substrate, sandy, rocky sand, sand and rubbles.

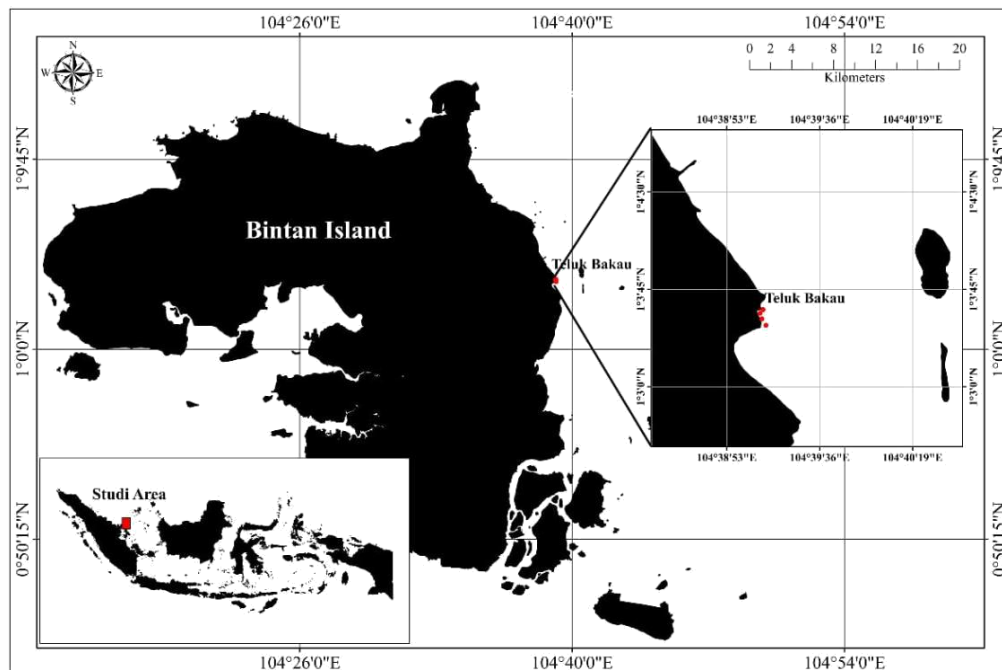


Figure 1. Location map and sampling point.

2.2. Sampling Methods

Determination of sampling points in the area was determined purposively. With consideration of substrate heterogeneity. Line transects in the field with three times replications and the length in every research station will placed in the quadrant. Megabenthos is taken by census on the line transect. Then the megabenthos sample is documented and identified in FIKP UMRAH.

2.3. Water quality

Determining the compatibility of seagrass as habitat, measurements of water quality are carried out, such as temperature, pH, salinity, nitrate and phosphate.

2.4. Data analysis

Qualitative data can be analysed descriptively, then quantitatively the seagrass was carried out by measuring seagrass density, and to obtain quantitative data from Megabenthos, the ecological index is calculated such as Diversity Index (H'), Domination Index (C) and Uniformity Index (E).

3. Results and Discussion

3.1. Type and Density of Seagrass

Based on the results of the research, there found six types of seagrass, such as Ea, Th, Cs, Cr, Si, and Ho. But the density of value only from two types of seagrass, the researchers only took quantitative data from two types of seagrasses, such as Ea and Th. Looked by visually of the area: types of Ea and Th are the dominant types which found among the other types, so they are sufficiently representative in the heterogeneity of the substrate.

Based on the results of the research obtained the highest density of type Ea on substrate rubbles with an average of 32.33 ± 5.82 Stand/m², and the lowest on Th type of rocky sand substrate with an average of 22.56 ± 4.06 Stand/m².

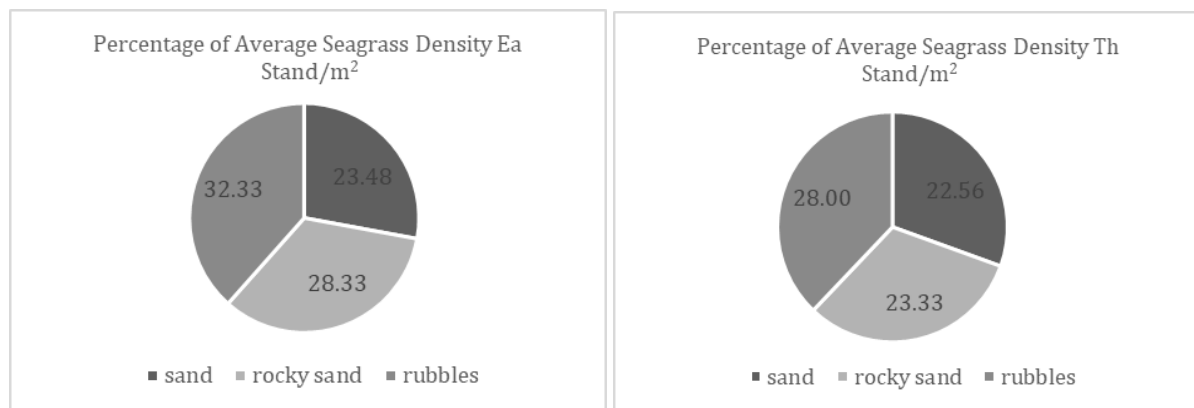


Figure 2. The average Percentage of seagrass density/m², left Ea and right Th.

Indirectly, there is no difference of density percentage between Ea and Th on the substrate heterogeneity. According to [10], suitable or not with its habitat is by looking at the decreasing power of seagrass cover, if the decrease in closure and small seagrass density, so the area is suitable for seagrass habitat. Beer [10] also said that there were four main requirements for seagrass growth, such as (1) shallow marine environment, (2) adequate substrate, (3) sufficient immersion, and (4) the ability of seagrasses themselves to maintain their survival. According to [11] light also plays an important role in seagrass recruitment. The response of seagrass to environmental changes is more difficult to measure, it must be connected to the limiting factor of seagrass, that the interaction between environmental variables, such as temperature, light and variety of grazer [12].

3.2. Types of Megabenthos and their Ecological Index

Megabenthos found in the Teluk Bakau area on habitat heterogeneity there are 21 species, which only two species found in all types of substrates that have been predetermined, such as the *Meretrik* sp. and *Clavatula* sp..

Table 1 present all types of megabenthos found in Teluk Bakau, from 21 species found, most encountered at station 1 with sandy substrates, then station II with a rocky sand substrate and at least found on station III with coral fracture substrate. Based on table 1 at station 1 to station 3, there found 5 classes and 3 phylum such as Echinodermata, Molluscs and Crustaceans which were dominant from the two phylum that from Mollusca.

The way of eating habits of biota from both phylum above are different and have their own characteristics depending on the type of biota (Robert 1982 in [13]). In general, eating habits from various types of sea cucumber are divided into two parts, such as silt sediment (deposit feeder) and suspension feeder (suspended material eaters). Various types of food that eaten by sea cucumbers are influenced by the shape of the tentacles [14]. Sea cucumbers in Teluk Bakau are found in two classes, those are Synaptidae and Holothuroidea. Habitat types favored by sea cucumbers are divided into several main parts, namely sandy substrate [15]. Furthermore, the type of food from echinoidea class in general is strongly influenced by the availability of food in nature, and the absence of certain chemicals that it

does not like, the grazing ability of this class depends on its body size. The larger the body size, the greater the grazing power. And favorite habitats are seagrass areas and also areas with a lot of algae in accordance with the type of food [16].

Table 1. Presents all types of megabenthos found in Teluk Bakau.

No	Species	Station 1 (Sand)	Station II (Rocky sand)	Station III (Rubbles)	Filum
1	<i>Synaptid sp.</i>	6	1		Echinodermata
2	<i>Holothuroidea edulis</i>	1		1	Echinodermata
3	<i>Stichopus variegatus</i>	1			Echinodermata
4	<i>sea Urchin</i>	1		1	Echinodermata
5	<i>sea hares</i>	1	4		Mollusca
6	<i>Anadara granosa</i>	12	6		Mollusca
7	<i>Anadara antiquata</i>	2		2	Mollusca
8	<i>Rectidens sp</i>	11	6		Mollusca
9	<i>pinna sp</i>	1			Mollusca
10	<i>Meretrix sp</i>	15	7	2	Mollusca
11	<i>polinices sp</i>	6			Mollusca
12	<i>Canarium sp</i>	2	8		Mollusca
13	<i>Vasum sp</i>	3	18		Mollusca
14	<i>Clavatula sp</i>	3	20	16	Mollusca
15	<i>Octopus sp</i>		1		Mollusca
16	<i>Portunus sp</i>		1	1	Crustacea
17	<i>Thalamita sima</i>		2	2	Crustacea
18	<i>Culcita novaeguineae</i>		1		Echinodermata
19	<i>tridacna gigas</i>		1		Mollusca
20	<i>Lambis lambis</i>			2	Mollusca
21	<i>Anadara antiquata</i>			2	Mollusca

Then there found in the research location such as Bivalvia, Gastropods, and Cephalopods, which belong to the mollusca phylum [17]. These three classes have different ways of eating and eating habits. Some types of gastropods are herbivores, carnivores, scavenger, suspension feeders and parasites, but the types of gastropods found in the mangrove bay area are herbivore and suspension feeders. Generally, gastropods which found in intertidal areas are grazers [18]. Bivalve is one of the classes of phylum molluscs which are known for their feeding methods, namely feeder suspensions and deposit feeders. Some species of Bivalve depend on the production of microalgae as the main food ingredient [19]. The cephalopod class which found in the mangrove bay waters is octopus. According to research results from [20] were carnivores, with the main foods being small fish and shrimp. Phylum from crustaceans which found at research sites is a type of crab, one of them is stone crab which is a carnivore in the bottom of the waters and the types of food are various kinds of sessile and slow-moving invertebrates¹. And the food that eaten by this type of crab is very dependent on availability in nature, the composition of food will change with the growth of the crab.

Various types of biota which found at the research site, all types of food available in seagrass habitats, so that seagrass can be said to be a habitat for various marine biota and is one of the habitats that provide complete ecosystem services in intertidal waters. And generally what is found at the research location is grazer. And according to [12], Grazer diversity is one of the limiting factors of seagrass productivity.

¹ Williams (1982).

3.3. Ecological Index of Megabenthos

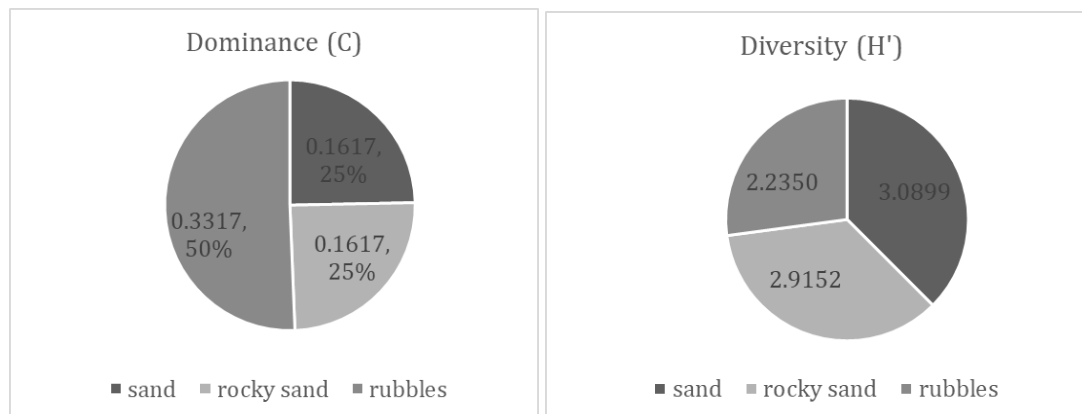


Figure 3. Ecological Index of Megabenthos, which includes Diversity (H'), Domination (C).

Based on the picture 3. Diversity index (H') megabenthos on the highest substrate heterogeneity is station 1 (sand substrate), then Station 2 with rocky sand substrate and station 3 (substrate of rubbles). In general, the biota encountered at the research location like the sandy area, in addition to shelter is also a place to find food for the megabenthos biota such as the holoturoidea, bivalvia and gastropods. For example, from the mollusca phylum. In many tropical and subtropical areas, invertebrate harvesting in seagrass meadows is common because the intertidal zone allows for easy access even to people without resources [21].

3.4. Water Quality Parameters

The average of nitrate content in the study location is 3.65 which is classified as medium category and phosphate is in the low category with a value of 2.06. The average of temperature is 31.330C, the average of Salinity is 33.03 PSU, and the average pH 6.36. In general water quality parameters are quite supportive to the ecological conditions of marine biota. 90 % of nutrients are used for seagrass growth through the root system [22].

4. Conclusion

The results of research indicate that megabenthos diversity has close connection with seagrass conditions and substrate types. The highest diversity (H') was found in sand substrate (3.0899), then rocky sand (2.9152) and rubbles (2.2350), with the dominant seagrass species being *Enhalus acoroides* (Ea) and *Thalassia hemprichii* (Th) with an average value of 32.33 ± 5.82 stands/m² and 22.56 ± 4.06 Stand / m², respectively. The most abundant types of megabenthos are mollusks and Echinodermata, while crustaceans are only found on rocky sand substrates and rubbles. This shows that the seagrass ecosystem with sand substrate is preferred as megabenthos habitat.

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