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INVENTORY OF SEAGRASS SPECIES AND THEIR ASSOCIATIONS WITH GASTROPODS IN BEACHES OF POKA, AMBON CITY, MALUKU PROVINCE

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ABSTRACT

This study aims to determine the types of seagrass and their association with gastropods in the coastal waters of Poka Village, Ambon Bay District, Ambon City, Maluku Province. The laying of transect lines was based on the presence of seagrass beds, seagrass and gastrooda samples were taken from the same transect, using the 1×1 m quadrant transect method. Sample identification was carried out by LIPI Ambon's Marine Biota Conservation Agency Laboratory. Three species of seagrass were found namely Enhalus acoroides, Holophila ovalis, Halodule uninervis. Ten species of gastropods were found, namely Polinices mammilla, Natica vitellusi, Strombus labiatus, Strombus urceus, Bursa tuberosissima, Liotina peronii, Conus coronatus, Conus moriculatus, Nassarius pullus, Nassarius limnaeiformis. There is a positive association between seagrass and gastropods which means that the species These tend to be found together in each observation plot and show tolerance for living together or there is a mutually beneficial reciprocal relationship.

Keywords: *seagrass, gastropods, association*.

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INTRODUCTION

Coastal and marine areas in Indonesia play an important role, because these areas have strategic value in the form of potential natural resources and environmental bodies which are referred to as coastal resources as a trophic area of coastal marine waters. Indonesia has a fairly high biodiversity such as mangrove forests, seagrass beds, coral reefs, fish, mammals, reptiles and various types of mollusks. Seagrass (seagrass) or also called sea grass or yar, is a group of flowering marine plants recorded in the marine environment. Seagrass plants live in shallow waters to a depth of 50-60 m (Nybakken, 1988) and even reach 90 m (Dahuri, 2003) but are abundant in tidal areas. Seagrasses thrive in open tidal areas and coastal waters or goba which are basically made of mud, sand, gravel, and dead coral rubble with a depth of 4 m (Dahury, 2003). Seagrass beds are ecosystems with very high organic productivity (Nontji, 2005). Because in seagrass beds there are marine biota, some live sedentary lives, some only act as supports, such as crustaceans, worms, fish, and molluscs (Gastropods) that interact with one another. The other is called an association pattern. One aspect of community studies is the pattern of association between species within a community. Michael (Michael,

1994) defines association as the relationship that occurs between species that live together in a community. Species association is important in a community, because a community is composed of several species that mutually influence the distribution, abundance and associations between species. The study of associations can provide an overview of the composition of the community. Within the seagrass community, mutual interactions occur which lead to the formation of a complex ecosystem which makes seagrass beds an important habitat for various types of marine biota, including gastropods.

Gastropods are a class of phylum molluscs that are known to be associated with the seagrass ecosystem. Economically, gastropods have high economic value because their shells are taken as materials for jewelry and souvenirs, while their meat is a delicious food and has important economic value, such as species from the Strombidae, Cypraeidae, Columbellidae, Cerithidae, Terebridae, Mitridae Olividae and Tunnidae tribes (Mudjiono, 1994). Ecologically, the gastropod community is an important component in the food chain in seagrass beds. Gastropods are basic animals that eat detritus (detritus feender) and litter from fallen seagrass leaves and circulate suspended substances in the water to get food (Tomascik et al, 1997). In addition, gastropods are also one of the constituent components of marine and coastal ecosystems, which act as the initial decomposer in the trophic level for the sustainability of the surrounding aquatic life systems. The coastal waters near Poka are located at 3o38'55.58' south latitude and 128°11'35.53' east longitude and are on Ambon Island, Maluku province. Poka village beach is part of the waters of the island of Ambon, to the east facing the inner Ambon Bay, to the west by Rumahtiga village, to the north by Hunut village and to the south by Galala village.

The coastal waters of Poka village have a visually quite productive coast because these waters have a wide distribution of seagrass. The wide distribution of seagrasses in these waters allows for various potential marine biological resources including seagrass ecosystems which can be used as habitats and food sources for aquatic organisms, but these waters receive a lot of organic and inorganic waste which can pollute these waters. Visually, the distribution of seagrass vegetation in the coastal waters of Poka village is quite wide with quite diverse conditions. The wide distribution of seagrasses in these waters allows for the existence of various types of seagrasses and gastropods that live in these waters, as found in the coastal waters of Poka village. However, data on the types of seagrass and the gastropod associations that live in the seagrass itself are not yet available. Therefore, research on seagrass species and their associations with gastropods in the coastal waters of Poka Village, Teluk Ambon District is important to do.

METHOD

This type of research is descriptive, this research was conducted in January 2017. The research location is the Poka Village Coastal Sea. Sample identification was carried out at the LIPI Ambon Marine Violin Conservation Center UPT Laboratory. The population of this study were all types of seagrass (seagrass) and gastropods found in the waters of Poka Beach. Meanwhile, the samples for this study were the types of seagrass and gastropods found in each observation plot.

Materials

The equipment used in this study consisted of: thermometer, refractometer, pH meter, DO meter, meter roll, digital camera, tropol, scope, sample bag, label paper, gloves, rubber bands, PVC pipe, ruler, raffia rope, tool writing paper, seagrass identification book (Den, 1970) and gastropod identification book (Dharma, 1992). The materials used were seagrass and gastropod samples found, tissue, distilled water, 70% alcohol and 4% formalin.

Site Review Work Procedures and Equipment Preparation

Review to obtain a clear picture of the research location and equipment preparation.

Measuring the Area of Seagrass

To determine transects based on the presence of seagrasses in the field and the provision of equipment to be used in the field and in the laboratory.

Determination of Transects and Plots

The research transect was determined based on the presence of seagrass ecosystems in the coastal waters of Poka Village. The length of the seagrass beds in the coastal waters of Poka Village is 100 m and the width of the seagrass beds is 240 so that the area of the coastal waters of Poka Village used as a research location is 24,000 m2. The research location is determined in 1 station based on the area of the study. At that station, transects were made with a total of 12 transects and the number of plots on each transect was 4 plots so that

the total plots used during the study were 48 plots as observation points for seagrass and gastropod species. The transect was observed from the highest to the lowest tide with a length of 100 m; On each transect there are 4 plots with a distance of 20 m between transects; On each transect, 4 plots were placed in observation plots with a size of 1 x 1 m with a distance between plots of 20 m.

Sampling Concurrent with Seagrass Association Observations

The method used in this study was a quadratic linear transect. Sampling was carried out at low tide. samples of seagrass (roots, rhizomes and leaves) from each plot and put it in a plastic sample, labeled and ready to be taken to the laboratory for identification. Seagrass samples found in each observation plot were documented for identification at the LIPI Ambon Marine Biota Conservation Center UPT Laboratory using an identification book (Den, 1970).

Gastropods

Sampling of gastropods from each plot and put in a plastic sample labeled and ready to be taken to the laboratory; Gastropod samples that lived in the substrate to a depth of 5 cm were excavated using tropol and then sieved using a sieve to separate the sample from the substrate and organic waste.

Identification of Samples in the Laboratory

Documentation of seagrass and gastropod species in the form of photographs on land; Count the number of stands of each species in the study area; Seagrass and gastropods that have been counted are taken by one individual for identification; Rinsed with water and dried; Separate all examples of seagrass and gastropods by type at each observation point.

Measurement of Physical Chemical Factors

The temperature of the water is measured using a mercury thermometer which is placed in the water for 2 minutes and then the scale is read. Substrate observation was carried out by direct observation at the research location. Substrate is taken using a scope to distinguish the state of the substrate in these waters. Water pH is measured using a pH meter by inserting the electrode into the water, the pH value can be read on the meter scale. The salinity of the waters was measured using a refractometer, namely by taking seawater samples using a dropper pipette. On the surface of the cleaned refractometer base, drop 1 drop of seawater sample, cover it and read the numeric indication scale. Dissolved oxygen measurements were carried out using a DO meter. Initially the DO meter was calibrated using distilled water. The DO meter is inserted into the water, then the DO determination results are expressed in mg/l.

Data Analysis Techniques

The data obtained is then arranged in a two-type correlation table (2 x 2) as stated by (Soegianto, 1994) or also called the Contingency Table:

Table 1. Contingency Table

species A	**Species B**		
	(presence)	**(absence)**	
(Presence)	A	b	(Presence)
(absence)	C	d	(absence)
	a + c	b + d	

Information :

Species A = seagrass species;
Species B = gastropod species
a = number of plot units where both species are present
b = number of plot units where seagrass species are present
c = number of plot units where gastropod species are present
d = number of unit plots where both species are absent
N = total number of plots

Furthermore, according to (Soegianto, 1994) to find out whether or not there is an association, the Chi-square formula is used as follows:

$$X2 = \frac{N\,(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)}$$

Description:
$xi2$ = number of individuals in plot I,
N = total number of plots
After obtaining the calculated value of $x2$, then compared with $x2$ table with degrees of freedom (df) = (r-1)(c-1), α = 0.05 (5% significant level). Because testing the association between 2 species means df = 1. With α = 0.05, we get $x2$ table = 3.84. If the value of $x2$ test ≥ $x2$ table, then there is an association, if $x2$ test ≤ $x2$ table then there is no association.

To find out the type of association using the formula according to (Soegianto, 1994) as follows:

$$E(a) = \frac{(a+b)(a+c)}{N}$$

Description: E(a) = expected value
a = number of unit plots where both species are present
b = number of unit plots where seagrass species are present
c = number of plot units where gastropod species are present
N = total number of plots

The type of association can be determined based on the criteria, if a> E(a) then the type of association is positive, that is, the two species often occur together rather than separately (independently of each other) and vice versa if the value a < E(a), then the negative association type, in which the two species occur singly (independently of each other) more often than together. To determine the level of association, tested with the Jaccard index according to (Soegianto, 1994) namely:

$$JI = \frac{a}{a+b+c}$$

Note:
JI = Jaccard index
a = number of unit plots where both species are present
b = number of unit plots where seagrass species are found
c = number of unit plots where gastropod species are found.
If the JI value = 1, then the maximum association level, and vice versa if the JI value < 1, then the minimum association level.

DISCUSSION RESULT

Based on research conducted in the coastal waters of Poka Village, 3 species of seagrass were obtained which are members of 2 orders, 2 families, 3 genera which can be seen in Table 2.

Table 2. Structure of Taxa and Number of Seagrass Species Stands

Classis	Ordo	Familia	Genus	Species	JTL
			Enhalus	*Enhalus acoroides*	4175 *Angiospermae*
	Hydrocharitales	Hydrocharitaceae	*Halophila*	*Halophila ovalis*	434
	Helobiae	Potamogetonaceae	*Halodule*	*Halodule uninervis*	255
Number of Seagrass Stands					4864

Note: JTL = Number of Seagrass Stands

Structure of Gastropod Taxa in Seagrass

Based on the research conducted, the number of individual gastropod species obtained in the coastal waters of Poka Village, Teluk Ambon District can be seen in Table 3. in the mesogastropoda order, 6 species were found belonging to 4 families, namely the family Naticidae 2 species, family Strombidae 2 species, family Bursidae 1 species, and family Liotidae 1 species. The Neogastropod order consists of 4 species belonging to 2 families, namely the Conidae family, 2 species, and the Nassaridae family, 2 species. The results of the species description are as follows: species can be described as follows:

1. Polinices mammilla, spilat shell shape sticking out, shell color before washing grayish white and shell color after washing shiny white as shown in the picture, shell mouth color is white, operculum color is yellow, shell surface is smooth, shell length is 2-2.3 cm. species found in sandy substrates.
2. Natica vitellus, dextral shell shape, shell color before washing brown image, white stripes on shell surface, white shell mouth color, white operculum color, shell surface smooth, shell length 2-2.5 cm. This species is found in muddy sand substrates.
3. Strombus labiatus, dextral shell shape, shell color before washing yellowish brown and shell color after washing blackish yellow, shell mouth color yellow, operculum color yellow, shell mouth (aperture) grows wider outward, shell surface rough, shell length 5 -5.7cm. This species is found in silty sand and rocky sand substrates.
4. Strombus urceus, this species is the same as Strombus labiatus but differs in the time of the shell mouth and the size of the slightly slender shape, the shape of the dextral shell, the color of the shell before washing is yellowish black and the color of the shell after washing is black and yellow as shown in the picture, the color of the mouth of the shell is yellowish white, operculum color is yellow, shell surface is rough, shell mouth (aperture) grows wider to the outside. Shell length 5-6 cm. This species is found in silty sand and rocky sand substrates. (Bursa tuberosissima, spiral shell shape, shell color before washing black-brown and shell color after washing gray-green as shown in the picture, mouth color is yellowish white, operculum color is yellow, shell surface is rough, shell length is 1.7-1.9 cm. This species found in muddy sand substrates.
5. Liotina peronei, sinistral shell shape, shell color before washing is black and shell color after washing is brownish yellow as shown in the picture, shell mouth color is yellowish white, operculum color is black, shell surface is rough, shell length is 2.6-4 cm. This species is found in silty sand and rocky sand substrates.
6. Conus coronatus, dextral shell shape, shell color before washing black-brown and shell color after washing striped as shown in the picture, white-black shell mouth color, black operculum color, shell surface rough, shell length 2-5 cm. This species is found in muddy sand substrates.
7. Conus moriculatus, dextral shell shape, the color of the shell before washing is black-brown, the color of the shell before washing is black-brown and the color of the shell after washing is brown mixed with black and white as shown in the picture, the color of the mouth of the shell is blackish brown mixed with white, the color of the operculum is black, the surface of the shell leathery, shell length 5-5.7 cm. This species is found in silty sand and rocky sand substrates.
8. Nassarius pullus, dextral shell shape, shell color before washing is black and shell color after washing is brownish gray as shown in the picture, the color of the mouth of the shell is brown, the color of the operculum is black, the mouth of the shell is thickened and widened, the surface of the shell is smooth, the shell length is 1.5- 1.7cm. This species is found in muddy sand substrates.
9. Nassrius limnaeiformis, dextral shell shape, shell color before washing is black and shell color after washing is gray and has a circular yellow line on each segment of the shell, the lines on the shell are brown, the color of the mouth of the shell is white-black, the color of the operculum is black, smooth shell surface, shell length 1.6 -1.8 cm. This species is found in silty sand and rocky sand substrates.

Table 3. Taxa Structure and Number of Individual Gastropod Species

Classis	Ordo	Familia	Genus	Species	JTI
Gastropoda	Mesogastropoda	Naticidae	*Polinices*	*Polinices mammilla*	40
			Natica	*Natica vitellus*	31
		Strombidae	*Strombus*	*Strombus labiatus*	50
				Strombus urceus	98
		Burnsidae	*Bursa*	*Bursa tuberosissima*	40
		Liotidae	*Liotina*	*Leotina peronei*	88
	Neogastropda	Conidae	*Conus*	*Conus coronatus*	49
				Conus moriculatus	38
		Nassaridae	*Nassarius*	*Nassarius pullus*	20
				Nassarius limnaeiformis	73
Total Individuals					**527**

Seagrass Association with Gastropods

From the results of the calculation of the two types of correlation using the contingency table and the chi-square test, it can be seen the association relationship. Based on the data in table 4, it shows that there is one type of seagrass associated with two gastropod species, namely (i) Enhalus acoroides with Strombus urceus and Liotina peronni. The existence of an association between one seagrass species and two gastropod species is shown by obtaining a calculated value of x^2 which is greater than the value of $x2$ taabel where the pair of species respectively has a chi-square value of (i) 20.86; (ii) 8:40 p.m.; greater than the value of $x2$ table (3.84). In addition, the research data showed that Halodule uninervis and Halophila ovalis were not associated with 10 other gastropod species because these two seagrass species were present at the study site but their associations were not counted because the distribution of these two seagrass species was not evenly distributed in each observation plot. Furthermore, the results of the study showed that the value of E(a) for one type of seagrass and two types of gastropods was smaller than the value of a. One seagrass species, namely Enhalus acoroides and two types of gastropod strombus urceus, Liotina peronei, respectively have an E(a) value of (i) 17.50; (ii) 14.58 is less than the a value (observation) of (i) 21; (ii) 16; This indicates that

the association that occurs between the two pairs of species is positive because the value a > E(a). Based on the results of the calculation of the association index (Jacard Index), it can be seen that the value of the association index is shown in table 4.

Table 4. Value of Association and Type of Association of Seagrass Species with Gastropods in the coastal waters of Poka Village.

No.	Species seagrass	Species Gastropods	X^2(5%)	X^2		a	E(a)	Type asociated
			Table	**Count**				
1	***Enhalus acoroides***	*Polinices mammilla*	3.84	0.45	* * *	15 14		+
		Natica vitellus	3.84	2.81	**	18	14.00	-
		Strombus labiatus	3.84	0,.57	*	**21**	14.67	+
		Strombus urceus	**3.84**	**20.86**		6	16.67	+
		Bursa tuberosissima	3.84	0.68			**17.50**	-
		Liotina peronii	**3.84**	**20.40**	**	**16**	14.21 **14.58**	+
		Conus coronatus	3.84	0.48	*	17	13.56	+
		Conus moriculatus	3.84	0.02	*	15	15.75	-
		Nassarius pullus	3.84	2.95	*	8	7.67	-
		Nassarius limnaeiformis	3.84	3.24	*	9	15.75	-

Note: ** There is an association between the two species, * There is no association between the two species + Positive association, - Negative association

Based on the results of the association index calculation using index jasard (Tabel 5), then the two gastropod species that are known to be associated with seagrass have a minimum association index meaning that these species can be associated but have an association index value of less than 1.

Table 5. Jacard Index Value of Seagrass Species with Gastropods in the Coastal Waters of Poka Village

No	Species Seagrass	Species Gastropod	Indeks Jacard
1	*Enhalus acoroides*	*Strombus urceus*	0.57
		Liotina peronii	0.43

Chemical Physical Parameters

The results of the physical-chemical parameter measurements showed that the temperature on the observation transect ranged from 29.5-32.6, Salinity 30-32%, the pH on the observation transect ranged from 6.197.12, Dissolved oxygen on the observation transect ranged from 4.7-6.9 mg/l. Based on the measurements of the physical-chemical parameters above and seen by the water quality standards, the

physical-chemical parameters in the coastal waters of Poka village are still within the water quality standards set by reference (Nybakken, 1992).

The results of the research on the coast of Poka village obtained 3 species of seagrass, namely Enhalus acoroides, Halophila ovalis and Holodule uninervis with a total of 4,864 individuals. Enhalus acoroides had the highest number of individuals, namely 4,175 individuals (Table 2). This is because the sampling area is an intertidal area where the area is the habitat of Enhalus acoroides, this is in line with the opinion Begen (2001) that the habitat of seagrass Enhalus acoroides is found in the intertidal area. The results of this study found the types that grow in Maluku waters. Enhalus acoroides is a type of seagrass that can contribute high density values and protect various types of marine biota, including gastropods. Apart from Enhalus acoroides, Halophila ovalis and Holodule uninervis were also found growing at the study site to form mixed vegetation. There is an association between seagrass species and gastropod species where seagrasses provide food in the form of dead Enhalus acoroides seagrass leaf litter for gastropods while gastropods help speed up the decomposition process of organic matter so that it makes it easier for microbes to decompose it into nutrients for aquatic producers (seagrass). In addition, at the lowest ebb, gastropod species use seagrass leaves to protect the body from the sun's heat (Soegiono, 1994).

Based on the results of the study, one species of seagrass Enhalus acoroides and two species of gastropods Strombus urceus and Liotina peronii were associated because the two species have the same biotic and abiotic environment including food, temperature, pH, salinity, dissolved oxygen and substrate. This condition causes the two species to tend to be together and are often found in one habitat. There are also a number of biotic and abiotic factors that can affect associations between species within a community (Soegionto, 1994). In general, relationships between the two species occur because both species choose or avoid the same habitat, and one or both species choose or avoid the same habitat the same, and one or both species have something in common with each other either in the form of an attraction or repulsion (Ludwig, 1988). The results showed that there were 8 pairs of seagrass species and unassociated gastropod species (Table 4) presumably due to community activities in Poka village in the form of taking marine products including gastropod organisms for consumption. The association between seagrass and gastropods was due to the fact that the number of observation plots where there was at least one species was less when compared to the observation plots where both species were present.

The results of calculating the type of association between one seagrass species and two gastropod species show that the association is positive (Table 4). The positive association that occurs between one seagrass species and three gastropod species is because the two associated species tend to always be found together rather than individually, meaning that the two pairs of species in the same habitat or there is a reciprocal relationship indicate tolerance to live together at different species. The same habitat or there is a mutually beneficial relationship. Positive associations tend to be mutualism. Mutualistic is a form of association in which two species are together and mutually beneficial to each other (Nybakken, 1988) Gastropod species that are known to be associated with seagrass species can provide a reciprocal relationship with these seagrasses where seagrasses provide food for epiphytic gastropod species attached to seagrass leaves, besides that gastropods utilize the litter from fallen seagrass leaves as a source of food. This is in accordance with the statement (Klump et al, 1992) that 20-60% of the efficient biomass in seagrass beds is used by the epifauna community which is dominated by gastropods. The benefits obtained by seagrass in the presence of these species are changes in the efficient load on seagrasses (Peterson et al, 2001). In addition, gastropods help decompose litter from fallen and old seagrass leaves by eating them which will produce organic material which seagrass will use for its growth.

Based on the results of the association level research using the Jacard index, it is known that the associated species have a minimum association level. The minimum association value is determined based on the calculation results where if JI = 1 then the maximum association level and if the JI value <1 then the minimum association level. This index is the proportion between the number of observation plots that have two species and the total number of observation plots that have at least one species. The minimum level of association occurs between pairs of species that are found together in one observation plot and in other observation plots only one of the pairs is found. The minimum level of association occurs if several species are found together in the same observation plot or not together in different observation plots (Ludwig, 1988).

CONCLUSION

Three species of seagrass were found namely Enhalus acoroides, Holophila ovalis, Halodule uninervis. Ten species of gastropods were found, namely Polinices mammilla, Natica vitellusi, Strombus labiatus, Strombus urceus, Bursa tuberosissima, Liotina peronii, Conus coronatus, Conus moriculatus, Nassarius pullus, Nassarius limnaeiformis.

There is a positive association between seagrass and gastropods which means that these species tend to be found together in each observation plot and show tolerance to live together or there is a mutually beneficial relationship.

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