



Research Article

Association patterns of seagrass with gastropods types in the intertidal zone of coastal waters, Suli village, Salahutu district, Ambon Island

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ABSTRACT

Seagrass beds play an important role in coastal aquatic ecosystems and are one of the tidal areas that are widely used by the community as a forum for the interests of educational institutions in research activities, conservation of various marine biota. Ecologically, the seagrass ecosystem acts as a shelter and a place to eat various marine biota, including gastropods. The purpose of this research is not only to explore the diversity of gastropods, but also to examine the interactions of gastropod species, both between the same species and between different species in a community of seagrass ecosystems. the diversity index calculation shows the diversity index value $H = 3.982 > 3$, this means that the diversity of gastropod species is quite good. The results of the basic analysis obtained the calculated X^2 value of 0.656, $> X^2_{table}$ with a significant level of 0.05%. There is an association relationship between seagrass ecosystems and the types of gastropods that live in seagrass ecosystems in coastal waters of Suli Village, Ambon.

Keywords: Gastropod, seagrass, , association

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INTRODUCTION

The sea and coastal waters of Maluku Province, especially Ambon Island, have natural phenomena with the characteristics of their seagrass ecosystems, in addition to the content of marine biological resources with a diversity of gastropods that have high economic value. Gastropod marine biota as a community in seagrass ecosystems shows association patterns in the form of stratified structures in functional patterns related to associations between gastropod species, reproductive behavior and food webs in seagrass ecosystems in the intertidal zone of marine and coastal waters. Yudi Wahyudin et al. (2016) say that one of the seagrass ecosystems with its characteristics and in it there are interactions between seagrass ecosystems and various marine biota. This interaction forms a balance of the marine and coastal waters environment. The seagrass ecosystem is one of the important components as a constituent of coastal ecosystems along with mangroves and coral reefs. Seagrass ecosystems do not get too much attention, even though seagrass ecosystems provide sufficient nursery ground, feeding ground, nutrient circulation and others. Even seagrass ecosystems have

strong relationships and are associated with several unique organisms and species unique surroundings, such as gastropods and other marine biota, all of which depend on seagrass ecosystems.

Seagrass beds play an important role in coastal aquatic ecosystems and are one of the intertidal areas that are widely used by people in coastal areas, including the Salahutu District, Ambon Island. Coastal waters with their own seagrass ecosystem are widely used as a place for the interests of educational institutions in research, conservation, education and tourism activities. seagrass ecosystem in this area needs to get attention. The seagrass ecosystem has an ecological function, such as a place to live and find food, a place for spawning and in it there are associations of various marine biota and form a community. The interaction and association of various marine biota allows the ecosystem to have good potential for marine resources, such as various types of gastropods and the movement of various marine biota to be in the seagrass ecosystem area. [Mahifal. \(2010\)](#) Explains that the seagrass ecosystem is an aquatic area that needs to be protected because it has aquatic resources with various interests, both research, conservation and a place to meet the needs of people's lives.

Concept of community is very important in an ecosystem, because community is a principle that emphasizes the regularity of various types of marine biota that exist in seagrass ecosystems, such as interaction between marine biota and the aquatic environment in seagrass ecosystems. [Mikael P. \(2005\)](#) that among the various types of organisms that make up a community, only a few species show real control in the functioning of the community. Thus, the relative importance of gastropods in seagrass ecosystems is not determined by their taxonomic position, but by their number, size, reproduction, and interactions between each other or association with seagrass ecosystems in coastal and marine waters. According to [Junita Supusepa. \(2018\)](#) that in ecological studies such as the interactions between species or associations that are most important are the benefits of the organism for the benefit of humans as some types of gastropods have significant value economy because various types can be consumed as a substitute for animal protein. In addition, the shell can be used as a decoration material (sofenier), generally shelled animals This serves as a source of food that is taken from the meat for consumption. As a type of gastropod, it plays a role as an ecological controller in coastal ecosystems, especially in seagrass ecosystems.

Measurement of the level of association between gastropods and marine ecosystems by observing and calculating the relationship between garopod species and environmental factors physical, chemical, and biological, in the intertidal zone of the coastal waters of Suli Village, Ambon Island. This association greatly determines the population and community of gastropod species as well as their diversity and dominance species of gastropods and the association pattern between gastropods and seagrass ecosystems. [Tuaputty H. \(2020\)](#) say that in the intertidal zone the coastal waters of Suli Village, Ambon Island have physical and chemical conditions such as salinity 30-34‰, temperature 28- 29 °C, pH 6,7 - 7.2. The existence of these fluctuations due to coastal waters greatly determines the existence of marine life. [Tebiari \(2021\)](#) say that the physical-chemical conditions of coastal waters occur due to coastal tides, changes in temperature, salinity, pH, and wind. This phenomenal cause the gastropod a characteristic feature. In generally, gastropods are found in physical and chemical conditions such as temperatures of 25 –32°C, salinity optimal for gastropod life is in the range of 28–34‰ and requires a pH of 7.2 – 8.1 for gastropod survival and reproduction.

The life of various types of gastropods in the intertidal zone of the seagrass ecosystem is strongly influenced by the conditions of the aquatic environment, both physical, chemical and biological. [Batau. \(2017\)](#) say that in addition to physical and chemical factors also influence the presence of gastropods as macrobenthos is the availability of nutrients or organic materials in the seagrass ecosystem, so that there is interaction or association as an effort to move gastropods to keep getting food sources for life. gastropods to form a stable community in the seagrass ecosystem which can lead to associations between various gastropod species and the seagrass ecosystem. The study of gastropod associations with seagrass ecosystems is not only related to physical and chemical factors but also to biological factors. this can determine a community of gastropod species and their existence both as a food source and as an ecological factor in preparing the food chain for life in the ecosystem seagrass meadow. [Hitalessy et al. \(2015\)](#) say that species association is a reciprocal relationship between species in a community and can be used to predict community composition.

The presence or absence of associations of gastropod species in a community can indicate the level of diversity in the community of these gastropod species. A high level of association of gastropod species will indicate a high diversity of gastropod species in a community. The purpose of this research is not only to explore the diversity of gastropods, but also to examine the interactions of gastropod species, both between the same species and between different species in a community of seagrass ecosystems.

METHODS

This research is a descriptive study make a survey of the presence of various types of gastropods in the seagrass ecosystem by observing the association pattern between seagrass in the intertidal zone of coastal waters, Suli Village, Ambon Island, conducted in March-April 2021. Sampling was carried out using a transect line, each transect was made of 5 quadrants with a size of 4 m² and physical and chemical factors were measured. To determine The diversity of gastropod species found in each quadrant was analyzed using the Shannon-Weaver formula (Odum 2005), namely:

$$H = - \sum_{ni=1}^S \left(\frac{ni}{N} \times \log^2 \frac{ni}{N} \right)$$

H = index of species diversity,

ni = Number of individuals I,

N = Total number of individuals of all species.

Interpretation of the level of diversity, among others:

H < 1 community is in an unstable state.

1 < H < 3 communities are in moderate condition,

H > 3 communities in good condition.

To determine the value of the association, calculations are carried out using a contingency table 1

Table 1. Analysis of association Shannon-Weaver

		Seagrass		
		Yes	No	
Type of gastropods	Yes	a	B	m=a+b
	No	c	D	n=c+d
Number		r = a+c	s = b+d	N

Based on the contingency value, an analysis of the association pattern of gastropod species with the seagrass ecosystem was carried out using the X² (chi square) value with the formula,

$$X^2 = \sum \frac{(O - E)^2}{E}$$

To determine the type of positive or negative association, the expected contingency value is used with the Chi-square test formula (X²) using the contingency value,

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

RESULTS AND DISCUSSION

Environmental conditions in the intertidal zone overgrown with seagrass in the coastal waters of Suli Village, Ambon Island, show that the temperature in the seagrass ecosystem inhabited by various types of gastropods ranges from 28.3 0C - 29.5 2C. Water temperature conditions like this are very good for gastropods in finding food. This is in line with the results of Tangke's (2010) research that seawater temperatures in the range of 28 0C - 30 0C will occur photosynthesis by seaweed, thus allowing many marine biota to like seagrass beds. According to Osni Sesfao et al. (2019) that the water temperature in the intertidal zone ranges from 26 C - 30 C, it is very good for the existence of a population of gastropod species, especially in coastal water ecosystems, encouraging the growth of gastropod species.

Measurement of the acidity level (pH) of seawater in the seagrass ecosystem as a habitat for gastropod species in the intertidal zone of the waters of Suli Village, Salahutu District, Ambon Island shows a pH range of 6.8 - 7.2. The level of pH of sea water like this is very stable and allows the presence of various types of gastropods to live in seagrass ecosystems. According to Wijayanti. (2007) that the pH of seawater that supports mollusc life ranges from 5.7 - 8.4, and for live gastropods it is in the range of pH 5.8 - 8.3. According to Effendi

(2003) that the pH value of seawater is more than pH 5 and greater than pH 9 creates unfavorable water conditions for most marine biota such as macrobenthos.

The results of measurements of dissolved oxygen in seagrass ecosystems in the intertidal zone of coastal waters values is in the range of 5.8 - 6.5 mg/L. This dissolved oxygen condition is very possible for the life of gastropod species in the seagrass ecosystem. Oxygen condition dissolved ideal for marine life, including gastropods, with an oxygen content of at least 5 mg/L. Dissolved oxygen is a chemical variable that has a very important role for the life of aquatic biota as well as a limiting factor for the life of marine biota. According to Kepmen. (2004) the dissolved oxygen content for biota in waters is > 5 mg/L. According to Effendi. (2003) a dissolved oxygen content of at least 2 mg/L is sufficient to support the normal life of aquatic organisms. However, the best dissolved oxygen is 5 mg/L – 6 mg/L. The results of the measurement of chemical and physical factors in the coastal waters of Suli Village, Salahutu District, Ambon Island, which were carried out in each quadrant on the types of gastropods, obtained the results in table 1 as follows:

Table 1. Results of measurement of physical and chemical factors in each quadrant of seagrass in the coastal waters of Suli village, Salahutu district, Ambon island.

Seawater Parameters	Transect I					Transect II					Σ Rata2
	5 quadrant					5 quadrant					
	1	2	3	4	5	1	2	3	4	5	
Temperature °C	29,2	29,5	28,5	28,5	29,0	29,4	28,5	28,5	28,5	29,0	28,9
pH	6,8	7,2	7,1	6,7	7,0	7,2	6,9	7,0	6,8	6,9	6,98
Salinity ‰	33	33	30	32	32	32	34	33	32	33	32,4
DO mg/L	6,0	5,8	5,9	6,2	6,0	6,5	6,0	6,2	6,2	6,2	6,0

Based on the data in table 1 above, it shows that the physical and chemical factors of the waters have an average seawater temperature of 28.9 °C, an average seawater pH of 6.98, an average seawater salinity of 32.4 ‰ and an average dissolved oxygen –average 6.0 mg/L. The condition of aquatic environmental factors like this is very good for the life of gastropod species in the seagrass ecosystem in the intertidal zone of Suli Village, Salahutu District, Ambon Island.

The presence of gastropod species found in seagrass ecosystems in the intertidal zone of coastal waters of Suli Village, Salahutu District, Ambon Island after identification, it turned out that the species found were *Conus muriculatus* Soweby, *Conus spongeialis*.Hwass, *Conus coronatus* Gmelin, *Conus lividus*, *Littoraria scabra*, *Polineces mammilla*, *Polineces tumidus*. Based on the number of each type of gastropod found and a performance index analysis was performed, the diversity index value was $H = 3.982 > 3$. This shows that the community of gastropod species that live in seagrass ecosystems is very stable and good for growth because it is supported by aquatic environmental factors. The results of observations and identification of Gastropod species found on 2 transect lines with 10 quadrants in the seagrass ecosystem in the intertidal zone of coastal waters, Suli Village, Ambon Island, can be seen in table 2 below.

Table 2. Results of Observation of Gastropod Types on 2 Transect Lines of Seagrass Ecosystems in Each Quadrant in the Coastal Waters of Suli Village, Salahutu District, Ambon Island

Types of Gastropods	Transect I					Transect II				
	quadrant					quadrant				
	1	2	3	4	5	6	7	8	9	10
<i>Conus muriculatus</i> Soweby	✓				✓	✓		✓		✓
<i>Conus sponsialis</i> .Hwass		✓			✓				✓	
<i>Conus coronatus</i> Gmelin	✓	✓			✓		✓			
<i>Conus lividus</i>				✓	✓				✓	
<i>Littoraria scabra</i>	✓			✓		✓				
<i>Polineces mammilla</i>					✓					✓
<i>Polineces Tumidus</i>	✓				✓		✓		✓	

The results of the identification and calculation of gastropod species found in seagrass ecosystems on two transect lines with 10 quadrants in the intertidal zone of coastal waters, Suli Village, Salahitu District, can be described in the table for calculating the diversity index shannon-weaver, (Odum 2005) in table 3 below.

Table 3. Calculation of garopoda diversity found in 10 quadrants in seagrass ecosystems in coastal waters, Suli village, Salahutu district, Ambon island

Spesies	Ni	Pi =n/N	Log Pi	Log Pi x Log Pi
<i>Conus muriculatus</i> Soweby	9	0,191	-0,718	-0,527
<i>Conus sponsialis</i> .Hwass	5	0,106	-0,974	-0,868
<i>Conus coronatus</i> Ggmelin	7	0,148	-0,829	-0,681
<i>Conus lividus</i>	8	0,170	-0,769	-0,599
<i>Littoraria scabra</i>	6	0,127	-0,896	-0,769
<i>Polineces mammilla</i>	3	0,063	-1,200	-1,137
<i>Polineces Tumidus</i>	8	0,170	-0,769	-0,599
- Σ	47			-3,982
	3.982			

Based on the data from the calculation of the diversity index in table 3, it shows that the value of the diversity index is $H = 3.982 > 3$. this shows that the diversity of gastropod species is quite good. the community of gastropod species in seagrass ecosystems is quite stable in the intertidal zone of coastal waters in Suli village, Salahu village, Ambon Island. Analysis of the association pattern of gastropod species with seagrass beds in the intertidal zone there according to the calculation with the hope contingency formula is shown in table 4 below

Table 4. Calculation of association types of gastroroda with seagrass beds based on expected contingency values

		Seagress		
		Yes	No	
Type of gastropods	Yes	21	11	$m = a + b = 32$
	No	8	7	$n = c + d = 15$
Number		$r = a + c = 29$	$s = b + d = 18$	$N = 47$

Based on the contingent values in table 4, calculations are carried out for each expected contingent frequency value, namely $E_a = rm/N$ or $E_a = 19.7$, $E_b = ms/N$ or $E_b = 12.2$, $E_c = rn/N$ or $E_c = 9.2$, $E_d = sn/N$ or $E_d = 5.7$. Next to determine the pattern the relationship between the types of gastropods and the seagrass ecosystem, the chi square value was calculated. The results of the chi square calculation to determine the association between the types of gastropods and the seagrass ecosystem are shown in table 5 below:

Table 5. Calculation results of the association between seagrass ecosystems and Gastropod species.

No	Quadrant	O	E	O - E	(O-E) ²	$\Sigma \frac{(O-E)^2}{E}$
1	Seagrass ecosystem quadrant with types of gastropods	21	19.7	1.3	1.69	0,0857
2	Seagrass ecosystem quadrant without types of gastropods	11	12.2	-1.2	1.44	0,1180
3	Gastropods without a seagrass ecosystem	8	9.2	- 1,2	1.44	0,1565
4	Quadrant not seagrass ecosystem and types of gastropods	7	5.7	1,3	1,69	0,2964
		47	46,8	0,2	6,26	$X^2 = 0,656$

Based on the data in table 5 shows that the calculated X^2 value is 0.656, $> X^2$ table with a significant level of 0.05% with db = 1 obtained a value of 0.016, then X^2 value is 0.656 $> X^2_{table}$ 0.016, so it can be said that there is an association relationship between seagrass ecosystems with the types of gastropods that live in the seagrass ecosystem of the coastal waters of Suli Village, Ambon Island. The determine type of association or association pattern between gastropod species and seagrass or seagrass ecosystems, make use Chi-square test.

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

$$X^2 = \frac{47 (60)^2}{29+18+32+15}$$

$$X^2 = 1.8$$

The results of the Chi-square calculation show that there is positive association pattern between seagrass beds and gastropod species in the coastal waters of Suli Village, Salahutu District, Ambon Island

CONCLUSION

Seagrass ecosystems in the intertidal zone of coastal waters of Suli Village, Salahutu Subdistrict, Ambon Island, have good water conditions, this is evidenced by the level of diversity of gatropoda species with index $H = 3.981 > 3$. So it can be said that the community in the ecosystem is still stable, because it is supported by physical and chemical factors of the waters as well as biological factors that allow positive interactions to occur. There is an association of communalism, namely the interaction between the types of gastropods that live in the seagrass ecosystem in the coastal waters of Suli Village, Salahutu District, Ambon Island, which is mutually beneficial between the two species.

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