Asian Journal of Aquatic Sciences, August 2023. Vol 6, Issue (2) 168-173
e-issn: 2716-4608
p-issn: 2655-366X

BIVALVE COMMUNITY STRUCTURE IN THE INTERTIDAL ZONE OF PASUMPAHAN ISLAND PADANG CITY WEST SUMATERA PROVINCE

Rahma Zani[1]*, Afrizal Tanjung[1], Elizal[1]
[1]Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau
Kampus Bina Widya KM. 12,5, Simpang Baru, Kec. Bina Widya, Pekanbaru, Riau 28293
*rahma.zani4468@student.unri.ac.id

ABSTRACT

Bivalvia is a class of the Mollusca phylum. Bivalvia is also known as Pelecypoda and Lamellibrankhiata. Bivalvia occupies an area of the intertidal zone, one of which is in the intertidal zone of Pasumpahan Island. But information about bivalves in the area does not exist. To know/understand information about the density and distribution pattern of bivalves on Pasumpahan Island, this research was conducted in January 2022. The sampling area was in the intertidal zone of Pasumpahan Island. Sampling was carried out at three stations, each station was divided into three transects. Bivalve sampling was carried out using a 1 x 1mm sieve. The movement of bivalves to the gravel substrate is very fast to avoid splashing waves. Bivalves samples were then identified. The density of bivalves in the intertidal zone of Pasumpahan Island ranged from 1.78-3.56 Ind/m^2. Station 2 has a higher density of bivalves, namely 3.56 Ind/m^2, the calculation of bivalves in the intertidal zone of Pasumpahan Island obtained bivalves distribution pattern data in groups.

Keywords: Bivalvia, Intertidal Zone, Density, Distribution Patterns, Pasumpahan Island

1. INTRODUCTION

The intertidal zone is the narrowest of all areas in the world's oceans. Although the area is very limited, compared to other marine areas, the types of environmental factors are limited. There are more types of life in this area, one of which is shellfish, including bivalves. With the potential to utilize natural resources to meet human needs, tidal areas are often explored. The many activities carried out in the area pose a threat to biota, especially bivalves.

Bivalves are one of the classes of the phylum Mollusca. Bivalves are also called Pelecypoda and Lamellibrankhiata, bivalves are called Pelecypoda because of their axe-shaped legs. Lamellibrankhiata is called because of their sheet-shaped gills which are very large and are also considered to have an additional function, namely food collectors, in addition to being a place of gas exchange. One of these animals is blood clams, oysters, mussels, mussels, and the like[1].

The purpose of this study was to determine the community structure which includes bivalve species, density, diversity, uniformity, dominance, and distribution patterns of bivalves in the intertidal zone of Pasumpahan Island, Padang City, West Sumatra Province.

2. RESEARCH METHOD

Time and Place

The research was conducted in January 2022. The research location was in the intertidal zone of Pasumpahan Island, Padang City, West Sumatra Province.

Methods

The method used in this study was the survey method. Samples were identified and analyzed at the Marine Biology and Marine Chemistry Laboratory, Department

Received : 7 May 2023
Accepted : 2 July 2023

of Marine Science, Faculty of Fisheries and Marine Sciences, Universitas Riau.

Procedure

Location Determination

The research location was divided into 3 (three) stations based on *purposive sampling*, namely station I was in the tourist area of Pasumpahan Island, station II was at the anchorage of fishing boats and tourist boats on Pasumpahan Island, and Station III was located in the eastern part of Pasumpahan Island which was dominated by coconut vegetation. Each station uses 3 transects whose distance is adjusted to the area after arriving in the field. The research sampling stations have represented the characteristics of the environment on Pasumpahan Island, Padang City, West Sumatra Province (Figure 1).

Figure 1. Research location

Sediment Organic Matter Content Analysis

The procedure for analyzing the content of organic matter in sediments was carried out using the loss on ignition method[2] and the procedure for analyzing the structure of the bivalve community using the formula[3]. As well as the analysis of suspended solids using the formula according to the BSN[4].

Measurement of Aquatic Environmental Parameters

Measurements of aquatic environmental parameters consisted of acidity (pH), temperature, brightness, and salinity.

3. RESULT AND DISCUSSION

Pasumpahan Island is one of the islands included in the administrative area of Bungus Teluk Kabung District, with coordinates located at 01°07'04" LS and 100°22'03" East. The island is populated and has its history based on Minang customs, including the history of Siboko or often called the Malin Kundang story. The general condition of Pasumpahan Island is a flat and partly hilly island with white sandy beaches overgrown with several types of high-level plants such as coconuts, shrubs, and grass. This location also has a rest house that can be used as a tourist spot. The condition of water quality parameters such as pH, temperature, salinity, and brightness is still in good condition as a place to live biota, but because the type of sediment on Pasumpahan Island is gravel, it causes a reduction in biota obtained, social activities such as people who travel also, affect the distribution of biota in the intertidal zone of Pasumpahan Island.

Aquatic Environment Parameters

The results of measurements of the aquatic environment of the physical and

chemical parameters of the waters at the research site have salinity values ranging from 30-31 ppt, pH ranging from 6-6.3. Brightness values range from 50-80 cm and temperatures between 30-32^{o} C. The results of the measurement of the aquatic environment can be seen in Table 1.

Table 1. Aquatic environment parameters

Station	pH	Temperature (^{O} C)	Salinity (ppt)	Brightness (cm)
I	6,3	30	30	50
II	6	30	31	80
III	6	32	31	60

Bivalve Species and Density

The types of bivalves obtained based on the zone, in the upper zone 5 different bivalve species were obtained from each station, including *C.tigerina*, *T.flavum*, *A.striata*, *D.cuneatus*, and *Pectinidae* sp., while in the middle zone, 3 bivalve species were obtained, including *A.striata*, *D.cuneatus*, and *B. violacea* and in the lower zone 3 bivalve species were obtained, including *A.striata*, *D.cuneatus*, *B.amygdalumtostum*. Bivalve species can be seen in Table 2.

Table 2. Bivalve species at the research site

Family	Genus	Species
Lucinidae	Codakia	*Codakia tigerina*
Cardiidae	Trachycardium	*Trachycardium flavum*
Mesodesmatidae	Atactodea	*Atactodea striata*
Arcidae	Barbatia	*Barbatia amygdalumtostum*
Donacidae	Donax	*Donax cuneatus*
Cyrenidae	Batissa	*Batissa violacea*
Pectinidae	Pecten	*Pectinidae* sp.

Table 3. Mean (±) standard deviation of bivalve density in the intertidal zone of Pasumpahan Island

Station	Mean ± Standard deviation
I	3,00 ± 0,27
II	3,56 ± 0,31
III	1,78 ± 0,16

The density of bivalves between stations in the intertidal zone of Pasumpahan Island was low, ranging from 1.78 to 3.56 ind/m^2. The highest average was found at station II, namely 3.56 ind/m^2, while the lowest density was found at station III, namely 1.78 ind/m^2 (Table 3).

The density of bivalves at station II was 3.56 ind/m^2, higher than station I and station III. This station is located between the anchorage of fishing boats and tourist boats. The organic matter at this station is 2.91 mg/l is the average between station I and station III. The organic matter at this station is influenced by community activities that cause ecological pressure and affect the density of bivalves. Following the statement of Ritniasih and Widianingsih[5], the high and low-density values are supported by the average content of organic matter contained in the sediment. This is thought to be due to organic matter playing an important role in providing food sources for bivalve organisms.

Differences in bivalve density between stations were analyzed by the ANOVA test. The results of the ANOVA test obtained a significant value of 0.001

where $p < 0.05$ then H_0 is rejected, the density of bivalves between stations is significantly different and then further LSD (Least Significant Difference) test is carried out to determine which average between stations is the most different among the three observation stations.

The density of bivalves at the station I was 3.00 ind/m^2. This area is located in the tourist area of Pasumpahan Island. The organic matter at this station is 2.97 mg/l higher than station II which is 2.91 mg/l and station III which is 2.25 mg/l. Following the statement of Nurdin et al.[6] which states that the density of bivalves is strongly influenced by habitat conditions and the high level of human activity in the habitat.

The density of bivalves at station III was 1.78 ind/m^2 which was the lowest density value compared to station I 3.00 ind/m^2 and station II 3.56 ind/m^2. The area is located in the eastern part of Pasumpahan Island which is dominated by coconut vegetation. This is following the views of Silaen et al.[7] the density and distribution of bivalves are influenced by habitat, food availability, predation, and competition.

Bivalve Diversity, Dominance, and Uniformity Indices

The diversity index of bivalves in the intertidal zone on Pasumpahan Island in this observation ranged from 1.53-1.57 (Table 4). Station I with a diversity index value of 1.53, station II with a diversity index value of 1.57, and Station III with a diversity index value of 1.53.

Table 4. Diversity, dominance, and uniformity of bivalves

Station	H'	C	E
I	1,53	0,36	0,05
II	1,57	0,34	0,04
III	1,53	0,36	0,09

Based on the diversity criteria at Station I, station II, and Station III, it can be concluded that the diversity index category at all stations is in the moderate category, where the index value ranges from $1.0 \leq H' < 3.0$: moderate diversity, sufficient productivity, balanced ecosystem conditions, moderate ecological pressure. An ecosystem can be said to be normal if it is characterized by a high level of community diversity without any dominant species, and the distribution of the number of individuals of each species is relatively uniform.

Bivalve Distribution Pattern

The distribution pattern of bivalves in the intertidal zone of Pasumpahan Island in this observation ranged from 2.77 - 2.85 (Table 5). Station I with a morisite index value of 2.77, station II with a morisite index value of 2.85, and Station III with a morisite index value of 2.78.

Table 5. Bivalve distribution pattern

Station	Id	Distribution Pattern
I	2,77	Clustering
II	2,83	Clustering
III	2,78	Clustering

Based on the morisite index criteria of station I, station II, and station III with Id>1, it can be concluded that the distribution of bivalves in the intertidal zone of Pasumpahan Island shows a clustered distribution pattern. This is following the statement Werdiningsih[8] that clustered distribution patterns are patterns of organisms or biota in a habitat that live in groups in certain numbers. The distribution pattern of each species and habitat type is very distinctive. The cause of the distribution pattern is due to differences in response to habitat. Distribution patterns with various levels of grouping are the most common form of distribution because individuals in a population tend to form groups of varying sizes.

Sediment Type and Organic Matter

Based on the analysis results, it is found that the type of sediment at each station is gravel. The highest percentage of

gravel sediment fraction is at station III lower zone 87.50%, the lowest is at station II upper zone 16.32% (Table 6).

The highest organic matter content is found at station I lower zone with an average amount of 2.7 mg/l while the lowest organic matter content is at station III lower zone with an average amount of 2.25 mg/l (Table 7).

Figure 6. Sediment type analysis

Station	Zone	% Sediment Fraction			Sediment Type
		Gravel	Sand	Mud	
I	Upper	34,46	61,66	3,89	Gravelly sand
	Middle	42,46	54,29	3,25	Gravelly sand
	Lower	74,56	22,75	2,69	Sandy gravel
II	Upper	16,32	79,77	3,92	Sand
	Middle	58,35	38,49	3,16	Sandy gravel
	Lower	70,15	27,85	2,00	Sandy gravel
III	Upper	17,71	78,72	3,57	Sand
	Middle	81,72	16,27	2,01	Gravel
	Lower	87,50	9,42	3,08	Gravel

Table 7. Mean (±) standard deviation of sediment organic matter content in the intertidal zone of Pasumpahan Island

Station	Average sediment organic matter content (mg/l)
I	2,97 ± 0,10
II	2,91 ± 0,11
III	2,25 ± 0,51

Suspended Solids

The average value of total suspended solid at each station in the waters of Pasumpahan Island ranges from 111 mg/l - 204.3 mg/l, where the lowest total suspended solid is found at station I which is 101.0 mg/l and the highest total suspended solid content is found at station II which is 159.0 mg/l. More details on the differences in the average value of suspended solids content at each station can be seen in Table 8.

Table 8. Mean (±) standard deviation of suspended solids values in the intertidal zone of Pasumpahan Island

Station	Mean ± standard deviation
I	111,0 ± 9,09
II	159,0 ± 63,16
III	136,3 ± 28,89

From the table above, it can be seen that the results of the calculation of the value of suspended solids content have varying values at each station. The average total suspended solid (TSS) that is good for bivalves ranges from 81 - 400 mg/l which can affect the life of bivalves and gastropods in the waters.

4. CONCLUSION

Based on the results of the research that has been done, the bivalve species found consist of 7 (seven) species namely *C.tigerina*, *T.flavum*, *A.striata*, *B.amygdalumtostum*, *D.cuneatus*, *B.violacea*, and *Pectinidae* sp. The density of bivalves in the intertidal zone of Pasumpahan Island is relatively low ranging from 1.78-3.56 ind/m^2, the density of bivalves between station I and station III has a significant difference and the density between station II and station III has a significant difference, while the density between station I and station II is not significantly different. The diversity index (H') of bivalves at each station is

categorized as medium. The dominance index (C) at all stations is categorized as no dominant species. The uniformity index (E) at each station is categorized as balanced. The overall distribution pattern of bivalves at each station is clustered

Based on the research that has been done, it is suggested that further research is needed on other environmental factors that affect the structure of the bivalve community which includes dissolved oxygen and also bivalve sampling is carried out in several periods so that the condition of the bivalve stock in the Pasumpahan Island area can be known more completely.

REFERENCES

1. Romimohtarto, K., Juwana, S. *Biologi Laut (Ilmu Pengetahuan Tentang Biota Laut)*. Jakarta: Djambatan. 2007.
2. Prasetia, M.N., Suprihayono, Frida, P. Hubungan Kandungan Bahan Organik dengan Kelimpahan dan Keanekaragaman Gastropoda pada Kawasan Wisata Mangrove Desa Bedono Demak. *Journal of Maquares,* 2019; 8(2): 87-92
3. Brower, J., Zar, J., Ende, C.V., Kane, K. *Field and Laboratory Methods for General Ecology*. America: Wm. C. Brown Publisher. 1990.
4. [BSN] Badan Standardisasi Nasional. *Air dan air limbah-Bagian 3: Cara uji padatan tersuspensi total (Total Suspended Solid, TSS) secara gravimetri*. BSN. Jakarta. 2004.
5. Riniatsih, I., Widianingsih. Kelimpahan dan Pola Sebaran Kerang-Kerangan (Bivalve) di Ekosistem Padang Lamun, Perairan Jepara. *Jurnal Ilmu Kelautan*, 12(1): 53-58.
6. Nurdin, J., Supriatna, J., Patria, M.P., Budiman, A. *Kepadatan dan Keanekaragaman Kerang Intertidal (Mollusca: Bivalve) di Perairan Pantai Sumatera Barat*. Universitas Lampung. 2008.
7. Silaen, I.F., Hendrarto, B., Supardjo, M.N. 2013. Distribusi dan Kepadatan Gastropoda pada Hutan Mangrove. *Journal of Management of Aquatic Resources*, 2(3): 93-103.
8. Werdiningsih, R. *Struktur Komunitas Kepiting di Habitat Mangrove, Pantai Tanjung Pasir, Tangerang, Banten. Fakultas Matematika dan Ilmu Pengetahuan Alam.* Institut Pertanian Bogor. Bogor. 2005.