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Bivalve Community Structure in Coastal Water of Lalang Village, Siak District Riau Province

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ABSTRACT

This research was conducted in July - September 2022 in the coastal waters of Lalang Village, Sungai Apit District. The purpose of this study was to determine the structure of the bivalve community including abundance, relative abundance, diversity, uniformity index, dominance index, and distribution pattern. Sampling was done using the line transect method at 3 stations. The results of the study obtained two species of bivalves in the waters of Lalang Village Beach, namely *Polymesoda erosa* and *Glauconome virens* with abundance at all stations ranging from 1.67 - 5.33 ind/m^2. The bivalve diversity index value at the study site is categorized as low diversity. The bivalve uniformity index value is high, and the dominance index value indicates the presence of dominating species. The distribution pattern of bivalves between observation stations is clustered.

Keywords: Bivalves, Community Structure, Lalang Village

1. INTRODUCTION

Indonesia has vast marine areas and most of these areas are still poorly managed. The sea is an ecosystem that has high biodiversity, almost every phylum of animals can be found in the sea. Organisms that live in the sea are influenced by the nature of seawater for their surroundings, either in the form of plants or animals so many common forms found are the result of adaptation to the liquid medium and its movement (Bengen, 2009)

Bivalves are a class of Mollusks that includes all shellfish that have a pair of shells (Bivalves means two shells). Other names for Bivalves are Lamellibranches, Pelecypoda, or Bivalves. However, the variation within bivalve is very wide. Bivalves are one of the most common groups of invertebrate organisms that live in intertidal areas. They have specialized adaptations that allow them to survive in areas of physical and chemical stress such as the intertidal. These organisms also have adaptations to withstand currents and waves. Bivalves cannot move quickly (motile), making them a very easy organism to catch (harvest) (Satino, 2011).

The waters of Lalang Village are one of the waters that have characteristics that are suitable for bivalve habitat. These waters are located in Sungai Apit District, Siak Regency, Riau Province. This water area has various activities such as fishing activities and the transport of goods ships and tankers. In addition, there are oil companies that can affect water quality and damage the structure of the bivalve community in these waters.

Previous research on the structure of bivalve communities in waters of various regions has been carried out including Krisvide (2019) in the waters of Nagalawan Village Beach, Serdang Bedagai Regency, North Sumatra Province**,** and Johen (2019) in Pulo Pane waters, Central Tapanuli Regency, North Sumatra Province. However, in the coastal waters of Lalang Village, no one has conducted research on the structure of the bivalve community; therefore researchers feel the need to conduct research in the coastal area of Lalang Village.

2. RESEARCH METHODS

Time and Place of Research

This research will be conducted in July - September 2022. The sampling location is in the waters of Lalang Village, Siak Regency, Riau Province (Figure 1). Research analysis activities continued at the Marine Biology Laboratory, Department of Marine Science,

Faculty of Fisheries and Marine, Universitas Riau.

Procedure

The sampling location is determined by purposive sampling, which is by determining the research location deliberately and considering and taking into account the conditions of the surrounding research area.

1. The station I is in the vicinity of a residential area.
2. Station II is around the mangrove area.
3. Station III is in the vicinity of the Lalang-Kurau crossing pier.

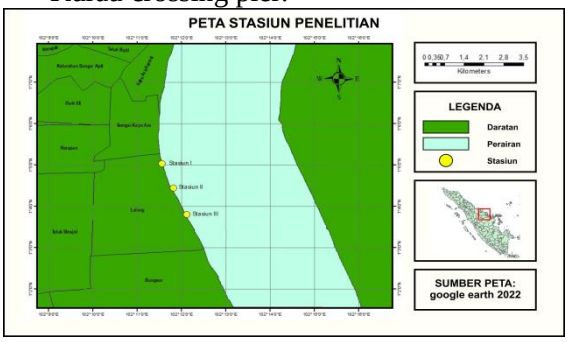

Figure 1. Research location map

Each station was set three transect lines whose distance was adjusted to the area after arriving in the field, each transect line had 3 plots (with a plot area of 1 m^2).

Data Analysis

Bivalve samples brought to the laboratory were then washed with fresh water, and then Bivalves were identified and grouped into trays that had been labeled according to the station point. Bivalves obtained during the observation were recorded in number and the samples were identified using an identification book according to Carpenter & Niem (1998); Robert et al. (1982). Population data that has been found will be collected, then identified, described, and classified.

Bivalve Abundance

The abundance of bivalves was calculated based on the formulation proposed by Odum (1993), which is the following formula:

$$K = \frac{ni}{A}$$

Description:

K = Species abundance (ind/m^2)
ni = Number of bivalve individuals found (ind)
A = Plot area (m^2)

Relative Abundance of Bivalves

The relative abundance of bivalves was calculated using the Shannon-Wienner formula (Odum, 1993), with the following formula:

$$R = \frac{ni}{N} \text{ x } 100\%$$

Description:

R = Relative abundance (%)
ni = Number of individuals of each species (ind)
N = Total number of individuals (ind)

Bivalve Diversity

The diversity of biota in water can be determined using the Shannon-Wienner information theory (H'). Diversity index to characterize the relationship of genus groups in the community in an ecosystem (Kasry et al., 2012) with the following formula:

$$H' = -\sum_{i=1}^{S} pi\ log2\ pi$$

Description:

H' = Species diversity index
Pi = ni/N
ni = Number of individuals in the I^{th} species (ind)
N = Total number of individuals (ind)
s = Number of species captured

Bivalve Diversity Index

Uniformity can be said to be the balance of the community, namely the composition of individuals of each species contained in a community. The bivalve species uniformity index was calculated using the Shannon-Wiener formula (Krebs, 1985), namely:

$$E = \frac{H'}{H'maks}$$

Description:

E = Uniformity index
H' = Shannon-wiener diversity index value
H'max = Log_2 S = 3.321928 log S
S = Total number of species

Dominance Index

The dominance index is used to determine the type of bivalve that dominates in an area, a large enough dominance will lead to a labile and depressed community. The dominance index is calculated using Simpson's formula (Kasry et al., 2012):

$$C = \sum_{i=1}^{S} \left(\frac{ni}{N}\right)^2$$

Description:
C = Dominance index
ni = Number of individuals of each species
N = Total number of individuals of all species
S = Number of species

Bivalve Distribution Pattern

There are 3 types of individual distribution patterns in nature, namely uniform, random, and clustered. The distribution pattern can be calculated by the calculation method using the Morisita index formula (Kamalia, 2013) as follows:

$$Id = n\frac{\sum X^2 - N}{N(N-1)}$$

Description:
Id = Morisita Spread Index
N = Number of Plots
n = Total number of individuals
$\sum X^2$ = Sum of Squares of Individual Plots

Sediment Total Organic Matter

Analysis of BOT content was carried out using the Loss on Ignition (LOI) method (Prasetia, 2019). The LOI method aims to determine the total organic matter (organic carbon) content in sediments so that the deposition environment is known, and the process of sediment occurrence is based on the organic carbon content of sediment samples. Organic matter content is calculated by the formula:

$$\text{BOT} = \frac{\text{(Wt-C)-(Wa-C)}}{\text{Wt-C}} \times 100\%$$

Description:
Wt = total weight (crucible + sample) before burning
Wa = total weight (crucible + sample) after burning
C = weight of the empty crucible

Data obtained in the form of calculations in the form of tables and graphs are then discussed descriptively. To determine the difference in bivalve abundance between stations, an ANOVA test was conducted using Microsoft Excel and Statistical Program for Social Science (SPSS) software applications.

3. RESULT AND DISCUSSION

General Condition of the Research Site

Lalang Village, Sungai Apit Sub-district, Siak Regency is located at the position of 102° 10'0" - 102° 13'35" East Longitude and 1° 2' 0" - 1° 6' 62" North Latitude. Lalang Village is one of 14 villages and 1 sub-district in Sungai Apit Sub-district with an area of 9,064 ha. In general, Lalang Village has regional boundaries, namely: the north is bordered by Sungai Kayu Ara Village, south of the border is Mengkapan Village, the west is bordered by Parit II Village, Teluk Masjid Village, and Perincit Village, and the east borders the Malacca Strait.

Water Quality Parameters

The water quality parameters measured were temperature, pH, salinity, and brightness. The measurement results can be seen in Table 1.

Table 1. Results of water quality measurements in the coastal waters of Lalang Village

Station	pH	Temperature (°C)	Salinity (‰)	Brightness (m)
I	7	29	22	0,27
II	8	30	24	0,3
III	7,5	31	25	0.26

Based on Table 3, it can be seen that the water temperature ranges between 29-31^{O} C, water salinity between 22-25‰, water pH between 7-8, and brightness ranges between 0.26-0.3m. The results of pH measurements at the research site as in Table 1 show that the pH range of water is still said to be suitable for the existence of bivalves.

This is following the statement of Ritniasih & Widianingsih (2007) that pH for bivalve survival ranges between >5 and >9. Hutabarat *et al.* (2014), the pH value greatly affects the biochemical processes of water, in the pH range <4, most aquatic plants will die because they cannot tolerate low pH. Based on the measurement results obtained 22-25‰, this value of salinity is still in the normal range for bivalve life. This is following the statement of Islami (2013) that the optimum salinity for bivalve survival can be tolerated up to 31‰, and Suwondo et al. (2006), state that bivalves can metabolize optimally in the temperature range between 25-35°C.

Sediment Total Organic Matter

The results of the analysis of sediment organic matter content in the waters of Lalang Village can be seen in Table 2.

Table 2. Sediment total organic matter content at each station in the coastal waters of Lalang Village

Station	Organic matter (%)
I	8,21
II	9,08
III	7,40

Based on the analysis conducted, the sediment organic matter content in the study area obtained a value at station I of 8.21%, station II of 9.08%, and station III of 7.40%. The highest organic matter content is found at station II, while the lowest organic matter content is found at station III. According to Ritniasih & Widianingsih (2007), the high and low abundance values are supported by the percentage of organic matter content in the waters. The high organic matter affects the abundance of bivalves at the station.

Sediment Type

The highest percentage is found at station II 86.69% and the lowest percentage is found at station I sampling point 78.63% (Table 3). Sediments are defined as materials derived from the overhaul of older rocks or ice material. Sediment comes from the process of weathering rocks and is assisted by water, air, and ice, or material deposited by processes that occur naturally, with the process than forming a layer on the earth's surface (Rifardi, 2008).

Table 3. Sediment fraction in the coastal waters of Lalang Village

Station	Sediment Fraction %			Sediment
	Gravel	Sand	Mud	Type
I	0,33	21,04	78,63	Mud
II	0,51	12,81	86,69	Mud
III	1,99	19,11	78,71	Mud

Types and Abundance of Bivalves in the Coastal Waters of Lalang Village

The results of observations of bivalve species obtained consisted of 2 families, 2 species. Bivalve families found at all research stations consist of Corbiludae, and Glauconomidae (Table 4).

Table 4. Types of bivalves found in research in the coastal waters of Lalang Village, Siak Regency.

No.	Family	Genus	Species
1.	Corbiculidae	Polymesoda	*P.erosa*
2.	Glauconomidae	Glauconome	*G.virens*

Based on Table 4, 2 bivalve species were found from different families. There are 2 families found at 3 stations. The types of bivalves found are *Polymesoda erosa* and *Glauconome virens.* Bivalves are found in mangrove forests, on mud substrates, sandy mud, and mangrove litter (Wanimbo, 2016).

Based on the results of the analysis, the abundance value of bivalves at each station is different. The abundance of bivalves found in the coastal waters of Lalang Village can be seen in Table 5.

Table 5. Mean abundance of Bivalves in the Coastal Waters of Lalang Village

Station	Bivalve abundance (Ind/m^2) (Mean ± Std. Deviation)
I	2,11± 0.278
II	5,33± 0.111
III	1,67± 0.389

In Table 5 it can be seen the abundance (mean ± standard deviation) of bivalves at each station in the coastal waters of Lalang Village obtained abundance between 1.67-5.33 ind/m^2. The highest station is at station II with a value of 5.33 ind/m^2 and the lowest is at station III with a value of 1.67 ind/m^2. According to Irawan (2008), a high abundance value indicates a large number of organisms. The abundance of bivalves in the coastal waters of Lalang Village, station III has a low abundance and station II has a high abundance. The high abundance of bivalves at the station is thought to be due to minimal human activity and the high content of organic matter at station II.

Based on the results of the ANOVA test, it is known that bivalves in the coastal waters of Lalang Village show a significant value of 0.025 where pvalue <0.05. Based on the statement of Tanjung (2014) this indicates that the abundance of bivalves between stations is significantly different, so the LSD (least Significance Different) test is conducted. LSD test results can be seen that the abundance of bivalves at station I with station II is significantly different, and station III with station II is significantly different.

Relative Abundance of Bivalves

In Table 6, it can be seen that the relative abundance of bivalves at each station in the coastal waters of Lalang Village obtained the highest relative abundance at station I, *namely P.erosa,* at station II, namely *P.erosa,* and station III *P.erosa*. The highest relative abundance at all stations is *P.erosa* species, which is 73.33%.

Table 6. Relative abundance of bivalves in the coastal waters of Lalang Village

Species	St.I (%)	St. II (%)	St. III (%)
P. erosa	63,16	52,08	73,33
G. virens	36,84	47,92	26,67

Bivalve Diversity, Uniformity, and Dominance Indices

The diversity index value (H') of bivalves between stations in the coastal waters of Lalang Village was found to be 0.58-0.69 with the highest diversity index value found at station II, namely 0.69, and the lowest diversity index value found at station III, namely 0.58. The value of the uniformity index (E) between stations is 0.84-1.00 with the highest uniformity index value at station II, namely 1.00, and the lowest uniformity index value at station III, namely 0.84. The dominance index value (C) between stations is 0.50-0.61 with the highest dominance index value at station III, namely 0.61, and the lowest dominance index value at Station II, namely 0.50.

Table 7. Mean values of diversity index (H'), uniformity (E), and dominance (C) of bivalves

Station	Diversity (H')	Uniformity (E)	Dominance (C)
I	0,66	0,95	0,53
II	0,69	1,00	0,50
III	0,58	0,84	0,61

The highest bivalve diversity index (H') in the coastal waters of Lalang Village is at station I with a value of 0.69. Following the bivalve species diversity index which states H' < 1.0 indicates that the diversity criteria at station I, station II, and station III are in the low diversity category, the distribution of low numbers of individuals, low community stability, and the state of water stability has been polluted.

The uniformity index (E) of bivalves in the coastal waters of Lalang Village at each station obtained values ranging from 0.84-1.00. Following the species uniformity index which states $0.6 \leq E \leq 1.0$, it can be concluded that the uniformity at Station I, station II, and Station III is in the high uniformity category. This is supported by the statement of Insafitri (2010), which states that the uniformity of biota in a body of water is highly dependent on the number of species in the community.

Following the dominance index value (C) of bivalves in the coastal waters of Lalang Village, the Simpson dominance index is used; if the Simpson dominance index ranges from C> 0.5 there is a dominating species. Based on the criteria that the dominance index at Station I, II, and III there are species that dominate. This is in line with Fachrul (2007) which states that the dominance index value is classified as a dominating category.

Bivalve Distribution Patterns

The calculation of the distribution pattern in the coastal waters of Lalang Village with clustering criteria. Results 4.41 - 5.23 where Id>1 which means the distribution pattern is clustered.

Table 8. Distribution pattern of bivalves in the coastal waters of Lalang Village

Station	Id	Distribution Pattern
I	4,58	Clustering
II	4,41	Clustering
III	5,23	Clustering

According to Suwondo *et al.* (2006), the clustering of mollusk species is thought to be due to their nature to live in groups, uniformly, and stick to a place all the time. Clustered distribution patterns are related to a way of life that chooses the right one that is less suitable. Random distribution patterns are related to abiotic environmental conditions (temperature and salinity), high availability of organic matter, and the type of substrate that is good and suitable for the life of the species (Yuniarti, 2012). According to Bahri (2006), the distribution pattern of biota is influenced by habitat type which includes physicochemical factors of water as well as food and adaptability of biota in an ecosystem.

4. CONCLUSIONS

The types of bivalves found at the research site on the beach of Lalang Village

consisted of two families, two genera, and two species. Bivalve species found at all research stations consisted of *P.erosa* and *G.virens.* The species found were dominated by *P.erosa* from the Corbiculidae family. The average abundance at all stations ranged from 1.67-5.33 ind/m^2, where differences in bivalve abundance showed significant differences. The bivalve diversity index value at the study site was categorized as low diversity. The bivalve uniformity index value is high, and the dominance index value indicates the presence of dominating species. The distribution pattern of bivalves between observation stations is clustered.

Based on the research conducted in the waters of Lalang Village Beach, it is necessary to conduct further research on bivalves by sampling in the form of several periods so that the condition of bivalve stocks in the area can be known more completely.

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