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Distribution of Bivalve Abundance in the Intertidal Zone of Bandar Laksamana Sub-District, Bengkalis District, Riau Province

Distribusi Kelimpahan Bivalvia di Zona Intertidal Kecamatan Bandar Laksamana Kabupaten Bengkalis Provinsi Riau

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Abstract

This study was conducted in June 2022 to know the diversity and abundance of bivalve species as well as know the relationship between the total organic matter content of sediments and the abundance of bivalves found in the intertidal zone of coastal waters of Bandar Laksamana District. This research was conducted using the survey method, where each station consisted of 3 plots perpendicular to the coastline. Station 1 is in Tenggayun Village, Station 2 is in Api-Api Village, and Station 3 is in Parit Satu Api-Api Village. Observations and sampling were conducted directly in the field and then analyzed at the Marine Biology Laboratory, Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau. Based on the research results, it is known that the highest abundance of bivalves is found at Station 2, which is 2.07 ind/m^2 with an organic content of 2.44%. At the same time, the lowest abundance of bivalves is found at station 1, which is 0.44 ind/m^2 with an organic content of 0.91%. The bivalves found include *Corbicula javanica, Anadara granosa, Solen* sp, *Pharella acutidens,* and *Anadara antiquata.*

Keywords: Bandar Laksamana, Bivalves, Organic matter.

Abstrak

Penelitian ini telah dilakukan pada Bulan Juni 2022 dengan tujuan untuk mengetahui keragaman dan kelimpahan jenis bivalvia sekaligus mengetahui hubungan kandungan bahan organik total sedimen dengan kelimpahan bivalvia yang terdapat dizona intertidal perairan pantai Kecamatan Bandar Laksamana. Penelitian ini dilakukan dengan menggunakan metode survey, dimana setiap stasiun terdiri atas 3 plot yang tegak lurus dengan garis pantai. Adapun stasiun 1 terletak di Desa Tenggayun, stasiun 2 terletak di Desa Api-Api dan stasiun 3 terletak di Desa Parit Satu Api-Api. Pengamatan dan pengambilan sampel dilakukan secara langsung di lapangan, yang selanjutnya dianalisis di Laboratorium Biologi Laut Jurusan Ilmu Kelautan Fakultas Perikanan dan Kelautan Universitas Riau. Berdasarkan hasil penelitian yang dilakukan diketahui bahwa kelimpahan bivalvia tertinggi terdapat pada stasiun 2 yaitu sebesar 2,07 ind/m^2dengan kandungan organic sebesar 2,44%. Sedangkan kelimpahan bivalvia terendah terdapat pada stasiun 1 yaitu sebesar 0,44 ind/m^2 dengan kandungan organic sebesar 0,91%. Adapun jenis bivalvia yang ditemui diantaranya adalah *Corbicula javanica, Anadara Granosa, Solen* sp, *Pharella acutidens,* dan *Anadara antiquata*.

Kata kunci: Bandar Laksamana, Bivalva, Bahan organik.

1. Introduction

Bandar Laksamana District is located in Bengkalis Regency, Riau Province. Bandar Laksamana District has the potential for marine tourism, one of which is found in Tenggayun Village where many local tourists visit the area. Coastal ecosystems are adjacent to land and marine ecosystems, influenced by tides and ebbs. Organisms on the beach have structural adaptations to adhere tightly to hard substrates. The intertidal zone is inhabited by several types of organisms, including bivalves (Arif et al. 2017).

Bivalves are a class of mollusks that includes all shellfish, having a pair of shells. Other names are Lamellibranchia, Pelecypoda, or Bivalvia, and this group includes various clams, shellfish, mussels, Lokan, oysters, and clams, although the variation in bivalves is very wide (Razak, 2002). The bivalve group as an organ is generally found in waters, especially coastal or intertidal areas. It is estimated that about 1000 species of bivalves live in Indonesian waters. Many types of bivalves have economic significance as a food source containing high protein, such as blood clams, bamboo clams, mangrove oysters, and crabs. These blood clams are commonly found in Rokan Hilir (Efriyeldi & effendi, 2022), Kepulauan Meranti (Efriyeldi & Kurniawan, 2023), and Indragiri Hilir (Nasution, 2009).

Bivalves have economic value, as they are a food source that contains high protein. This causes people to be interested in exploiting these biological resources. The existence of bivalves is determined by the presence of mangrove vegetation on the coast (Arif et al., 2017). The distribution and abundance of bivalves are influenced by environmental factors, food availability, predation and competition. Environmental pressures and changes affect the number of species and differences in bivalve community structure.

Zakarsyi et al. (2016) stated that the distribution of bivalves tends to cluster due to local differences in response to habitat. This can occur because mangroves provide a lot of nutrients to the waters, so food availability is quite a lot. Furthermore, on the other hand, with its function of absorbing heavy metals in the waters, the waters will become clean so that bivalves can live well. The existence of bivalves is largely determined by the presence of mangrove vegetation on the coast (Arif et al., 2017). Therefore, seeing this problem makes the author interested in researching "Distribution of bivalve abundance in the intertidal zone of Bandar Laksamana District, Bengkalis Regency, Riau Province".

This study aims to determine the diversity and abundance of bivalve species present and how the relationship is related to the organic content available by mangrove vegetation in the coastal area.

2. Material and Method

2.1. Time and Place

This research was conducted in June 2022 in the intertidal zone of the coastal area of Bandar Laksamana District, Bengkalis Regency, Riau Province.

2.2. Methods

The research method used in this study is the survey method. Monitoring stations by *purposive sampling* were set in Tenggayun Village as Station 1, Api-Api Village as Station 2, and Parit Satu Api-Api Village as Station 3 to represent the characteristics of the area on the coast of Bandar Laksamana District. Samples from the field were then identified at the Marine Biology Laboratory of the Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau.

2.3. Procedures

2.3.1. Bivalve Sampling

The Bivalve samples were taken using a shovel to a depth of 20-30 cm and then sieved using a sieve with a 1 mm mesh. Next, the filter results were put into a plastic bag that had been labeled and then added 10% formalin. The samples were then cooled in an ice box filled with ice cubes to keep them durable until they were brought to the laboratory.

2.3.2. Sediment Sampling

Sediment collection was carried out using PVC pipes taken to a depth of 30 cm. taken in three zones (upper, midle, and lower) at each station. Sediment sampling uses a random method then sediment samples are put into plastic samples, then the plastic samples are tightly closed and labeled.

2.3.3. Bivalve Analysis

Bivalves were analyzed in the Marine Biology Laboratory and cleaned using running water. After cleaning, the length of the bivalve body was measured using a ruler. Then, the bivalve samples were counted as the number of individuals. After that, it was entered into the table that had been prepared.

2.3.4. Bivalve Abundance

Abundance is done by calculating the percentage of each species obtained during identification by dividing the number of individuals per species by the total number of individuals. According to Brower et al. (1990), the abundance of each species at each observation location is calculated using the following formula:

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

Description:
K = Abundance of the i-th individual species (ind/m^2)
ni = Number of individuals of the i-th species obtained
A = Plot area of the i-th species found (m^2)

2.3.5. Bivalve Dispersal Pattern

There are three types of individual distribution patterns: uniform, random, and clustered. This distribution pattern is known from the results of the morisita index (Id) value (Brower et al. 1990). The dispersal index is calculated using the formula:

$$Id = \frac{n \sum x2-1)}{(\sum x(\sum x-1)}$$

Description:
N = Number of plots
∑x = total number of individuals in each quadrant = x1+x2
∑x2 = the number of individuals in each quadrant squared = x12+x22
X2 = is the test statistic for the Morisita index (chi-square distribution).

2.3.6. Sediment Fraction Analysis

Two methods were used to analyze the sediment fraction: the wet sieving and pipette. The graded sieve method was used to obtain -1- 7, while for the pipette method a volumetric pipette was used to obtain 5- 7. To analyze the type of sediment fraction in each subplot (Rifardi, 2008).

2.4. Data Analysis

The data collected includes the type and abundance of bivalves. The data obtained were presented as pictures, graphs, and tables. Furthermore, the data were analyzed statistically using SPSS software. A one-way ANOVA test was conducted to see differences in bivalve abundance between stations and differences in abundance between sampling zones, and a simple regression test in Microsoft Excel. Furthermore, the data obtained were discussed descriptively concerning existing sources and references.

3. Result and Discussion

3.1. Bivalve Species and Abundance

The research found several types of bivalves, including *C.javanica, A.granosa, Solen* sp, *P.acutidens,* and *A.antiquate,* consisting of 4 families and five genera. The distribution of bivalves at each station can be seen in Figure 1.

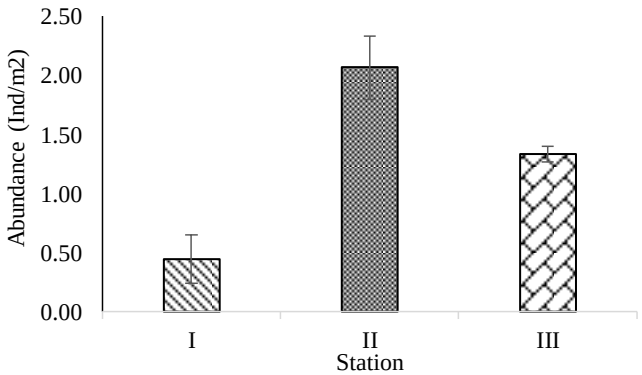

Figure 1. Bivalve abundance in the coastal water of Bandar Laksamana

From the Table 1, it can be seen that the abundance of the highest number of individuals is at Station 2, namely 93 individuals, followed by Station 3 with 60 individuals. In comparison, the abundance of the lowest number of individuals is at Station 1, which is 20 individuals. This condition can occur because Stations 2 and 3 are areas whose coastal borders still have good mangrove vegetation. Station 1 is an area that has poor mangrove vegetation cover.

The calculation results of the average value of Bivalve abundance have varying values at the three stations, ranging from 0.44 - 2.07 ind/m^2. The highest average abundance value was found at station 2, which amounted to 2.07 ind/m^2, and the lowest abundance was found at Station 1, which amounted to 0.44 ind/m^2. The different levels of bivalve density in each subzone in the intertidal zone indicate the availability of different foodstuffs in each subzone, the length of time submerged, the level of predators, high suspended solids, low organic matter and intensive capture by local communities. This is supported by research by Ramadhan et al. (2017), which found that the density of bivalves in Teluk Lancar Village was 0.88 ind/m^2, and the density of bivalves in Api-Api Village ranged from 3.3-23.3 ind/m^2 (Ulfa et al., 2020). In the research conducted in Persian Bay, the abundance of bivalves found ranged from 1.5 to 4.2 per 0.25 m^2 with muddy sand substrate types (Niamaimandi, 2012).

This is supported by the research of Ahyuni et al. (2014), the density of clams is influenced by fishing activity. The lower the fishing activity, the better the opportunity for the clam population to develop, so the abundance found at this location is low. If the fishing activity is high, the density found is low.

Table 1. Bivalve abundance among subzones in the intertidal zone of Bandar Laksamana Subdistrict

Subzone	Number of individuals	Mean abundance± std. dev
Upper	69	7.67± 1.15
Middle	42	4.56± 0.19
Lower	63	7.00±1.45

Table 1 show that the highest average value is in the upper subzone, followed by the lower subzone, while the middle subzone has a very low abundance value. The calculation results of the average value of bivalve abundance between sub-zones have varying values in the three sub-zones, ranging from 4.56-7.67 ind/m^2. The highest average abundance value is found in the upper subzone, which is 7.67 ind/m^2, and the lowest abundance is found in the middle subzone, which is 4.56 ind/m^2.

3.2. Organic Matter Content and Sediment Fraction

Dense and good mangrove vegetation or cover can provide high organic matter because the mangrove function is running well. The high content of organic matter at Stations 2 and 3 is influenced by the large number of areas receiving mangrove leaf litter input, thus increasing the content of organic matter in the basic substrate. The results of this study are similar to research conducted by Fahlefi (2013) mangrove density is closely related to the availability of organic matter that occurs in the growth environment of decomposers to decompose organic matter.

Table 2. Sediment organic matter in the intertidal zone of Bandar Laksamana District, Bengkalis Regency

Station	Sediment organic matter (%)
1	0,91
2	2,44
3	2,47
Average	1,94

Table 3. Percentage of fraction weight and sediment type in Bandar Laksamana Sub-district

Station	Sampling point	Sediment fraction			Sediment type
		Gravel (%)	Sand (%)	Sludge (%)	
1	Upper	0,19	92,77	7,05	Sand
	Middle	0.20	92.60	7.20	Sand
	Lower	0.32	94,79	4.89	Sand
2	Upper	0.30	28.19	71.51	Sandy Mud
	Middle	0.05	85.30	14.65	Silty Sand
	Lower	0.01	87.24	12.75	Silty Sand
3	Upper	0.31	4.39	95.30	Mud
	Middle	0.04	81.08	18.89	Silty Sand
	Lower	0.02	83.38	16.59	Silty Sand

Table 2 shows that the highest to lowest organic matter content is at Station 3, which is 2.47%, followed by Station 2, which is 2.44%, and Station 1, which is 0.91%. When viewed from the relationship between the abundance of individual species with existing organic matter, it can be said that the availability of organic matter utilized by bivalve organisms is normal or balanced. Suppose the availability of organic matter in water or substrate is very high. In that case, it will also hurt organisms because the oxygen needed to decompose organic matter will be high, causing the dissolved oxygen content in these waters to be low.

On the other hand, the explanation for the condition where Station 2 or 3 is higher than station 1 is due to the influence of the substrate or sediment where the bivalves live. The characteristics of the intertidal zone (Table 3) further strengthen the relationship between the abundance of individual species and the organic matter present at

each station. The low content of organic matter at Station 1 is influenced by the type of substrate, namely sand, where the sand substrate is difficult to accumulate organic matter input. This situation follows Clark in Ardi (2002), which states that sandy sediments have less organic matter content than mud sediments because muddy bottom waters tend to accumulate organic matter carried by water flow, where the texture and fine particle size facilitate organic matter absorption.

The relationship between sediment organic matter content and bivalve abundance obtained a positive correlation value of 0.3092, as presented in Figure 2.

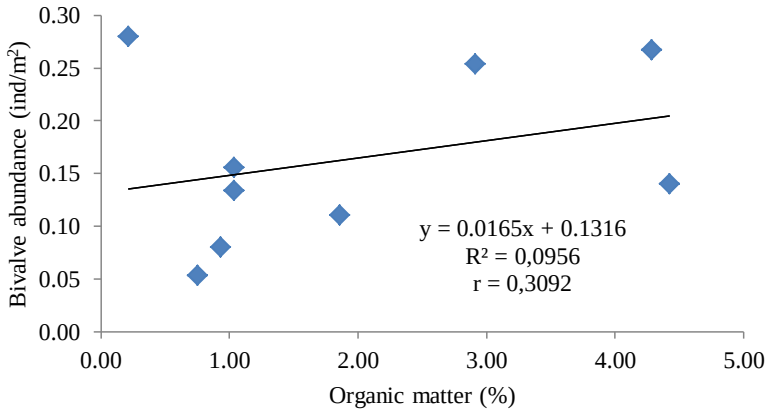

Figure 2. Relationship between organic matter and bivalve abundance

The relationship between sediment total organic matter content and bivalve abundance obtained a positive correlation of 0.3092. This means there is a weak relationship where total sediment organic matter content does not affect the survival of bivalves. The effect of total sediment organic matter content on bivalve abundance is 9.56%, while other factors influence 90.44%. Another factor that is thought to affect the abundance of bivalves is the continuous capture of humans without considering their sustainability. According to Nurfakih et al. (2013), continuous human capture without considering sustainability can also affect a biota species' abundance.

4. Conclusions

Based on the study's results, it can be concluded that the availability of organic matter and sediment type greatly affects the abundance of bivalves found in the intertidal zone of the coastal area of Bandar Laksamana district. The contributor of organic matter is known to come from the presence of mangroves on the coastal border of each station. Therefore, the Api-Api village (Station 2), with mangrove conditions that are in good or dense condition, has the highest abundance of bivalve individual species. While in Tenggayun village (Station 1) because of the presence of few mangroves and supported by sandy sediment types, the abundance of bivalve individual types is low. The bivalves in this study are *C. javanica*, *A.granosa*, *Solen* sp, *P.acutidens*, and *A.antiquata*.

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