Journal of Coastal and Ocean Sciences *e-issn: 2746-4512*
Volume 5 No. 2, May 2024: 114-124 *p-issn: 2745-4355*

Macrozoobenthos Community Structure as an Indicator of Water Quality in the Intertidal Zone of Pariaman City, West Sumatra Province

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Received: 15 February 2024; Accepted: 8 April 2024

ABSTRACT

Community structure refers to the arrangement and composition of species in a natural community and their abundance. Ecologists use various indices to assess community structure, including diversity index, evenness index, and dominance index. One helpful indicator for evaluating water quality is the presence and characteristics of macrozoobenthos, organisms living in the sediment of aquatic environments. The study focused on the community structure of macrozoobenthos as an indicator of water quality in the coastal waters of Pariaman City, West Sumatra. Conducted between February and March 2023, the research analyzed samples collected from the Marine Biology and Marine Chemistry Laboratories at Universitas Riau. Findings revealed the presence of 7 phylum, eight genera, and 16 macrozoobenthos species, with abundance ranging from 8.56 Ind/m^2 to 18.44 ind/m^2. The diversity index indicated moderate diversity, while the evenness index suggested an uneven distribution of individuals. No dominant species were found. Based on the analysis of macrozoobenthos community structure, water quality in Pariaman City's coastal waters was classified as good.

Keywords: Macrozoobenthos, Community structure**,** Water quality

1. INTRODUCTION

The Community structure is a concept that focuses on examining how species are arranged and distributed in a natural community, as well as their relative abundance. It involves studying the environmental conditions and food resources within a water body. One way to understand community structure is by analyzing the size composition and species diversity within a habitat. Several ecological indices are used to assess community structure, including diversity index, evenness index, and dominance. These indices are interconnected and impact one another (Latuconsina, 2016).

Macrozoobenthos reside in the sediment at the bottom of oceans, lakes, or rivers, including mud, sand, gravel, rocks, and organic waste. These organisms are typically attached to the substrate and move by crawling or digging holes in the water bottom. Macrozoobenthos serve as indicators of water quality because they are relatively immobile and, therefore, more susceptible to the effects of sediment and other pollutants, which can impact their composition and abundance. They play a crucial role in aquatic ecosystems as consumers of organic matter, sediment bioturbators, and environmental bioindicators (Suhanda et al., 2019). This makes macrozoobenthos a valuable indicator for assessing water quality.

The coastal area of Pariaman City is subjected to various activities to support human needs, such as industry, transportation, fishing, and waste disposal. These activities directly or indirectly impact water quality, which tends to deteriorate over time due to pollution. Therefore, it is vital to assess the quality of these waters (Rachmawaty, 2011). Pollutants, including waste and harmful substances, enter aquatic organisms through the food chain, ultimately affecting humans who consume these organisms.

The structure of the macrozoobenthos community can be understood by examining its composition, abundance, diversity, distribution, and energy flow within the ecosystem (Zulkifli, 2009). A decrease in the composition, abundance, and diversity of macrozoobenthos often indicates disturbances within the aquatic ecosystem. Assessing the abundance and diversity of macrozoobenthos in a body of water can provide insights into its water quality. High-quality waters typically exhibit high species diversity, whereas poor or polluted waters tend to have low species diversity (Fachrul, 2007). According to Strin in Prihatiningsih (2004),

natural coastal aquatic ecosystems are characterized by high diversity, the absence of dominance by particular species, and an even distribution of species throughout the water body.

Given the pollution issues caused by various human activities, particularly tourism, in the coastal area of Pariaman City, the author is interested in researching the macrozoobenthos community structure as an indicator of water quality at Pariaman City Beach.

2. RESEARCH METHOD

Time and Place

The research was conducted in February-March 2023 and located on the beach of Pariaman City, West Sumatra Province, where Station I was on Gondoriah Beach, and Station II was on Cermin Beach. Station III was on Kata Beach (Figure 1). Followed by analysis of macrozobenthos and sediment samples at the Marine Biology Laboratory and Marine Chemistry Laboratory, Department of Marine Science, Faculty of Fisheries and Marine Sciences, Universitas Riau.

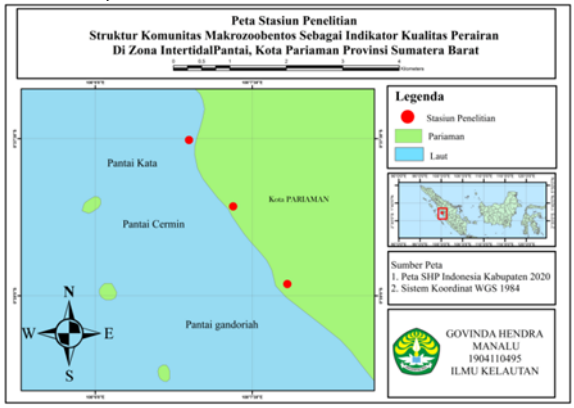

Figure 1. Map of Research Locations

Method

The study employed a survey method involving direct observation, measurement, and field sampling. This included the collection of macro-zoobenthos samples and the measurement of water quality parameters.

Procedures

Determination of Research Stations

The sampling locations were determined using the purposive sampling method. Before the research, a survey was conducted to identify suitable locations based on the researcher's needs. It was decided to have three stations, each consisting of three transects divided into three plots. These stations were intended to represent the research waters.

Sampling took place at three stations. Station I was at Gandoriah Beach, while Station II was at Cermin Beach. Both of these areas are popular tourist destinations with high human activity. Station III was positioned at Kata Beach, a fishing boat dock. Each Station had three transects, each placed in a different zone: lower, middle, and upper.

These locations were selected to ensure that the three stations effectively represent the research area. The choice of locations also considered the utilization of the water area, aiming to establish a relationship between environmental factors and benthic communities.

Macrozoobenthos Sampling

Macrozoobenthos sampling was performed at three stations, each station containing three transects. There were three plots along each transect, each measuring 1m x 1m. The macrozoobenthos within each plot along the transect were carefully collected and placed into designated containers based on their respective numbering. Subsequently, the samples were cleaned and preserved in a 10% formalin solution. They were then transferred into labelled plastic containers for further analysis. The macrozoobenthos species were identified at the Marine Biology Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Riau.

Measurement of Physical and Chemical Parameters

Physical and chemical parameters were measured simultaneously with the macrozoobenthos sampling. The physical parameter measured was temperature, while the chemical parameters included pH, salinity, and DO (Dissolved Oxygen).

Macrozoobenthos Abundance

Abundance refers to the number of individuals per unit area or unit volume. The abundance of a living organism is influenced by various physical and chemical factors and the availability of natural resources necessary for the organism's life cycle. The important value (NP) can be utilized to calculate abundance, following the formula described by Krebs in Hamidy (2010).

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

Description:
Di = Abundance of the i individual species (ind/m^2)
ni = The number of individuals of the i species obtained
A = Plot area of the i species found (m^2)

Diversity Index (H')

The Diversity Index is employed to quantitatively describe the population status in a specific location, facilitating the analysis of information regarding the number of individuals within a community. The calculation is carried out using the Shannon-Wiener equation, as described by Fachrul (2007):

$$H' = -\sum_{i=1}^{s} pi \ln pi$$

Description:
S = Number of species
pi = The proportion of individuals of the Ith species to total individuals of all species (pi=ni/N
ni = Total number of individuals of the Ith species (individuals/m^2)
N = Total individuals of all species (individuals/m^2)

Shanon-Wiener diversity index criteria (H'), according to Setiawan (2009) has a specific range of values as follows:

(H' < 1) = The diversity of species is low, the number of individuals per species is low, the stability of the community is low, and the state is heavily polluted.
(1 ≤ H' < 3) = Diversity is moderate; the distribution of the number of individuals of each species is moderate, and the waters are moderately polluted.
(H' > 3) = High diversity, high distribution of individuals of each species and unpolluted waters.

Uniformity Index

The uniformity index is a measure that characterizes the evenness or balance in a community by describing the distribution pattern or composition of individuals among different species (Ferianita et al., 2005).

$$E = \frac{H'}{\ln S}$$

Description:
E = Uniformity index
H' = Diversity index
S = Number of all species

Criteria for the uniformity index, according to Brower (1990), are as follows:

E < 0.4 = Low level of uniformity
0.4 ≤ E< 0.6 = Medium level of uniformity
E > 0.6 = High level of uniformity

Dominance Index

The dominance index is a calculation that provides information about the dominant species within a community. The Simpson formula, as proposed by Odum (1998), is used to calculate the dominance index and is as follows:

$$C = \sum_{i=1,2,3,\ldots}^{S} \left(\frac{ni}{N}\right)^2$$

Description:
C = Dominance index
s = Number of species successfully
ni = Number of individuals of type I (Individuals/cm^2)
N = Total number of individuals of all species (Individuals/cm^2)

With criteria: 0≤C<0.3 = low dominance; 0.3 ≤ C < 0.6 = moderate dominance; 0.6≤C<1=high dominance.

Organic Matter

The LOI method aims to determine the total organic matter (organic carbon) content in sediments, which provides information about the depositional environment and sedimentary processes based on the organic carbon content of the sediment samples. The content of organic matter is calculated using the following formula:

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

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

The organic matter content of sediments can be classified as shown in Table 1.

Table 1. Criteria for Organic Matter in Sediments

No	Organic Material Content (%)	Criteria
1	> 35	Very High
2	17 - ≤ 34	High
3	7 - < 17	Medium
4	3,5 - < 7	Low
5	< 35	Very Low

Data Analysis

The data obtained will be analyzed and discussed using descriptive analysis. The results of the analysis will be presented in tabular form. To determine the differences in macro-zoobenthos abundance between stations and subzones (intertidal), a one-way ANOVA test will be conducted

3. RESULT AND DISCUSSION

Research Location

Pariaman City is an expansion area of Padang Pariaman Regency, as defined by Law No. 12 of 2012. It is at coordinates 00°33'00"-00°40'43" LS and 100°04'46"-100°10'55" East. Pariaman City has four sub-districts: Pariaman Selatan, Pariaman Tengah, Pariaman Timur, and Pariaman Utara. This coastal region possesses diverse natural resources, including tourism, fisheries, and forestry potential (Mazidah et al., 2016). Pariaman City is situated on the west coast of Sumatra Island, which experiences relatively large waves (Samulano & Mera, 2011). The coastal dynamics of Pariaman City are heavily influenced by the strong waves from the Indian Ocean, leading to erosion and coastal erosion primarily along the coastline (Rafdi, 2016). Land erosion also occurs in upstream areas, characterized by high sediment transport carried by river flows to the sea. Additionally, Pariaman City is prone to tidal floods and tsunamis. However, the waters of Pariaman City are renowned for their beauty, particularly at Kata Beach, Gandoriah Beach, and Cermin Beach.

Kata Beach, located in the southern part of Pariaman City, stretches into Taluak Village and Karan Aur Village. The name "Kata" is derived from combining the two adjacent villages, Karan Aur and Taluak. This beach allows visitors and tourists to enjoy the beautiful and natural coastal panorama.

Gandoriah Beach, situated in the central area of Pariaman City, is just 100 m from the City centre. It offers a picturesque view of small islands and features a train station that connects Pariaman City and Padang City. According to records from the Tourism Office, Gandoriah Beach attracts a relatively high number of tourists, especially during cultural events like the Tabuik festival. The beach hosts the peak event of the Tabuik tradition, drawing crowds from all over West Sumatra.

Cermin Beach, located in Karan Aur Village, about 1.5 km south of Pariaman City, boasts an interesting natural environment that remains relatively preserved. It is a popular camping site due to its spacious and excellent location. The beach also features a park dedicated to Anas Malik, a leader who successfully developed the area. Additionally, Mirror Beach offers treehouses built by the Pariaman City government to provide a play area for children.

Water quality parameters, including physical (temperature and salinity) and chemical (pH and dissolved oxygen) parameters, were measured in the intertidal zone of Pariaman City. The recorded temperature ranged from 30 to 32°C, pH levels were at 7, salinity ranged between 29 and 30 ‰, and dissolved oxygen levels varied from 5 to 5.6 mg/L at each research station. The results of the water quality measurements can be found in Table 2.

Table 2. Measurement of Water Quality in the Coastal Waters of Pariaman City

Parameter	Station			Quality standard
	I	II	III	
Temperature (^{O}C)	30	31	32	25-36
Salinity ($^{0}/_{00}$)	29	29	30	18-32
pH	7	7	7	7-8,5
DO (mg/L)	5,2	5,2	5,6	>5

The water quality measurements obtained in the field indicate that they meet the criteria for good water quality. A higher water quality corresponds to meeting the criteria values for abundance, diversity index, uniformity index, and dominance index, which are considered favourable. Water quality is directly related to the structure of the macrozoobenthos community, making benthic organisms suitable as bioindicators or natural indicators of water quality.

The temperature measurements at the three stations did not vary significantly and

remained within the normal range of 30-32°C. According to Hasniar et al. (2013), the optimal temperature range for the survival of marine organisms is around 26-32°C. The temperature values observed at the three stations are relatively similar and fall within the acceptable range, indicating that the coastal waters of Pariaman City provide suitable conditions for the life of macrozoobenthos.

Salinity is the total weight of all dissolved salts in one litre of water, expressed in grams per litre. The salinity measurements obtained ranged from 29-30 ‰. The salinity values observed at stations 1 to 3 fall within the normal category. These values are considered favourable for the life of macrozoobenthos, as the ideal salinity range to support aquatic organisms, especially macrozoobenthos, is typically between 27 and 34 ppt (Sinyo & Idris, 2013). Salinity in a body of water plays a crucial role in the growth and distribution of aquatic biota, including macrozoobenthos (Rachmawaty et al., 2012).

The acidity (pH) measurements at the three stations yielded a value of 7, which falls within the normal category. According to Pratiwi (2010), the optimal pH range for aquatic organisms is between 5 and 9. Organisms thrive when the pH of the water is within this range, while excessively high or low pH values can adversely affect their survival (Odum, 1994). Effendi (2003) also noted that most aquatic biota are sensitive to changes in pH, with the preferred range typically around 7-8.5.

The Dissolved Oxygen (DO) values obtained in the coastal waters of Pariaman City ranged from 5-5.6 mg/L. This range is suitable for macrozoobenthos life, as stated in MENLH NO 51 TAHUN 2004, where normal water should have a DO value above 5 mg/L. Dissolved oxygen content significantly affects a body of water, with higher DO values indicating better conditions for the abundance, species diversity, and life stages of macrozoobenthos. A decrease in DO levels can be detrimental to macrozoobenthos and lead to sensitive species' mortality (Effendi, 2003).

Sediment Organic Matter

The results of the analysis of sediment organic matter content in the coastal waters of Pariaman City are presented in Table 3.

Table 3. Sediment Organic Matter Content

Station	Transect 1 (%)	Transect 2 (%)	Transect 3 (%)	Average ± STDV
I	9,63	5,97	3,71	6,43 ± 2,44
II	9,61	5,75	6,05	7,14 ± 1,75
III	5,70	8,45	2,87	5,68 ± 2,28

Table 3 shows that the average organic matter content in the coastal waters of Pariaman City ranges from 5.68% to 7.14%. The highest recorded organic matter content is at Station I, transect 1, with a value of 9.63%, while the lowest recorded organic matter content is at Station III, transect 3, with a value of 2.87%. According to Anugrah et al. (2014), the organic matter content of sediments in the coastal waters of Pariaman City falls into the low-medium category. This may be attributed to the sediment fractions predominantly of sand and gravel, which are less prone to accumulating organic matter.

Sediment Fraction

The results of the sediment fraction analysis at each research station in the coastal waters of Pariaman City indicate the presence of three types of sediment fractions: sandy gravel, gravelly sand, and sand. The classification of sediment types at each Station based on the proportion of gravel, sand, and mud content is determined using the Sheppard triangle. The percentage weight fractions and sediment types are presented in Table 4.

Based on the table provided, it can be concluded that the sediment type in the coastal waters of Pariaman City is predominantly sand. The highest percentage fraction is observed in the sand fraction at station III, transect 2, with a value of 91.09%. In contrast, the lowest percentage fraction is found in the gravel fraction at station III, transect 2, with a value of 0.98%. According to Nugroho & Basit (2014), the distribution of sediment fractions is typically influenced by physical factors such as currents, waves, and other environmental factors. The velocity City of currents plays a significant role in sediments' transportation, deposition, and

distribution. Beaches with solid currents are likelier to have sand and gravel as the dominant sediment types.

Table 4. Percentage of Sediment Fraction (%) and Sediment Type

Station	Transect	Sediment Fraction Average (%)			Sediment Type
		Gravel	Sand	Mud	
I	1	49,63	40,81	9,57	Sandy Gravel
	2	20,16	73,49	6,34	Gravelly Sand
	3	65,03	25,20	9,77	Sandy Gravel
II	1	14,46	77,91	7,63	Sand
	2	10,49	75,97	13,54	Sand
	3	6,40	84,84	6,40	Sand
III	1	5,23	82,96	11,81	Sand
	2	0,98	91,09	7,93	Sand
	3	2,00	87,60	10,40	Sand

Macrozoobenthos Species

Following the identification of macrozoobenthos samples, the results reveal the presence of 16 species of macrozoobenthos belonging to 7 families and seven genera. The macrozoobenthos found across all research stations include the following families: Donacidae, Littorinidae, Nacellidae, Neritidae, Olividae, Planaxidae, and Turritellidae. The specific species of macrozoobenthos identified can be seen in Table 5.

Table 5. Macrozoobenthos Species Found at Each Station of Pariaman City Beach Waters

No	Class	Family	Genus	Species
1	Bivalvia	Donacidae	*Donax*	*Donax trunculus*
2				*D. variabilis*
3	Gastropoda	Littorinidae	*Littoraria*	*Littoraria angulifera*
4				*L. articulata*
5				*L. intermedia*
6				*L. scabra*
7				*L. undulata*
8			*Littorina*	*Littorina littorea*
9				*L.scutulata*
10				*L. saxatilis*
11		Nacellidae	*Cellana*	*Cellana radians*
12		Neritidae	*Nerita*	*Nerita atramenthosa*
13		Olividae	*Olivella*	*Callianax biplicata*
14				*Olivella plana*
15		Planaxidae	*Planaxis*	*Planaxis sulcatus*
16		Turritellidea	*Turritella*	*Turritella communis*

Based on the identification of macrozoobenthos samples in the coastal waters of Pariaman City, a total of 16 species were identified. These species include *C. biblical, C.radians, D.trunculus, D.variabilis, Littoraria angulifera, L.articulata, L.intermedia, L. scabra, L.undulata, L.littorea, L.saxatilis, L.scutulata, N. atramenthosa, O.plana, P.s sulcatus,* and *T.communis*.

Among these species, *D. trunculus* was the most common in the study area. *D.trunculus* is a species of clam that prefers to live in clean, refined, and well-sorted sand at a depth of 0-2 m. These clams are efficient burrowers, and their survival is closely linked to the composition of the sand in which they burrow. Their burrowing behavior varies depending on the coarseness of the sand, which explains their abundance in fine sandy environments. They are typically found in the shallowest part of the littoral zone, where the waves wash the sand during tidal changes (Sitompul, 2020). The research location in the coastal waters of Pariaman City is characterized by sandy

substrates, and sandy beaches are often dominated by infauna, particularly molluscs (Herawati et al., 2021).

Based on the table provided, it can be concluded that the dominant species belong to the Bivalve and Gastropoda classes. This is because these classes have a strong ability to adapt to their environment. With their hard shells, they can survive and protect their bodies from environmental influences compared to organisms from other classes that are in direct contact with the environment. During low tide, Bivalves close their shells tightly for protection, while Gastropods close their shells with their operculum. This wide distribution and adaptability allow both classes to thrive even in extreme environments (Widyastuti, 2013).

Although various macro-zoobenthos were found at the research site, the species distribution is not evenly spread across each Station. According to Odum (1994), species diversity is influenced by the distribution of individuals within each species. If the distribution of individuals is uneven, the overall diversity of species is considered low to moderate.

Abundance of Macrozoobenthos

The abundance of macrozoobenthos at Station I was 18.44 ind/m^2. At Station II, it was 8.56 ind/m^2; at Station III, it was 11.22 ind/m^2. Regarding subzones, Subzone 1 had an abundance of 15.89 ind/m^2, Subzone 2 had an abundance of 15.67 ind/m^2, and Subzone 3 had an abundance of 6.56 ind/m^2. The highest abundance of macrozoobenthos was observed at Station I, with a value of 18.44 ind/m^2, while the lowest abundance was found at Station II, with a value of 8.56 ind/m^2. Among the subzones, Subzone 1 exhibited the highest abundance, with a value of 15.89 ind/m^2, while Subzone 3 had the lowest abundance, with a value of 6.56 ind/m^2. The average abundance of macrozoobenthos in each subzone can be seen in Figure 2.

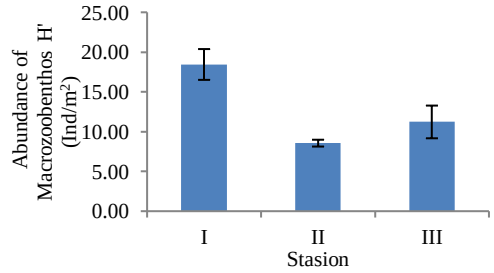

Figure 2. Average (±std. deviation) Macrozoobenthos Abundance

Based on Figure 2, it can be concluded that the abundance values of macrozoobenthos vary at each Station. The average abundance value of macrozoobenthos in the coastal waters of Pariaman City is 12.73 ind/m^2. Differences in macrozoobenthos abundance between stations were tested using an ANOVA test. The ANOVA test resulted in a significant value of 0.038, where $p < 0.05$, indicating a significant difference. Therefore, a further LSD test was conducted. The LSD test results showed that Station I was significantly different from Station II, and Station II was significantly different from Station III.

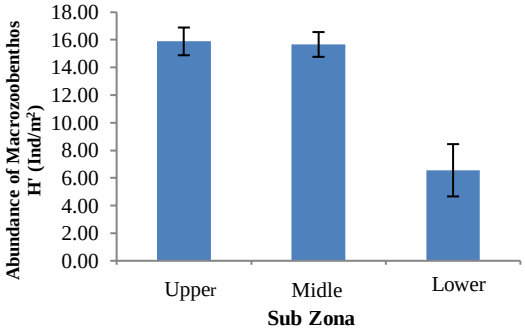

Figure 3. Average (±std. deviation) Macrozoobenthos Abundance

Based on Figure 3, it can be concluded that the calculation of the abundance value of macrozoobenthos in each subzone has varied values. The average abundance value of macrozoobenthos in each subzone in the coastal waters of Pariaman City is 12.96 ind/m^2. Differences in macrozoobenthos abundance between subzones were tested using an ANOVA test. The results of the ANOVA test obtained a value of 0.282, where $p > 0.05$, indicating that the null hypothesis (H0) is accepted. This means that the abundance between subzones is not significantly different; therefore, no further tests were conducted.

The results of the calculation of macrozoobenthos abundance in the coastal waters of Pariaman City showed the highest abundance at Station I, with a value of 18.44 ind/m^2. This can be attributed to better physical and chemical factors of the water at Station I compared to the other stations. Additionally, the water substrate, which is sandy gravel and gravel, provides a suitable habitat for macrozoobenthos. On the other hand, the lowest abundance was found at Station II, with an abundance value of 8.56 ind/m^2. This could be due to the impact of human activities at the

tourist attraction of Station II, which may have led to a decrease in the abundance of macrozoobenthos.

The water quality parameters in the coastal waters of Pariaman City are categorized as good for the life of macrozoobenthos by the quality standards for seawater and the survival of marine biota. The abundance of macrozoobenthos is influenced by water temperature and dissolved oxygen levels. Temperature affects macrozoobenthos' metabolic activity and proliferation, while dissolved oxygen is essential for their survival.

The measurements of macrozoobenthos abundance obtained at each research station and the research site as a whole showed a relatively high number. This indicates that the water quality is favourable, as higher macrozoobenthos abundance is generally associated with better water quality. Conversely, polluted areas tend to have lower macrozoobenthos abundance.

Macrozoobenthos Diversity Index (H')

Based on the data, the diversity index value obtained in the coastal waters of Pariaman City at the three stations ranged from 1.28 to 2.09. The diversity index values are classified as medium. The diversity index at Station I is 1.81, station II is 2.09, and station III is 1.28 (Figure 4).

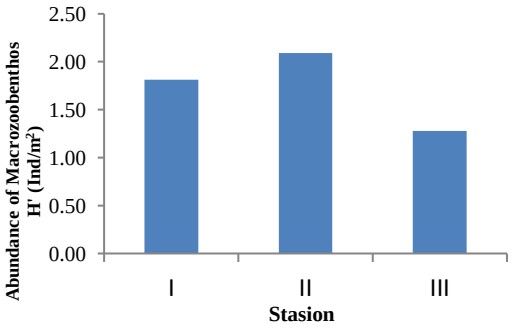

Figure 4. Macrozoobenthos Diversity Index

Figure 4 illustrates the macrozoobenthos diversity index in the coastal waters of Pariaman City, which falls within the range of 1≤H'≤3. This indicates moderate macro-zoobenthos diversity, sufficient productivity, a balanced ecosystem condition, and moderate ecological pressure. The diversity index is influenced by factors such as the number of species and the distribution of individuals within each species. A higher diversity index is observed at Station II with a value of 2.09, indicating a more significant number of species and a more even distribution of individuals among them. In contrast, station III has the lowest diversity value of 1.28, which can be attributed to fewer species and dominance by a single species. A low diversity value suggests an uneven distribution of individuals and lower community stability. The diversity index can be influenced by various factors, including the number of species or individuals obtained and critical coastal ecosystems such as seagrass beds, coral reefs, and mangrove forests, which serve as habitats for aquatic fauna.

Overall, the macrozoobenthos diversity in the coastal waters of Pariaman City is categorized as moderate, indicating moderate productivity, a relatively balanced ecosystem condition, moderate ecological pressure, and moderate stability. Moderate community stability implies that the community is susceptible to changes when environmental conditions fluctuate, even on a small scale.

The diversity index value depends on the total number of individuals from each species or genus, with higher values achieved when individuals are derived from different genera or species. In the research location, the moderate diversity category is likely influenced by the area's status as a tourist attraction with significant human activities. The water quality at the research location is considered normal and meets the water quality standards.

Index of Uniformity (E')

The calculation of the uniformity index at Station I is 0.65. At Station II, it is 0.75, indicating a high uniformity index. On the other hand, at station III, the uniformity index is 0.46, the lowest among the three stations (Figure 5).

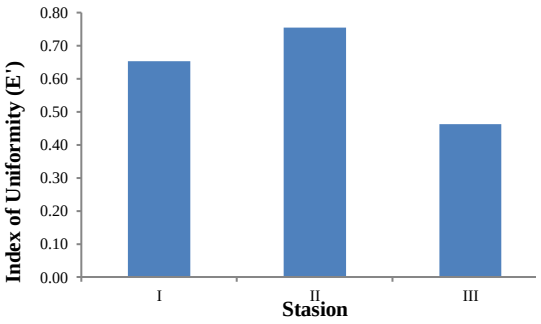

Figure 5. Index of Uniformity

Based on Figure 5, it can be observed that the uniformity index of macrozoobenthos in the coastal waters of Pariaman City falls within the

range of 0.46 - 0.75. This indicates a moderate level of uniformity. The Uniformity Index (E) values obtained at the three research stations varied from 0.46 to 0.75. Station II exhibited the highest uniformity index of 0.75, while Station III had the lowest value of 0.46. The low uniformity index value at Station III can be attributed to the abundance of certain species compared to others.

Conversely, at Station II, the number of individuals for each species is evenly distributed. According to Budi et al. (2013), the uniformity index is a valuable indicator for assessing the dominance of a particular environment. The uniformity index value will be lower if one or more species are abundant.

Based on the uniformity index values in the coastal waters of Pariaman City at the three research stations, it can be inferred that the overall uniformity is at a moderate level, falling within the range of 0.4 to 0.6 (Meisaroh et al., 2019). This suggests an uneven distribution of macrozoobenthos species. The uniformity index reaches its maximum value when the distribution of individuals for each species is even. A smaller uniformity value (closer to zero) indicates an uneven distribution of individuals among species, with a tendency for certain species to dominate the community (Hidayani, 2015).

The obtained uniformity index of macrozoobenthos in the coastal waters of Pariaman City falls within the "good" category for the growth and life of macrozoobenthos. A lower uniformity index implies an uneven distribution of individuals among species, with a tendency towards dominance by certain species in the ecosystem (Odum, 1998). A low uniformity index may also indicate water pollution.

Macrozoobenthos Dominance Index (C)

Based on the conducted analysis, the macrozoobenthos dominance index values at each observation station ranged from 0.13 to 0.37. the calculation of the dominance index obtained at Station I is 0.21, indicating the lowest dominance index. At station II, the dominance index is 0.13; at station III, it is 0.37, representing the highest dominance index (Figure 6).

The macrozoobenthos dominance index is utilized to assess the presence of specific species that dominate a community (Bai'un et al., 2021). In the coastal waters of Pariaman City, the dominance index values range from 0.13 to 0.34 (Figure 6). The highest dominance index value, 0.37, is observed at station III, indicating the presence of dominant species. This high value is attributed to a lower number of species obtained, where one species exhibits a higher abundance and dominance (Odum, 1993). Conversely, the lowest index value of 0.13 is recorded at Station II, indicating the absence of any dominating species.

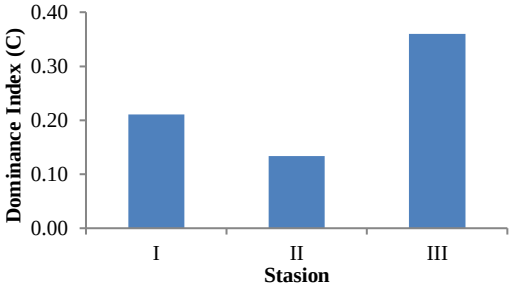

Figure 6. Index of Dominance

At the three research stations, the dominance index values in the coastal waters of Pariaman City indicate a low dominance level with $0 \leq C < 0.3$. This suggests an even distribution and stability among all species at these locations. Although certain species may have more individuals at the research station, this is likely influenced by water conditions or substrate types supporting the population.

The low dominance index value in the coastal waters of Pariaman City indicates good water conditions and the absence of pollution (Meisaroh et al., 2019). It further confirms that the water quality in the area remains excellent and not yet polluted, as supported by the results of water quality measurements at the research site, which adhere to the standards for macrozoobenthos habitat.

The findings from this dominance index analysis align with the outcomes of the diversity index and uniformity index analysis, where lower values of the dominance index typically accompany higher values of diversity and uniformity and vice versa (Hidayani, 2015).

4. CONCLUSION

During the study conducted in the coastal waters of Pariaman City, the macrozoobenthos observations revealed the presence of 7 phylum, eight genera, and 16 species. The abundance values ranged from 8.56 ind/m^2 to 18.44 ind/m^2. The diversity index value (H') in the coastal waters of Pariaman City indicates a moderate level of diversity, accompanied by a moderate

uniformity index value (E), indicating an uneven distribution of individuals among species. Furthermore, the dominance index value (C) indicates the absence of any dominant species. Based on the macrozoobenthos community structure index, it can be inferred that the water quality in the coastal waters of Pariaman City is classified as good.

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