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Structure Of Polychaeta Community in Banyuasin Mangrove Coast Waters, South Sumatera

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Abstract: This study aims to determine the structure of Polychaeta Community, and how the physical and chemical conditions and describe water conditions based on aquatic biota. The research time took place in March – October 2020. The determination of the sampling location was carried out using the purposive sampling method, which is based on differences in environmental baseline around. Data analysis was carried out by calculating abundance, diversity index, dominance index, and evenness index. The results obtained 22 polychaeta genera consisting of 22 Family, namely Sternaspidae, Arenicolidae, Ctenodrilidae, Parergodrilidae, Magelgnidae, Heterospionidae, Capitellidae, Scalibregmidae, Ophellidae, Pontodoridae, Pisionidae, Hesionidae, Eunicidae, Flabelligeridae, Fauveliopsidae, Pectinariidae, Nerillidae, Dinophilidae, Cirratulidae, Cossuridae, Alciopidae and Nereididae. The species diversity index belongs to the medium category, which ranges from 1.8 to 2.81. The dominance index of polychaeta in the coastal waters of the Banyuasin mangrove is relatively small or no species dominates because all stations have an average dominance index value below 0.5. While the physico-chemical factors of the waters in this river are classified as stable.
Keywords: *Mangrove Coastal Waters,* Polychaeta *Community, South Sumatra*

1. Introduction

Mangrove ecosystem is a system in nature where life takes place that reflects the reciprocal relationship between living things and their environment and between living things themselves, is found in coastal areas, is affected by tides and is dominated by tree or shrub species that are unique and able to grow in salty/brackish waters. Mangrove forests are those that develop in coastal areas and protected from the waves and their existence in forests of sea water and rivers. Ecologically, mangroves have a very important function as a food chain in a waters, it can also create a conducive atmosphere for the biota that live in it [1]. Mangrove ecosystem problems include, among others, the role, benefits and impacts of using the ecosystem. The role of the mangrove ecosystem is a combination of physical functions and biotic functions known as ecological functions. Utilization is more directed to the socio-economic aspect where one of the elements is humans as user beings. This is related to direct or indirect use [1]. Some of the ecological functions of mangrove forests include: protecting the coastline, preventing sea water intrusion, habitat (dwelling), feeding ground, nursery ground, spawning ground for various aquatic biota as well as a microclimate regulator.

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The high primary productivity in the mangrove ecosystem is the result of the activity of benthic macrofauna which is the main element that affects the high rate of decomposition of detritus and nutrient recycling. Polychaeta, crabs, gastropods, bivalves, barnacles, sponges, tunicates and sipuncula are the main groups that make up the macrofauna community in mangrove ecosystems. Among the benthic macrofauna groups, Polychaeta is the dominant component in terms of the number of species and

individuals, as much as 60-80% of the benthic macrofauna population. The substrate surface which is rich in organic C content makes mangrove forests an ideal habitat for Polychaeta [3].

Polychaeta can quickly respond to the addition of organic matter and high temperatures, while also being able to live in low oxygen conditions. The worms that are commonly found in mangroves are the Nereididae family that live immersing themselves in mud (infauna). In the food chain, Polychaeta can act as natural food for fish and shrimp. In addition to playing a role in aquatic ecosystems, the presence of Polychaeta in the mangrove ecosystem in Banyuasin Regency also has an important role as food for migratory birds that forage on the mangrove coast of Banyuasin Regency.

Research on Polychaeta that has been carried out in Indonesia, among others, was conducted by Junardi (2001) [9] in the waters of the east coast of South Lampung, Indarjo et al., (2005) [3] in the Klaces and Sapuregel mangrove forest areas, Segara Anakan, Jauhara (2012) in five estuaries of the Gulf. Jakarta, and Mahfud et al., (2013) [10] in Maron Beach and Tapak River Semarang. Especially for the mangrove forest area in Banyuasin, information about Polychaeta is still very limited. Therefore, considering the important role of Polychaeta in the food chain and the limited information about Polychaeta in the mangrove ecosystem in Banyuasin, it is necessary to know the abundance and diversity of Polychaeta at that location.

In the food chain, Polychaeta can act as natural food for fish and shrimp. In addition to playing a role in aquatic ecosystems, the presence of Polychaeta in the mangrove ecosystem in Banyuasin Regency also has an important role as food for migratory birds that forage on the mangrove coast of Banyuasin Regency. This study aims to determine the Polychaeta community structure, and how physics and chemistry conditions and describe the condition of the waters based on aquatic biota.

2. Materials and Methods

This research began by conducting a preliminary survey, which was carried out in October 2019, while sampling was carried out in March 2020, which was located in the mangrove waters of Banyuasin, South Sumatra. The place for measuring physical parameters is done directly, namely at the time of sampling. Chemical factor analysis was carried out in the laboratory, observation and exploration of Polychaeta was carried out at the Laboratory of Animal Ecology and Physiology, Biology Department, Faculty of Mathematics and Natural Sciences, Sriwijaya University, Indralaya.

The sampling method used the purposive sampling method, while the determination of the station was determined by selecting an area that represented the research location or based on the surrounding environment. This research is an area that is far from the general reach, therefore this area is still rarely touched by humans directly. Therefore, the researchers wanted to compare the conditions of the substrate, water, and the state of Polychaeta organisms at the four locations which could later be used as supporting data for the conservation and proper management of mangrove beaches.

2.1 Location of Sampling

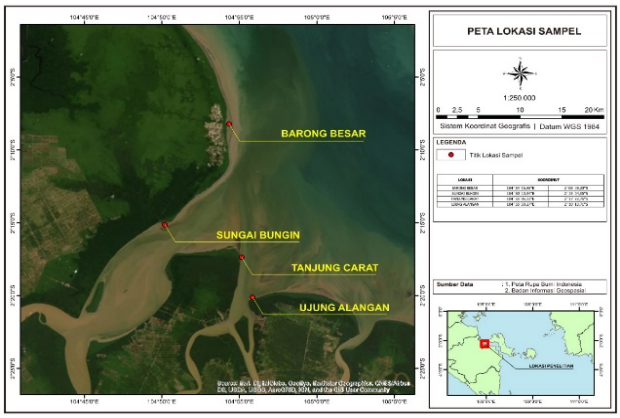

Figure 1. Map of Banyuasin Mangrove Coast Waters,and station point for sampling.

Source: (Personal Document, 2020).
Station Point for sampling:
St 1: Barong
(S 02°08’09.23”, E 104°54’16.98”);
St 2: Bungin River
(S 02°15’04.05”, E 104°50’10.94”);
St 3: Tanjung Carat
(S 02°17’22.75”, E 104°55’05.13”);
St 4: Ujung Alangan
(S 02°20’13.71”, E 104°55’50.27”).

Determination of stations is determined by the purposive sampling method, which is a sampling method by selecting an area that represents the research location or based on the surrounding environment, namely in former pond areas, port activities, population activities, and natural vegetation. While the sampling is done by the

clustered sampling method, namely by taking samples at different points 3 times replicates, then combined in one place or one bottle. Station position is determined based on GPS (Global Positioning System).

2.2 Polychaeta Sampling

Polychaeta samples were taken using Ekman grab size 20 x 20 cm^2, each station was taken 3 times for Polychaeta and 1 replicate for sediment analysis, Furthermore, the sample was filtered using a modified macrozoobenthos sieve with a mesh size of 0.5 mm to separate the macrozoobenthos animals from the mud (substrate). The filtering results are put into a sample bottle that has been labeled with the station number and replicates. Samples in bottles were preserved with 4% formalin, then collected in a cool box and brought to the laboratory. Identification and calculation of the number of individuals was carried out using a binocular microscope for small ones and a magnifying glass for larger ones.

2.3 Polychaeta Identification

Identification of Polychaeta is emphasized on the head and tail because it is one of the differences between families and genera. Considering that several Polychaeta families are often found with cases of sibling species, the identification process is carried out at the genus. Identification refers to *The Polychaete Worms. Definition and keys to the order, families and genera* [4]. identification book. The identification process was carried out in the Biology laboratory of the Faculty of Mathematics and Natural Sciences, Sriwijaya University.

2.4 Measurement of Physical and Chemical Factors

2.4.1. Temperature (^oC)

Measurement of temperature in the water is carried out in situ or carried out directly in the field. How it works from measuring the level of water temperature is Measurement of water temperature can immediately dip the tip of the thermometer to the surface of the water. Then wait a while until the thermometer shows a constant temperature, observed on the thermometer what is the temperature of the water.

2.4.2. pH

The pH value is measured using a pH meter by inserting the tip of the pH meter into a water sample taken from the water until a constant reading and reading the number printed on the pH meter. Furthermore, pH measurements are carried out with pH paper to avoid errors in measuring the pH of water.

2.4.3. TSS & TDS

Measurements of TSS & TDS of waters were carried out at the Environmental Health Engineering Center Palembang.

2.4.4. Free Dissolved Oxygen, COD, and BOD

Measurements of the levels of free Dissolved Oxygen, COD and BOD in the waters were carried out at the Environmental Health Engineering Center of PP Palembang.

2.5 Data analysis

Data analysis was performed by calculating abundance, diversity index, dominance index, and evenness index, and similarity index.

2.5.1 Diversity Indeks

The Polychaeta diversity index describes the state of the Polychaeta community whether it is stable (stable), more stable, very stable, or unstable in the habitat or station of the research. The species diversity index was analyzed using the Shannon-Wiener formula [5].

$$H' = - \Sigma Pi \ln Pi$$

With:

H ': Species Diversity Index

Pi: ni / N

this: Number of individuals in the i species

N: Total number of individuals

S: Number of Species

Table 1. Diversity Index Criteria Shannon Wiener [5]

No	Diversity Inde	Criteria
1	≤ 1	Low organism community
2	1,0-3,0	Community of medium orgar
3	>3,0	Highorganism community

2.5.2 Species Dominance Indeks

The dominance of species is not the same spread of individuals and there is a tendency for a species to dominate. The calculation method used is the Simpson dominance index formula [5].

$$C = \Sigma(ni/N)^2$$

With:
C: Dominant index of species
This: The number of individuals per species
N: Total number of individuals for all species

Criteria [5] :
The value of C is between 0-1, namely:
If C is close to 0 (<0.5),
then there is no species that dominates.
If C is close to 1 (≥ 0.5),
then there is a species that dominates.

2.5.3 Evenness Index

Calculation of type evenness is done using a formula [5] as follows:

$$E = H' / H_{max}$$

Description:
E: Evenness index
H ': Diversity Index
Hmax: In s (s is the number of genera)

The index value ranges from 0-1 [5].
If E approaches 0 (<0.5):
evenness among species is low, meaning that the individual wealth of each species is very different.

If E approaches 1 (≥ 0.5):
evenness between species is relatively even or the number of individuals in each species is relatively similar.

3. Results and Discussion

Based on research that has been carried out at the Banyuasin Mangrove Beach representing four research stations, namely Barong, Bungin River, Tanjung Carat, and Ujung Alangan, the number of polychaeta found at Banyuasin Mangrove Beach was 22 genera. One of the types of polychaeta found is Sternaspis. These polychaeta can dig mud and soft substrates to look for food in the form of organic matter, therefore if the substrate condition contains a lot of organic matter, the polychaeta will be more abundant or the polychaeta abundance index will be high.

The diversity of genera found at sampling point 1 which is located on the edge of the mangrove beach found as many as 21 genera, at sampling point 2 which is 200m from point 1 found as many as 20 genera, while at point 3 which is 400m from the mangrove beach found as many as 21 genera. For the genera diversity at each sampling point, the average is the same, but the abundance shows significant difference.

Table 2. Results Identification

Number	Taxa Composition	Abundance(Individu / 0,2m^2)			
		S	S	S	St4
I	STERNASPIDAE				
1	*Sternaspis scutate*	2	2	1	-
II	ARENICOLIDAE				
2	*Arenicola*		1		26
III	CTENODRILIDAE				
3	*Crenodrilus serratus*	6	2	8	7
IV	PARERGODRILIDAE				
4	*Stygocapitella subterranea*	3	9	12	9
V	MAGELGNIDAE				
5	*Magelona*	14	13	12	-
VI	HETEROSPIONIDAE				
6	*Heterospio cataliensis*	9	8	7	8
VII	CAPITELLIDAE				
7	*Capitella teleta*	11	9	13	13
VIII	SCALIBREGMIDAE				
8	*Scalibregma injlatum*	4	7	6	9
IX	OPHELLIDAE				
9	*Ophelia rathkei*	9	8	8	4
X	PONTODORIDAE				
10	*Pontodora pelagica*	5	9	12	5
XI	PISIONIDAE				
11	*Pisione oerstedi*	9	8	11	7
XII	HESIONIDAE				
12	*Hesione intertexta*	6	8	14	9
XIII	EUNICIDAE				
13	*Eunice antennata*	11	3	19	7
XIV	FLABELLIGERIDAE				
14	*Pherusa inflata*	13	1	9	8
XV	FAUVELIOPSIDAE				
15	*Fauveliopsis brevis*	4	2	7	2
XVI	PECTINARIIDAE				
16	*Amphictene capensis*	9	7	10	7
XVII	NERILLIDAE				
17	*Mesonerilla sp*	8	6	9	6
XVII	DINOPHILIDAE				
18	*Diurodrilus ankeli*	7	9	10	-
XIX	CIRRATULIDAE				
19	*Tharyx moniloceras*	6	9	9	9
XX	COSSURIDAE				
20	*Cossura brunnea*	10	13	13	-
XXI	ALCIOPIDAE				
21	*Vanadis formosa*	7	9	5	5
XXII	NEREIDIDAE				
22	*Namalycatis rhodochorde*	-	2	1	-

Table 3. Value of Index

NO	Index	St 1	St 2	St 3	St 4
1	Total Genera	21	22	22	17
2	Diversity Index	2,91	1,73	2,31	2,68
3	Dominance Index	0,06	0,31	0,37	0,23
4	Evenness Index	0,56	0,33	0,44	0,52
5	Similarity Index	16	10	7	9

St 1 = Station 1 St 3 = Station 3
St 2 = Station 2 St 4 = Station 4

Based on research that has been carried, the total number of polychaeta found on the Banyuasin Mangrove Beach is 22 genera. One type of polychaeta found is Sternaspis. This polychaeta has a unique shape where this type of polychaeta has a rounded body shape and the body length of this Sternaspis is between 20-30 mm. has few segments, a narrow prostomium, anteriorly there are tentacles and chitin plates. Can dig mud to look for food in the form of organic matter, therefore, if the substrate conditions contain a lot of organic matter, the polychaeta will be more abundant or the polychaeta abundance index will be high. Sternaspis is only found in Barong, Bungin River, and Tanjung Carat. Whereas in Ujung Alangan, there is no Sternaspis, this indicates that Ujung Alangan has a different substrate and composition of mangrove species.

3.1 Diversity Index

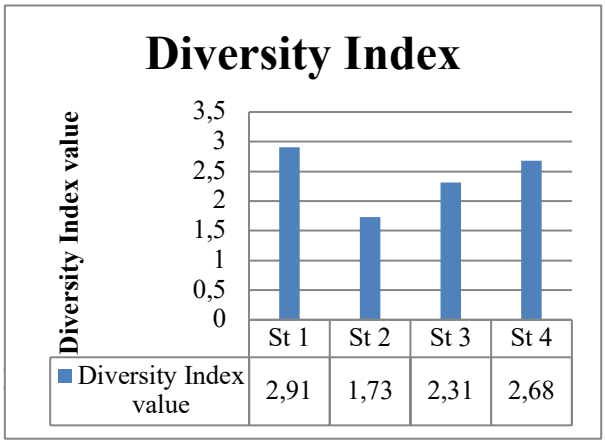

Figure 2. Diversity Index

Based on figure 2, The highest polychaeta diversity index value was obtained at stations 1 and 4 this could be due to this location being far from residential areas, while at stations 2 and 3 there was a lot of plastic waste that had an impact on aquatic ecosystems, especially macrozoobenthos in the area. The diversity index value at station 2 shows an index value of < 2.0 polychaeta diversity at station 2 indicates an unstable index value in the ecosystem where if H'> 1 - < 2.0 means the condition of the community of organisms in the ecosystem is unstable. While stations 1, 3, and 4 have a moderate diversity index, where if the diversity index values 1-3 are included in a stable condition.

The highest diversity of polychaeta species at the research station was found at stations 2 and 3, which were 22 genera, at station 1 there were 21 genera, while the diversity of the genus at station 4 was only 17 genera.

3.2 Dominance Index

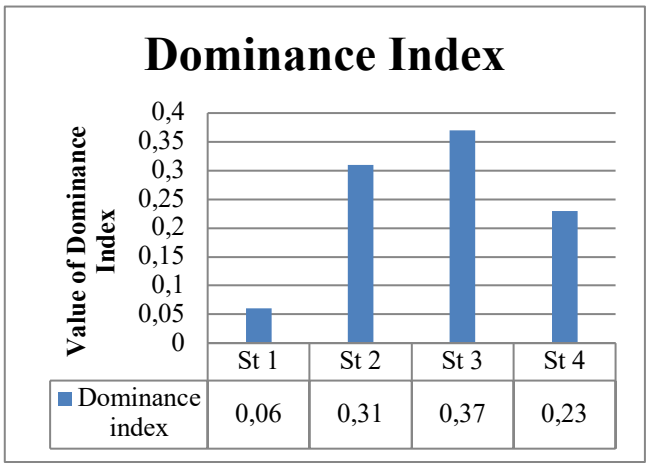

Figure 3. Dominance Index

Based on the polychaeta dominance index diagram, it can be explained that overall, there is no dominant species, but the dominance index values at stations 2 and 3 are higher when compared to stations 1 and 4 which have very low dominance index values. The dominance index is inversely proportional to the diversity index because if there is a dominan genera, the development of other genera will be disrupted, so that only a few other types of organisms can live in that location because of the dominant genera.

According to [6], if C < 0.5 means that in the community structure of the biota that we

observe, there is no species that dominates other species in an extreme way. This shows that the condition of the community structure is stable, the environmental conditions are quite prime, and there is no ecological pressure (stress) on the biota in their habitat.

3.3 Evenness Index

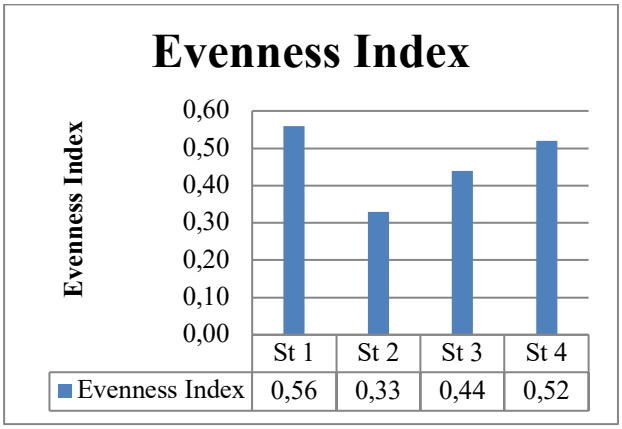

Figure 4. Evenness Index

Based on Figure 4, the evenness index value at stations 1 and 4 shows a value > 0.5 which means that there is an evenness of species at this station. The evenness index will be relatively the same if the evenness index is close to 1 or > 0.5 – 1. Meanwhile, if the evenness index only shows a value below 0.5 then the individual wealth of each genera is very different. At stations 2 and 3, the number <0.5 means that the evenness index between genera is not evenly distributed or the number of individuals in each genera is relatively different.

The lowest evenness index value is found at stations 2 and 3, this is due to the presence of certain genera that dominate more at stations. This causes the distribution of genera at this station to be uneven. While at stations 2 and 3 the evenness index was 0.5 where the value was close to 1, which means the genera at the station were evenly distributed because there was no influence of species dominance at that station. The index value obtained at each station is of course also related to environmental conditions.

3.4 Physical and Chemical Quality Analysis

Table 4. Physical and Chemical Quality Analysis

No	Environmental Parameters	Observation Station			
		1	2	3	4
	A. Physycal				
1.	Temperature (°C)	28°c	30 °c	28 °c	29 °c
2.	TSS (mg/L)	29,6	27,8	30,0	28,6
3.	TDS (mg/L)	9340	10136	10333	12322
	B. Chemistry				
4.	pH (Unit)	7,97	7,89	7,86	7,83
5.	DO (mg/L)	2,85	2,78	2,90	3,03
6.	COD (mg/L)	5	5	8	5
7.	BOD_5 (mg/L)	1,72	1,73	2,31	1,74

3.4.1 Temperature

The water temperature at each station has a temperature that is not much different where in the Barong area or station 1 it has a temperature of 28^0C, station 2 has a temperature of 30^0C, station 3 has a temperature of 28^0C while station 4 has a temperature of 29^0C. at this temperature is normal for polychaeta growth.

3.4.2 TSS

The lowest TSS level at the research location was at station 2 where it only showed a

number of 27.8 while the highest TSS level was found at station 3 which showed a value of 30. Although the difference in numbers was not significant, this still had an effect on the aquatic environment. High levels of TSS are sourced from all solid substances (sand, mud, and clay) or suspended particles in water and can be in the form of living (biotic).

3.4.3 TDS

The highest TDS content is at station 4 which has a value of 12,322 while the lowest TDS content is at station 1 which has a value of only 9340. The TDS content at all stations is relatively high.

The high level of TDS is caused by the large amount of organic and inorganic compounds that are soluble in water, minerals and salt. In seawater, the TDS value is high because it contains many chemical compounds, which also results in high salinity values and electrical conductivity [7].

3.4.4 pH

The pH of a water is very influential on the life of the organisms in it. Because the pH of a water determines what organisms live in it. All stations have a normal or high enough PH value, whereas all stations have a pH of 7 or close to 8, which means that the pH of the water is normal for seawater.

Marine and coastal waters have a relatively more stable pH and are in a narrow range, usually ranging from 7.7 to 8.4 pH because it is influenced by the buffer capacity, namely the presence of carbonate and bicarbonate salts they contain [8].

3.4.5 Dissolved Oxygen

At station 1 there is a DO content of 2.8 station 2 obtained a DO content of 2.7 station 3 obtained a DO content of 2.9 while at station 4 there is the highest DO content of 3.0 [9] states that the source of oxygen input dissolved in water can come from air diffusion and photosynthesis.

3.4.6 BOD_5

The analysis results show that the levels of BOD5 in each sample taken there are differences, other factors that influence BOD5 values include: temperature water, degree of acidity (pH) and water conditions overall. Compound content high organic lead to an increase in the value of suspended solids. at each research station, the BOD5 content value at stations 1,2 and 4 showed the same results, namely 1.7, while at station 3 it had a different and higher value of 2.3 mg/L.

4. Conclusion

1. Polychaeta diversity is getting smaller towards the middle of the sea, which means that the highest abundance is on the coast
2. The value of COD content at station 1 was 5, station 2 got a value of 5, at station 8 a value of 8 was obtained, while at station 4 the value was 5 mg/L. at station 3 located in Tanjung Carat the highest value was obtained, but overall, the research station obtained a normal value because it did not exceed the quality standard of water pollution parameters.
3. The diversity index value at station 2 shows an index value of < 2.0 polychaeta diversity at station 2 indicates an unstable index value in the ecosystem where if H'> 1 - < 2.0 means the condition of the community of organisms in the ecosystem is unstable. While stations 1, 3, and 4 have a moderate diversity index, where if the diversity index values 1-3 are included in a stable condition.
4. The highest diversity of polychaeta species at the research station was found at stations 2 and 3, which were 22 genera, at station 1 there were 21 genera, while the diversity of the genus at station 4 was only 17 genera.

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