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Benthos Diversity as a Water Quality Indicator of Coastal Waters Klumpang Beach, Labuan Bajo, East Nusa Tenggara, Indonesia

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Abstract. Indonesia as an archipelagic country has a very high wealth of aquatic resources with the level of diversity of aquatic ecosystems as the role of living organisms. Benthos is an organism that lives on the bottom sediment of a body of water. This organism lives relatively sedentary and cannot avoid contact with pollutants and its lifespan is relatively long, so that if there is a change in water quality and the substrate in which it lives, it will affect its composition and abundance. The purpose of this study was to determine the index of benthos diversity found in coastal waters. Klumpang, Labuan Bajo, East Nusa Tenggara, Indonesia. Therefore, benthos can be used as a bioindicator in observing pollution in water, especially on the Klumpang coast. The result shows that Klumpang beach shoreline has a medium diversity index, adequate productivity level, balanced ecosystem, and medium ecological pressure. The three sampling points has Shannon-Wiener diversity index by 1.790, 1.589, and 1.309 by sequence. The unbalanced species distribution of the species may indicate an unstable ecosystem in the shoreline, as the impact of surrounding activities especially in the eastern side of the coast.

Keywords: *Benthos; Klumpang; Labuan Bajo; Species; Substrate*

1. Introduction

Water can be defined as a collection of water masses located in a certain area. . In Indonesia, it is called an archipelagic country with a coastline of more than 95,000 km2 and has more than 17,504 islands. This situation certainly makes Indonesia one of the countries that have a fairly high wealth of aquatic resources with diverse biological resources. The beach is a border area between land and sea waters, a zone on the border where the highest and lowest tides occur (littoral zone), the coastal environment has a diversity of species because it is supported by environmental conditions such as biodiversity. Biodiversity (*biodiversity* or *biological diversity*) is a term used to describe the richness of various forms of life on this earth ranging from single-celled organisms to higher organisms. The high level of diversity (*biodiversity*) in coastal and marine ecosystems cannot be separated from the role of organisms in aquatic ecosystems. Coastal ecosystems have enormous natural resource potential in both renewable and non-renewable natural resources. One of the diversities of these organisms is benthos [1].

Benthos is an organism that lives on the surface or in the bottom sediment of a body of water. Based on their size, benthos are grouped into 3, namely microbenthos, meiobenthos, and macrobenthos. Based on

body size benthos are divided into three groups, namely macrobenthos, mesobenthos and microbenthos. Macrobenthos are organisms that have a size of more than 1.0 millimeter like molluscs. Mesobenthos are organisms that have a size of 0.1-1.0 millimeters such as cidaria and microbenthos are organisms that have a size of less than 0.1 millimeters. This organism lives relatively sedentary and cannot avoid contact with pollutants and its lifespan is relatively long, so that if there is a change in water quality and the substrate in which it lives, it will affect its composition and abundance [2,3].

Klumpang waters are included in the administrative area of the city of Labuan Bajo, West Manggarai Regency, East Nusa Tenggara, Indonesia is currently experiencing the development of various kinds of vectors, such as tourist destinations to activities around the coast. This increase can be seen from the number of tourists who enter every year to enjoy the natural beauty of this city. This will certainly affect the quality of coastal waters that cause pollution. Water quality generally indicates the quality or condition of water associated with a particular activity or purpose. A decrease in the quantity and quality of water will disrupt growth and even cause infectious diseases that grow and develop in waters of poor quality [4].

Observing the level of pollution in coastal areas can be done through bioindicators, One of them is through the activities of the benthos ecosystem. Bioindicators are said to be used as a measure of water quality because bioindicators respond specifically to changes that occur such as temperature, pH and so on. The role of benthos in the waters includes being able to recycle organic matter, assisting the mineralization process, occupying an important position in the food chain and an indicator of environmental pollution.

This research is important to do because research on benthos diversity in the Klumpang coastal waters area has never been done. This study aims to determine the types of marine biota ecosystems, especially benthos as an indicator of water quality parameters in the coastal estuary area so that it is expected to provide information about benthos, the quality of environmental conditions and the pollution index of the Klumpang coastal estuary waters, Labuan Bajo, East Nusa Tenggara, Indonesia.

2. Research Method

The research was conducted in coastal area of Klumpang beach, Labuan Bajo, East Nusa Tenggara, Indonesia (Figure 1). Samples were collected using an Eckman Grab. Benthic samples were washed in situ and stored in properly labeled bags with 70% alcohol. In the laboratory, the samples were washed again and the organisms were identified to lowest possible taxonomic level. Identified organisms were then analyzed for its each number per volume, abundance, dominance, and diversity index of Shannon-Wiener.

Figure 1. Sampling locations nearby Klumpang Beach

3. Result and Discussion

Klumpang Beach is located in the northeast of Labuan Bajo Town. As one of destinations in Labuan Bajo, its environment may highly affect from local tourism activity. It also surrounded by local settlement, hotels and resorts, and also vessel traffic. Benthos diversity analysis from this study is aimed to give insight to the current condition of the shoreline environment. The three sampling points analyzed in Klumpang Beach were selected from the west to the eastern side of the beach.

Sediment analysis in the first sampling point had identified 8 benthic organisms (Table 1). The first sampling point has 1.790 diversity index. This number shows that the ecosystem has medium diversity index, adequate productivity, balanced ecosystem, and medium pressure (5). In this location, a *Holothuria scabra* was also found, which its habitat is usually a nutrient-rich environment and has a good relation with seagrass and algae (6). *Sorites sp.* and *Nassarius sp.* is dominating in tgis area with 0.292 abundance value. *Sorites sp* is commonly associated with coral reef, while *Nassarius sp.* is commonly found in sandy shoreline (7,8).

Table 1. Benthos diversity in sampling point 1.

Organism name	Counted ind. (n)	Ind./m^2 (Ni)	Dominance ($Ni^2/\Sigma N^2$)100%	Abundance	Diversity
Sorites sp	7	700	8.51%	0.292	-0.359
Trochus sp	3	300	1.56%	0.125	-0.260
Dosinia sp	1	100	0.17%	0.042	-0.132
Nassarius sp	7	700	8.51%	0.292	-0.359
Microthele Nobilis	1	100	0.17%	0.042	-0.132
Holothuria scabra	1	100	0.17%	0.042	-0.132
Cerithium sp	2	200	0.69%	0.083	-0.207
Clithon sp	2	200	0.69%	0.083	-0.207
Total	24	2400		H'	1.790

The second sampling point has a little lower diversity index, but still in the same classificiation with the first sampling point, with 1.790. There are 6 species of microorganisms identified in this location (Table 2). *Anadara sp.* is the most abundant species found, which usually lives in a relatively lentic shoreline with salinity between 30 – 33% (9). The other abundant species are *Sorites sp* and *Nassarius sp* similar with the first sampling point.

Table 2. Benthos diversity in sampling point 2.

Organism name	Counted ind. (n)	Ind./m^2 (Ni)	Dominance ($Ni^2/\Sigma N^2$)100%	Abundance	Diversity
Sorites Sp	3	300	2.49%	0.158	-0.291
Trochus sp	1	100	0.28%	0.053	-0.155
Anadara sp	7	700	13.57%	0.368	-0.368
Nassarius sp	4	400	4.43%	0.211	-0.328
Cerithium sp	3	300	2.49%	0.158	-0.291
Parvanachis	1	100	0.28%	0.053	-0.155
Total	19	1900			1.589

The third sampling point has identified 4 organisms, with lowest diversity index by 1.309. However, this number is still in the medium range of diversity index described with adequate productivity, balanced ecosystem, and medium pressure environment. *Cerithium sp.* with the highest abundance value is commonly found in muddy or sandy shoreline with high nutrient (10). Visual observation to the sampling

points indicates that the more eastern shoreline the field turns muddy from sandy shore.

Table 3. Benthos diversity in sampling point 3.

Organism name	Counted ind. (n)	Ind./m^2 (Ni)	Dominance ($Ni^2/\Sigma N^2$)100%	Abundance	Diversity
Anadara sp	2	200	2.78%	0.167	-0.299
Acesta sp	3	300	6.25%	0.250	-0.347
Cerithium sp	5	500	17.36%	0.417	-0.365
Parvanachis	2	200	2.78%	0.167	-0.299
Total	12	1200			1.309

The three sampling points indicate that Klumpang beach shoreline has medium diversity index, with adequate productivity level, and balanced ecosystem. *Sorites sp.* that can be found in the first and second sampling point but not the third sampling point may become a sign that there is alteration to the eastern side of the coast. The unbalanced species distribution of the species may shows an unstable ecosystem in the shoreline, which probably the impact of surrounding activities. This monitoring results may be used as a reference for the local authority evaluating biodiversity in the north shoreline of Labuan Bajo area.

4. Conclusion

Klumpang beach shoreline has a medium diversity index, adequate productivity level, balanced ecosystem, and medium ecological pressure. The three sampling points has Shannon-Wiener diversity index by 1.790, 1.589, and 1.309 by sequence. The unbalanced species distribution of the species may indicate an unstable ecosystem in the shoreline, as the impact of surrounding activities especially in the eastern side of the coast.

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