Inventory of macrozoobenthos community in Mangrove Ecosystem, Labombo Beach, Palopo, South Sulawesi

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Abstract. Mangrove ecosystem has ecological roles as habitats for many organism and also minimizing the effects of sea water abration in Labombo shoreline. However, marine tourism area in Labombo beach potentially change that ecological roles. So, it is important to monitor the ecosystem quality for maintaining sustainability of ecosystem. This study aimed to determine the quality of ecosystems using macrozoobenthos community structure as a bioindicator. The sample was taken from three station using transect and cuadrant methods. The samples then stored in 70% alcohol bottle and indentified based on morphological characteristic in laboratory. 14 species of macrozoobenthos were identified in study area. The data showed that Shannon Wiener diversity index (H') was 2.44; Evenness index was 0.91; and Dominance index was 0.10. Based on Shannon Wiener cathegory, the macrozoobenthos diversity in study area was moderate and indicate that the ecosystem was stable.

1. Introduction

The Labombo Beach area has great potential in providing natural resources as well as tourism. Natural resources on Labombo Beach are expected to support economic growth in Palopo City so that it is hoped that these natural resources are well preserved to avoid environmental crises. On the other hand, the conversion of Labombo Beach into a tourism area allows changes in the quality of the ecosystem.

The Labombo Beach area has a mangrove forest ecosystem. The mangrove ecosystem has an ecological function, which is to become a habitat for various marine life. Mangrove forest is a general term used to describe a variety of tropical coastal communities dominated by several species of distinctive trees or shrubs that have the ability to grow in salty waters [1].

Macrozoobenthos is one of the organisms that live in association with ecosystems. Macrozoobenthos are known to be sensitive to water status alteration, and macroinvertebrates are justifiably the most frequently employed biological elements in monitoring studies [7]. Macrozoobenthos commonly found in mangrove areas are the Crustacean, Polychaeta, Bivalvia, and Gastropoda classes. Macrozoobenthos has the ability to adapt to environmental conditions. The physical environment affects macrozoobenthos activity and its distribution associated with soil dredging which is a physical action in sediment such as waves, tides and currents [9]. Most of the macrozoobenthos that live in mangrove areas live in hard substrates to muddy environments [5].
Macrozoobenthos are living organisms that are crawling, sticking, burying, and burrowing either in the bottom waters or bottom surface of the waters \cite{4}.

Macrozoobenthos also has an important role in the nutrient cycle at the bottom of the waters and also acts as one of the connecting links in the energy flow and the cycle of plantonic algae to high-level consumers. The existence of macrozoobenthos can be used as an indicator of water quality, so macrozoobenthos are bioindicators to detect whether or not the environmental quality of a waters is good \cite{7}. The purpose of this study was to determine the quality of the ecosystem by using the macrozoobenthic community structure as a bioindicator.

2. Materials and Methods

2.1 Study area

Study area of the research can be seen in Figure 1. Sampling sites were determined by purposive sampling, based on purpose of the research. This research was conducted at Labombo Beach, Palopo, Makasar, South Sulawesi in November, 2019. Sampling sites consist of three stations along the coast of Mangrove ecosystem. The distance between stations was 15 meter.

![Figure 1. Study area](image)

2.2 Methods

2.2.1 Sample Collection. Samples were collected using transect quadrant methods. Transect line was laid along mangrove area and plots (1 m x 1 m) were laid in each station. Samples of sediment (300 grams) were collected in 4 points each plot using shovel, with three replication in each station, and then filtered using sieve mesh 5 mm. The filtered sample then rinsed using aquadest and stored in bottle sample with ethanol 70%.

2.2.2 Identification of Macrozoobenthos. Samples of macrozoobenthos were identified with magnifying lense based on morphology characteristics using Guedlines Book of Macrobenthos Identification, in Cell and Tissue Laboratory, Cokroaminoto University, Palopo. Identification result then recorded and analyzed.
2.2.3 Data Analysis. Data were analyzed, based on Diversity Index by Shanon-Wiener (H'), Dominance Index (D) and Evenness Index (E).

3. Results and Discussion

3.1 Abiotic Factor

Abiotic factors measured in this study include water temperature and salinity. The average of water temperature and salinity at the study area respectively 33.5°C and 33.66/00. The measured abiotic factors did not show significant differences at each research station. Although it did not show a significant difference, the salinity in the estuary and the intertidal zone was very fluctuating, so that the organisms that live in this area must have reliable physiological abilities to be able to withstand erratic salinity fluctuations[10,12,13].

Type of substrate and vegetation in each station showed slightly different. In Station I, the substrate was slightly muddy and sandy, vegetation were dominated by Sonneratia alba. In station II, the substrate was muddy and sandy, close to river mouth, vegetation were dominated by Rhizophora apiculata. And the last one, characteristics in the area of station III were muddy and sandy substrate, there were no dominant mangroves vegetation. Mangrove species in station III include Rhizophora apiculata, Rhizophora mucronata, and Sonneratia alba spread evenly.

3.2 Abundance of Macrozoobenthos

Macrozoobenthos has important roles in the nutrient cycle in the bottom waters. In the mangrove ecosystem, macrozoobenthos acts as a primary consumer as well as a secondary consumer, utilizing plankton, algae, bacteria, and organic matter as food. Macrozoobenthos community in mangrove forest areas are relatively sedentary and contained by water, so that both the aspect of biodiversity and their adaptability are largely determined by environmental factors in the area. Changes in ecosystem ecological conditions affect the structure and composition of macrozoobenthos[2,12].

Mangrove ecosystem has ecological roles as habitats for many organism and also minimizing the effects of sea water abration in Labombo shoreline. So far, there were no research has been reported on the diversity of macrozoobenthos in the mangrove area of Limbolo Beach. In fact, the macrozoobenthos community structure can be used as a bioindicator of water quality[11]. Based on result research conducted in 2019, abundance of macrozoobenthos in each station can be seen in Table 1.

Table 1. Abundance of macroozobenthos in Mangrove Ecosystem, Labombo Beach, Palopo, South Sulawesi (ind/m²)

| No | Species                  | Number of identified sample |
|----|--------------------------|----------------------------|
| 1  | Murex trapa              | 3  3  3                      |
| 2  | Littoraria intermedia    | 4  4  4                      |
| 3  | Cerithidea obtusa        | 3  3  3                      |
| 4  | Scylla sp.               | 8  6  1                      |
| 5  | Ophiactis savignyi       | 1  1  0                      |
| 6  | Nereis sp.               | 1  0  1                      |
| 7  | Tellina sp.              | 4  2  0                      |
| 8  | Gafarium tumidum         | 2  3  1                      |
| 9  | Strombus gibberulus      | 0  2  1                      |
| 10 | Barbatia decussata       | 2  2  1                      |
Table 1 showed that based on 83 sample from field study, there were 14 species of macrozoobenthos, that classified in five group or class (Figure 2). The average abundance of macrozoobenthos was 27.6 ind/m². The abundance in station I did not significantly differ with station II. But, the lowest abundance in study area found in station III. The highest abundance class was gastropoda and followed by bivalvia. The large number of species from the Gastropod and Bivalvia classes found in mangrove forests in Labombo Beach waters is related to the ability of these species to adapt to tidal environments. Gastropod classes have an operculum that can tightly close the shell gap, when the water recedes they enter the shell and then close the operculum tightly so that water shortages can be overcome. Furthermore, the high abundance of Gastropods is because this class has water-resistant skin and functions as a barrier, it can climb trees to get food [8].

According to Tabel 1 and Figure 2, the most dominant macrozoobenthos from each station was the family Ocypodidae from the Malacostraca class. Presumably because it is able to adapt to tidal currents and can live in mud and sandy areas. This result was consistent with the statement of that the violin crab (Genus Uca) consists of a group of brachyura crabs that live in burrows in the intertidal area of mud and sand [6]. Overall, the lowest abundance of macrozoobenthos is at station III. This is probably due to its location close to the location of the tourist sites. Thus, the potential for habitat damage at this station is greater than at other stations.while the highest abundance was found at station II. Based on location description, station II is close to the estuary. Organisms in the estuary area have a high diversity because it was not only consist of permanent organism, but also come from freshwater, seawater, and nomadic migrate organisms [3].

### 3.3 Diversity of Macrozoobenthos

As describe before, community structure of macrozoobenthos can be used as biondicator to value quality of waters. Table 2 showed three parameter that use to indicate quality of waters in Mangrove area in Lambobo Beach, Palopo, South Sulawesi. The parameters consist of diversity index (H’), Dominance Index (D) and Similarity Index / Eveness (E).

According to Shannon-Wiener Index, the macrozoobenthos diversity (H’) in study area showed between 2 > H’ > 3. It means that the diversity was moderate and indicate that the ecosystem was
stable. While similarity and dominance index indicate that there were no dominant species in the study area, it was seen from the low value of dominance index (close to zero). It was approve with similarity index that showed the high value. It was indicate that the species were distributed equally.

| Table 2. Diversity Index, Evenness Index and Dominance Index of Macrozoobenthos in Mangrove Ecosystem, Labombo Beach, Palopo, South Sulawesi |
|---------------------------------------------------------------|
| **Parameter** | **Value** |
| Diversity Index (H') | 2.44 |
| Similarity/ Evenness Index (E) | 0.91 |
| Dominance Index (D) | 0.10 |

4. Conclusion
Inventory of macrozoobenthos community in Mangrove Ecosystem, Labombo Beach, Palopo, South Sulawesi showed 14 species that classified in 5 class. The most abundance class was found in Gastropoda, followed by Bivalvia. The high abundance of they were well-adapted in unpredictable fluctuation condition, based on morphologi, physiologi and behaviour adaptation. According to Shannon-Winner Index, the diversity of macrozoobenthos categorized as moderate. It was indicate that the quality of ecosystem was stabel.

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References
[1] Bengen DG. 2000. *Pengenalan dan Pengelolaan Ekosistem Mangrove*. Pusat Kajian Sumber Daya Pesisir dan Lautan. Bogor. Indonesia.
[2] Choirunnisa and Takarina N. 2019. Community Structure of Macrozoobenthos at Blanakan Fish Pond, Subang, West Java. *IOP Conf. Series: Earth and Environmental Science*, 284.
[3] Hakiki TS. 2017. Macrozoobenthos Community Structure in The Estuary of Donan River, Cilacap, Central Java Province, Indonesia. *Omni-Akuatika*, 13 (2): 163 – 179.
[4] Lee SY. 2008. Mangrove macrobenthos: Assemblages, services, and linkages. *J Sea Res* 59: 16-29.
[5] Marzano CN, Liaci LS, Fianchini A, Gravina F, Mercurio M, Corriero G. 2003. Distribution, persistence, and change in the macrozoobenthos of the lagoon of Lesia (Apulia, southern Adriatic Sea). *Oceanol Acta* 26: 57-66.
[6] Muramatsu D. 2010. Sand structure construction in Uca lactea (DE HAAN, 1003) is related to tidal cycle but not yo male or female densities. *Crustacean*, 83(1): 29-37.
[7] Odum EP. 1993. *Fundamentals of Ecology*. Gadjah Mada University Press. Yogyakarta.[In Indonesian]
[8] Sabar M. 2016. Biodiversitas dan adaptasi makrozoobentos di Perairan Mangrove. *Bioedukasi*, 4(2).
[9] Sassa S, Watabe Y, Yang S, dan Kuwae T. 2011. Burrowing Criteria and Burrowing Mode Adjustment in Bivalves to Varying Geoenvironmental Conditions in Intertidal Flats and Beaches. *PLoS ONE*, 6 (9): e25041.
[10] Sinaga NH. 2019. Structure of Macrozoobenthos (Gastropods) Community in Mangrove Forest Ecotourism Pandansari Kabupaten Brebes, Central Java. *Asian Journal of Fisheries and Aquatic Research*, 4(3): 1-6.

[11] Tarwotjo UR. 2018. Community structure of macrozoobenthos as bioindicator of pepe river quality, Mojosongo Boyolali. *IOP Conf. Series: Journal of Physics: Conf. Series*, 1025.

[12] Yunita FL. 2018. Macrozoobenthos Community Structure in the Coastal Waters of Marsegu Island, Maluku, Indonesia. *International Journal of Applied Biology*, 2(1): 1-11.

[13] Zallesa SR. 2020. A Survey of Macrozoobenthos Assemblages in a Tropical Mangrove Estuary in Brebes, Java Island. *Omni-Akuatika*, 16(1): 62-68.