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ABUNDANCE AND POTENTIAL OF MEGABENTHOS IN THE BANDA SEA WATERS TOURISM PARK IN LONTHOIR VILLAGE, BANDA ISLANDS, CENTRAL MALUKU

KELIMPAHAN DAN POTENSI MEGABENTOS PADA KAWASAN TAMAN WISATA PERAIRAN LAUT BANDA DI DESA LONTHOIR KEPULAUAN BANDA, MALUKU TENGAH

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ABSTRACT

Megabenthos are benthic biota with a size of more than 1 cm and are found living on the bottom of the water, either in coral reef or seagrass ecosystems. Megabenthos also provides benefits to the economy of the surrounding community. This research was conducted in the Banda Sea Tourism Park Area, Lonthoir Village, Banda Islands, Central Maluku, from February 11th to April 21st, 2022. This study aims to determine the type, abundance, and potential of megabenthos in the Banda Sea Waters Tourism Park. Data collection at the observation station is done using the quadratic linear transect method, which is drawn along 400 meters perpendicular to the sea and 300 meters parallel to the coastline with a quadrant size of 10 x 10 m^2 with a distance of 10 m between quadrants and a distance of 30 m between transects. From the results of the research carried out, 6 classes of Megabenthos were found, namely Gastropoda, Bivalvia, Holothoroidea, Asteroidea, Echinoidea, and Malacostraca. The Gastropoda class is the megabenthos that is most commonly found in the Banda Sea Marine Tourism Park, namely 1118 individuals with an abundance value of 0.072 ind/m2 and a potential value of 8600 ind. while the lowest class is the Asteroidea class with 20 individuals with an abundance value of 0.011 ind/m2 and a potential of 1333 ind and Malacostraca with 9 individuals with an abundance value of 0.011 ind/m2 and a potential of 1350 ind. The high potential for megabenthos in the waters of the Banda Marine Tourism Park can be influenced by the high population of various marine biota.

***Keywords**: Abundance, Banda Sea, Megabenthos, Potential*

ABSTRAK

Megabentos merupakan biota bentik dengan ukuran lebih dari 1 cm dan ditemukan hidup di dasar perairan baik pada ekosistem terumbu karang atau padang lamun. Megabentos juga memberi manfaat terhadap ekonomi masyarakat sekitar. Penelitian ini dilaksanakan di Kawasan Taman Wisata Perairan Laut Banda, Desa Lonthoir, Kepulauan Banda Maluku Tengah pada 11 Februari sampai 21 April 2022. Penelitian ini bertujuan untuk mengetahui jenis, kelimpahan, dan potensi megabentos di Taman Wisata Perairan Laut Banda. Pengambilan data pada stasiun pengamatan dengan menggunakan Metode Transek Linier Kuadrat yang ditarik sepanjang 400 meter tegak lurus ke arah laut dan 300 m sejajar garis pantai dengan ukuran kuadran 10 x 10 m^2 dengan jarak 10 m antar kuadran, serta jarak antar transek 30 m. Dari hasil penelitian yang dilakukan, ditemukan 6 kelas Megabentos, yaitu Gastropoda, Bivalvia, Holothoroidea, asteroidea, Echinoidea, dan Malacostraca. Kelas Gastropoda merupakan megabenthos yang paling banyak ditemukan di Taman Wisata Bahari Laut Banda yaitu sebanyak 1118 individu dengan nilai kelimpahan 0,072 ind/m2 dan nilai potensi 8600 ind. sedangkan kelas terendah ialah Kelas Asteroidea sebanyak 20 individu dengan nilai kelimpahan 0,011 ind/m2 dan potensi 1333 ind dan Malacostraca sebanyak 9 individu dengan nilai kelimpahan 0,011 ind/m2 dan potensi 1350 ind. Tingginya Potensi megabentos diperairan Taman Wisata Laut Banda, dapat berpengaruh dengan tingginya populasi berbagai biota laut.

***Kata kunci**: Kelimpahan, Megabenthos, Potensi, Laut Banda*

INTRODUCTION

Indonesia is an archipelagic country with a marine area of about 75% of the total area (Riani, 2007). Furthermore, it is also said that Indonesia's waters cover approximately 5.8 million km^2, with a coastline length of 81,000 km. Such a vast marine area allows the country to have the potential for a variety of abundant marine and coastal resources. Some types of resources that are abundant in almost all coastal areas in Indonesia are megabenthos.

Megabenthos is a benthic biota with a size of more than 1 cm and is found living on the bottom of the water either in coral reef or seagrass ecosystems (Arbi & Sihaloho, 2017). This type of biota is found living on the bottom of the water, either in coral reef ecosystems or seagrass ecosystems, and has a very important role in food networks, the utilization of organic matter, and as an agent of degrading organic matter at the bottom of the perarian. One location where many megabenthos species are found is in the waters of the Banda Islands. The waters of the Banda Islands are located in Maluku Province, precisely in Central Maluku Regency. This archipelago is one of the islands in Indonesia with fertile waters and is rich in marine biological resources because it has a high diversity of marine biota that inhabits its waters, ranging from shallow waters to deep sea waters, such as molluscs, echinoderms, and various types of fish, which are important commodities and have high economic value (Amiluddin, 2014). This condition is also supported by the upwelling process that occurs every year, which increases nutrients in the water.

The existence of megabenthos in the coastal Banda Islands has long been realized by both the community and the government. This is evidenced by the utilization of several species on several coasts in the Islands (Amiluddin, 2014), while utilization without being based on information about their existence can result in overexploitation, which leads to species extinction, so data and information on the existence of megabenthos are needed as a first step and for future management efforts. One of the management efforts made by the government, especially from the Ministry of Maritime Affairs and Fisheries, is to establish several locations in Banda to enter the protection zone called the Banda Sea Marine Tourism Park (TWP).

Banda Sea Marine Tourism Park (TWP) is a marine tourism park in Banda District, Central Maluku Regency, Maluku Province. The establishment of the Banda Sea TWP is based on the decree of the Minister of Marine Affairs and Fisheries. This tourist park has an area of 2500 hectares and is located on 10 islands in Banda District. Banda Sea Marine Tourism Park (TWP) is a working area under the Kupang National Marine Conservation Area Center (BKKPN). The Banda Sea TWP has been in Banda Sub-district since 2010 and has carried out conservation and management activities related to coastal and marine areas. However, the presence of several types of megabenthos at the Banda Sea TWP location has not yet been identified, and to carry out management, minimal data on the presence of megabenthos at the location is needed. Thus, this study aims to identify and calculate the abundance value and potential of megabenthos found in the Banda Sea Tourism Park (TWP) area, especially in the waters of Lonthoir Village, Banda Islands, Central Maluku.

MATERIALS AND METHOD

Time and Place

This research was conducted from February 11th to April 21st 2022. Banda Sea Marine Tourism Park (TWP) under the National Marine Conservation Area Center (BKKPN) Kupang coastal waters of Lonthoir Village, Banda District, Central Maluku Regency, Maluku Province, which is part of the Banda Sea TWP conservation area A map of the data collection location can be seen in **Figure 1**.

Work Procedure

Preparation of tools and materials includes equipment that will be used at the observation site, including 10 x 10 m^2 quadrant transects, a Geographic Positioning System (GPS), roll meters, stationery, underwater cameras, digital water checkers, booties, masks, snorkels, gloves, lifebuoys, water quality equipment (Thermometer, Refractometer, pH meter or litmus paper) and benthic identification sheets. Determination of observation stations using the purposive sampling method, where sampling locations are determined based on certain considerations by researchers (Fachrul, 2007). The determination of station points took one station with 11 repetitions by taking coordinate points using GPS.

Sampling megabenthos is carried out at low tide. Sampling was conducted using the quadratic linear transect method (Khouw, 2009). Transect lines were drawn perpendicular to the sea along 400 meters, with a distance of 30 meters between transects and a distance of 10 meters between quadrants. The number of

transects used was 11 with a total of 231 quadrants used for the entire transect, which consisted of 21 quadrants for each transect. Sample identification is done by counting the number of megabenthos in the quadrant, recording it with the observation form that has been provided, taking megabenthos samples to be documented as a representative of the species found, referring to the identification sheet, and then grouping megabenthos based on class. The Megabenthos data collection scheme can be seen in **Figure 2**.

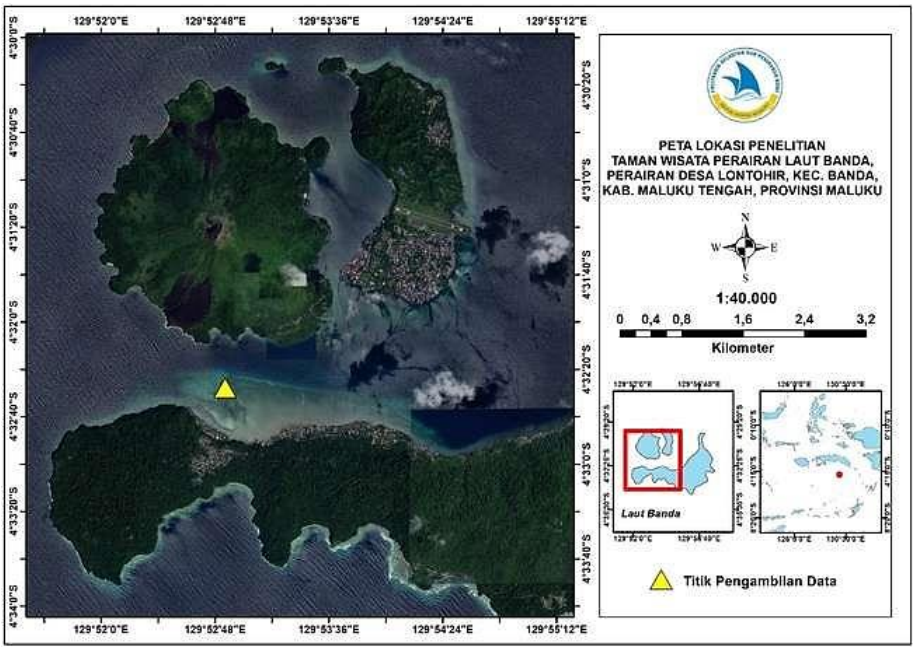

Figure 1. Research location map

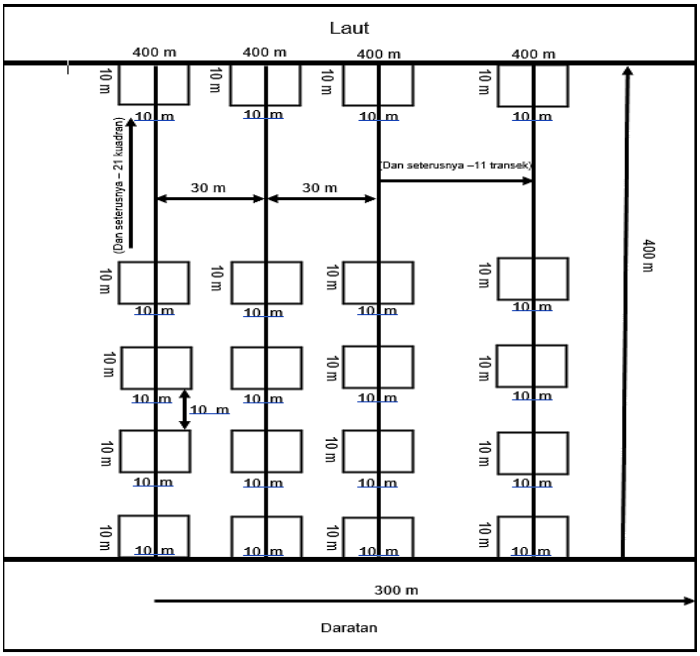

Figure 2. Megabenthos data collection scheme

The identification of megabenthos is done by the morphoristic method by looking at morphological structures such as shell shape, color, and size (Dharma *et al.,* 2005) and the book Bioecology of Echinodermata Phyllum, as well as the 2nd edition of the Megabenthos Monitoring Guidebook from the Indonesian Institute of Sciences (LIPI, 2017). The abundance value is obtained by summing the individuals from all quadrants obtained at the observation location and then dividing by the area of the observation area. The potential value is obtained by calculating the abundance value first, and then the abundance obtained is multiplied by the area of the observation area.

Measurements of environmental parameters were taken at the same time as megabenthos data collection when the tide moved; each measurement was carried out three times. Temperature, salinity, and pH measurements were taken in situ. Measurements are made using a digital water checker that functions as a water quality character reader according to its specifications, namely by dipping the sensor probe into seawater and then waiting 1–5 minutes until a fixed value of temperature, salinity, and pH appears.

Data Analysis

The data analyzed in this observation is the abundance and potential of megabentos by using the following formula:

Abundance is the number of individuals per unit area (Brower *et al.,* 1998):

$$Di = \frac{N_i}{A} \quad \text{..... (1)}$$

Where, Di: Abundance (ind/m^2); Ni: Number of individuals (ind); A; Area of observation (m^2)

The potential is the total abundance of the expanded area. Potential is calculated using the formula proposed by Khouw (2009) as follows:

$$P = \bar{X}.A \quad \text{..... (2)}$$

Where, P: Potential; X: Abundance (ind/m^2); A: Area of observation (m^2)

RESULT AND DISCUSSION

Banda is an archipelago located at latitudes 040 11' N, 040 40' N, and 1290 39' East, 1300 05' East. Lonthoir Village is one of the villages that has biological resources. This is evidenced by the many types of marine life found at that location. Lonthoir waters have two ecosystems, namely seagrass and coral reef ecosystems, which are places of refuge, spawning, and food for the biota that live in them. The observation location is located in the astronomical positions S 04.535.04° and E 129.87086°, and administratively, the waters of Lonthoir Village have the following boundaries: east bordering Boiyauw Village, west bordering Ay Island, south bordering Banda Sea, and north bordering Gunung Api Island. Lonthoir beach waters have a sloping beach typology with varied substrates, including sand substrates, muddy sand, broken corals, dead corals, and coral reefs.

From the results of observations in the field using quadratic linear transects with quadrants measuring 10 x 10 m to observe benthos in the area In Megabenthos encountered, there are six classes consisting of gastropods, bivalves, holothuroidea, asteroidea, echinoidea, and malacostraca in the waters of Lonthoir Village, which are included in the Banda Sea Waters Tourism Park area. Observations can be seen in **Figure 3**.

Figure 3. (a) Transect stretching; (b) Quadrant installation; (c) Megabenthos observation.

Data collection was carried out by determining the point of observation location, installing stakes as a marker of the starting point, stretching the transect along 400 m, installing quadrants, and then continuing with the

observation of megabenthos contained in the quadrant.

Gastropods

From the results of observations in the field, the gastropod class is the most widely found; almost in every quadrant, gastropods always dominate. The number of gastropods in the observation location is 12 species out of a total of 1118 individuals found. The gastropod class can be seen in **Figure 4**.

Figure 4. Gastropod class

Bivalves

Based on the results of observations, there are several species found that belong to the bivalve class, such as clams and other shelled biota, with 32 total individuals. Bivalves belong to the Mollusc class, which includes all shellfish that have a pair of shells (Bivalvia means two shells). The bivalve class can be seen in **Figure 5**.

Figure 3. Bivalve class

Holothuroidea (Sea Cucumber)

Sea cucumbers found at the observation site were 20 total individuals in several sandy and muddy substrates. The sea cucumbers can be seen in **Figure 6**.

Figure 4. Class Holothuroidea

Asteroidea (Starfish)

Based on the results at the observation site, there are four types of asteroidea (starfish). Starfish found in the observation area are mostly found around seagrass beds, and only a few individuals are found on sandy substrates. Starfish can be seen in **Figure 7**.

Figure 5. Class Asteroidea

Echinoidea (sea urchins)

Based on the observation, 37 individuals of 4 species of Echinoidea (sea urchins) were found at the observation site. Sea urchins are found on sandy substrates and seagrass beds. Sea urchins can be seen in **Figure 8**.

Figure 6. Class Echinoidea

Malacostraca

Malacostraca is a class of invertebrate animal members included in the phylum Arthropods, subphylum Crustacea. In the Malacostraca class, lobsters and crabs are found. Lobsters were found hiding behind dead coral rocks as well as crabs. Based on the results of observations, as many as nine individuals were found among the lobsters and crabs. Individuals from the malacostraca class were found to be the least affected compared to other megabenthos. Malacostrata can be seen in **Figure 9**.

Figure 9. Malacostraca class

Megabenthos Abundance

The Megabenthos abundance value obtained in the waters of Lonthoir Village shows the highest abundance value in the gastropod class with 0.072 ind/m^2, followed by the bivalve class with 0.017 ind/m^2, the echinodea class with 0.015 ind/m^2, and the holothuroidea class with 0.013 ind/m^2, while the lowest abundance is in the asteroidea and malacostraca classes, which are only 0.011 ind/m^2. The graph of abundance values can be seen in **Figure 10**.

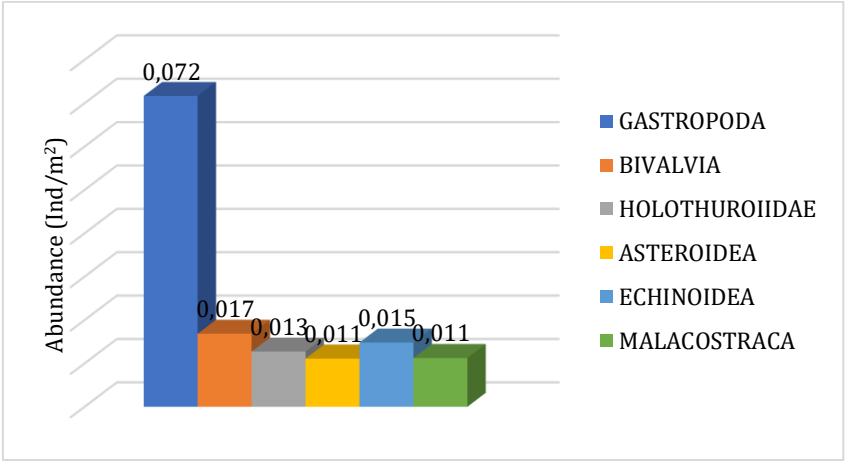

Figure 10. Megabenthos abundance values

Potential Abundance

The potential abundance of megabenthos at the observation site in Lonthoir village shows that the total value of megabenthos found is 1244 individuals from the classes of gastropods, bivalves, holothuroidea, asteroidea, echinodea, and malacostraca. The highest total potential value of megabenthos is owned by the gastropod class of 8600 ind, followed by the bivalve class of 2021 ind, the echinoidea class of 1776 ind, the holothuroidea class of 1527 ind, and the malacostraca class of 1350 ind. The lowest potential is owned by the asteroidea class, which is only 1333 ind. Potential abundance can be seen in **Figure 11**.

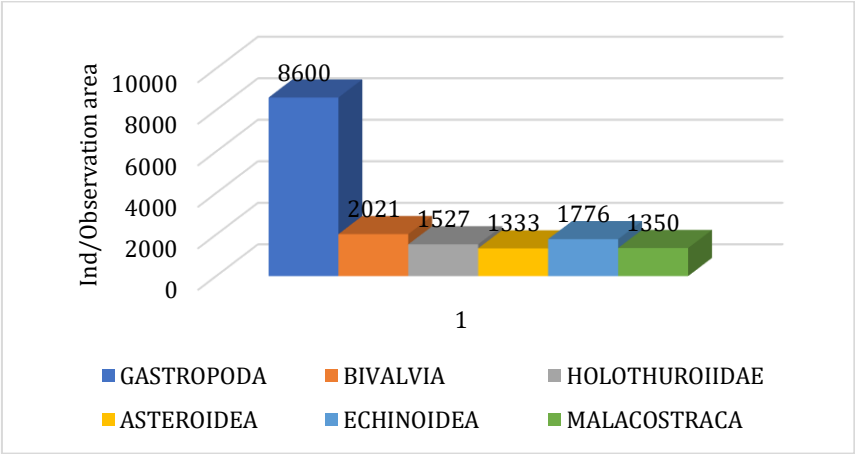

Figure 7. Potential abundance of Megabenthos

At the observation site, the substrate found varied: sandy, sandy mud, muddy sand, seagrass areas, and rubble. Gastropods were the most common aquatic mollusks found. Gastropod mollusc groups usually hide behind rocks or around aquatic plants, and some bury themselves in sand. The large number of gastropods found at the observation location is due to the sandy substrate. According to Pratiwi (2006), sandy habitats generally have more gastropods, including shellfish (pelecypoda) and snails (gastropods). There were also three types of sea cucumbers found in sand, mud, and seagrass substrates; this is in accordance with the statement of Darsono (2007) that holothuroidea are slow-moving benthic animals that live in sand, mud, coral reef environments, and seagrass beds that are often found in Indonesian waters. While the presence of bivalves at the observation site is not too great, only in a few quadrants, this is because some species of bivalves are used as food for local people to consume. The meat is consumed as a source of protein.

The waters of Lonthoir Village are intertidal areas consisting of various substrates and also include seagrass areas. Yusron (2006) and Lompo & Musfirah (2018) stated that sea urchins (Echinoidea) are members of the Echinoidermata group, whose presence is quite abundant in seagrass and seaweed zones. Sea urchins are able to adapt based on the substrate in the intertidal area. Most sea urchins live regularly on hard substrates, namely rocks or coral reefs, and only a small number inhabit sand and mud substrates. Clark and Rowe (1971) and Radjab (2014) stated that echinoderms can be found in all coastal waters, ranging from tidal areas to deep waters with a depth of 0.5 to 40 meters. The highest abundance value is from the gastropod class. This is because the substrate at the observation location is sandy and muddy. Cappenberg *et al.* (2006) stated that gastropods can occupy a variety of habitats and ecosystems, such as seagrass ecosystems, coral ecosystems, and mangrove ecosystems, and prefer sandy and muddy substrates.

Water Quality

Water quality parameters measured at the observation site include temperature, salinity, and pH. Measurements were made three times during sampling. Water quality is one of the important factors that affect the survival of organisms in the water. Water quality results can be seen in **Table 1**.

Table 1. Water quality results

Measurement	Temperature (˚C)	Salinity (˚/₀₀)	pH
I	29	28	7
II	29	29	7
III	29	28	7

The water quality measures measured in this study were temperature, salinity, and pH. Temperature information is one of the parameters that determine water quality because it can affect the metabolism and development of marine organisms (Emiyanti *et al.,* 2015). Temperature also has an important role for marine organisms because it can affect the dynamics or movement of seawater horizontally and vertically (Azizah & Wibisana, 2020). The results of temperature measurements in the waters of Lantohir Village are 29 °C.According to Nontji (2002), the surface water temperature in the archipelago waters generally ranges from 28 to 31 °C. Salinity is an oceanographic factor that greatly affects the osmoregulation process of marine biota, especially fish. The results of salinity measurements in Lantohir Village Waters ranged from 28 to 29 ˚/₀₀. According to Nontji (2002), in oceanic waters, salinity usually ranges from 28 to 35 ˚/₀₀. The low salinity value of the waters is likely because it is still influenced by land, such as flow water from rivers, and other factors such as rain. While the pH condition of Lantohir Village Waters is an average of 7, which indicates the condition of neutral waters, it can still help the development of megabenthos. This is in accordance with the statement of Simanjuntak (2012) that pH is one of the important parameters in monitoring the stability of waters.

CONCLUSION AND SUGGESTION

Based on the results of observations, it can be concluded that the megabenthos found at the observation site in the waters of Lonthoir village in the Banda Sea Marine Tourism Park area consists of six classes, including gastropods, bivalves, holothuroidea, asteroidea, echinodea, and malacostraca. The abundance value of megabenthos shows the highest abundance value of the gastropod class with 0.072 ind/m2, while the lowest abundance is in the asteroidea and malacostraca classes, which are only

0.011 ind/m2. The highest potential abundance of megabenthos is owned by the gastropod class with 8600 individuals, while the lowest potential is owned by the asteroidea class with only 1333 individuals. Better management of marine utilization activities is needed. Policy recommendations and more sustainable management measures can help maintain the sustainability of megabenthos populations.

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