COMPOSITION AND DENSITY OF MACRO MARINE DEBRIS IN THE MANGROVE AREA OF KERAMAT VILLAGE MANANGGU SUB-DISTRICT BOALEMO REGENCY

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Abstract

This study aims to determine the composition and density of macro marine debris in the mangrove area of Keramat Village, Mananggu Sub-District, Boalemo Regency. This research was carried out from August to September 2021. Data collection was carried out using a purposive sampling survey method using 3 line transects to collect macro-sized waste types. The study found that several types of waste in the mangrove area of Keramat Village consisted of plastic and non-plastic waste. Composition amounted to 99.14%, and non-plastic waste was 0.86%. The highest density was found in line transect 1 with a 6500 amount/ha.

Keywords: Mangrove Waste, Mangrove Pollution, Plastic Waste

INTRODUCTION

Coastal areas are known as areas that are rich in natural resources and have various potentials to be developed and utilized by humans to improve the economy of an area, including as a fishery area, marine tourism area, and as a means of supporting transportation. The beauty and abundance of Indonesia's marine resources are critically endangered due to marine debris pollution that change the beauty of coastal and marine areas [1]. Marine debris is a solid object produced by human activities, directly or indirectly, intentionally or unintentionally thrown into the sea [2].

The waste indirectly enters the sea waters through rivers, sewers, runoff water, wind or is accidentally lost, including items lost at sea (fishing equipment) and often found in coastal or coastal areas. Types of marine debris consist of plastic, cloth, foam, styrofoam, glass, ceramics, metal, paper and rubber. The impact caused by marine debris can threaten the mangrove ecosystem and the life of the biota found in the ecosystem [3].

Mangrove ecosystems have ecological and economic functions. The ecological function of the mangrove ecosystem is as a coastal protector from abrasion, flood control, a place for marine life to live for shelter, foraging for food, spawning and nurturing, as a source of food for existing species, anchoring toxic substances, carbon sinks, while the economic function of the ecosystem [4]. Mangrove is a mangrove ecosystem that can be used to produce medicinal ingredients, as a producer of foodstuffs such as fish, shrimp, crab shells, as well as a place for recreation and tourism [5]. These various activities are one of the causes of waste pollution, especially plastic waste that enters the mangrove area. In addition, marine debris is already in the sea, which can also enter the mangrove ecosystem due to the process of ups and downs. The potential for marine debris that enters the mangrove ecosystem is very high [6].

Various activities as above can cause various negative impacts that affect the food web, reduced fish productivity, affect the metabolism of marine plants such as mangroves and others. The presence of marine debris in the mangrove area can cause the soil layer to be impermeable to plant roots and impermeable to water so that water and mineral infiltration that can fertilize the soil is lost and the number of microorganisms in the soil will decrease [7].

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Gorontalo Province has mangrove forests with a total area of ± 12,832.04 hectares. One of the coastal areas of Gorontalo that has potential for mangrove resources is Boalemo Regency with a total area of ± 1,959.75 hectares. Mananggu Village, South Tabulo Village, and Keramat Village are villages located in Mananggu District, Boalemo Regency, which are mangrove distribution areas. In Mananggu District, the mangrove forest has an area of 1,005.48 ha with a criticality level of heavily damaged 839.42 ha, lightly damaged 91.36 ha and the condition of mangroves is still good at 74.70 ha. The damage based on the data above, it can be seen that the level of damage to mangroves is relatively high [8], [9]. The damage could have occurred due to the presence of garbage. This study aims to determine the composition and density of macro marine debris in the mangrove area of Keramat Village, Mananggu District, Boalemo Regency.

RESEARCH METHODS

Research time and place

This research was conducted in August-September 2021. The research location is in Boalemo District, Mananggu District, Kramat Village. The research location is presented in Figure 1:

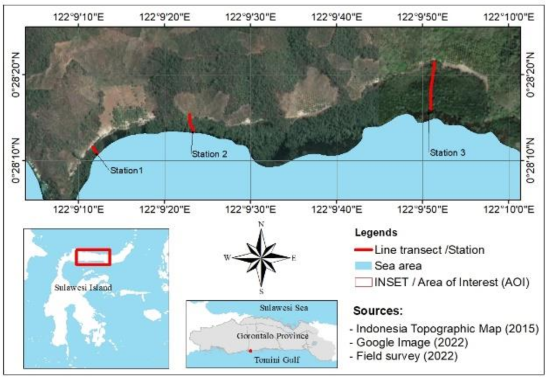

Figure 1. Research location map

Quadrant placement and sampling

The data collection method was carried out using a survey method at three stations determined by purposive sampling based on differences in the area of the mangrove patch. The object of research in the form of macro marine debris was collected at each station using a line transect with a quadrant of 10×10 meters with a distance of each quadrant 10 meters which were pulled straight from land to sea at each station. The following is an example of quadrant compression presented in Figure 2.

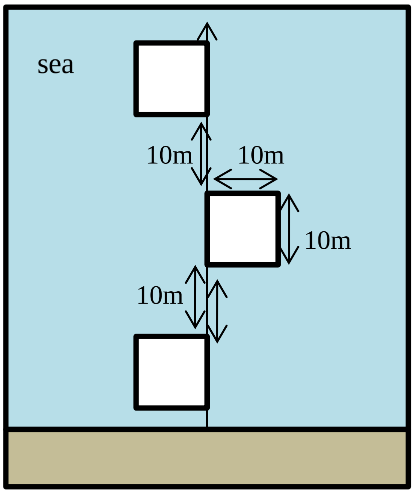

Figure 2. Quadrant placement sketch

Research object processing

The collected waste is cleaned before being identified and counted. Sorting is done based on the type of waste such as plastic, ceramic, aluminium and iron waste. After the waste is sorted by type, then the waste is weighed and calculated using a digital scale tool.

Measuring water quality current speed

Measurement of current velocity is carried out using a current kite twice at the time of the highest tide and the lowest low tide. The current kite is allowed to be carried by the current until the rope is straight, after which it records a travel time of 1.5 meters. Current velocity is also taken by using a current kite on each transect line.

$$V = s/t$$

Keterangan:

V = Current speed (m/sec)

s = Stream kite distance (m)

t = Time spent (second)

Data analysis

The data on the distribution of waste types observed in this study were the composition of the type and density, and the two variables could be calculated by following the instructions or formulas set by [10]:

$$\text{Composition of Waste Type (P)} = \frac{si}{N} x100\%$$

$$\text{Waste Type Density (KJS)} = \frac{si}{A}$$

Where, P is the composition of the types of waste found in the mangrove area, KJS is the density of each type of waste found, si is the number of types of waste to i, N is the total number of all types of waste found, and A is the area where the marine debris sample is exposed.

RESULTS AND DISCUSSION

Composition of types of marine debris

The composition of each type of marine debris in each line transect based on the waste code is shown in Figure 3.

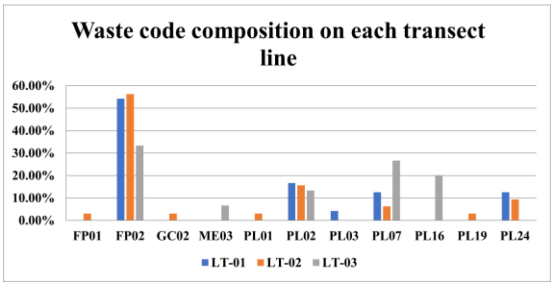

Figure 3. Composition based on waste code on each line transect.

From Figure 3, it can be seen that the data obtained show differences in the composition of waste based on the waste code on each line transect. The highest waste composition based on waste code is dominated by FP02 waste with different waste distribution on the three line transects, followed by PL02, PL07, PL16 and PL24. These four codes have a percentage value of more than 10%. Meanwhile, other waste codes are distributed unevenly on each line transect, such as waste codes FP01, GC02, ME03, PL01, PL03, and PL19 with a presentation value of less than 10%.

The type composition of each waste code in each line transect is shown in Figure 4.

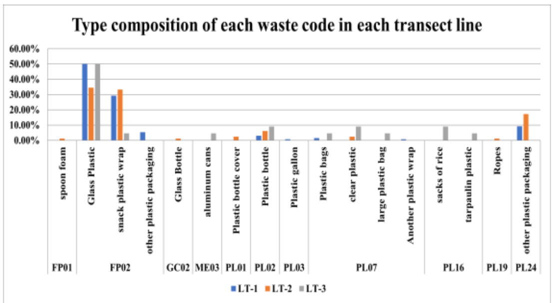

Figure 4. Type composition of each waste code in each line transect

Figure 4, shows that the overall composition consists of glass plastic, snack plastic wrap, other plastic wraps, plastic bottles, glass bottles, sponge foam, rice sacks, plastic tarpaulins, aluminium cans and ropes. The most dominant waste is the inorganic type of plastic glass, code FP02 with a presentation value of ±50%, the distribution of which is found in LT-1 and LT-3, while for plastic waste, snack packaging, code FP02, the highest waste distribution is in LT-02 with a presentation valuemore than 30%. Plastic-type waste is more dominant than other types of waste, and certain factors cause this. This plastic is the dominant marine waste because plastic is a pollutant material globally distributed in all waters due to its durable, lightweight and easy-to-float nature. Plastic-type waste is more dominant than other types of waste, and certain factors cause this. This plastic is the dominant marine waste because plastic is a pollutant material globally distributed in all waters due to its durable, lightweight and easy-to-float nature. This causes the mobility of plastic waste both from land to sea and from sea to land easier than other types of waste [11].

Marine garbage density

The average solid waste density (amount/ha) of all locations is shown in Figure 5.

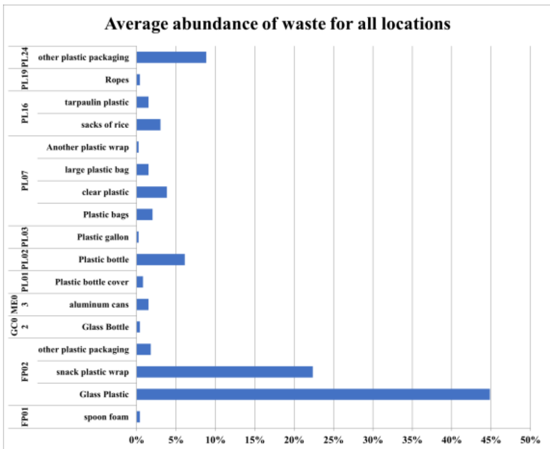

Figure 5. Average solid waste density (amount/ha) across all locations.

Based on the calculation of the waste density at all locations (amounts/ha) in the mangrove area, the data in the form of a graph is presented in Figure 8. These results show that glass plastic coded FP02 got the highest density value of 1341.11 amount /ha followed by plastic snack wrap code FP02 with a value of 860.56 amount/ha, other plastic wrap code PL24 316.67 amount /ha, other plastic wrap code FP02 116.67 amount /ha, plastic bottle code PL02 112.78 amount/ha.

Plastic is the most abundant inorganic waste found in the coastal mangrove ecosystem of Talawaan Bajo (adjacent to residential areas) which is 162, with an average of 10.80 amount/ha [12]. The same conditions were also reported in studies with research sites on the Tongkaina and Talawaan Bajo Beaches [13]. Where the density of plastic waste is 481 with an average of 8.014 amount/ha. In addition, research on the Tumpaan beach in Tateli Village also found that the percentage of solid waste found in the mangrove ecosystem of Lesah Village was 161 items with an average value of 17.89 amount/ha, followed by the highest plastic at 228 with an average of 76 [14]. Some of these studies show that this type of plastic waste has a higher distribution and presence than other types. The National Oceanic and Atmospheric Administration [15] reports that plastic waste is found in all waters and is a concern in the world.

The comparison pattern of the amount of waste (amount) and its density (amount/ha) is shown in Figure 6.

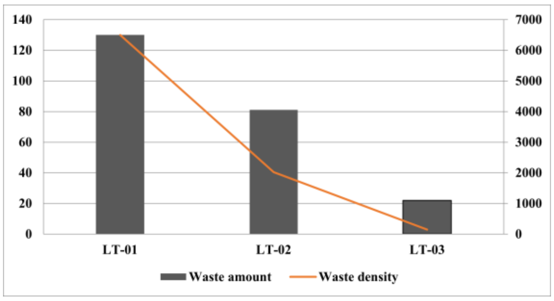

Figure 6. Comparison pattern of the amount of waste (amount) and density (amount/ha).

Based on the graph of the comparison pattern of the amount of waste (amount) and density (amount/ha) in Figure 6, it shows the highest amount and density on line transect 1 with a total of 130 waste with a density of 6500 amount/ha found with different types of waste. It is suspected that the mangrove stands are pretty sparse, and the number of plots on the line 1 transect is less than the line 2 and line 3 transects, so a lot of waste is exposed on the line transect 1.

Velocity

Current velocity data from each line transect at high and low tide (m/s), are presented in Table 2.

Line transek	High tide (m/s	Low tide (m/s)
1	0.021	0.014
2	0.025	0.013
3	0.022	0.014

Based on Table 2 shows there is no significant comparison of the results of the current velocity calculation. At high tide, the current rate is relatively fast on line transect 2 with an average value of approximately 0.025 m/s; at low tide, the speed is relatively fast on line transect 1 with an average value of 0.0143 m/s.

The same condition is also found in the mangrove ecosystem of Sungai RaMengkapwa Village in Riau Province, where the current velocity at high tide is 0.35 m/s and at low tide is 0.19 m/s. This is due to differences in the geographical conditions of the two mangrove ecosystems, causing the current direction to be parallel to the coastline due to the presence of an island in front of the beach, which causes an increase in current velocity due to narrowing [6].

Community activities in the Keramat Village, Mananggu District

Garbage in coastal areas is one of the most complex problems found in an area close to the beach or coast [16], [17]. Based on the type of waste found during the study, it showed that the dominant type of waste was derived from anthropogenic activities on the mainland, with the types of waste found such as glass plastic, plastic snack wrap, other plastic wrap and glass bottles. Plastic waste is the dominant marine waste because plastic is a pollutant globally distributed in all waters due to its durable nature and ease of floating [18]. The types of marine waste obtained at the research site were plastic waste, clothing, styrofoam, rubber, metal, wood, rope and glass. The results showed that plastic was found in the most significant number followed by glass and metal [19].

As a whole, based on the categories and types of waste identified in the field, it is suspected from monitoring activities around the mangrove area that there are three ctivities such as residential activities, plantation activities and fishing activities that have the potential to donate waste to the mangrove area. Marine debris comes from two sources: garbage disposed of from household activities and waste from the land through rivers [2]. Plastic waste and household appliances are the most common types of waste found in everyday life where the waste is difficult to degrade in nature. This waste is the most significant contributor to waste and causes damage to the balance of nature [20].

CONCLUSION

The types of waste found consisted of glass plastic waste, plastic bottles, plastic snack wrap, plastic bottle caps, clear plastic, plastic crackle bags, gallon plastic, other plastic wraps, sponge foam, glass bottles, aluminium cans and ropes, withthe highest composition value on line transect 2 with a comprehensive presentation of 45.07% and the lowest presentation on line transect 1 with a comprehensive presentation of 21.13%. The density of waste found varied, with the highest value being the type of glass plastic waste code FP02 with a density value of 1341.11 amount/ha, while based on the comparison pattern of the amount of waste (amount) and density (amount/ha) the highest value was on line transect 1 with a total waste 130 amount with a density of 6500 amount/ha.

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