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IDENTIFICATION OF MARINE DEBRIS IN THE BEACH OF KODINGARENG LOMPO ISLAND, MAKASSAR CITY

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ABSTRACT

Marine debris may become a serious threat because of the increasing in its quantity every day, especially in marine areas around the world. The purpose of this study was to identify the amount, weight, and type of marine debris and to determine the abundance based on the amount and weight present in the coastal area on Kodingareng Lompo Island, Makassar City. This research was carried out during the ebb of the east monsoon period, i.e., in June 2021. The most common types of waste found in the three observation locations were plastic waste. The abundance of waste based on the amount is most commonly found at station 2, which is located near a residential area, so that most of the waste at the station is household waste. Meanwhile, the greatest abundance of weight was also observed at station 3 which has the widest intertidal area and the majority of the waste there came from a type of cloth which was larger than other wastes. Station 3 also has a faster flow rate than the other stations. The existing waste facilities on Kodingareng Lompo Island in the form of garbage motorbikes and Garbage Banks in general have not been effective. Several factors that can also worsen, i.e., lack of understanding, low awareness, and laziness of the community in managing their waste, people prefer to throw garbage into the sea, so the accumulation of marine waste in the coastal area of Kodingareng Lompo Island may have a negative impact in various fields of life.

Keywords: Marine debris, Identification, garbage facility, Kodingareng Lompo Island

INTRODUCTION

The area around the pelagic and coastal areas is important for biological productivity and geochemical cycles, however, with increasing human activities in coastal areas, it may damage and endanger marine sustainability, one of which is by large-scale waste disposal around water areas (Hetherington et al., 2005). The results of research by Jambeck et al., (2015) showed that the world's coastal areas are polluted by garbage and Indonesia is the second largest contributor to marine debris in the world after China, with an estimated annual volume of 480-129 tons.

NOAA (2013) argued that marine debris debris is a solid object that is directly or indirectly, intentional or unintentional, and is simply thrown away and left alone in the marine environment. The existence of marine debris will certainly have an impact on human health and other organisms in the marine environment, especially for humans who eat marine products contaminated with marine debris. Marine debris can be transported by ocean currents and winds from one place to another and can even travel far distances from its source.

Kodingareng consists of Kodingareng Keke and Kodingareng Lompo islands. Kodingareng Keke Island is an uninhabited island, while Kodingareng Lompo Island is a densely populated island with a population of 4,526 people, consisting of 2,276 men, 2,250 women, 1,081 families and an area of 14 hectares. This island has beautiful white sand, so the government has decided that this area will become a popular tourist destination for foreign tourists (Thaha et al., 2020). The relatively dense population on Kodingareng Lompo Island may have a direct impact on the amount of waste produced every day, especially organic waste from the household activities (Gani & Ikhsan, 2020). Local residents have also carried out a sorting process in advance, where organic waste is converted into compost and inorganic waste is collected through the Garbage Bank. However, since the establishment of the garbage bank building in Kodingareng Lompo area, this place has not operated properly due to certain reasons, so residents have returned to throwing their garbage in the sea around the settlement which has resulted in a huge pile of garbage.

Therefore, considering the potential for coastal areas on Kodingareng Lompo Island which can be a contributor to marine debris and the sustainability of waste infrastructure in the form of a Garbage Bank on the island, it is necessary to identify the types, amounts, sizes and masses of waste. which is located in the coastal area of Kodingareng Lompo Island, Makassar City.

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MATERIALS AND METHODS

Time and Location

This research was conducted in April – June 2021, located in Kodingareng Lompo, Sangkarrang District, Makassar City, South Sulawesi (Figure 1).

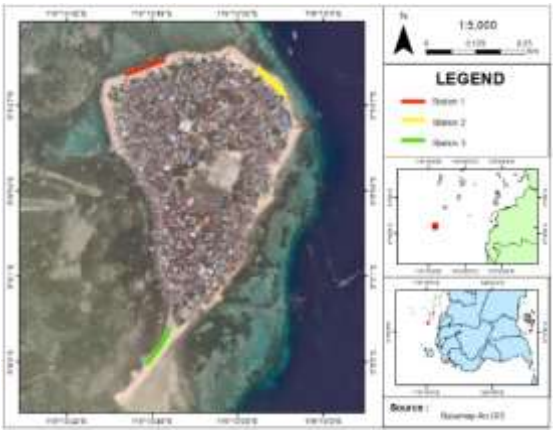

Figure 1. Map of the Study LocationSampling Method

Marine Debris Data Collection

Marine debris data collection is carried out at low tide in the intertidal (coastal) area. Sampling of marine debris was carried out in areas above and below the highest tide. In the area above the highest tide, garbage collection was carried out from the highest tide line to the backshore and the area under the highest tide from the highest tide line to the lowest low tide line (Figure 2).

The sampling area has a coastline length of 100 m perpendicular to the coastline which is divided into 20 lanes so that each lane has a length of 5 m. Number each row (left to right) from 1 to 20. Next, choose 4 of them at random from the 20 rows. Take the coordinates of each lane that has been selected. If the beach width is <6 m, then the coordinates are taken in the middle of the transect, while for the beach width >6 m, the coordinates are taken at the back of the shoreline and near the lowest low tide area (Lippiatt et al., 2013).

The size of the waste taken is having a cross-sectional area of >1 m (mega) and 2.5 cm – 1 m (macro). Waste samples that have been collected in each plot are then sorted by type and size (mega/macro). For mega-sized waste, it must be documented before the type identification process is carried out. As for macro-sized trash, the trash is first cleaned and then put into the trash bag/garbage bag. The waste is then weighed according to its type in a shady place and there is no wind disturbance at the time of weighing, after which it is then identified. The classification of waste types is carried out based on a waste classification system for all waste surveys collected or identified in situ (Cheshire et al., 2009)

Figure 2. Sampling Illustration of Marine Debrisn (Source: Lippiatt *et al*., 2013).

Infrastructure Data Collection

According to Purnomo & Palupi (2016) a questionnaire is a method of collecting data by presenting a series of statements or questions that have been previously written to respond to the user requests. The questionnaire in this study was addressed to the people of Kodingareng Lompo Island which will be used to find out information regarding the existing waste infrastructure on Kodingareng Lompo Island, Makassar City.

Data Analysis

Abundance of Waste

Abundance of waste (K) calculated from the amount and weight of waste per type per m² (Lippiatt et al., 2013) :

$$\text{Abundance (K)} = \frac{number/weight tumlah/berat}{area(m^2)}$$

Note
K= total abundance of waste in numbers (item/m2) in weight (g/m2)
Number/weight= total amount (item) /weight(g) of identified garbage at each lane
Area= the number of area sizes per lane from 4 lanes chosen randomly at each station

The difference in mean abundance at the three stations was analyzed using the One-Way AOVA Test.

RESULTS AND DISCUSSION

Abundance of Marine Debris

Mega Debris

Mega-debris is waste that has a length of more than 1 meter which is commonly found in open waters. Types of waste that fall into this category include

fishing nets, ropes, clothing and others (Lippiatt et al., 2013).

Based on the results of the study, there were several mega-sized garbage found at each station. Plastic waste is the most mega-sized waste found at each station. As in Station 1, there were 3 mega wastes, dominantly in the form of sacks. Mega waste in station 1 is in the form of sacks which are assumed to be mostly garbage originating from residents around the observation station. Meanwhile, for Station 2, 2 mega wastes were found, dominantly in the form of nets. As it is known that the people who live in station 2 are the majority of fishermen and there are also those who work as seaweed farmers. and at Station 3 found 1 mega waste in the form of a plastic carpet which is assumed to be garbage originating from the high seas and then at low tide it accumulates and settles in the sediment. This is also supported by the fact that tarpaulin waste, which is plastic waste, already has an incomplete shape, faded color and has been contaminated with other materials.

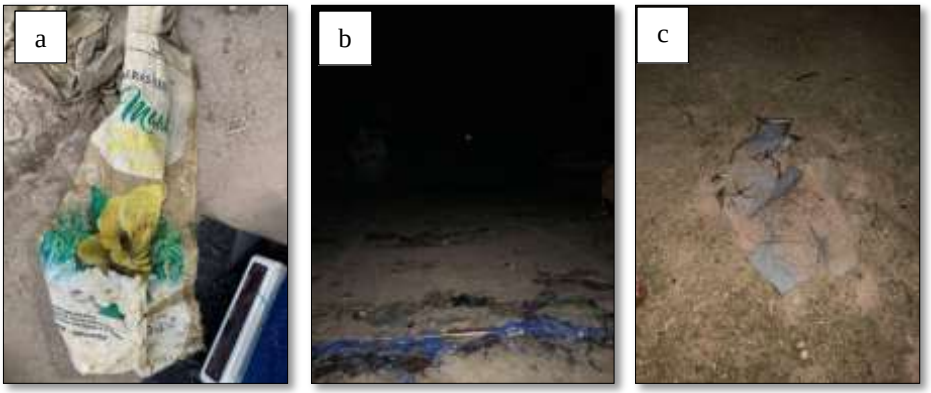

Figure 3. Mega debris at Station 1 (a), Station 2 (b), and Station 3 (c)

Macro Debris

The total macro waste found at the three observation stations amounted to 903 items with a weight of 23,257 grams and an average abundance of 1.15 items/m2 and an average abundance of weight of 24.82 gr/m2. This total macro waste is more and heavier than that found on Teluk Laikang Beach, Takalar Regency, which is 429 items weighing 2191.3 grams (Yahya, 2020). This is also influenced by human activities as it is known that Kodingareng Lompo is a densely populated island with an area of up to 14 hectares as well as the position of the island in the Spermonde area adjacent to Makassar City. The most dominant category of macro waste comes from the type of plastic waste with a total of 611 items and a weight of 7546 grams (Figure 5). Plastic foam type waste is the second largest macro waste in terms of the amount that dominates after plastic waste which has a total of 95 items. Meanwhile, in terms of weight, fabric macro waste is the heaviest waste after plastic waste with a total of 5945 grams. Furthermore, for other types of macro waste, the weight is below 4000 grams and the number is <50items

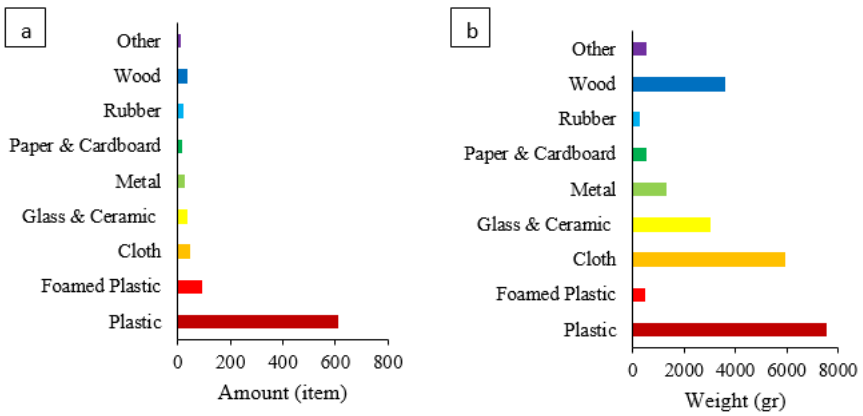

Figure 4. Macro debris category in (a) total and (b) weigh

Marine debris that dominates at each station comes from plastic waste as found at station 1 of 229 items weighing 1875 grams, station 2 of 181 items weighing 2016 grams and station 3 of 201 items weighing 3655 grams. Then followed by plastic foam waste with a total of 95 items weighing 491

grams. Then the type of fabric with a total of 39 items and a weight of 46 items and a weight of 5945 grams. Next, followed by glass and ceramic waste, wood, metal, paper and cardboard for other types of macro waste weighing under 4000 grams and totaling <50 items. In line with what has been reported by NOAA (2016) regarding the findings of marine debris found in all waters around the world, plastic waste is the most common type and is at risk of affecting the oceans and the organisms in them.

Based on the number of marine debris found at the research site, station 1 is the location where the most marine debris was found. Most of the marine debris in station 1 comes from household waste dumped by the local community into the sea. The waste can also come from garbage that accumulates as a result of the movement of water (currents) at high and low tide and then settles on the coast. In addition, the continuous input of waste from land will also increase the accumulation and burden on the coast in accommodating waste. Station 2 is a coastal area that is close to residential areas, so most of the waste found also comes from household waste. The community around station 2 is the majority of fishermen, so marine debris is also commonly found, such as plastic tape and cooling insulation corks and fishing nets. Station 3 is a swell area with land jutting into the sea and far from residential areas so that the garbage found in this area is garbage that comes from the high seas and accumulates and some settles in the sediment, which can be seen from the shape and color indicating that the garbage has been around for a long time. on the shoreline. The marine debris found, especially plastic waste, has an incomplete shape, faded color and has been contaminated with other materials.The average abundance of waste based on the amount and weight at each station as well as the abundance of each type can be seen in Figure 6. Based on the One-Way ANOVA test regarding the abundance of waste by number, there is no significant difference in the average abundance of marine debris between the three station (p= 0.252). Even so, the average abundance of waste was seen to be the highest at station 2 with a value of 1.59 items/m2. Then station 1 with an abundance of 1.27 items/m2 and station 3 with an abundance of 0.61 items/m2. The average abundance of waste based on the amount in the coastal area of Kodingareng Lompo Island is 1.15 items/m2 which is lower than the results of research conducted by Lae-Lae Island which is 1.82 items/m2 by Ningsih et al., (2020). The high abundance of waste on Lae-Lae Island is possible because the area is closest to Makassar City so that waste from the city can be carried to the area with the help of currents. (Ningsih et al., 2020).

The abundance in station 2 is the largest among other stations due to the large amount and type of waste in the sampling plot and also because the waste at station 2 comes from household waste which is assumed to have a variety of types of waste. This is in line with the statement submitted by Djaguna et al., (2019) which states that the activities of local residents or local tourist attractions have a significant impact on the amount of waste on beaches such as those on Tongkaina Beach and Talawaan Bajo, North Sulawesi Province. The high average abundance in station 2 can also be influenced by the sampling location area which has a smaller area than other stations.

Based on the One-Way ANOVA test on the abundance of waste by weight, there was no significant difference in the mean abundance of marine debris between the three stations (p = 0.679). However, it can be seen at station 3 that the average abundance of the largest weight with a value of 28.40 gr/m2.

The greatest abundance of weight was at station 3 due to the large amount of cloth type waste which had a larger size and heavier than other wastes that had accumulated in the sediments at the sampling plot location. Then station 1 with an average abundance of 24.94 gr/m2 and station 2 with an average abundance of 84.57 gr/m2.

The average weight abundance in the coastal area of Kodingareng Lompo Island, which is 21.14 gr/m2, is also lower than the abundance of solid waste on Lae-Lae Island, which is 21.87 gr/m2. The heaviest waste on Lae-Lae Island comes from the type of plastic which is assumed to come mostly from the mainland, Makassar City, where plastic waste is a type of garbage that easily floats and is then carried away by water currents and stirred by waves, making it very possible to make waste this is the type of waste with the most accumulation in the waters (Ningsih et al., 2020).

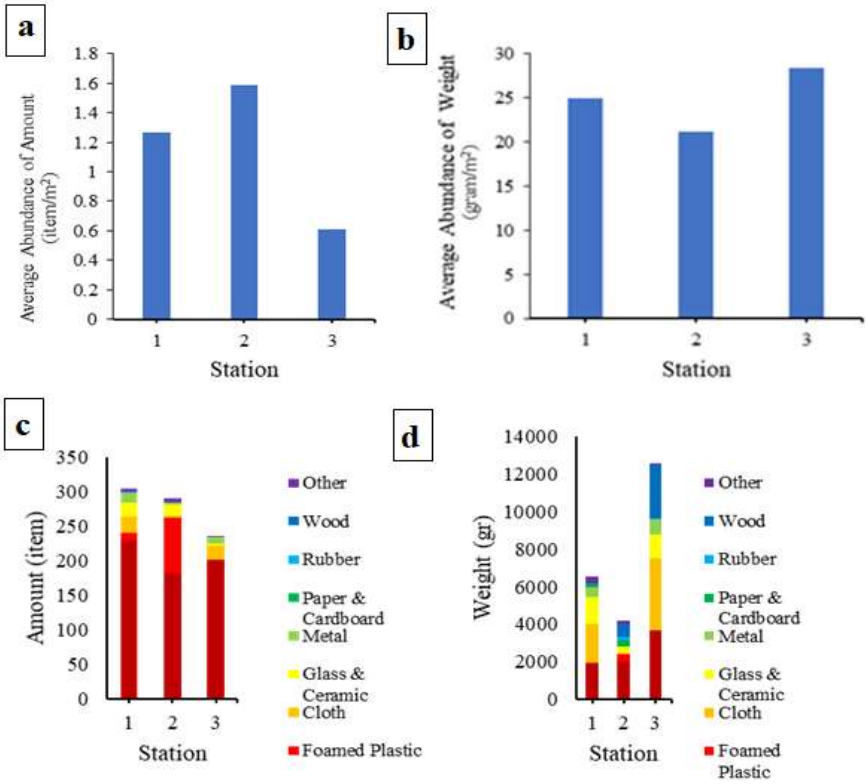

Figure 5. Average abundance of marine debris by amount (a) and average abundance of marine debris by weight (b) types of marine debris by total amount (c) and types of marine debris by total weight (d) at each station

Infrastructure Data

Based on the questionnaire data spreaded, it was found that the people of Kodingareng Lompo Island, especially on the east side of the island, mostly had garbage dumps around their homes. However, people living in coastal areas usually do not have a garbage disposal area near their residence and prefer to throw their garbage directly into the sea.

Kodingareng Lompo Island has waste facilities such as garbage motorbikes which according to local residents are operated by workers who have been employed by the local government, totaling ± 6 people to go around every morning by picking up trash that has been piled up in front of residents' houses. After that, the garbage that has been collected in the garbage motorbike is then dumped into a TPS in the middle of the island and thenburned. However, the existence of waste facilities such as garbage motorbikes is not felt by all island residents, especially in the northern part of the island which is far from the village location. Therefore, people who do not get this facility choose to throw garbage into the sea as an option.

Kodingareng Lompo Island also has a Garbage Bank building. However, since it was officially established, this Waste Bank has never been used and until now this building is filled with building materials. According to a report by Thaha et al., (2020) that the local government established a waste bank called "Kabajikanta Kodingareng." in 2018 to overcome the problem of garbage scattered on the beach. However, due to low awareness, lack of understanding, and laziness of the community in managing waste, the waste bank was converted into a cement storage area by the residents.

Garbage thrown into the sea can also have a negative impact on life. For example, it has a huge impact on the economy, especially tourism. This is caused by humans so that it can reduce the economic benefits due to the garbage found on the beach and provide an unfavorable view. In addition, marine debris attached to the body of organisms such as fish can affect the selling price of commercial fish to the detriment of fishermen (NOAA, 2016)

CONCLUSION

The most common type of waste found at the research site was plastic waste and was found in densely populated stations, therefore, it was assumed that it came from household waste. Heavy waste is mostly found in intertidal areas which have relatively higher current velocity characteristics

than other locations. The existing waste facilities on Kodingareng Lompo Island in the form of garbage motorbikes and Garbage Banks in general have not been effective. Several factors that can also worsen are the lack of understanding and low awareness of the community in disposing of waste in its place and managing waste so that garbage accumulates in the intertidal coastal area of Kodingareng Lompo Island which has a negative impact on various fields of life

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