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TYPES AND ABUNDANCE OF MARINE DEBRIS IN THE NORTH COASTAL REGION OF BENGKALIS ISLAND, RIAU

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ABSTRACT

Marine debris is a threat that is currently the biggest problem in the world due to the impact that trash can have on the survival of aquatic biota. This research was conducted to analyze the type and abundance and differences in the abundance of marine debris found in the northern coastal area of Bengkalis Island, Riau Province, which is assumed to be a location with the potential for accumulation of waste that could threaten the life of biota in the waters. The method used is the survey method, namely collecting data, documentation, and observation. Waste collection is carried out at three stations by determining the research location along 100 m and dividing each 20 m so there are five transects. Then, on each transect, a plot with a size of 5x5 m was made. Then, collect every type of waste contained in the plot. The results showed that plastic waste was the most common type (62%), while wood was the least found (1%). The abundance of waste on weekends is higher than on weekdays. The difference in the abundance of waste between stations was not significantly different, while the difference between the abundance of time (weekdays and weekends) was significantly different.

Keywords: Bengkalis, Marine Debris, Plastic, Pollution

1. INTRODUCTION

Garbage is the biggest threat of pollution, which is an environmental problem in the world that cannot currently be resolved. Waste producers are waste from people who live and carry out activities in coastal areas. Waste is sent from upper land areas that flow through rivers or other waterways because it is carried by rainwater or wind into the sea. Current movements carry it to the beach or the bottom of the waters or remain floating. Furthermore, from now on, it is referred to as ocean trash[1-2].

It is feared that the large number of human activities will result in piles of rubbish in residential areas. As the population increases in these areas, waste in coastal areas is one of the complex problems faced by regions that are right or close to beaches or river banks[3].

Various kinds of problems arise due to marine debris, such as reducing the beauty of coastal areas, causing numerous diseases, affecting the food web, and reducing the productivity of fish caught so if this happens, it will have an impact on the food chain, economy, and public health[4]. This was also proven in previous research by Aditya et al.[5], which explained that the problems faced in coastal regions were the amount of waste produced from tourism activities in the form of tourist visits and surrounding environmental factors that influenced the production of marine waste in the area. Research conducted in West Sumatra found that the large types and amounts of waste produced from anthropogenic activities directly threaten marine habitats, human health, and navigation safety, resulting in severe socio-economic losses.

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Currently, marine waste is attractive to research because it can have a dangerous impact on the survival of organisms in the sea. In addition, marine debris can spread disease to humans. As is the case in Bengkalis Regency, many activities around the waters, such as tourist attractions, settlements, ports, and shipping in the Malacca Strait, contribute to marine waste in the area.

Information regarding the existing condition of the marine waste problem in Bengkalis Regency, including the type, quantity, and weight of waste in the area, must be well documented. Seeing the various kinds of issues that occur, it is essential to carry out this research to look at the distribution and abundance of marine waste in the northern coastal area of Bengkalis Island as a location with the potential for large amounts of garbage from tourism activities and ship traffic in the Malacca Strait so that it can become a source of threat to contribute to life biota in marine waters.

2. RESEARCH METHOD

Time and Place

This research was conducted in March 2022 in the northern coastal area of Bengkalis Island, Riau Province (Figure 1). Data management and analysis were conducted at the Marine Chemistry Laboratory, Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau.

Method

The method used in this research is a survey method, namely carrying out data collection, documentation and direct observation in the field. The method used for data processing is a descriptive statistical analysis method, namely, analysis that explains data, conditions, symptoms or problems.

Procedure

The sampling location consists of 3 (three) stations. Station I is in the Pantai Village area of Angkang Village, a community residential area. Station II is in the Selat Baru Village area, a tourist area and culinary spot near the beach. Station III is on the Liong River, a port where fishing boats anchor. Furthermore, sampling was conducted on weekdays (Wednesday and Thursday) and weekends (Saturday and Sunday).

Sampling was carried out when sea water was receding. The data collection process was carried out by determining a research area of 100 m^6. Then, divide the area into 20 m lengths each so that there are five transects. Next, a plot of 5x5 m 2 was made on each transect (Figure 2). Then, all the rubbish in the plot is taken and put into sacks. Next, characterize the type of waste. After characterizing the type of waste, the amount is calculated, and then the trash is weighed using a scale. This research also measured water quality parameters, including current speed, wave height, and wave period.

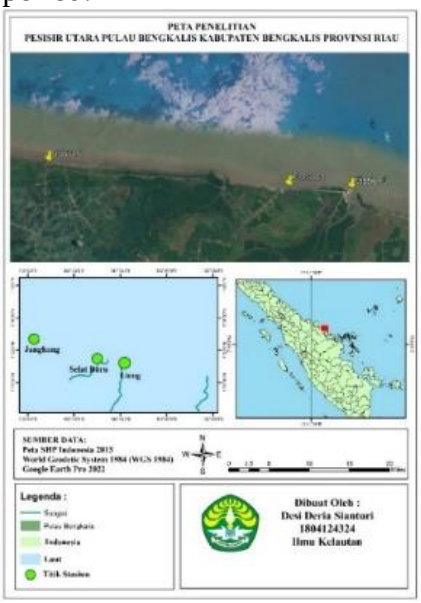

Figure 1. Research sites

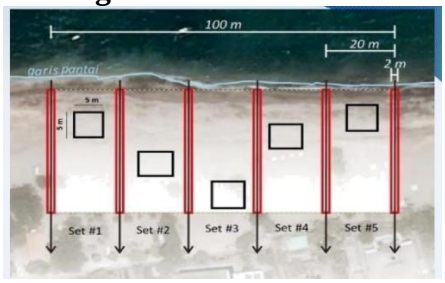

Figure 2. Marine waste collection in the field

Waste that has been weighed then enters the stage of calculating the amount of waste abundance (K) using the formula:

$$\text{Abundance (K)} = \frac{\text{amount of waste per type}}{\text{length (m) x Width(m)}}$$

Flow Speed (V) = s/t

Information:
V = Current speed (m/sec)
s = distance by current meter (m)
t = time used (seconds)

Wave Height (H) = Wave crest – valley
Wave period (T) = t/n

Information:
H = Wave height (m)
T = Wave period (s)
t = Observation time (s)
n = Number of waves

Data Analysis

The results of processing the data obtained were then analyzed using One Way Anova to see differences in waste abundance between stations and a t-test to see whether there was a difference in the quantity of waste on weekdays and weekends. Next, the data obtained is discussed descriptively by referring to existing sources and references.

3. RESULT AND DISCUSSION

Water Quality Parameters

Based on the water quality parameter, it shows the slow current category (Table 1). The class is by the grouping determined by Mason[7] that the values for water movement are swift (>1 m/sec), fast (0.5 – 1 m/sec), moderate (0.25 – 0 .5 m/sec), slow (0.01 – 0.25 m/sec) and very slow (<0.01 ms). Meanwhile, the data obtained for wave height was around 0.13 m, and the wave period was about 2.40 seconds.

Table 1. Water quality

Parameter	Unit	Station I	Station II	Station III	Average
Speed Current	m/s	0.02	0.02	0.10	0.05
Tall Wave	m	0.1	0.1	0.2	0.13
Period Wave	second	2,3	2,3	2.6	2.40

Table 2. Types and amount of marine debris found at each research station

Type	Amount Waste (units)							
	Weekdays			Amount	Weekends			Amount
	I	II	III		I	II	III	
Plastic	103	165	132	400	362	234	298	894
Metal /metal	4	33	5	42	35	20	20	75
Glass	16	8	1	25	5	13	35	53
Rubber	8	7	2	17	9	9	7	25
Wood	2	4	-	6	5	2	3	10
Other	62	47	47	156	110	112	143	365
Total	195	264	187	646	526	390	506	1,422

Note: I: Panjang Beach; II: Selat Baru Beach; III: Liong River

Composition of Types, Amount and Weight of Marine Debris

The types of waste collected at the research location consist of several general categories based on NOAA[8]: plastic, metal, glass, rubber, wood, and others. Among the available types of waste, these are further differentiated based on the categories found at the research location (Table 2).

Based on the research results conducted at three-weekday stations, the highest waste producer is Selat Baru Beach, which has 264 units. The second-highest waste producer is Panjang Beach, with a

total of 195 units, while the lowest is Liong River, with 187 units. Meanwhile, on weekends, Panjang Beach is the highest producer of waste, with a total of 526 units; the second highest producer of waste is Liong River, with a total of 506 units; and the lowest producer is Selat Baru Beach, with a total of 390 units.

The total weight of marine waste that has been collected is 56,535 kg. The whole waste was obtained from the total weight accumulation from three stations during weekdays and weekends. It can be seen in Table 3 that on weekdays, the highest weight of rubbish is at Selat Baru Beach at 9,325 kg. This is due to the large number of visitors who come, causing the importance of marine garbage to increase. The second-highest weight of rubbish came from Panjang Beach at 4,755 kg. Then, the weight of the lowest amount of marine waste was found in the Liong River, namely 3,347 kg.

Table 3. Weight of marine debris found at each research station

Type	Heavy garbage (g)							
	Weekdays			Amount	Weekends			Amount
	I	II	III		I	II	III	
Plastic	1,085	2,419	1,785	5,289	9,714	6,349	7,944	24,007
Metal /metal	123	323	16	462	2,357	664	424	3,445
Glass	1,590	1,675	142	3,407	1,096	2,149	1,360	4,605
Rubber	1,230	1,124	320	2,674	1,170	1,179	927	3,276
Wood	283	2,500	0	2,783	1,106	235	621	1,962
Other	444	1,284	1,084	2,812	369	456	988	1,813
Total	4,755	9,325	3,347	17,427	15,812	11,032	12,264	39.108

Note: I: Panjang Beach; II: Selat Baru Beach; III: Liong River

Meanwhile, on weekends, Jangkang Village is the location that produces the highest weight of marine waste, namely 15,812 kg. This is caused by fishing boats that stop on the beach and carelessly throw away rubbish such as nets and net buoys. The second-highest weight of waste came from the Liong River, which produced 12,264 kg of marine debris. Then, the weight of marine litter with the lowest amount was found at Selat Baru Beach, which had a waste weight of 11,032 kg.

Based on the data in Table 3, plastic waste is the type of marine waste most often found, amounting to 1,294 units or 62% of all types of waste. This is followed by types of waste that cannot be classified (521 units or 25%), metal/metal (117 units or 6%), glass (78 units or 4%), rubber (42 units or 2%), and wood-type waste. The least found was 16 units, or equal to 1%. The results of research conducted by various studies show that plastic is the type of marine waste that is found in the highest quantities in multiple regions, such as the Seribu Islands, Jakarta[9], Tongkaina Beach and Talawaan Bajo Beach, North Sulawesi[10], Air Manis Beach, Nirwana Beach and Beach Carolina, West Sumatra[5] and many others. The amount of marine debris in percentage form can be seen in Figure 3.

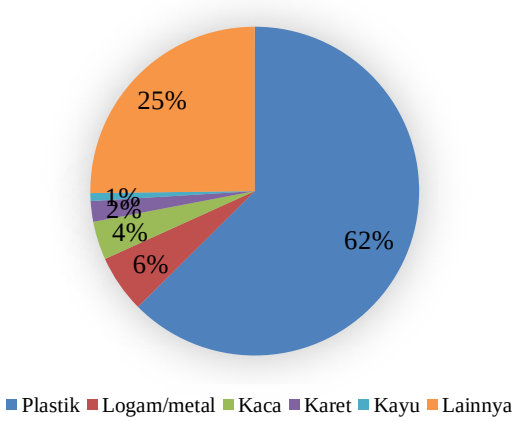

Figure 3. Composition of marine debris on the north coast of Bengkalis Island

A large amount of plastic-type marine waste is thought to be because plastic waste is a type of waste that effortlessly floats and is carried by water currents and is also swayed by waves, so it is possible to make this type of waste the type of waste with the most significant accumulation in waters. According to NOAA[8], the research results on marine waste found in all seas show that plastic waste is the most abundant and commonly found type and has the most significant risk of impacting organisms in the waters.

Abundance of Marine Debris

The abundance of marine debris based on collection time refers to Appendix 4, and the abundance of marine debris can be seen in Figure 4.

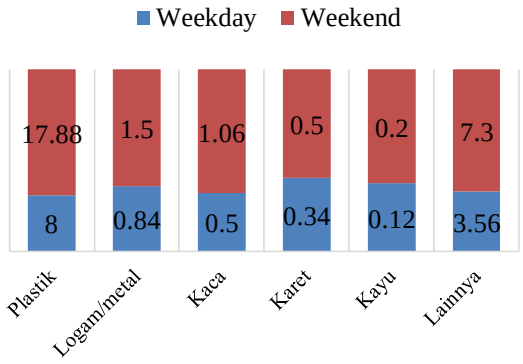

Figure 4. Abundance of marine debris during weekdays and weekends

Research conducted in March 2022 found that the highest waste abundance was on weekends at 28.44 units/m^2, while the lowest was on weekdays at 13.36 units/m^2. This is supported by Aditya et al.[5], who state that weekend waste production is higher than weekdays. The abundance of marine debris on weekends is thought to be caused by more human activity on weekends than on weekdays. The presence of cleaning staff and garbage collection on weekends can also influence the amount of marine debris on weekdays. The leading cause of the entry of waste into the aquatic environment is the large number of human activities that produce waste.

4. CONCLUSION

According to research results, marine waste is found in plastic, metal, glass, rubber, and wood. Plastic waste is the most common type found (62%), and the least found is wooden waste (1%). The abundance of waste on weekends is higher than on weekdays. The differences in waste abundance between stations are not significantly different, while the differences in waste abundance between times (weekdays and weekdays) are significantly different.

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