The relationship between the characteristics of seagrass beds as a macro-rubbish trap in Balikpapan Bay, East Kalimantan

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ABSTRACT

Balikpapan Bay is a waters that become sea transportation used by the community and also companies. Community and company activities that use sea transportation cause a lot of garbage in the waters of Balikpapan Bay Seagrass beds are stretches of seagrass vegetation that cover a coastal area or shallow sea. seagrass Balikpapan Bay, East Kalimantan. Data collection using to quadrant transect sampling. Analysis of the data used to determine the relationship between macro-rubbish and seagrass types of rubbish, rubbish volume and seagrass stands. Sampling was carried out using a 50 x 50 cm transect at 4 stations with 3 repetitions. The results of the study found 2 types of seagrass, namely *E. acoroides* and *T. hemprichii.* Then 2 types of waste were found, namely organic and inorganic waste Based on the results of the correlation test between macro-rubbish volume and trash seagrass stands, it stated that there was no positive correlation in seagrass beds in the waters of Balikpapan Bay, East Kalimantan.

INTRODUCTION

Seagrass Ecosystems

Seagrass meadows are coastal ecosystems characterized by seagrass as the dominant vegetation, which can permanently live below the surface of the sea. Seagrass ecosystems are complex and have very important functions and benefits for coastal waters. Taxonomically, seagrasses belong to the Angiospermae group and are restricted to marine environments, generally living in shallow coastal waters (Tangke, 2010).

Marine Waste

Marine waste consists of residual materials from products that are left or discarded into the sea by humans, whether intentionally or unintentionally, into the marine environment (Johan et al., 2020). Inorganic waste discarded into the sea can impact seagrass by covering it, thereby reducing the light intensity available to the seagrass.

METHODOLOGY

Research Location

This research was conducted in the waters of Balikpapan Bay, East Kalimantan (Figure 1). The study was carried out from October 2022 to January 2023.

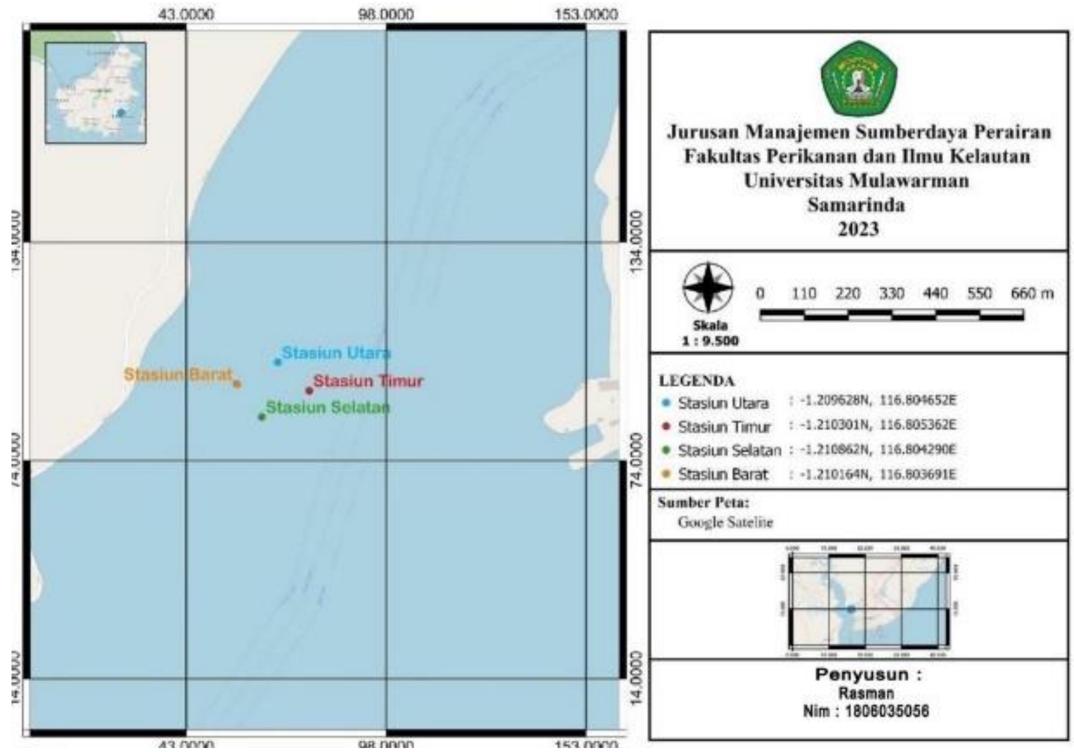

Figure 1. Study area map

Research Procedure

The research was conducted in five stages, which served as guidelines during the fieldwork. The first stage involved preparation, the second stage was preliminary observation, the third stage was station determination, followed by data collection, and finally, data analysis.

Data Analysis

Absolute Density of Species

The absolute density of seagrass species is the total number of individuals within a given area, calculated as follows:

$$Ki = Ni/ A$$

Where:
Ki = Absolute density of the (i)-th species
Ni = Total number of individuals of the (i)-th species
A = Total area of sampling

Density and Relative Density of Seagrass

Species density refers to the number of individuals (stands) of a particular species per unit area. The density of each species at each location is calculated using the following formula (Odum, 1998):

$$Di = Ni/ A$$

Where:
Di = Density of the species
Ni = Total number of stands of the species

A = Area of the plot used

Relative density is the ratio between the number of individuals of a species and the total number of individuals of all species, aimed at determining the percentage density of each species in the total number of all species (Odum, 1998).

$$RDi = (Ni/\Sigma n) \times 100\%$$

Keterangan:
RDi = Relative density
Ni = Total number of stands of species i
Σn = Total number of individuals of all species

Relationship Between Seagrass Abundance and Waste Density

The relationship between seagrass abundance and waste density was analyzed using simple correlation analysis with the Pearson formula, as follows:

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{\{n\sum x^2 - (\sum x)^2\}\{n\sum y^2 - (\sum y)^2\}}}$$

Where:
n = Number of data pairs for seagrass species and waste types
$\sum x$ = Total number of seagrass species
$\sum y$ = Total number of waste types
$\sum x^2$ = Square of the total number of seagrass species
$\sum y^2$ = Square of the total number of waste types
$\sum xy$ = Product of the total number of seagrass species and waste types

RESULT AND DISCUSSION

Water Quality Parameters

The results of water quality measurements in Balikpapan Bay are presented in Table 2.

Table 2. Water Quality Measurement Results

Parameter	Unit	Station				Quality Standard
		North	East	South	West	
Temperature	˚C	32,1	30,7	32,7	32,9	28-30
Salinity	‰	20,4	20,7	19,2	18,6	33-34
Water clarity	m	0,97	0,68	1,21	0,85	>3
Current Speed	m/s	0,399	0,595	0.135	0,217	0,5 – 1
pH	-	8,2	8,3	8,2	8,2	7-8,5
DO	mg/L	8,3	6,8	8,1	9,1	>5
Nitrate (NO_3)	mg/l	0,059	0,032	0,026	0,02	0,06
Phosphate (PO_4)	mg/l	0,011	0,014	0,02	0,003	0,015

Quality Standard: PP No.22 of 2021, Appendix VIII on Marine Water Quality Standards for Marine Biota.

Macro Waste Volume

The volume of macro waste found differed at each observation station. The macro waste volume was 4,849 cm^3 at the North station, 4,717 cm^3 at the East station, 6,040 cm^3 at the South station, and 3,440 cm^3 at the West station.

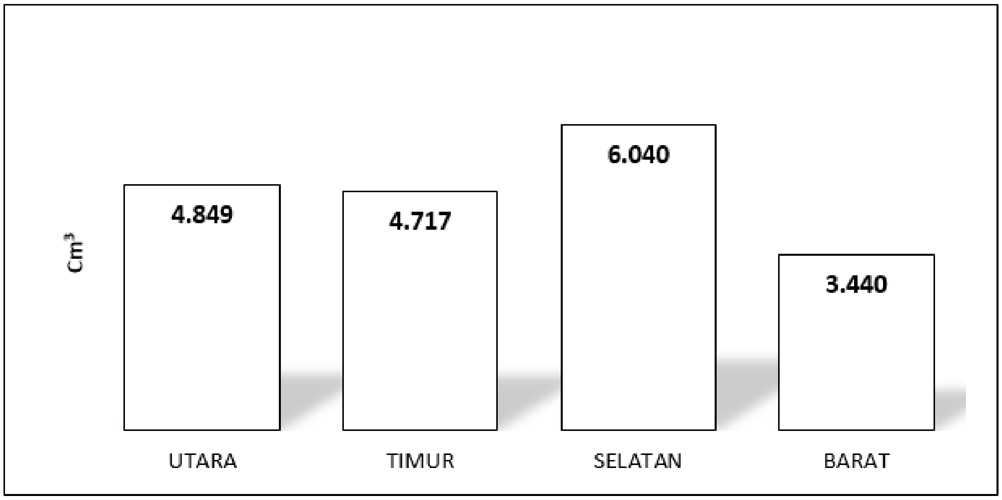

Figure 2. Trash volume

Total Density

Total density of seagrass in Balikpapan Bay shows the following values: At the North station, the seagrass density is 1,676 shoots/m^2. At the East station, it is 1,928 shoots/m^2. At the South station, it is 1,648 shoots/m^2. At the West station, it is 2,397 shoots/m^2.

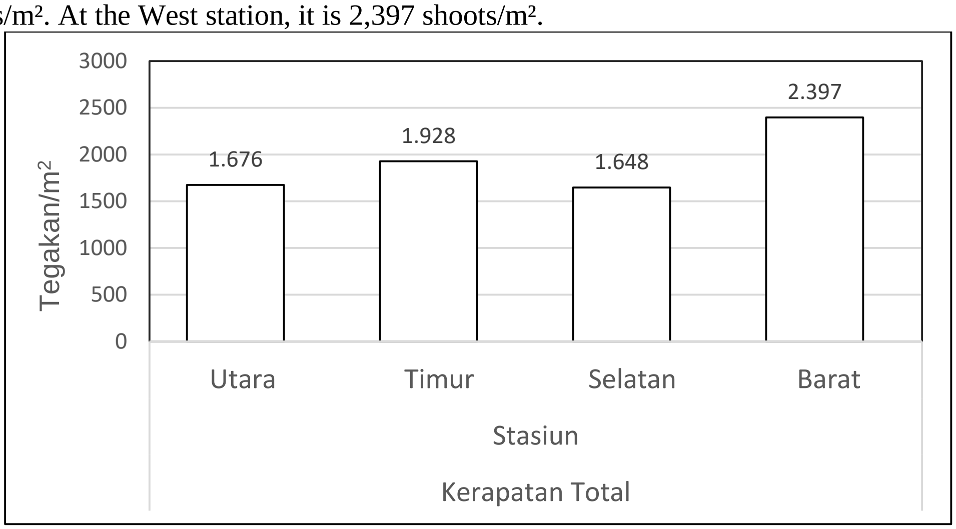

Figure 3. Total Seagrass Density

Individual Density

In the study conducted in Balikpapan Bay across four observation points, two seagrass species were found: *Enhalus acoroides* and *Thalassia hemprichii*. According to the figure, *E. acoroides* has the highest average density at 2,051 shoots/m^2. The *E. acoroides* species observed at the site often has leaf morphology with a length ranging from 35-60 cm. This is consistent with the substrate type where the seagrass grows, which is suitable for its development. *E. acoroides* grows in muddy substrates in turbid waters and can form single-species stands or dominate seagrass meadows (Bengen, 2001).

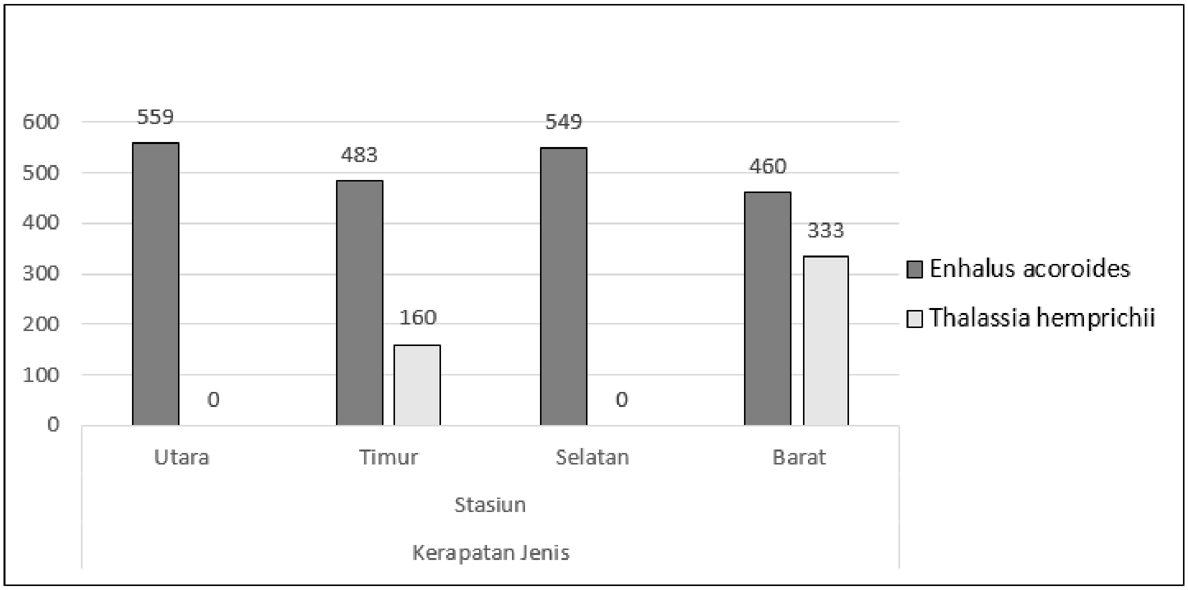

Figure 4. Individual Seagrass Density

Relationship Between Macro Trash Volume and Seagrass Density

In this study, to determine the relationship between macro trash volume and total seagrass density, a correlation test was performed. The correlation test results are as follows:

Table 3. Correlation Test Results

Correlations			
		Trash	Seagrass
Trash	Pearson Correlation	1	-.904
	Sig. (2-tailed)		.096
	N	4	4
Seagrass	Pearson Correlation	-.904	1
	Sig. (2-tailed)	.096	
	N	4	4

Based on the correlation test results shown in Table 3, the macro trash volume (Figure 1) and total seagrass density (Figure 2) show a correlation value of -0.904 with a significance level of 0.096. According to Pearson's correlation categories: if r = 0, there is no correlation; if r = 0 – 0.5, the relationship between the two variables is weak; if r = 0.5 – 0.8, the relationship is moderate; if r = 0.8 – 1, the relationship is very strong; if r = 1, the relationship is perfect; if r = -1, the relationship is very strong but inverse; and if r = +1, the relationship is very strong and direct.

From the results in Table 3, it can be concluded that the correlation test result in Balikpapan Bay falls into the category of r = 0.8 – 1, indicating a strong but not direct relationship. This means that the data collected did not prove a relationship between macro trash volume (variable Y) and total seagrass density (variable X), though it does not mean the variables are unrelated. The correlation test also suggests that macro trash volume does not positively correlate with seagrass density in Balikpapan Bay.

Based on the significance level results, if the significance is > 0.05, H_0 is accepted and H_1 is rejected. If the significance is < 0.05, H_0 is rejected and H_1 is accepted. In Table 5, the significance level of 0.096 is greater than 0.05, so it is decided that H_0 is accepted and H_1 is rejected. This indicates that there is no relationship between macro trash volume and seagrass density in Balikpapan Bay.

Submerged marine debris can cover seagrass plants and inhibit their growth, potentially leading to death. This occurs due to the reduced light intensity received by seagrass when covered by trash (Amri et al., 2010). Trash covering seagrass can impede sunlight penetration to the seagrass leaves, making it difficult for seagrass to photosynthesize, which results in changes in leaf color, morphometry, and eventually death. The light requirement for each seagrass species is estimated to be 4.4 - 29% of surface light (Dennison et al., 1993), while the average light requirement for seagrass meadows is 11% of surface light (Duarte, 1991).

CONCLUSION

1. Two seagrass species were found in Balikpapan Bay: *Enhalus acoroides* and *Thalassia hemprichii*.
2. Both organic and inorganic trash types were identified in Balikpapan Bay, with volumes being nearly the same at each station.
3. The correlation test between macro trash volume and seagrass density indicates no positive correlation. This suggests that high seagrass density does not necessarily correlate with a higher amount of trapped trash in the seagrass beds of Balikpapan Bay, East Kalimantan.

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