Tropical Oceanographic
Research Frontiers

Research Article
Volume 1(1), 2026, 48−62
https://doi.org/10.53623/torf.v1i1.1011

Characteristics of Beach Debris in Labuhan Haji District, East Lombok Regency, Indonesia

Indah Fitri Ramdani Putri, Paryono, Sholihati Lathifa Sakina*

Marine Science Study Program, Department of Fisheries and Marine Sciences, Faculty of Agriculture, University of Mataram, Mataram, Indonesia

*Correspondence: paryonoap1@unram.ac.id

SUBMITTED: 25 January 2026; REVISED: 28 February 2026; ACCEPTED: 2 March 2026

ABSTRACT: Beach debris was defined as marine debris found in coastal areas within the zone between high and low tide (intertidal zone). This study aimed to determine the characteristics of beach debris in Labuhan Haji District, East Lombok Regency. The study was conducted using a purposive sampling method. A 100 m transect line was established parallel to the coastline, with sampling stations placed at 20 m intervals. Each transect consisted of a 5 × 5 m plot, which was subdivided into 25 sub-transects. The main parameters observed included debris weight (total debris weight), debris composition (weight per type), and debris density (number of items per type). The results showed that macro-debris was more dominant than meso-debris, with plastic being the most commonly found type, followed by rubber, wood, plastic foam, metal, and glass. Based on total weight, Ijo Balit Beach recorded the highest waste accumulation at 359.60 g/m². This was influenced by its proximity to coconut plantation activities, river estuaries, and temporary disposal sites (TPS), which contributed to substantial waste input from both domestic sources and ocean currents. Suryawangi Beach ranked second, with a total debris weight of 252.80 g/m², predominantly originating from tourist and coastal community activities, as well as river-borne debris. Meanwhile, Labuhan Haji Beach, although it had the lowest total debris weight (76.60 g/m²), recorded the highest debris density at 123.50 items/m². This was dominated by plastic debris, which was likely generated from the activities of fishermen, tourists, and local traders.

KEYWORDS: Beach debris; Labuhan Haji; macro and meso debris

1. Introduction

Indonesia boasted coastal and marine resources that played a vital role in human life, providing shelter, livelihoods, and recreation. However, Indonesia was one of the world's largest contributors of plastic waste after China, accounting for approximately 3.32 million metric tons per year [1]. Coastal areas in Indonesia were among the regions most impacted by pollution, particularly debris. The accumulation of debris in coastal areas occurred in line with increased human activity around the coast [2].

Beach debris was defined as marine debris found in coastal areas within the zone between high and low tide (intertidal zone) [3]. Marine debris, also known as beach litter, referred to objects or materials that were no longer used, worn, or desired, and had been discarded, either directly or indirectly, intentionally or unintentionally, in coastal environments. Beach debris had significant detrimental impacts on humans, as it affected human health and aquatic biota both directly and indirectly.

Labuhan Haji was a sub-district in East Lombok Regency that experienced both direct and indirect debris pollution, originating from land-based sources and other aquatic environments and transported by currents to coastal areas. Several coastal areas in Labuhan Haji Sub-district that were affected by debris pollution included Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach. Based on initial observations, these beaches were natural beaches with a large amount of debris originating from various sources, such as domestic household waste, plastic waste from human activities, and waste carried by ocean currents. The accumulation of waste on the beach not only affected the natural beauty but also impacted the marine life inhabiting the area. Research on the characteristics of beach debris aimed to identify the types and composition of debris in Labuhan Haji District. This was conducted by measuring parameters such as debris weight, composition, and density [4]. This was necessary because the area was often characterized by limited public awareness regarding the impacts of debris and its management, thus requiring a more comprehensive approach to maintain environmental cleanliness and sustainability in Labuhan Haji District [5]. Furthermore, this could help inform policy development for coastal area management and sustainable debris management.

The problem of coastal waste in Labuhan Haji District was not only related to the characteristics of the waste but was also influenced by the behavior and perspectives of the local communities living along the coast, including those in Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach. This condition indicated that coastal pollution was influenced not only by natural factors but also by human–environment interactions.

Therefore, this study examined the characteristics of coastal waste in Labuhan Haji District, East Lombok Regency. These characteristics were determined by analyzing parameters such as debris weight, composition, and density [4]. This research was important as it provided a basis for policy-making in coastal area management and sustainable waste management, thereby addressing the issue of marine debris in Labuhan Haji District. This study aimed to determine the characteristics of coastal debris in Labuhan Haji District, East Lombok Regency.

2. Materials and Methods

2.1. Time and place.

This research was conducted over a four-month period, from December 2024 to March 2025, encompassing both the early and peak phases of the monsoon season in the region. The study took place in the coastal area of Labuhan Haji District, which is located in East Lombok Regency, Indonesia. This coastal zone is characterized by dynamic environmental conditions influenced by tidal fluctuations, seasonal winds, and human activities such as tourism, fisheries, and coastal settlements. Field observations and data collection were specifically carried out at three selected sampling sites: Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach. These locations were chosen to represent varying coastal characteristics, including differences in human activity intensity, shoreline morphology, and exposure to ocean currents. Labuhan Haji Beach is known for its relatively high human activity due to its accessibility and role as a local tourism spot. In contrast, Suryawangi Beach exhibits moderate anthropogenic influence, while Ijo Balit Beach represents a comparatively less disturbed environment with more natural coastal conditions. The selection of these three sites allowed for a comprehensive assessment of spatial variations in coastal conditions and provided a representative overview of the study area. Data collection was conducted systematically during low tide conditions to ensure consistent sampling within the intertidal zone across all locations

2.2. Research procedures.

2.2.1. Research stage of beach debris characteristics.

The data collection process used a purposive sampling method. Purposive sampling was used as the basis for determining specific sampling points because not all research areas have the characteristics of the sample objects to be observed. [4], before collecting waste data, the coordinates of the research location were first determined. Labuhan Haji District used GPS (Global Positioning System) to obtain coordinates. Six sampling points were then determined at three stations, each 20 meters apart, and a 100-meter roll meter was installed parallel to the shoreline to collect waste samples every 20 meters. Next, a 5x5-meter transect was prepared, divided into 25 subtransects. The 5x5-meter transects were installed in rotation, starting with the first, second, third, fourth, and fifth transects, to represent the research location. Then, on the shoreline where the tide has receded, place large stakes first at the edge of the transect, followed by smaller stakes. Next, dig through the sand using a small shovel until you see any debris within, then sift through it using a sieve. The resulting debris is then placed in a trash bag or trash envelope. The sampling points at each debris e collection station were determined based on [4], where each subtransect was assigned a number, with some numbers highlighted in yellow. After debris data collection in Labuhan Haji District, it was grouped based on size and type, and the debris swas weighed in the laboratory. After all data was collected, it could be further analyzed.

2.3. Data analysis.

2.3.1. Junk data analysis.

The collected debris data were analyzed quantitatively using several key parameters, namely total debris weight, debris composition, and debris density. These parameters were calculated to evaluate the distribution, proportion, and abundance of debris at each sampling location following the method described in [4]. The total debris weight was calculated to determine the mass of debris per unit area. This parameter provides an estimate of the overall accumulation of debris within the sampling site. It was computed using the following equation:

$$\mathrm{M} = \frac{\text{Total Debris Weight}}{\text{Length (m)} \times \text{Width (m)}}$$

where *M* represents the debris weight per unit area (kg/m²), while length and width correspond to the dimensions of the sampling transect.

Debris composition was analyzed to determine the relative contribution of each type of debris based on its weight. This parameter helps to identify the dominant types of debris present in the study area. The percentage composition of each debris type was calculated as follows:

$$\text{Percentage}(\%) = \frac{\times}{\sum_{i=1}^{n} \times i} \times 100\%$$

where x_i is the weight of debris for a specific type, and $\sum_{i=1}^{n} \times i$ is the total weight of all debris types.

Furthermore, debris density was calculated to assess the abundance of debris items per unit area. This parameter reflects how many debris pieces are distributed within the sampling site and was determined using the following equation:

$$K = \frac{\text{Number of Debris Pieces per Type}}{\text{Length (m)} \times \text{Width (m)}}$$

where *K* denotes the debris density (items/m²).

Overall, these analytical parameters provide a comprehensive understanding of debris characteristics, including its mass distribution, proportional composition, and spatial density across the study area. The results obtained from these calculations were further used to compare debris conditions between sampling stations and to evaluate the level of coastal pollution in Labuhan Haji District.

3. Results and Discussion

3.1. Debris weight.

3.1.1. Total weight of debris found at the three locations.

The total weight of debris at the three locations showed significant differences. Based on its classification, the debris consisted of macro- and meso-debris. The high level of activity at each location influenced the amount of debris generated. A comparison of the total weight of debris at Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach is shown in Figure 1. It was found that the highest or most dominant total weight of debris was macro-debris at Ijo Balit Beach, with a weight of 359.60 g/m², followed by Suryawangi Beach at 252.80 g/m² and Labuhan Haji Beach at 76.60 g/m². Meanwhile, the lowest total weight of debris was dominated by meso-debris at Ijo Balit Beach, at 16.35 g/m², followed by Suryawangi Beach at 12.10 g/m² and Labuhan Haji Beach at 1.90 g/m². Ijo Balit Beach had a relatively high accumulated total debris weight, which coincided with its location near coconut plantation activities carried out by local residents and its proximity to the river estuary. Furthermore, this location was adjacent to the Ijo Balit Temporary Disposal Site (TPS). The presence of beach debris in this area was influenced by tidal dynamics, which caused the accumulation of waste along the shoreline. This waste originated not only from the activities of the surrounding community but also from outside Labuhan Haji District and was suspected to come from household debris transported by ocean currents and tidal processes. The greater the total weight of debris found, the higher the risk of coastal ecosystem pollution, which could potentially damage the biota and organisms around Ijo Balit Beach [6, 7].

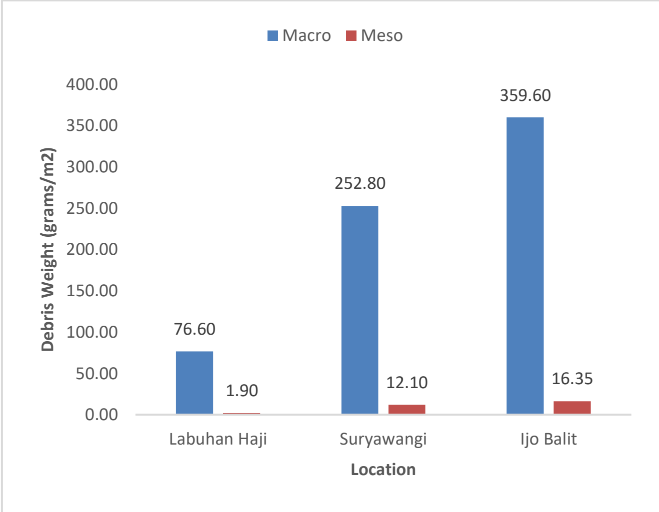

Figure 2. Total debris weight.

3.1.2. Macro debris weight per type.

The weight of macrowaste by type showed varying contributions to the total debris collected. Other materials and plastics were the most dominant categories by weight, while plastic foam, fabric, wood, and rubber contributed relatively small proportions. The average weight of macrowaste per type is shown in Figure 2. Ijo Balit Beach showed a dominance of debris weight in the other materials category at 129.20 g/m², followed by rubber at 95.20 g/m², plastic at 53.30 g/m², plastic foam at 41.15 g/m², and wood at 40.75 g/m². Furthermore, Suryawangi Beach was dominated by plastic waste with a weight of 126.10 g/m², followed by rubber (68.80 g/m²), other materials (31.45 g/m²), wood (24.20 g/m²), and plastic foam (2.25 g/m²). Meanwhile, Labuhan Haji Beach showed relatively low debris weight, with plastic being the dominant type at 43.25 g/m², followed by fabric (16.15 g/m²), other materials (8.20 g/m²), rubber (6.45 g/m²), and plastic foam (0.35 g/m²). Other types of debris that were not found, or had a value of 0 g/m², included glass and ceramic waste, metal, and paper and cardboard. Other materials and plastic exhibited the highest accumulated debris weight compared to other types because they tended to be denser and larger in size, making them more persistent and difficult to decompose. This condition may lead to greater pollution impacts on coastal and marine environments [5,8].

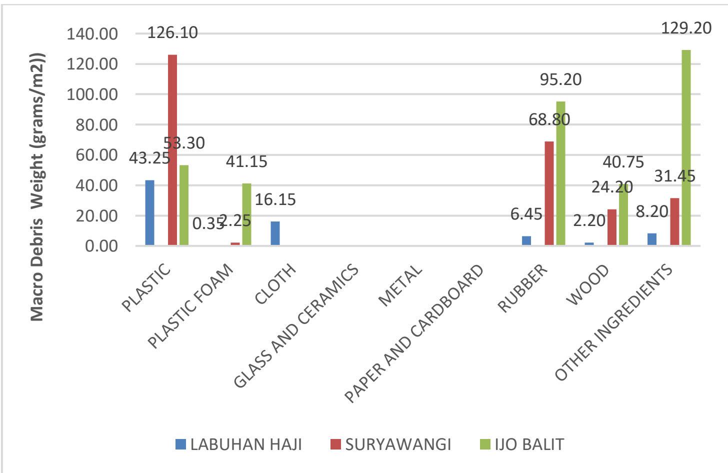

Figure 2. Graph of average macro debris weight per type.

3.1.3. Meso debris weight per type.

The weight distribution of mesowaste by type showed significant differences in proportion to the total debris collected. Plastic and rubber constituted the primary components, with the highest weights, while plastic foam, fabric, metal, and other materials were present in relatively limited quantities. The average weight of mesowaste by type is shown in Figure 3. Based on Figure 4, Ijo Balit Beach recorded the highest average meso-debris weight, with plastic as the dominant component at 16.35 g/m². Suryawangi Beach followed, dominated by rubber (5.45 g/m²) and plastic (4.15 g/m²), followed by plastic foam (1.85 g/m²), metal (0.50 g/m²), and other materials (0.15 g/m²). In contrast, Labuhan Haji Beach showed lower values, with plastic recorded at 1.15 g/m², plastic foam at 0.55 g/m², and fabric at 0.20 g/m². Other types of debris, such as glass and ceramics, paper and cardboard, and wood, were not found or had values of 0 g/m².

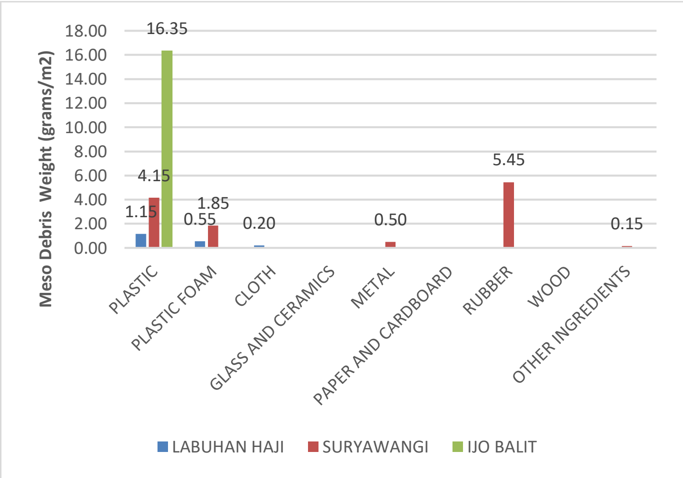

Figure 3. Graph of average weight of meso debris per type.

3.2. Percentage of debris weight composition.

3.2.1. Percentage of weight composition of macro and meso debris found in the three locations.

The percentage composition of macro- and meso-debris weights at the three locations showed different results at each site. Areas with higher activity levels generally produced larger amounts of debris. The percentage composition of macro- and meso-debris at Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach is shown in Figure 5. It shows that the debris weight composition at all three locations was dominated by meso-debris, with the highest contribution recorded at Ijo Balit Beach (54%), followed by Suryawangi Beach (40%) and Labuhan Haji Beach (6%). In contrast, the macro-debris fraction contributed less to the total debris weight, with Suryawangi Beach showing the highest proportion (44%), followed by Ijo Balit Beach (43%) and Labuhan Haji Beach (6%). Overall, Ijo Balit Beach exhibited a relatively higher accumulation of debris by weight compared to the other two locations. This was attributed to the area's proximity to community-owned coconut plantations, the presence of river estuaries on both sides of the beach, and its proximity to the Ijo Balit Temporary Disposal Site (TPS). These factors increased the potential for various types of debris to enter the coastal environment, originating from both local human activities and household waste transported by river flow and ocean currents to the coastal area and surrounding waters [6, 9].

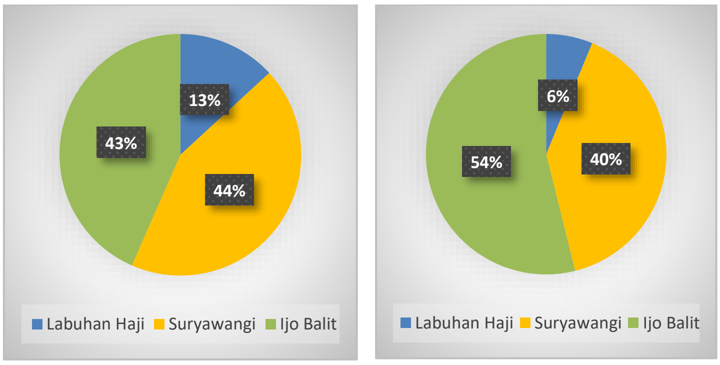

Figure 4. Percentage of weight composition of meso (right) and macro (left) debris found in the three location.

3.3. Total debris amount.

3.3.1 Total amount of debris found at the three locations.

In addition to weight, the characteristics of debris at the research sites were also analyzed in terms of quantity or abundance. This approach was important for understanding the intensity of waste accumulation at each location, as the number of debris items did not always correlate directly with their total weight. In general, the identified debris was classified into two size categories: macro and meso. A comparison of the total amount of debris at Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach is shown in Figure 5. Based on Figure 6, the highest amount of debris was dominated by the macro-scale fraction at Labuhan Haji Beach (123.50 items/m^2), followed by Suryawangi Beach (79.50 items/m^2) and Ijo Balit Beach (51.50 items/m^2). Conversely, the meso-scale fraction showed lower values, with the highest amounts also recorded at Labuhan Haji Beach (9.50 items/m^2), followed by Suryawangi Beach (8.00 items/m^2) and Ijo Balit Beach (7.50 items/m^2). The high amount of debris at Labuhan Haji Beach was related to its proximity to the pier on both sides of the beach and its function as a tourist area. Human activities by residents, tourists, and fishermen were suspected to be the main sources of debris, in addition to inputs from household waste carried by currents and tidal processes. The increasing amount of debris had the potential to increase coastal environmental pollution, disrupt ecosystems and marine biota, and reduce the tourism attractiveness of Labuhan Haji Beach [5, 10].

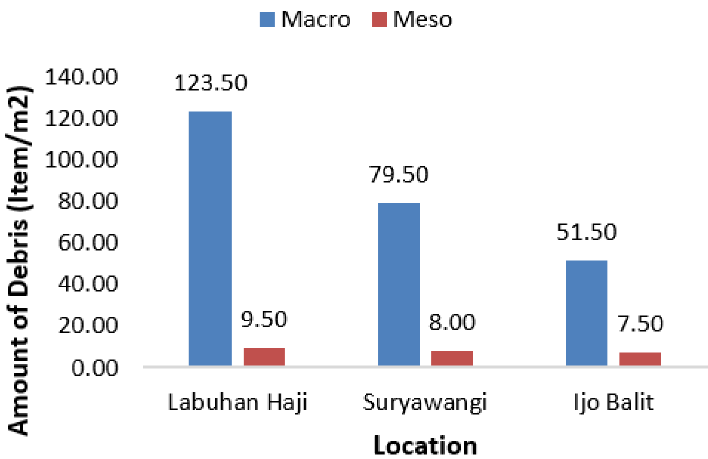

Figure 5. Total amount of debris.

3.3.2 Amount of macro debris per type.

After assessing the total amount of debris at each location, the next analysis focused on the distribution of macro debris by type. This approach aims to identify the most dominant macro debris types in terms of quantity and to understand the source and activity patterns that contribute to their presence in coastal environments. The average amount of macro debris per type at the three observation locations can be seen in Figure 7. The analysis results show that Labuhan Haji Beach has the highest amount of macro debris compared to Suryawangi Beach and Ijo Balit Beach. At this location, plastic is the most common type found with a total of 110.50 items/m², followed by wood at 7.50 items/m², other materials at 2.00 items/m², cloth at 1.50 items/m², and plastic foam and rubber at 1.00 items/m² each. Suryawangi Beach shows a lower amount with a dominance of plastic at 55.00 items/m² and wood at 11.50 items/m², followed by other materials (9.50 items/m²) and plastic foam (2.50 items/m²). Meanwhile, Ijo Balit Beach recorded the least amount of macro debris, with wood as the main type (26.00 items/m²), followed by plastic (21.50 items/m²), other materials (1.50 items/m²), plastic foam (1.00 items/m²), and rubber (1.00 items/m²). Other types of debris, such as glass and ceramics, metal, and paper and cardboard, were not found or had a value of 0 items/m². In general, plastic and wood were the most dominant types of macro-debris in terms of quantity. Plastic tends to accumulate over the long term due to its difficult-to-decompose nature, while wood generally originates from coastal and surrounding land activities. The presence of these two types of waste is suspected to be related to the activities of residents, tourists, and fishermen, as well as input from household debris carried by currents and tides, potentially affecting the balance of coastal ecosystems and marine biota [5, 10].

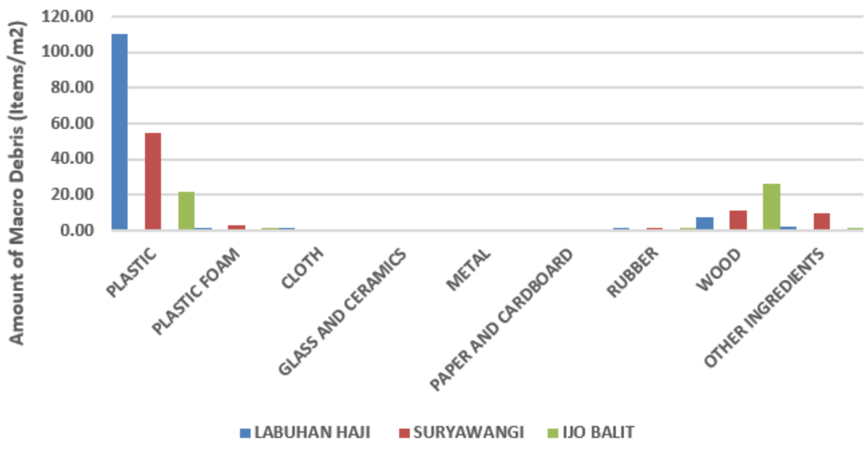

Figure 6. Graph of average amount of macro debris per type.

3.3.3 Amount of meso debris per type.

Unlike macro-debris, which was generally directly related to surface activities, meso-debris analysis focused on smaller fractions that tended to originate from fragmentation and environmental transport processes. This approach was used to identify the most frequently occurring types of meso-debris and their relationship to the characteristics of each study location. The pattern of meso-debris quantities by type is shown in Figure 7. In general, plastic debris was the most frequently found type in the meso fraction at all three observation locations, while other types such as plastic foam, cloth, metal, rubber, and other materials occurred at lower frequencies. Ijo Balit Beach recorded the highest amount, with 7.50 plastic items/m². Labuhan Haji Beach showed relatively similar values, with 7.00 plastic items/m², followed by 2.00 plastic foam items/m² and 0.50 cloth items/m². In contrast, Suryawangi Beach had the lowest amount of meso-debris, with 5.00 plastic items/m², 1.00 rubber item/m², 1.00 other material item/m², and 0.50 plastic foam and metal items/m² each. Debris types such as glass and ceramics, paper and cardboard, and wood were not detected or had values of 0 items/m² at all locations. The high frequency of plastic debris in the meso fraction was related to the nature of plastic materials, which were easily fragmented but difficult to decompose naturally. This condition was reinforced by the characteristics of Ijo Balit Beach, which is adjacent to community coconut plantation areas, has river estuaries on both sides of the beach, and is located close to the Ijo Balit Temporary Disposal Site (TPS). The combination of terrestrial and marine influences increased the potential for debris input from community activities, river discharge, and transport by ocean currents, thereby contributing to the accumulation of meso-debris in the coastal area of Ijo Balit Beach [9,6].

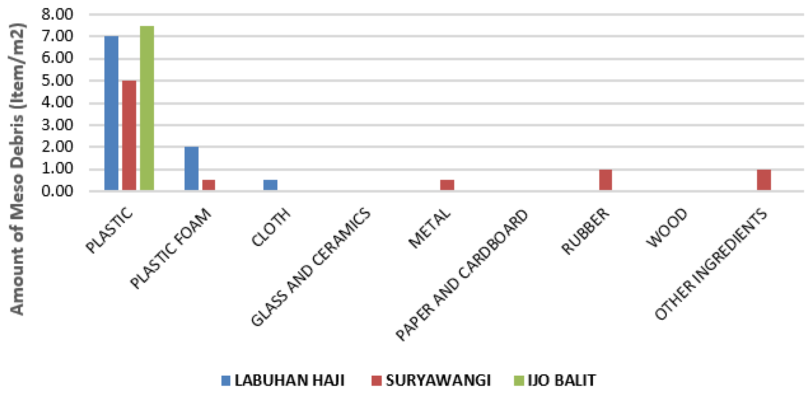

Figure 7. Average amount of meso debris per type.

3.4. Debris density.

3.4.1. Total density of debris pieces found at the three location.

The density of debris fragments identified at the three research locations showed significant differences between locations. Based on observations, the accumulated debris was grouped into two size categories: macro and meso. The high intensity of human activity at a location tends to result in increased debris accumulation density. The total distribution of debris fragment density at Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach can be seen in Figure 8. The figure showed that the largest contribution to the total density of debris items at all three locations came from the macro-debris category. The highest value was recorded at Labuhan Haji Beach, with a density of 4.94 items/m², followed by Suryawangi Beach (3.18 items/m²) and Ijo Balit Beach (2.06 items/m²). Conversely, the meso-debris category showed relatively low densities at all locations, with values of 0.38 items/m² at Labuhan Haji Beach, 0.32 items/m² at Suryawangi Beach, and 0.30 items/m² at Ijo Balit Beach, respectively. The high density of debris items at Labuhan Haji Beach was thought to be related to its proximity to the pier on both sides of the beach. Furthermore, this beach was also used as a tourist area; therefore, activities of coastal communities, tourists, and fishermen were likely major sources of debris. This debris originated from both direct activities on the beach and household waste transported by currents and tides. High debris accumulation had implications for increasing the risk of coastal environmental pollution, which not only threatened ecosystems and marine biota but also had the potential to reduce the tourism attractiveness of Labuhan Haji Beach [5, 10].

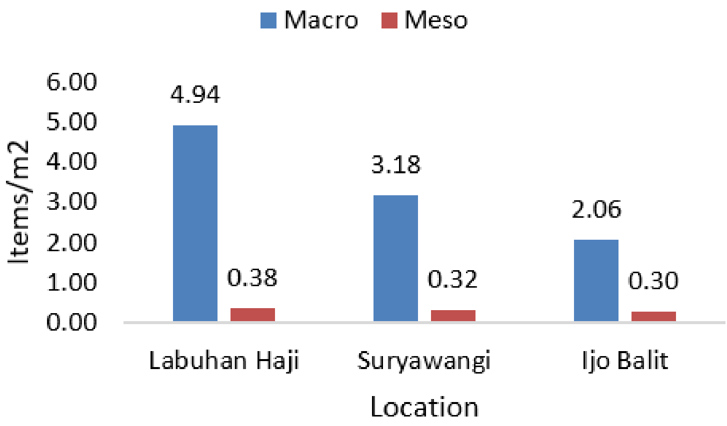

Figure 9. Total number of debris piece density.

3.4.2. Total density of macro debris pieces per type.

As a follow-up to the discussion of debris density based on size, the next analysis focused on the composition of macro-debris density by type. Each waste category showed different contributions to the total density of debris items collected at the study site. In general, plastic and wood debris made up the largest proportions, while other types such as plastic foam, fabric, rubber, and other materials contributed relatively small amounts. The average distribution of macro-debris density per type at each location is shown in Figure 10. Based on Figure 10, Labuhan Haji Beach showed the highest macro-debris density compared to the other two locations. At this site, plastic debris dominated with a density of 4.42 items/m², followed by wood debris at 0.30 items/m². Other types were found in lower quantities, namely other materials at 0.08 items/m², fabric at 0.06 items/m², and rubber and plastic foam at 0.04 items/m² each. This condition indicated that human activities in the surrounding area contributed significantly to the high density of macro-debris, particularly plastic. A slightly different pattern was observed at Suryawangi Beach, where plastic also remained the dominant debris type at 2.20 items/m². Wood debris density at this location was relatively higher than at Labuhan Haji Beach, at 0.46 items/m², followed by other materials at 0.38 items/m². Meanwhile, plastic foam and rubber were present in limited quantities. In contrast, Ijo Balit Beach exhibited a lower overall macro-debris density. Wood debris was the most dominant type, with a density of 1.04 items/m², followed by plastic debris at 0.86 items/m². Rubber and other materials were each recorded at 0.06 items/m², while plastic foam was found in the smallest quantities. At all three locations, glass and ceramic debris, metal, and paper and cardboard were either absent or had a density of 0 items/m². The predominance of plastic and wood debris across the three research locations indicated that these two types contributed significantly to macro-debris density in coastal areas. Plastic materials tend to persist for long periods in the marine environment due to their resistance to decomposition, allowing them to accumulate easily in coastal zones. A similar situation also occurs with wood debris, which has a relatively higher density than several other waste types, making its presence more stable and less easily dispersed. As stated by [11,12], the physical characteristics of debris materials significantly influence their density and accumulation patterns on the coast. Therefore, the high density of plastic and wood debris at the study sites can be understood as the result of interactions between debris properties and coastal environmental dynamics.

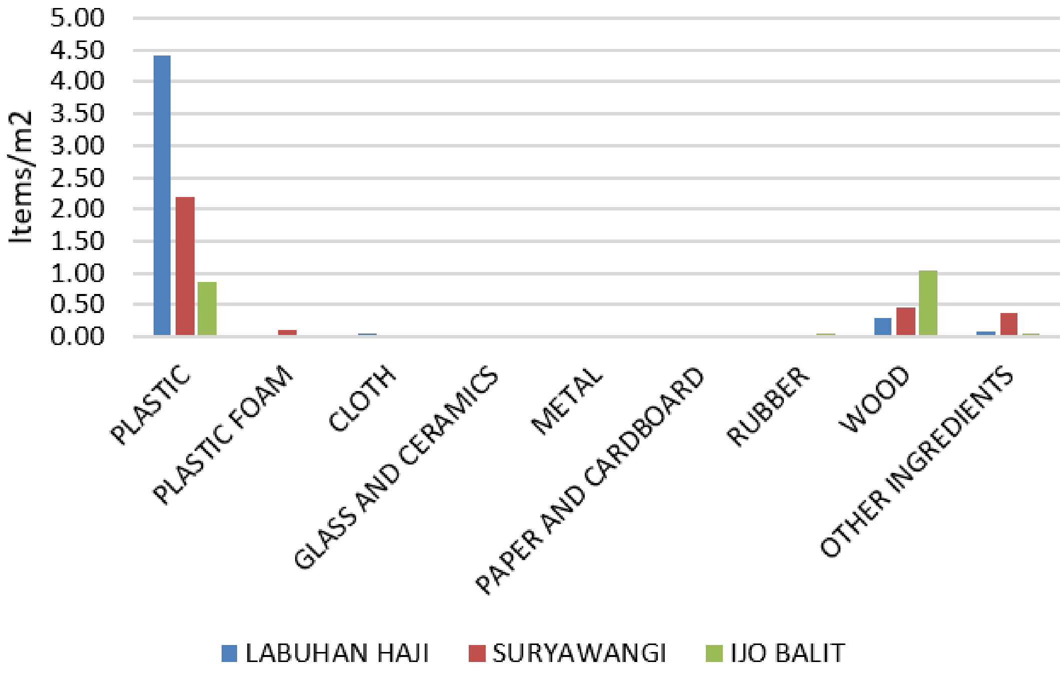

Figure 9. Average density of macro debris pieces by type.

3.4.3. Number of meso debris piece density per type.

Following the analysis of macro-debris density, the characteristics of meso-debris density also showed varying patterns across different types. The data processing results showed that plastic debris remained the primary contributor to meso-debris density across all observation locations. Conversely, plastic foam, fabric, metal, rubber, and other materials contributed relatively small amounts to the total density. A comparison of meso-debris density by type is shown in Figure 10. Figure 10 showed that Ijo Balit Beach had the highest average meso-debris density compared to the other two locations, with the main contribution coming from plastic waste at 0.30 items/m². At Labuhan Haji Beach, the meso-debris density was slightly lower but still dominated by plastic at 0.28 items/m², followed by plastic foam at 0.08 items/m² and fabric at 0.02 items/m². Meanwhile, Suryawangi Beach recorded the lowest density, with plastic as the dominant type at 0.20 items/m², followed by other materials and rubber at 0.04 items/m² each, and metal and plastic foam at 0.02 items/m². The absence of several types of meso-debris, such as glass and ceramics, paper and cardboard, and wood at all locations, indicated that these materials either did not fragment into meso-sized particles or were more easily degraded in coastal environments. Plastic debris had the highest accumulated density value compared to other meso-debris types at all three study locations. This indicated that plastic was the most dominant debris type in the meso-size fraction. Plastic is known to be a material that is difficult to decompose and requires a long time to degrade in coastal environments, allowing it to persist longer than other waste types. As reported by [13,14], the characteristics of plastic cause it to be frequently found in marine and coastal environments in various size fractions. The dominance of plastic in meso-debris density at Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach indicated the potential for ongoing pollution pressure in coastal areas.

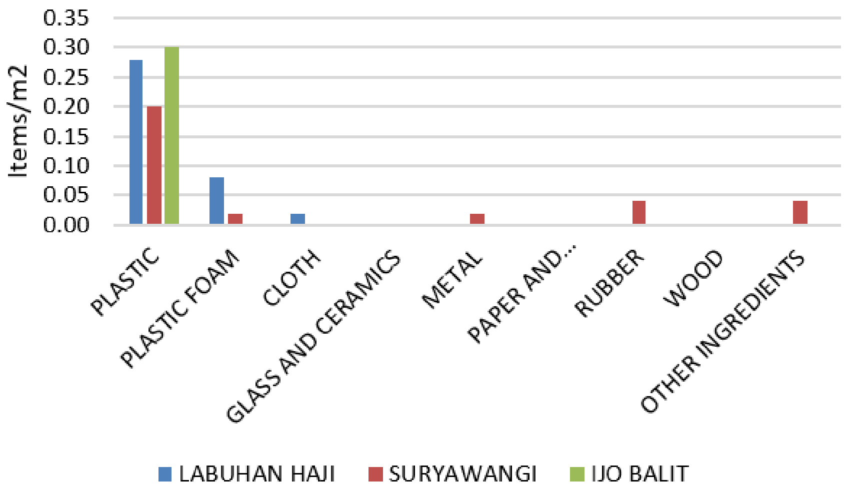

Figure 11. Average number of density of meso debris pieces per type.

4. Conclusions

The condition of the beaches at the three research locations, namely Labuhan Haji Beach, Suryawangi Beach, and Ijo Balit Beach, based on debris weight, percentage, quantity, and density, showed that macro-debris was more dominant than meso-debris. The most common types of debris found were plastic, followed by rubber, wood, glass, metal, and plastic foam. Based on total debris weight, Ijo Balit Beach recorded the highest accumulation at 359.60 g/m², followed by Suryawangi Beach at 252.80 g/m², while Labuhan Haji Beach showed the lowest total weight at 76.60 g/m². Labuhan Haji Beach recorded the highest number of debris items, reaching 123.50 items/m², with dominance of plastic bottles, plastic bags, and food packaging. This high amount of debris was likely associated with the activities of fishermen, tourists, and traders in the area. Meanwhile, the relatively high debris levels at Ijo Balit Beach and Suryawangi Beach were influenced by their proximity to river estuaries, residential areas, and intensive coastal community activities, which contributed to the continuous input and accumulation of debris in these coastal environments.

Acknowledgments

The author expresses sincere gratitude to Allah SWT for granting good health throughout the research process until its completion. The author also extends appreciation to the Environment and Forestry Service (DLHK) of East Lombok Regency, the community of Labuhan Haji, and colleagues who provided assistance during the fieldwork conducted in Labuhan Haji District, East Lombok Regency.

Author Contribution

All authors contributed.

Competing Interest

This research did not receive any funding sources.

References

[1] Jambeck, J.R.; Geyer, R.; Wilcox, C.; Siegler, T.R.; Perryman, M.; Andrady, A.; Narayan, R.; Law, K.L. (2015). Plastic Waste Input from Land to Ocean. *Marine Pollution Science*, *347*(6223). https://doi.org/10.1126/science.1260352.

[2] Suheri, D.A.; Ditya, D.N.; Sandi, K.; Sari, L.R. (2019). Design of a Wind-Powered Waste Transporter (PESTA) as an Effort to Reduce Marine Waste. *Journal of Technology and Applied Research*, *1*, 43–47. https://doi.org/10.30871/jatra.v1i2.1422.

[3] Dobiki, J. (2018). Analysis of Waste Infrastructure Availability on Kumo Island and Kakara Island in North Halmahera Regency. *Spatial*, *5*(2), 220–228. https://doi.org/10.35793/sp.v5i2.20803.

[4] Karliansyah, M.R. et al. (2020). Marine Debris Monitoring Guidelines. Edition II. Ministry of Environment and Forestry, Jakarta, Indonesia.

[5] Parmi, H.J.; Ani, M. (2020). Coastal Cleanup at Labuhan Haji Beach, East Lombok Regency to Raise Tourist Awareness of Beach Cleanliness. *JISIP (Journal of Social Sciences and Education)*, *4*(4). https://doi.org/10.58258/jisip.v4i4.1471.

[6] Djaguna, A.; Pelle, W.E.; Schaduw, J.N.W.; Rumampuk, N.D.; Ngangi, E.L. (2019). Identification of Marine Debris on Tongkaina and Talawaan Bajo Beaches. *Journal of Tropical Coastal and Marine Studies*, *7*(3), 175–182. https://doi.org/10.35800/jplt.7.3.2019.24432.

[7] Nafsi, A.I.; Sitohang, L.L.S.L. (2025). Identification of Marine Debris Based on Composition and Density with a Focus on the Beach Cleanliness Index on the Labuhan Haji Coastline, East Lombok. *Swara Bhumi*, *1*(1).

[8] Ardan, A.; Rafi'i, A.; Ghitarina, G. (2022). Identification of Macro Marine Debris on Le Grandeur Beach, Balikpapan City, East Kalimantan. *Journal of Tropical Aquatic Sciences*, *1*(2), 16–22. https://doi.org/10.30872/tas.v1i2.635.

[9] Isman, M.F. (2016). Identification of Marine Debris in the Coastal Tourism Area of Makassar City. Master's Thesis, Hasanuddin University, Makassar, Indonesia. https://doi.org/10.30872/tas.v1i1.469.

[10] Hafizin, H.; Adhika, I.M.; Sunarta, I.N. (2018). Potential and Carrying Capacity of Labuhan Haji Beach in Tourism Development in East Lombok Regency. *Ecotrophic*, *12*(2), 199–211. https://doi.org/10.24843/EJES.2018.v12.i02.p09.

[11] Suriadi, I. (2019). Population Dynamics and Its Impact on Environmental Change (The Case of Ijobalit Pumice Mining in Labuan Haji District, East Lombok). *Journal of Economics and Business*, *5*(2), 64–96. https://doi.org/10.29303/ekonobis.v5i2.34.

[12] Nafiri, et al. (2020). Characteristics of Marine Debris on Tumpaan Beach, Tateli Dua Village, Mandolang District, Minahasa Regency. *Journal of Coastal and Tropical Marine Science*, *8*(1), 71–72. https://doi.org/10.35800/jplt.8.1.2020.27493.

[13] NOAA. (2016). Impact of Marine Debris on Coastal and Benthic Habitats. National Oceanic and Atmospheric Administration Report.

[14] Smith, S.; Marlic, A. (2013). Estimation of Marine Debris Accumulation on Beaches Is Significantly Influenced by Sampling Timescale. *One Help*, *8*(12), e83694.

[15] Adawiyah, H.; Mutia, T.; Subhani, A.; Kabul, L.M.; Saputra, A.M. (2021). Geographic Information System Analysis of Land Use Change in Labuhan Haji District. *Geodika: Journal of Geographical Science and Education Studies*, *5*(1), 174–184. https://doi.org/10.29408/geodika.v5i1.3674.

[16] Andika, Y.; Pratiwi, B.; Erniati, E.; Erlangga, E.; Imanullah, I. (2023). Identification and Density of Inorganic Waste on Ujong Blang Beach. *Journal of Marine Sciences*, *5*(1), 27–34.

[17] Alpiana, A.; Rahmawati, D.; Isfanari, I.; Ariyanto, A.; Firaz, M.F.; Matrani, B.F.A. (2022). Identification of Geomorphological Changes Due to Sirtu Mining in Labuhan Haji District. *Journal of Mining and Environment*, *3*(1), 43–50. https://doi.org/10.31764/jpl.v3i1.10005.

[18] Attamimi, A.F.R.; Lisminingsih, R.D.; Latuconsina, H. (2023). Composition and Density of Beach Debris Species in Lamongan Regency. *Scientific Journal of Science Students*, *1*(1), 34–41.
[19] CSIRO (2014). Sources of Marine Debris, Distribution and Fate of Plastic and Other Debris, and Their Impacts on Marine and Coastal Wildlife. Commonwealth Scientific and Industrial Research Organisation Report.
[20] Haerudin, H.; Putra, A.M. (2019). Analysis of Seawater Quality Standards for Marine Tourism Development in Labuhan Haji Waters. *Geodika: Journal of Geographical Science and Education Studies*, *3*(1), 13–18. https://doi.org/10.29408/geodika.v3i1.1473.
[21] Kristianto, K.; Situmorang, M.; Trisilawati, T.; Halim, D.; Yolanda, Y.; Turnip, R.A.; et al. (2024). Socialization of Organic Waste Recycling for Students. *Sapangambei Manoktok Hitei Community Service Journal*, *4*(1), 80–84. https://doi.org/10.36985/akn5f155.
[22] Larasati, N.; Fitria, L. (2020). Analysis of Organic Waste Management System at University of Indonesia. *National Journal of Global Environmental Health*, *1*(2), 3. https://doi.org/10.7454/jnklg.v1i2.1032.
[23] Larasati, C.E.; Damayanti, A.A.; Nurliah; Astriana, B.H.; Rahman, I. (2022). Marine Debris Composition on West Coast of Ampenan Beach. *Enggano Journal*, *7*, 42–51. https://doi.org/10.31186/jenggano.7.1.%25p.
[24] Lippiatt, S.M.; Arthur, D.C.; Wallace, E.N. (2013). Assessing the Abundance and Type of Marine Debris in Shorelines and Surface Waters of Chesapeake Bay Tributaries. Proceedings of Marine Science Meeting, Salt Lake City, USA.
[25] Nurmayanti, W.P.; Kertanah, K.; Hasanah, S.H.; Rahim, A. (2023). Forecasting Waste in East Lombok Regency Using ARIMA and Decomposition Methods. *Jambura Journal of Probability and Statistics*, *4*(2), 72–84. https://doi.org/10.37905/jjps.v4i2.19954.
[26] Patuwo, N.C.; Wilmy, D.R.; Manengkey, H.; Schaduw, J.N.W.; Manembu, D.I.S.; Edwin, D.I. (2020). Characteristics of Marine Debris on Tumpaan Beach. *Journal of Coastal and Tropical Seas*, *8*, 70–83. https://doi.org/10.35800/jplt.8.1.2020.27493.
[27] Sukib; Muti'ah; Siahaan, J.; Supriadi. (2019). Increasing Awareness of Marine Hazards Through Community Guidance. *Journal of Community Service for Science Education*, *2*, 102–106. https://doi.org/10.29303/jpmpi.v2i2.343.
[28] Tuahatu, J.W.; Tuhumury, N.C. (2022). Marine Debris Stranded on the Coast of Hative Besar. *TRITON: Journal of Aquatic Resources Management*, *18*(1), 47–54. https://doi.org/10.30598/TRITONvol18issue1page47-54.
[29] Wardana, J.; Maharani, H.W.; Diantari, R. (2022). Identification of Inorganic Marine Debris on Sebalang and Tanjung Selaki Beaches. *Journal of Fisheries and Marine Affairs*, *27*(1), 67–73. https://doi.org/10.31258/.