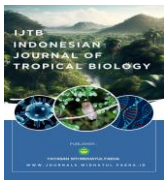
IJTB VOLUME 1 (2) 2025

Indonesian Journal of Tropical Biology

https://journals.widhatulfaeha.id/index.php/ijtb



Original Research Paper

Analysis of Factors Causing Garbage Accumulation in The Tanjung Karang Coastal Area

Irtiqa Ulya[1*], Valhalla Yudha Pramana[1], Syaum Sahruramadhan[1], Nadia Tarissya Pratiwi[1]

[1]Environmental Science Study Program, Faculty of Mathematics and Natural Sciences, University of Mataram, Jl. Majapahit No.62 Gomong, Mataram 83115, West Nusa Tenggara, Indonesia,

Article Info

Artikel History
Recived:10 May 2025
Revised: 30 May 2025
Accepted: 30 June 2025,
Published: 31 August 2025

Corresponding Author: Irtiqa Ulya
Author Name: Irtiqa Ulya
Email: irtiqaulyy@gmail.com
Number Hp: 62 87-854-727-355

ISSN **3108-9801**
ESSN: **3109-0842**

Abstract

Tanjung Karang Beach in Mataram City faces serious waste accumulation due to rising human activities, especially tourism. This study aims to identify the types and sources of waste and analyze the main contributing factors. A qualitative approach was used through field observations, interviews, and literature reviews. The results show that inorganic waste, particularly single-use plastics and styrofoam, dominates the area. The main sources include tourist activities, river runoff, and marine debris. Using a Fishbone Diagram, four contributing factors were identified: (1) Machine limited infrastructure and budget; (2) Method irregular waste collection and weak implementation of the 3R principle; (3) Man low awareness and careless littering; and (4) Material inadequate trash bins. The study concludes that waste accumulation in Tanjung Karang is a multidimensional issue involving technical, behavioral, and institutional aspects. This research contributes to understanding coastal waste problems and recommends improving infrastructure, promoting community education, enforcing regulations, and strengthening collaboration between stakeholders to ensure sustainable coastal tourism.

Keywords: coastal tourism, single-use plastic, Tanjung Karang Beach, waste accumulation waste management

INTRODUCTION

The waste problem in coastal areas has become a global environmental issue that continues to increase along with the growth of human activities, particularly in the tourism sector (Tsai et al., 2020). Coastal zones, as one of the most important ecosystems, not only play a role in maintaining ecological balance but also hold strategic social and economic functions, especially as tourism destinations. Unfortunately, tourist activities along the coast often generate large amounts of waste, mainly inorganic materials such as plastics and styrofoam, which are difficult to decompose naturally (Maione, 2021). Various studies have shown that tropical coastal areas are hotspots for waste accumulation, posing serious threats to marine ecosystems and the livelihoods of surrounding communities (Herrera-Franco et al., 2023). Therefore, scientific studies on waste management in coastal areas are crucial to promote both environmental sustainability and regional economic resilience.

Conceptually, coastal waste management should ideally integrate technical, social, and institutional systems, emphasizing the principles of a circular economy and community participation. This approach positions local communities not merely as passive objects but as active agents in maintaining the cleanliness and sustainability of coastal areas. The application of the 3R principles (Reduce, Reuse, Recycle) serves as a key foundation for reducing the volume of waste entering the environment, particularly non-biodegradable waste that dominates coastal zones (Putera et al., 2024). In addition, synergy among governments, business actors, and tourists is a prerequisite for establishing effective waste governance. Thus, coastal waste management cannot be carried out in a sectoral manner but must instead be based on multi-stakeholder collaboration.

In practice, however, waste management in many coastal areas, including Tanjung Karang Beach, remains far from ideal. The challenges encountered include the lack of waste management infrastructure, low awareness among local communities and tourists, weak regulations, and the absence of consistent monitoring systems. On the other hand, some communities still rely on tidal movements as a so-called “natural” mechanism for disposing of waste, which further exacerbates marine pollution (Sagala, 2024; Asmal et al., 2023). Studies in several regions indicate that active involvement of local communities, supported by regulatory frameworks, can significantly improve the effectiveness of waste management (Latumahina et al., 2023). Therefore, a contextual approach based on field data is urgently needed to identify the types, sources, and root causes of waste accumulation in a comprehensive manner.

This research is particularly important because Tanjung Karang Beach is one of the leading tourist destinations in Mataram City, which is currently facing environmental pressures due to waste accumulation. The study not only provides an updated overview of on-site conditions but also offers an in-depth analysis of the contributing factors to waste

How to Cite
Ulya, I., Pramana, V.Y., Sahruramadhan, S., & Pratiwi1Zahra, N.T. (2025). Analysis of Factors Causing Garbage Accumulation in The Tanjung Karang Coastal Area. *Indonesian Jornal of Tropical Biology,* 1(2), 71-77.

accumulation through the Fishbone Diagram approach. The main objective of this research is to identify the types and primary sources of waste, as well as to analyze the root causes underlying waste accumulation in the coastal area. The findings are expected to serve as a foundation for formulating more effective and sustainable waste management strategies, while simultaneously supporting ecosystem conservation and the development of environmentally friendly tourism.

RESEARCH METHODS

Time and Location of Study

This research was conducted at Tanjung Karang Beach (Figure 1), located on Jalan Sultan Hasanudin, Pagesangan, Mataram City, West Nusa Tenggara Province, in March 2025. Geographically, Tanjung Karang Beach is situated at coordinates 8°36'13" S and 116°4'20" E. The site was chosen because it is one of the most popular coastal tourist destinations with a high level of human activity. However, this area is also experiencing serious problems related to waste accumulation.

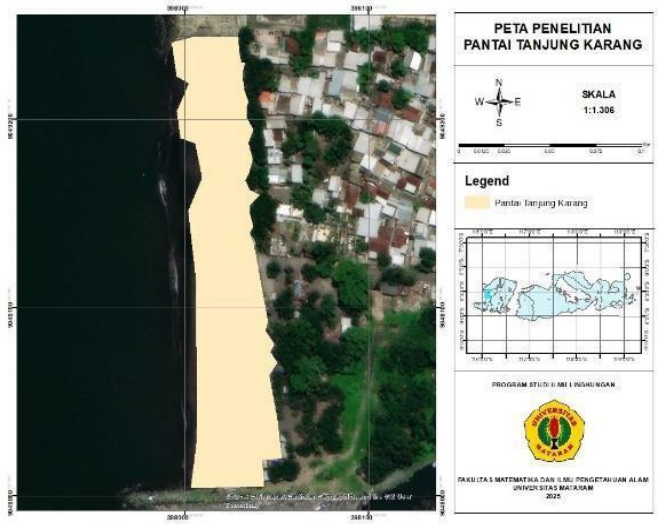


Figure 1. Research Location Map

Type of Research

This study employed a descriptive qualitative approach aimed at gaining an in-depth understanding of the waste accumulation phenomenon at Tanjung Karang Beach by exploring actual field conditions. This approach allowed the researchers to uncover meanings, perceptions, and social interactions that influence the dynamics of waste management in coastal areas.

The qualitative method was chosen because it aligns with the research focus, which emphasizes the identification of waste types and sources, as well as the analysis of contributing factors to waste accumulation. Rather than measuring the phenomenon quantitatively, this study seeks to trace and interpret data from various perspectives of the actors involved, including local communities, tourists, and business operators in the coastal area.

Research Procedure

The research procedure was carried out in three main stages: field observation, in-depth interviews, and literature review. Field observations were conducted directly at Tanjung Karang Beach to examine the physical environmental conditions, community activities, and patterns of waste accumulation at the site. The observations were participatory in nature and conducted systematically by recording various aspects such as the types and distribution of waste, the disposal habits of tourists and vendors, as well as the availability and condition of waste management facilities such as trash bins, temporary disposal sites (TPS), and recycling facilities. The data obtained from these observations provided an initial overview of the actual problems occurring in the field and served as the basis for developing relevant interview instruments.

Furthermore, data collection was also carried out through in-depth interviews with informants selected purposively. The informants consisted of local residents living around the beach, food vendors or culinary business operators in the coastal area, and tourists visiting the research site. Semi-structured interviews were used to allow researchers to explore broader and deeper information regarding the informants' perceptions, knowledge, and behaviors related to waste management. The information obtained from these interviews played a crucial role in identifying social interaction patterns, environmental awareness, and obstacles to the effective implementation of waste management in the tourist area.

As a complement, the researchers also conducted a literature review by examining various relevant scientific references, including national and international journals, academic books, previous research reports, policy documents, and other reliable sources. This literature review was used to strengthen the theoretical and conceptual framework of the study and to serve as a comparative basis for the field findings. By integrating these three procedures triangulatively, the research is expected to provide a comprehensive and in-depth analysis of the waste accumulation problem at Tanjung Karang Beach, as well as offer contextual and applicable solutions.

RESULTS AND DICCUSSION

Types of Waste at Tanjung Karang Beach

The results of observations and interviews showed that the most common types of waste found in the Tanjung Karang coastal area were inorganic waste, particularly single-use plastics and fragments of styrofoam. Both types fall into the category of non-biodegradable waste, requiring decades to centuries to decompose naturally, and they pose a significant threat to the marine environment and aquatic life (Pilapitiya & Ratnayake, 2024).

Field findings revealed that inorganic waste dominated the Tanjung Karang area, with the most abundant types being single-use plastics and styrofoam fragments. Plastics were mainly in the form of plastic bags, beverage bottles, straws, and food and drink packaging from vendors around the beach. Meanwhile, styrofoam mostly originated from food containers and packaging materials for fresh fish sold by coastal business operators. These types of waste are non-biodegradable, difficult to decompose naturally, and have high potential to pollute marine waters and threaten marine organisms.

A visual overview of the waste accumulation is presented in Figure 2, showing piles of plastics and styrofoam along the shoreline. Details on the types, sources, characteristics, and potential environmental impacts of these wastes are provided in Table 1, which clarifies the contribution of each waste category to the coastal pollution problem. This

condition strongly indicates that human activities, particularly in the tourism and trade sectors, are the primary contributors to the inorganic waste problem at Tanjung Karang. These findings highlight the urgent need for systematic waste management strategies to prevent further degradation of the coastal ecosystem and to safeguard its ecological and economic functions.

Figure 2. Waste accumulation at Tanjung Karang Beach

Table 1. Types of waste at Tanjung Karang Beach

Type of Waste	Main Source	Characteristics	Potential Environmental Impact
Single-use plastics	Vendors, tourists	Lightweight, non-degradable	Microplastics, polluting the sea and food chain
Styrofoam (foam)	Food containers, fish packaging	Fragile, easily broken	Chemical toxins, ingestion by marine organisms
Mixed waste	River flow, household waste	Unsorted, heterogeneous	Difficult to recycle, poor aesthetics

These wastes not only damage the aesthetic value of the beach but also pose serious ecological risks, such as disrupting turtle and fish habitats and causing systemic marine pollution (Thushari & Senevirathna, 2020). The findings of this study indicate that inorganic waste, particularly single-use plastics and styrofoam, are the most dominant types of waste in the Tanjung Karang coastal area. This result is consistent with the study by Maione (2021) on coastal tourism sites in Zanzibar, Tanzania, which reported that more than 75% of beach waste consisted of plastics and single-use packaging left behind by tourists. Instant food and beverage packaging is considered practical by both tourists and vendors but is often carelessly discarded due to a lack of facilities and environmental education.

A study by Kumar et al. (2021) in India also found that single-use plastics are the main contributors to coastal ecosystem pollution, directly impacting the decline of ecosystem services, fisheries productivity, and tourism potential. This indicates that unsustainable consumption patterns and poor waste management practices represent a common challenge in tropical coastal areas, not only in Indonesia.

Sources of Waste

The waste found at Tanjung Karang Beach comes from various sources, both land-based and marine-based, which accumulate due to the lack of integrated and coordinated waste management. These sources simultaneously contribute to the increasing volume and diversity of waste in the coastal area. Details on each source, their pathways into the beach area, and the dominant waste types produced are presented in Table 2.

1. Tourist and Vendor Activities
   Tourism activities and culinary businesses around the coastal area were the main contributors of inorganic waste, especially during weekends and holiday seasons. Tourists and vendors tended to massively use single-use food and beverage packaging without being supported by adequate waste management systems. As a result, much of the waste was left in open spaces and eventually polluted the coastal environment.
2. River Flow
   Tanjung Karang Beach is intersected by a river estuary that serves as an entry route for domestic waste from upstream areas. During heavy rainfall, the river's water volume increases and carries waste from dense settlements, markets, and poorly managed drainage systems. This waste is then discharged into coastal waters and stranded along the shoreline.
3. Marine Debris
   Another source of waste originated from offshore activities, particularly fisheries, shipping, and other coastal areas with poor waste management. Ocean currents carry this waste from various locations, making Tanjung Karang Beach a natural accumulation point for marine debris.

Table 2. Sources of Waste

No	Source of Waste	Pathway to the Beach	Dominant Waste Types
1	Tourist activities	Directly left at the site	Plastics, food packaging
2	Coastal culinary vendors	Operational residues	Styrofoam, plastics, food waste
3	River flow	Carried during flooding or rainfall	Mixed waste, household plastics
4	Offshore (marine debris)	Transported by ocean currents	Plastics, fishing gear

These results indicate that the waste problem is not merely a matter of local behavior but also a regional and cross-sectoral issue. At Tanjung Karang Beach, the sources of waste originate from three main pathways: tourist activities, river inflow, and marine debris. This pattern is very similar to the findings of Jambeck et al. (2015), who reported that around 80% of marine waste originates from land, primarily through river flows that carry household waste to estuaries and eventually deposit it on beaches.

Research by Onink et al. (2021) further supports these findings through global ocean circulation simulations, which demonstrated that coastal zones function as natural traps for floating waste originating from shipping and fishing activities. Such waste is transported by ocean currents and accumulates along shorelines, creating a pollution burden that is not only generated by local activities but also by other coastal regions.

Analysis of Factors Causing Waste Accumulation

To identify the root causes of waste accumulation, this study employed the Fishbone Diagram (also known as the Ishikawa Diagram), which categorizes various contributing factors into four main groups: Man, Method, Machine, and Material. This approach was chosen because it provides a systematic and comprehensive visual mapping of complex and interrelated problems. Overall, the diagram illustrates that waste accumulation in the Tanjung Karang coastal area is driven not only by individual behavior but also by systemic weaknesses in waste management and insufficient infrastructure support. Based on the analysis using the Fishbone Diagram, four main categories of factors were identified as the causes of waste accumulation at Tanjung Karang Beach. Each of these factors contributes in an interconnected manner, reinforcing the complexity of waste management problems in coastal areas.

Man (Human Factor)

The behavior of local communities and tourists is the most significant factor. Low awareness of the importance of maintaining environmental cleanliness, limited concern for the long-term impacts of waste, and the habit of littering have accelerated the accumulation of waste along the coastline. The lack of participation in community clean-up activities also reflects a weak sense of ownership toward the area.

Method

From a methodological perspective, waste management practices are still inconsistent and unstructured. The absence of a fixed waste collection schedule has led to the buildup of waste, especially during holiday seasons. Furthermore, the implementation of the 3R principles (Reduce, Reuse, Recycle) has not been effective among local communities and business operators due to insufficient outreach and monitoring.

Machine (Infrastructure/Facilities)

Infrastructure limitations serve as a major obstacle in waste management. Facilities such as temporary disposal sites (TPS), plastic shredding machines, and recycling systems are not yet available. In addition, the allocation of regional budgets for waste management remains very limited, resulting in low prioritization of infrastructure development.

Material (Supporting Facilities)

Supporting facilities, such as trash bins along the beach, are very limited in both quantity and quality. Most bins are in poor condition, uncovered, or not placed in strategic locations with high visitor density. Moreover, the absence of segregated bins (organic and inorganic) hampers the initial process of sorting and managing waste sustainably. A summary of these four factors can be seen systematically in Table 3, which provides a concise overview of the types of problems within each category based on the Fishbone Diagram analysis. This table strengthens the understanding that waste accumulation at Tanjung Karang Beach is a multidimensional problem that requires cross-sectoral interventions and a comprehensive approach.

Table 3. Summary of causal factors based on the Fishbone Diagram

No	Factor	Main Problems
1	Man	Low awareness, littering behavior, minimal participation in clean-up activities
2	Method	No fixed collection schedule, weak 3R socialization
3	Machine	Lack of waste management infrastructure, limited budget allocation
4	Material	Damaged trash bins, uneven distribution, absence of waste segregation

The analysis using the Fishbone Diagram revealed that waste accumulation at Tanjung Karang Beach is influenced by four main factors: human, method, infrastructure, and supporting facilities. The human factor was identified as the most significant contributor, consistent with the findings of Jotaworn & Nitivattananon (2023) in Thailand, which showed that tourist behavior and low participation of local communities in waste management were the main barriers to the success of beach clean-up programs. From the methodological perspective, weak implementation of the 3R principles and the absence of a regular waste collection schedule further intensified waste accumulation. This condition is in line with the study of Herdiansyah et al. (2021) in Ambon Bay, which found that coastal waste management failed due to the absence of governance systems and continuous socialization efforts.

Meanwhile, infrastructure (machine) and supporting facilities (material), such as temporary disposal sites (TPS), segregated bins, and transport equipment, also represent classic problems in many coastal regions of Indonesia. Lestari & Trihadiningrum (2019) stated that in most Indonesian coastal cities, waste management infrastructure remains underdeveloped, particularly in tourist destinations where rapid growth in visitor numbers is not matched by adequate investment in waste management systems.

Impacts

The accumulation of waste has wide-ranging environmental, social, and economic impacts. Marine ecosystems are disrupted, the attractiveness of tourism declines, and public health is at risk due to microplastic contamination. Similar studies have shown that the coastal waste crisis in tropical regions is closely linked to weak synergy among stakeholders (Herrera-Franco et al., 2023). Waste accumulation in coastal areas, such as that occurring at Tanjung Karang Beach, poses serious threats to ecosystem health, tourism economic value, and community well-being. Microplastics resulting from the degradation of plastics and styrofoam may enter the marine food chain and accumulate in the human body through the consumption of fish and shellfish (Jiang et al., 2021).

A study by Tsai et al. (2020) in Vietnam's coastal cities showed that environmental degradation caused by waste has a direct impact on declining tourist visits and reduced investor confidence in the tourism sector. A similar situation is very likely to occur in Tanjung Karang if systematic and collaborative waste management measures are not implemented.

A comparison between the results of this study and several similar studies conducted in various coastal areas is presented in Table 4, which shows relatively similar patterns of problems and implications across different geographical contexts. This comparison strengthens the argument that coastal waste problems are not merely local but represent a global challenge requiring cross-sectoral and cross-regional approaches in a sustainable manner. The comparison between the findings at Tanjung Karang Beach and those from other coastal regions, both in Indonesia and abroad, aims to place the waste issue in a broader context, while identifying common patterns, sources of problems, and impacts observed in various locations.

The findings of this study demonstrate that the dominance of single-use plastic and styrofoam waste in coastal areas is not a local phenomenon. In Zanzibar, Tanzania, Maione (2021) reported that more than 75% of beach waste originated from tourism activities, particularly food and beverage packaging. A similar trend was also found in Vietnam's coastal areas by Tsai et al. (2020), where plastic waste caused a decline in environmental quality, which in turn reduced tourist arrivals and investor confidence in sustainable coastal tourism.

Meanwhile, the study by Herdiansyah et al. (2021) in Ambon Bay highlighted low community participation and weak environmental education systems as the main barriers to effective coastal waste management. This condition is highly relevant to the findings at Tanjung Karang, where community and tourist awareness of waste management remains low and is not supported by strong social systems or regulations. Such parallels demonstrate that behavioral and institutional dimensions are as critical as technical ones in ensuring effective waste governance.

Emphasized the importance of multi-stakeholder synergy and the provision of supporting infrastructure as key factors for the success of waste management in coastal tourist destinations. This resonates with the situation at Tanjung Karang, where the lack of basic facilities such as trash bins, temporary disposal sites (TPS), and waste transportation systems exacerbates the problem of waste accumulation. These findings illustrate that infrastructure is not merely a supporting factor but a prerequisite for sustainable tourism, as it directly shapes the behaviors of both tourists and local businesses in managing their waste.

Table 4. Comparison of similar studies in various locations

No	Research Location	Main Findings	Reference
1	Zanzibar, Tanzania	75% of beach waste consists of single-use plastics	Maione (2021)
2	Ambon Bay, Indonesia	Low community participation and weak 3R socialization	Herdiansyah et al. (2021)
3	Eastern Coast, Thailand	Low tourist awareness and inadequate facilities	Jotaworn & Nitivattananon (2023)
4	Coastal cities, Vietnam	Waste reduces tourism attractiveness and hinders investment	Tsai et al. (2020)
5	Jakarta Coastline, Indonesia	Lack of infrastructure hampers sustainable waste management	Akbar et al. (2024)

Furthermore, the study on the Jakarta Coastline by Akbar et al. (2024) pointed out the lack of government investment in waste management infrastructure, which has led to suboptimal management of coastal areas despite the continuous increase in tourist numbers. This demonstrates that the growth of the tourism sector without corresponding improvements in infrastructure will only exacerbate environmental pollution. It also indicates that inadequate policy prioritization and budget allocation for waste management undermine long-term sustainability goals, even in economically significant urban coastal zones.

By comparing these studies, it becomes evident that coastal waste problems follow a similar global pattern, driven by the rapid expansion of tourism, weak institutional capacity in waste management, and low levels of environmental awareness among stakeholders. However, while the challenges are global in nature, their solutions must be localized and context-specific. Community-based models, for instance, may succeed in regions with strong social cohesion, whereas areas with higher tourism intensity may require stricter regulatory enforcement and economic incentives for waste reduction.

These findings reinforce the urgency of implementing cross-sectoral and community-based approaches in coastal waste management, not only in Tanjung Karang but also in other similar destinations. A combination of infrastructure investment, environmental education, regulatory enforcement, and multi-stakeholder collaboration offers the most promising pathway toward sustainable coastal tourism. This integrated approach aligns with the principles of circular economy and sustainable development, which emphasize reducing resource consumption while maximizing ecological, social, and economic benefits.

Synthesis and Implications

The findings at Tanjung Karang Beach reinforce that coastal waste is a multidimensional issue encompassing technical, social, economic, and institutional aspects. The patterns and factors identified are consistent with phenomena observed across various parts of the world, underscoring the need for integrative strategies in coastal area management.

The success of waste management does not rely solely on infrastructure but is also strongly influenced by behavioral change among communities, effective enforcement of regulations, and multi-stakeholder synergy. Studies have shown that collaboration between government, business actors, local communities, and non-governmental organizations is essential to create an integrated and sustainable waste management system (Wang et al., 2022). Behavioral changes can be encouraged through education, incentives, and consistent rule enforcement, while strict and

adaptive regulations are crucial for improving compliance and the effectiveness of waste management practices (Cui et al., 2021; Xu et al., 2024).

Multi-stakeholder synergy, including the involvement of the private sector and local communities, strengthens coordination and accelerates the adoption of best practices that have been proven effective in other regions (Koiwanit & Filimonau, 2023; Salvia et al., 2021). By considering local contexts and learning from successful experiences elsewhere, areas such as Tanjung Karang have great potential to be revitalized into clean, healthy, and sustainable tourist destinations through collaborative and systemic approaches (Walters et al., 2024; Jotaworn & Nitivattananon, 2023; Hu et al., 2021; Raghu & Rodrigues, 2020).

CONCLUSION

The accumulation of waste at Tanjung Karang Beach is dominated by inorganic materials, particularly single-use plastics and styrofoam fragments. These wastes primarily originate from tourist activities (especially food consumption on-site), river estuaries that carry land-based waste, and marine debris transported by ocean currents. The analysis of causal factors confirmed that the accumulation of waste is driven by a combination of: (1) Machine, limited infrastructure and budget allocation for waste management; (2) Method, inconsistent collection schedules, weak implementation of the 3R principles, and lack of operational regulations; (3) Man, low awareness and irresponsible littering behaviors without strict sanctions; and (4) Material, insufficient number and quality of trash bins. The interplay of these four factors perpetuates waste accumulation in the coastal area.

ACKNOWLEDGEMENT

The authors would like to express their gratitude to the Tanjung Karang community for their participation, to all team members involved in conducting this research, and to the supervising lecturer of the Environmental Development Issues course for their valuable guidance and support.

REFRENCE

Akbar, H., Koda, S., Dewi, R., Amalia, S., N., & Sapanli, K. (2024). The tourism improvement potential through waste management for along Jakarta coastline. *IOP Conference Series: Earth and Environmental Science*, 1366. https://doi.org/10.1088/1755-1315/1366/1/012002.

Asmal, I., Walenna, M., Nas, W., &, R. (2023). Application of local wisdom in handling waste in coastal settlements as an effort to minimize waste production. *Environmental and Sustainability Indicators*. https://doi.org/10.1016/j.indic.2023.100283.

Cui, T., Su, X., & Zhang, Y. (2021). Study on Compulsory Classification Management and Behavior Synergy of Municipal Solid Waste. *Sustainability*, 13, 6265. https://doi.org/10.3390/SU13116265.

Herdiansyah, H., Saiya, H., Afkarina, K., & Indra, T. (2021). Coastal Community Perspective, Waste Density, and Spatial Area toward Sustainable Waste Management (Case Study: Ambon Bay, Indonesia). *Sustainability*. https://doi.org/10.3390/su131910947.

Herrera-Franco, G., Merchán-Sanmartín, B., Caicedo-Potosí, J., Bitar, J., Berrezueta, E., & Carrión-Mero, P. (2023). A systematic review of coastal zone integrated waste management for sustainability strategies. *Environmental research,* 117968. https://doi.org/10.1016/j.envres.2023.117968.

Hitige, L., & Samarakoon, T. (2021). Status of Solid Wastes and its Management in the Coastal Environments of Sri Lanka. *International Journal of Environment, Agriculture and Biotechnology*. https://doi.org/10.22161/ijeab.65.1.

Hu, J., Tang, K., Qian, X., Sun, F., & Zhou, W. (2021). Behavioral change in waste separation at source in an international community: An application of the theory of planned behavior. *Waste management*, 135, 397-408. https://doi.org/10.1016/j.wasman.2021.09.028.

Jambeck, J., Geyer, R., Wilcox, C., Siegler, T., Perryman, M., Andrady, A., Narayan, R., & Law, K. (2015). Plastic waste inputs from land into the ocean. *Science*, 347, 768 - 771. https://doi.org/10.1126/science.1260352.

Jiang, Y., Yang, F., Kazmi, S., Zhao, Y., Chen, M., & Wang, J. (2021). A review of microplastic pollution in seawater, sediments and organisms of the Chinese coastal and marginal seas. *Chemosphere*, 286 Pt 1, 131677. https://doi.org/10.1016/j.chemosphere.2021.131677.

Jotaworn, S., & Nitivattananon, V. (2023). Multi-stakeholder synergies for enhancing environmental management of beach recreation in the eastern coast, Thailand. *Current Research in Environmental Sustainability*. https://doi.org/10.1016/j.crsust.2022.100204.

Jotaworn, S., Nitivattananon, V., Kusakabe, K., & Xue, W. (2021). Partnership towards Synergistic Municipal Solid Waste Management Services in a Coastal Tourism Sub-Region. *Sustainability.* https://doi.org/10.3390/su13010397.

Koiwanit, J., & Filimonau, V. (2023). Stakeholder collaboration for solid waste management in a small tourism island. *PLOS ONE*, 18. https://doi.org/10.1371/journal.pone.0288839.

Kumar, R., Verma, A., Shome, A., Sinha, R., Sinha, S., Jha, P., Kumar, R., Kumar, P., S., Das, S., Sharma, P., & Prasad, P. (2021). Impacts of Plastic Pollution on Ecosystem Services, Sustainable Development Goals, and Need to Focus on Circular Economy and Policy Interventions. *Sustainability*. https://doi.org/10.3390/su13179963.

Latumahina, F., Putra, S., Buamona, Z., & Mualo, S. (2023). Coastal Tourism Enhancement and Waste Management Initiative in Negeri Ureng, Central Maluku. *Indonesian Journal of Cultural and Community Development.* https://doi.org/10.21070/ijccd2023896.

Lestari, P., & Trihadiningrum, Y. (2019). The impact of improper solid waste management to plastic pollution in Indonesian coast and marine environment. *Marine pollution bulletin*, 149, 110505. https://doi.org/10.1016/j.marpolbul.2019.110505.

Li, W., Tse, H., & Fok, L. (2016). Plastic waste in the marine environment: A review of sources, occurrence and

effects. *The Science of the total environment*, 566-567, 333-349. https://doi.org/10.1016/j.scitotenv.2016.05.084.

Maione, C. (2021). Quantifying plastics waste accumulations on coastal tourism sites in Zanzibar, Tanzania. *Marine pollution bulletin*, 168, 112418. https://doi.org/10.1016/j.marpolbul.2021.112418.

Mance, D., Vilke, S., & Debelić, B. (2020). Sustainable Governance of Coastal Areas and Tourism Impact on Waste Production: Panel Analysis of Croatian Municipalities. *Sustainability*. https://doi.org/10.3390/su12187243.

Onink, V., Jongedijk, C., Hoffman, M., Van Sebille, E., & Laufkötter, C. (2021). Global simulations of marine plastic transport show plastic trapping in coastal zones. *Environmental Research Letters*, 16. https://doi.org/10.1088/1748-9326/abecbd.

Pilapitiya, P., & Ratnayake, A. (2024). The world of plastic waste: a review. *Cleaner Materials*. https://doi.org/10.1016/j.clema.2024.100220.

Prambudi, W., & Giyanti, I. (2021). Lean Analysis Framework for Waste Management: A Case of Indonesian Textile Company. *Jurnal Optimasi Sistem Industri*, 20, 11. https://doi.org/10.25077/JOSI.V20.N1.P11-21.2021.

Putera, D., Rofii, E., Lawi, A., Rini, R., & Putra, A. (2024). Enhancing Waste Management and Marine Ecosystem Protection for Tourism Sustainability on Buluh Island. *BIO Web of Conferences.* https://doi.org/10.1051/bioconf/202413406010.

Raghu, S., & Rodrigues, L. (2020). Behavioral aspects of solid waste management: A systematic review. *Journal of the Air & Waste Management Association*, 70, 1268 - 1302. https://doi.org/10.1080/10962247.2020.1823524.

Sagala, I. (2024). From Legal to Customary Approach: Seeking an Alternative Policy on the Coastal Area Solid Waste Management in Jambi, Indonesia. *JISPO Jurnal Ilmu Sosial dan Ilmu Politik*. https://doi.org/10.15575/jispo.v13i1.24050.

Salvia, G., Zimmermann, N., Willan, C., Hale, J., Gitau, H., Muindi, K., Gichana, E., & Davies, M. (2021). The wicked problem of waste management: An attention-based analysis of stakeholder behaviours. *Journal of Cleaner Production*, 326. https://doi.org/10.1016/j.jclepro.2021.129200.

Suhartini., Harisun, E., & Conoras, M. (2022). Waste Management in Laluin Village, South Halmahera. *MATEC Web of Conferences*. https://doi.org/10.1051/matecconf/202237205003.

Thushari, G., & Senevirathna, J. (2020). Plastic pollution in the marine environment. *Heliyon*, 6. https://doi.org/10.1016/j.heliyon.2020.e04709.

Tsai, F., Bui, T., Tseng, M., Lim, M., & Tan, R. (2020). Sustainable solid-waste management in coastal and marine tourism cities in Vietnam: A hierarchical-level approach. *Resources, Conservation and Recycling*, 168, 105266. https://doi.org/10.1016/j.resconrec.2020.105266

Walters, J., Véliz, K., Vargas, M., & Busco, C. (2024). A systems-focused assessment of policies for circular economy in construction demolition waste management in the Aysén region of Chile. *Sustainable Futures*. https://doi.org/10.1016/j.sftr.2024.100186.

Wang, W., Chu, Z., & Zhang, T. (2022). Synergy Degree Evaluation of Stakeholder Engagement in Integrated Municipal Solid Waste Management: A Case Study in Harbin, China. *Energies*. https://doi.org/10.3390/en15145000.

Xu, X., Luo, L., Lai, Q., Dong, C., & Feng, C. (2024). A network perspective on tourism waste management: An evolutionary game analysis of stakeholders' participation in the Third Pole region. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2024.141378.

Yusup, M., Purbawati, P., Atmaja, D., & Rosanti, I. (2025). Penerapan Diagram Sebab Akibat (Fishbone Diagram) pada Identifikasi Kerusakan Mekanisme Pengumpan dan Penyusuana Standard Operating Procedure Mesin Skrap. *Mars: Jurnal Teknik Mesin, Industri, Elektro Dan Ilmu Komputer*. https://doi.org/10.61132/mars.v3i1.619.