Impact of Domestic Waste Disposal on The Environment in The Coastal Area of Mangunharjo Urban Village, Semarang City

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Abstract: Mangunharjo Beach located in Tugu District, Semarang City, is an ecologically and economically significant coastal area that supports local livelihoods through fishing, tourism, and related industries. However, rapid urban and industrial growth has led to severe pollution that threatens its sustainability. This qualitative study conducted in February 2023 by direct observation and a literature review, aims to provide an initial report on the current state of pollution at the beach focusing on domestic, industrial, and oil contamination. Observations revealed significant accumulations of plastic and styrofoam debris, including food and detergent containers, along with visible traces of oil and industrial effluent. These pollutants reduce water and sediment quality, endanger marine biota, and negatively impact local socioeconomic activities, especially fisheries and tourism. The findings are consistent with similar studies across other coastal regions in Indonesia, indicating a widespread pollution issue that requires immediate attention. Implementing sustainable waste management strategies — including the 3R concept (Reduce, Reuse, Recycle), public awareness campaigns, and stronger policy enforcement — is vital for mitigating pollution, preserving marine ecosystems, and ensuring the long-term sustainability of Mangunharjo Beach and its surrounding communities.

Keywords: *Mangunharjo, Domestic waste, Coastal area*

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1. Introduction

The rapid development of human activities around coastal areas significantly contributes to water pollution. Coastal aquatic ecosystems form an integral part of the broader human environment and are highly influenced by diverse anthropogenic pressures. These activities range from residential and industrial processes to agricultural runoff, all of which contribute pollutants to water bodies and can serve as critical indicators of the extent of environmental degradation (Muchtar, 2012). Among the most significant impacts is the decline in socio-economic activities in coastal regions. Environmental pollution reduces water and ecosystem quality, which directly affects important economic sectors such as tourism and fisheries. Coastal pollution degrades aesthetic value and natural beauty, making the area less attractive to tourists. It also reduces fish stocks and endangers the livelihoods of communities who depend on the sea.

Organic matter pollution can be divided into three main sources: domestic waste, industrial waste, and agricultural waste (Hasibuan, 2016). Domestic waste is the residual material produced or abandoned by humans, intentionally or unintentionally entering the ocean directly or indirectly through rivers and drainage systems. Domestic waste also falls under the broad definition of marine debris, which refers to any man-made object found on the ocean's surface, seabed, or beaches resulting from human behavior. Domestic debris varies greatly in size, from microplastics and small particles to mega- and macro-debris. Both large and small debris pose serious hazards to marine life. Macro- and mega-debris like plastic bags, ropes, or containers can cause entanglement of turtles, seabirds, and fish, leading to injuries, infections, or even death. Smaller debris can accumulate inside animals after being ingested due to their resemblance to food. The internal bleeding, blockages in respiratory or digestive tracts, and infections caused by such debris have been documented across a range of species, posing a serious threat to biodiversity (Iftitah & Musta'in, 2018).

Mangunharjo Village in Semarang City is one of the most strategically important coastal areas in the region, offering substantial economic and ecological potential. Its proximity to key industrial and shipping routes, combined with its diverse marine habitats, makes this coastal zone a vital center for local commerce, tourism, and fishing. The area's rich natural resources—such as mangroves, fishery grounds, and fertile intertidal zones—have historically supported the livelihoods of local fishermen and small-scale entrepreneurs, while also providing crucial ecosystem services like coastal protection and carbon sequestration. Despite these advantages, Mangunharjo faces serious and growing environmental challenges that increasingly jeopardize its sustainability. Field observations reveal the widespread presence of domestic wastes, untreated industrial effluents, and oil contamination along the shoreline. Plastic debris, styrofoam, and other household refuse accumulate on beaches and enter the coastal waters, where they degrade into microplastics that might be accumulated in the tissues of marine life. Industrial discharges containing heavy metals and toxic chemicals further degrade water quality and sediment health, posing risks to aquatic organisms and humans who rely on seafood. Oil pollution from shipping and other maritime activities compounds these threats by creating slicks on the water surface and toxic residues along the shore, impairing habitat quality and harming fish, birds, and other wildlife. Among the most pressing issues in Mangunharjo is the improper management of domestic effluent.

Domestic wastewater generated by households — containing food debris, detergents, soaps, and other chemicals — is often released into the sea without adequate treatment. According to Mada et al. (2023), this domestic waste exhibits five primary characteristics; It contains bacteria, parasites, and possibly viruses that can contaminate shellfish and bathing areas, posing serious health risks to humans. It contains significant amounts of organic matter and suspended solids that raise biochemical oxygen demand (BOD5) in the water column, leading to oxygen depletion as organic materials are decomposed. Its nutrient content, especially nitrogen and phosphorus, is excessively high, which can cause eutrophication — an over-enrichment of water bodies that promotes harmful algal blooms. It contains visible floating debris consisting of inorganic materials (e.g., plastics and synthetic chemicals) that degraded very slowly and accumulated in the marine environment. It contains potentially hazardous substances such as surfactants, preservatives, and fragrances which are difficult to break down naturally.

Inorganic domestic waste, especially plastic materials such as food packaging, detergent bottles, and cosmetic containers, is among the most persistent and environmentally damaging types of pollution found in coastal and urban areas. Unlike organic matter that breaks down relatively quickly, these synthetic materials are not degraded easily under natural conditions, allowing them to be accumulated in terrestrial and aquatic ecosystems for decades. According to Laapo et al. (2019), under stable environmental conditions, physical, chemical, and biological processes in nature can gradually recycle some of these materials. However, this natural recycling rate is extremely slow and is vastly outpaced by the rapid growth of human population, urbanization, and consumption. This imbalance between plastic production and natural degradation processes has led to an alarming increase in plastic waste pollution across land and coastal areas, severely disrupting ecosystem functions.

Furthermore, the widespread presence of plastic debris in water bodies, beaches, and soil layers not only degrades the visual landscape and reduces the quality of recreational spaces, but also poses serious, long-term threats to human health. Plastics often act as carriers for hazardous substances — including dyes, plasticizers, and other persistent organic pollutants — which can leach into the environment over time and accumulate in the food chain. Prolonged exposure to these toxic compounds has been associated with serious health risks such as cancer, reproductive disorders, developmental impairments, and tissue damage in humans and other living organisms (Sari & Yulianto, 2018). Beyond its direct health impacts, plastic pollution also interferes with local economies by reducing the productivity of fisheries and coastal tourism, further endangering the livelihoods of coastal communities.

In light of these risks, urgent interventions — including stricter regulations on plastic use, improvements in waste management infrastructure, increased public awareness, and the promotion of eco-friendly materials — are essential to mitigate the escalating plastic pollution crisis. Addressing this issue will not only help protect human health and preserve biodiversity but also contribute to long-term sustainability and resilience in coastal and marine environments.

This research aims to provide an initial report on the state of marine pollution at Mangunharjo Beach. Pollution is presented as complex and persistent, requiring a holistic and long-term solution supported by all stakeholders.

Addressing marine pollution must involve collaborative efforts from local governments, the industrial sector, surrounding communities, and research institutions. This research is expected to serve as a communication bridge that raises awareness of existing pollution problems and promotes cooperative action toward sustainable solutions that benefit both the environment and the socioeconomic welfare of Mangunharjo Village.

2. Materials and Method

This research employed a qualitative approach utilizing direct observation methods, supported by an extensive literature review. The primary aim was to describe the existing condition of coastal pollution in Mangunharjo Beach, located along the North Coast of Tugu District, Semarang City. The observations were carried out over several days in February 2023 to capture a representative snapshot of the pollution levels and types of pollution affecting this particular coastal area. By using observable physical parameters, the research was able to identify visible signs of pollution and evaluate the extent of its impact on the surrounding environment. All findings were subsequently compiled and presented in a rich descriptive format, providing an in-depth overview of the current environmental status.

Throughout the observation period, three key parameters were systematically investigated. The first parameter focused on industrial waste, including direct evidence of factory discharges, metallic residues, effluent streams, and other hazardous materials deposited along the shoreline. These pollutants, mostly originated from industrial processes, were noted for their varying color, consistency, and potential toxicity, all of which may contribute to long-term harm to the coastal ecosystem. The second parameter focused on domestic waste produced by nearby communities, which encompassed a broad range of debris such as plastic bags, beverage bottles, food wrappers, and organic matter left scattered on the beach and washed into the ocean. The presence of such litter indicated the current level of public awareness and effectiveness of existing waste management practices in the area. Finally, the third parameter examined oil contamination, where the researchers searched for visual signs of oil slicks, tar balls, or sheens on the surface water and along the shoreline. They also investigated sediment discoloration and any observable stress or mortality among local marine organisms that might signal the occurring pollution.

By synthesizing all observations into a coherent narrative, this research provides a baseline dataset that can inform local policy makers, community groups, and industry stakeholders. Furthermore, the findings will help shape future initiatives and restoration efforts to reduce pollution, protect marine biodiversity, and enhance the long-term sustainability of Mangunharjo Beach and its vital coastal ecosystem.

3. Results and Discussion

Based on the survey results, a substantial amount of domestic waste was observed along Mangunharjo Beach, primarily consisting of plastic and styrofoam debris, especially empty detergent containers (Figure 1). The presence of this domestic waste is highly concerning because it can severely compromise the sustainability of the region's aquatic ecosystems. When plastic enters the marine environment, it does not biodegrade easily but gradually breaks down into smaller pieces under the influence of sunlight, waves, and microbial activity. Over time,

these plastics are further eroded into tiny fragments known as microplastics. Microplastics pose significant threats to aquatic biota due to their toxic properties — they can accumulate persistent organic pollutants, inhibit the growth rates of marine species, and cause direct physical damage when ingested. Once inside the tissues or cells of aquatic organisms, these plastic particles may block digestive tracts, impair nutrient absorption, and even result in mortality (Jovanovic, 2017).

In addition to plastic debris, other domestic wastes such as household chemicals and detergents were also evident during the survey. Continuous input of these substances into the coastal waters can lead to a significant disturbance of the water's chemical composition. Excessive detergents and surfactants, for example, may promote the proliferation of algae through eutrophication, resulting in harmful algal blooms that reduce dissolved oxygen levels. This process can deprive other aquatic species of oxygen and suitable habitat, leading to mass mortality and long-term ecosystem instability (Laapo et al., 2019).

Beyond its impact on marine life, the contamination of coastal waters with plastic and chemicals also endangers human health and local livelihoods by affecting fishery yields and reducing the recreational value of beaches. Without proper mitigation strategies, the continued accumulation of these wastes will not only decrease biodiversity but also undermine the ecological balance and sustainability of Mangunharjo's coastal ecosystem. An example is algae blooming which causes other organisms to not get living space, causing mass mortality.

Figure 1. Observation results in Mangunharjo Beach

Beach litter, especially in the form of plastic debris, poses a serious and persistent threat to coastal and marine ecosystems. The presence of plastic waste along beaches is not only visually unappealing but also highly detrimental to the health of coastal environments. When plastic materials accumulate in the ocean, they do not easily degrade; instead, they persist for long periods, gradually breaking down into smaller particles known as microplastics. This accumulation has far-reaching consequences for marine ecosystems across Indonesia. Plastic debris can physically damage coral reefs, seagrass beds, and mangrove forests — vital habitats that support biodiversity — and contribute to the disruption of marine food webs, pollution, and damage to fish and other consumables for human consumption. Beyond its direct impact on aquatic life, plastic pollution also negatively affects local economies that depend on fishing and coastal tourism. Coastal pollution reduces the aesthetic value of beaches, deters visitors, and harms the livelihoods of coastal communities. Without effective and sustainable waste management practices, the continuous increase in plastic pollution will severely undermine the resilience of

Indonesia's marine ecosystems and pose a threat to food security, public health, and sustainable development goals.

Ocean, plastic waste can degrade into micro and nano sizes, and plastics of this size can be consumed by marine life and invertebrates. In addition, fragmented plastics can easily disperse to depths of 2000 feet in pristine marine environments. This leads to metabolic disorders, gastrointestinal irritation, and death of marine life. Plastic wastealso impacts human settlements. The presence of plastic waste in Mangunharjo Beachis a major consequence of the large amount of plastic that floats in the ocean and is carried by the waves to the shore. The negative impact of plastic waste is inevitable because this condition creates a synergistic effect between damage to marine ecosystems and environmental damage to local communities (Apriliani et al., 2017).

Similar findings have been reported in other coastal pollution studies across Indonesia, confirming that domestic waste pollution is a widespread issue. For example, research conducted by Pratama et al. (2020) on the coast of Malangrapat Village in Bintan Regency revealed that non-organic domestic wastes — particularly plastic materials such as empty detergent packages, soap wrappers, and shampoo bottles — were the most prevalent types of debris. This indicates a pattern of inadequate waste management and highlights the persistence of plastic materials in the marine environment. Additionally, Sihombing et al. (2022) documented substantial accumulations of coconut shells and other organic debris along the coast of Pantai Cermin. These materials not only reduced the aesthetic appeal of the beach but also affected its recreational value and potential for tourism. Similarly, Mada et al. (2023) observed large amounts of household food scraps scattered across the coast of Namandoi Hamlet, which produced foul odors and attracted scavengers, thereby further diminishing the beach's environmental quality and usability.

Moreover, Akbar & Pratiwi, (2022), who conducted research at Makassar Beach, reported comparable findings where significant volumes of domestic waste, especially food debris and plastic packaging, had accumulated along the shoreline. These persistent pollution problems not only degrade the visual appeal of the coastal area but also pose serious threats to the health of local ecosystems and communities. Taken together, these studies underscore the need for more comprehensive and collaborative waste management strategies, as well as public education initiatives, to prevent continued pollution of coastal areas across Indonesia and protect the integrity and sustainability of marine environments for future generations.

In addition to directly polluting the coastal waters and harming the biological communities that inhabit them, the presence of garbage also significantly reduces the aesthetic value of the beach and deters visitors. The accumulation of litter — especially plastics, food packaging, and other domestic waste, not only spoils the visual appeal of the landscape but also emits unpleasant odors that make the beach an undesirable destination for tourists. This loss of beauty and cleanliness can have serious socio-economic implications, as coastal tourism is often a key source of income for surrounding communities. If this pollution continues unchecked, it will gradually erode the natural charm of the coast, diminish tourist interest, and ultimately cause long-term damage to local livelihoods that depend on tourism.

To prevent further degradation of coastal areas, proactive measures must be taken. Reducing the use of single-use disposable materials is one of the most effective strategies, as these items contribute greatly to the volume of plastic and inorganic debris that reaches the ocean. Simply relying on proper garbage disposal is insufficient; a more sustainable, long-term shift in behavior is needed. Communities and visitors alike must embrace the practice of choosing eco-friendly, reusable, and biodegradable materials to minimize the amount of waste generated. Moreover, public awareness campaigns, waste management programs, and community-based clean-up initiatives must be strengthened to address this issue comprehensively. By collectively working toward these goals, we can protect the environment, enhance the sustainability of coastal ecosystems, and preserve the natural beauty of beaches for future generations (Kusumawati & Prasetyo, 2019).

Waste obtained from human activities and causes problems for humans can be handled with the 3R concept of Reuse, Reduce, and Recycle. Reuse imeans to utilize at least once more some previously used items, such as cardboard, plastic, and others. Reduce means diminishing the use ofdisposable items, such as single use plastic bags and replace them by reusable bags. The last is recycling, which means reprocessing used or unused goods into other products. Examples of this are recycling plastic waste in such a way that the waste does not become waste, even though it can still be converted into goods, or by composting the waste into economically useful goods. To reduce waste and stop environmental pollution, especially dirty water, which can affect many things, the sustainability of the coastal area should be maintained, and the ecosystem and coastal aquatic biota should not be harmed, also in terms of sustainability. Coastal future and sustainable development goals should be achieved in simultaneous effort. So environmental sustainability, especially in the context of coastal ecosystems and coastal marine biota, must be maintained and protected because waste is everyone's responsibility and must be managed together for the benefit of sustainable development of coastal ecosystems (Haryanto & Purwanto., 2017).

An effective way to manage household's waste pollution, so as to protect the environment, maintain cleanliness, and prevent the spread of diseases, is by implementing proper and sustainable waste management at the household level. This begins with separating organic and inorganic waste at the source. Every household should provide two separate containers for organic and inorganic materials, and all family members must be educated to dispose of their waste accordingly. Organic waste, such as food scraps, vegetable peels, and leftover fruits, can be processed into compost, which is highly beneficial for enriching soil and supporting plant growth. Although the decomposition process can produce unpleasant odors, composting offers significant ecological and economic benefits. If producing fertilizer at home is not feasible, organic waste can be sent to local organic waste processing centers so that it can be recycled into high-quality fertilizer. In contrast, inorganic waste, particularly plastics from food packaging and groceries, can be reduced by switching to reusable shopping bags and containers, thereby decreasing the amount of plastic that enters the environment.

In addition to separating organic and inorganic waste, it is also crucial to manage hazardous household materials separately. Items such as used batteries, broken electronic devices, pesticide containers, and light bulbs must not be mixed with regular household garbage. These types of waste contain harmful chemicals that can leach into soil and water if improperly disposed of, posing serious risks to ecosystems and human health. By collecting hazardous materials separately and bringing them to recycling

centers or returning them directly to the manufacturers, these wastes can be properly treated and even recycled into new products. Moreover, reducing the overall volume of waste generated is equally important. Simple habits like carrying a refillable water bottle to avoid buying single-use plastic bottles, bringing personal containers for food purchases, and choosing eco-friendly, minimally packaged products can significantly reduce the amount of household waste produced each day. By practicing these measures collectively and consistently, communities can help reduce pollution, prevent the spread of diseases, and support the sustainability of coastal and marine ecosystems for future generations. Ultimately, responsible household waste management is a shared responsibility that plays a vital role in achieving sustainable development goals and preserving the health and integrity of both the environment and society (Kusumawati & Prasetyo, 2019)

4. Conclusions

This study underscores the significant environmental challenges faced by Mangunharjo Beach, driven by the accumulation of domestic, industrial, and oil-related waste. The findings reveal that plastic debris, styrofoam, household chemicals, and other pollutants have profoundly degraded the coastal environment, disrupting marine ecosystems and threatening biodiversity. The proliferation of plastic waste — which eventually breaks down into microplastics — and excessive use of detergents and other surfactants contribute to water quality deterioration, harmful algal blooms, and mass mortality of aquatic species. Moreover, pollution reduces the beach's aesthetic and recreational value, resulting in declining tourist interest and socioeconomic losses for local communities that depend on fishing and tourism.

This issue is not isolated to Mangunharjo alone; similar observations have been reported across Indonesia's coastal areas, highlighting the urgent need for collaborative actions. Effective strategies such as implementing the 3R (Reduce, Reuse, Recycle) concept, separating household waste at the source, and conducting public awareness campaigns must be prioritized to manage waste sustainably. These interventions require the commitment and cooperation of the government, industries, local communities, and researchers to protect coastal ecosystems and ensure the long-term sustainability of marine resources. By taking proactive measures today, we can restore the beauty, productivity, and ecological balance of coastal areas like Mangunharjo Beach for future generations.

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