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Efforts to Prevent Marine Plastic Waste Based on Local Regulations and Participation of Coastal Communities in Semarang City

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ABSTRACT

Marine plastic waste pollution is an increasingly urgent environmental problem in Semarang City, characterized by the increasing accumulation of plastic in coastal areas and marine waters which has an impact on ecosystem degradation, decline in the quality of fishery resources, and socio-economic vulnerability of fishing communities. This condition is triggered by high industrial and coastal economic activity, population density, and weak source-based waste management and low involvement of coastal communities. The urgency of preventing marine plastic waste requires a legal approach that not only focuses on regulations, but also on strengthening community participation as the main actor in coastal areas. This study aims to analyze the adequacy of local regulations in Semarang City in preventing marine plastic waste and formulate a prevention model based on regulations and participation of coastal communities. The research method used is normative juridical with legislative, conceptual, and policy approaches. Legal materials include laws and regulations in the field of waste management and the environment as well as relevant scientific literature. The results of the study show that regional regulations in Semarang City have not been specifically and integrated to regulate the prevention of marine plastic waste, and have not optimally accommodated the strategic role of coastal communities. This study concludes that the prevention of marine plastic waste needs to be directed at the harmonization of regional regulations, strengthening local institutions, and increasing the participation of coastal communities through community-based education, incentives, and supervision to realize sustainable and environmentally fair management of marine plastic waste.

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1. INTRODUCTION

The problem of marine plastic waste has become a serious global and national environmental issue. Indonesia, as an archipelagic country with a very long coastline, faces major challenges in controlling plastic waste entering the sea, where plastic waste is estimated to dominate marine waste and adversely affect coastal ecosystems and coastal people's lives(Ilmu et al., 2025).

The city of Semarang as one of the coastal cities in Indonesia is also inseparable from this challenge. Population growth and increased plastic consumption in urban areas result in significant volumes of plastic waste, some of which have the potential to leak into the marine environment if not managed effectively. Preliminary studies show the high proportion of plastic waste in the total waste in Semarang and the need to strengthen the management of formal and informal parties to reduce plastic leakage into the sea(Andarani et al., 2018).

Marine plastic waste in the coastal area of Semarang City cannot be understood solely as a problem of individual behavior, but as a structural problem that is closely related to the land waste management system, coastal area governance, and the effectiveness of regulations. Studies show that more than 70% of marine plastic waste is sourced from land-based activities, especially from densely populated urban areas and coastal industrial areas (Jambeck, J. R., 2015)(Lebreton, L., & Andrady, 2019). This condition is relevant to the characteristics of Semarang City as a coastal city with port activities, industry, trade, and dense settlements along the river that empties into the sea.

Efforts to control marine plastic waste in Indonesia have been regulated through various policies and regulations, both at the national and local levels. One of the important policy instruments is the Presidential Regulation of the Republic of Indonesia Number 83 of 2018 concerning Marine Waste Handling which establishes the National Action Plan for Marine Waste Management 2018–2025 with the target of reducing marine debris, especially plastics, through a comprehensive, collaborative, and integrated strategy. These regulations encourage the involvement of a wide range of stakeholders including local governments, the private sector, community organizations, and local communities(Presidential Regulation (Perpres) Number 83 of 2018 concerning Marine Waste Handling, 2018).

In the local context, regional regulations on waste management are also an important instrument in regulating the system for reducing, managing, and preventing plastic leakage into the sea, including the implementation of Semarang City Regional Regulations that regulate waste management at the city level. Despite these regulations, implementation and compliance with regulations are often constrained by management capacity, as well as limited community participation(T. A. Waste et al., n.d.).

In addition to regulatory aspects, the active participation of coastal communities is a crucial component in efforts to prevent marine plastic waste. Community involvement in educational activities, beach clean-up actions, community-based waste management, and the development of community empowerment models has been shown to increase ecological awareness and the role of communities in reducing plastic waste in coastal areas. Activities such as socialization of the impact of plastic pollution on marine life and community involvement in waste management have shown positive results in increasing the involvement of local communities in protecting the coastal environment(Aba et al., 2024).

Based on this, research on marine plastic waste prevention efforts that focus on the integration between local regulations and coastal community empowerment in Semarang City is important to understand how existing policies can be optimized through local community participation to achieve the goal of sustainable marine plastic waste reduction.

2. METHODS

This study uses Normative Juridical Method (normative legal research), which is a research method that emphasizes the study of written legal norms in the positive legal system. This method was chosen because the focus of the research is to analyze legal provisions regarding marine plastic waste management and its prevention strategies based on applicable regulations and policies, not through

field data collection. In normative juridical research, analysis is carried out by systematically and critically examining relevant legal materials to gain a comprehensive understanding of applicable legal regulations and concepts(Credits, 2024).

The research approach in this study is applied three complementary approaches, namely:

Statute Approach

The legislative approach is carried out by examining all legal regulations relevant to the theme of marine plastic waste prevention. This approach includes an analysis of national and local laws and regulations governing waste management, environmental protection, and specific policies related to marine debris. The study of the regulation aims to understand the structure and substance of the applicable positive law as well as the relationship between legal rules relevant to the prevention of marine plastic waste. This approach is commonly used in normative legal research to examine written legal norms as the main object of study(Rahmadian et al., 2024).

Conceptual Approach

A conceptual approach is used to analyze the basic concepts that underlie legal norms related to marine plastic waste, such as the concept of environmental sustainability, producer responsibility, and prevention principles (*precautionary principle*), and community participation. This approach helps to explain the theoretical and doctrinal foundations of the law that are the basis for understanding the legal norms and strengthens the normative interpretation of the purpose and function of the regulation under study(Rahmadian et al., 2024).

Policy Approach

Policy approach or *policy approach* It is carried out by examining the direction, objectives, and values of legal policies contained in various regulatory instruments. This approach not only looks at what is written in the regulations, but also *Why* the norm is formulated and *How* The purpose of the legal policy is expected to be fulfilled in the practice of regulating marine plastic waste management. This policy approach is important to understand the effectiveness of legal instruments in encouraging the prevention of marine debris and its relevance to strategies to strengthen coastal community participation(Researcher/Institution, 2025).

Primary legal material is in the form of laws and regulations that have binding legal force and are the basis for regulating plastic waste prevention. These primary ingredients include:

- Laws related to waste management and the environment (e.g. the Law on Waste Management, the Law on Environmental Protection and Management, and its implementing regulations).
- Semarang City Regional Regulations that regulate waste management and coastal conservation policies.

Secondary legal materials consist of scientific literature such as books, journal articles, previous research reports, other academic sources, as well as relevant policy documents and scientific studies to provide context, interpretation, and conceptual support for the primary legal materials being studied.

Legal Data Collection Techniques are collected through literature studies (*library research*) and document studies (*documentary research*). Researchers collect, inventory, and verify primary and secondary legal materials from official sources such as national regulatory portals, digital libraries of international and national journals, and related books and scientific publications. All the materials collected are then systematically analyzed to answer the formulation of the research problem(Credits, 2024).

The data analysis technique is carried out in a Normative qualitative by identifying, interpreting, and examining legal norms found in primary and secondary legal materials. The researcher maps the relationship between rules, examines legal terms and provisions, and draws policy implications based on legislative, conceptual, and policy approaches. This qualitative analysis aims to produce an in-depth understanding of the strengths and limitations of regulations in the prevention of marine plastic waste as well as relevant policy recommendations(Credits, 2024).

3. FINDINGS AND DISCUSSION

Implementation of Local Regulations in Semarang City

Case Location & Year	Problems	Chronology	Completion efforts
Tambakrejo, Tanjung Mas Village (2019-2024)	Plastic waste trapped by sea embankment	The construction of sea embankments inhibits the flow of waste, causing puddles of plastic waste and domestic waste in coastal settlements to cause poor sanitation conditions and odors that disturb coastal residents. This condition shows that technical solutions without waste management considerations can exacerbate local plastic pollution.	Drainage rearrangements, routine waste hauling, and citizen involvement in environmental stewardship (Kompas, 2024)
Marina Beach & Tirang Beach (±2018–2020)	Dominance of macro plastic waste on coastlines	Monitoring shows that plastic (bottles, bags, styrofoam) is the largest fraction of waste, especially after high tide and rain, coming from land and tourist activities. These findings show that there is a leakage of waste from the mainland carried by ocean currents and human activities on the coast (monitoring plastic waste) and poses ecological and aesthetic risks to the coast, which has an impact on the tourism sector and the health of the marine environment(Sibero et al., 2020).	Recommendations for routine monitoring, strengthening waste management from sources, and involving coastal communities in beach cleanup(Sibero et al., 2020).
Mangunharjo Coast, Tugu District (2021–2023)	Accumulation of domestic plastics and styrofoam	Household waste is carried away by rivers and accumulates in coastal areas, reducing water quality and	Education on household waste management, strengthening TPS, (Waste Disposal Sites)

		disrupting marine life and fishermen's activities(Adhityan et al., n.d.).	and coastal community-based approaches (Adhityan et al., n.d.).
North Semarang Coast (2019–2022)	High load of coastal macroplastics	Scientific monitoring found that daily macroplastic runoff was quite high and correlated with urban activities(Zaman, B., Purwanto, & Widodo, 2023).	Data-driven policy recommendations, integration of regional regulations with national policies(Zaman, B., Purwanto, & Widodo, 2023).
Semarang coastal community education program (2020–2022)	Low awareness and participation of the community	Coastal communities have not been actively involved in the prevention of marine plastic waste(Fitriani, E., & Yulianto, 2020).	3R training, formation of coastal environmental care groups, and ongoing education campaigns(Fitriani, E., & Yulianto, 2020).

This table shows that cases of marine plastic waste on the coast of Semarang are repetitive and systemic, influenced by land leakage factors, weak infrastructure, and limited regulations and community participation. Effective solutions are proving to be inadequate through a purely technical approach, but require policy integration, strengthening of local regulations, and the active participation of coastal communities.

Presidential Regulation Number 83 of 2018 concerning *Marine Waste Management* is a national policy instrument that explicitly targets a 70% reduction in marine plastic waste by 2025. This Presidential Regulation emphasizes five main pillars, namely behavior change, land-based waste management, coastal and marine waste management, funding and policy reform, and law enforcement.

Cases on the coast of Semarang City such as the accumulation of plastic waste at Marina Beach, Mangunharjo, and Tambakrejo show that The implementation of the Land and Coastal Waste Management Pillar as mandated by Presidential Regulation 83/2018 has not been running optimally at the regional level. The plastic waste that dominates the coastal area of Semarang mostly comes from the mainland through rivers and urban drainage, which is in line with the national finding that the majority of marine debris comes from land activities(Purba, N. P., 2019).

Furthermore, Presidential Regulation 83/2018 requires local governments to prepare regional action plans (RAD) as a derivative of national policies. However, based on the case in Semarang, there has not been a strong integration between the national target for reducing marine debris with technical policies and regional budgeting, so prevention efforts are still reactive (e.g. beach clean-up actions) and have not touched the root of structural problems.

The Mayor of Semarang City pointed out that the local government has issued a number of legal instruments related to waste management and plastic use control. For example, Semarang City Regional Regulation Number 12 of 2025 concerning Waste Management Regulate the scope of comprehensive waste management including the duties of local government authorities and the participation of the community in general in the management of municipal waste, waste banks, and community groups (*Semarang City Regional Regulation Number 12 of 2025*, Article 4). This regulation establishes the role of the community in general, but it is still general in nature and lacks emphasis on the reduction or prevention of plastic waste in the sea specifically (Semarang City Regional Regulation Number 12 Of 2025 Concerning Waste Management, 2025).

In addition, Semarang Mayor Regulation Number 7 of 2025 concerning the Utilization of Plastic Waste into Alternative Fuels is a local innovation that encourages the use of plastic waste through pyrolysis by involving various parties including the community and waste banks. However, the focus is more on the use of plastic as fuel than efforts to prevent plastic leakage into the sea or coastal protection specifically(Semarang Mayor Regulation Number 7 Of 2025 Concerning The Use Of Plastic Waste As Alternative Fuel, 2025).

Previous regulations such as Regulation of the Mayor of Semarang Number 27 of 2019 concerning the Control of Plastic Use It also encourages the reduction of the use of plastic bags, pipettes, and Styrofoam to encourage public awareness of the use of single-use plastics. However, empirical studies indicate that the implementation of these regulations is not yet fully effective and there is no strong link with the issue of marine debris, and often enforcement and socialization are still limited(Rahmayani & Aminah, 2021).

The city of Semarang already has a Regional Regulation related to waste management and environmental cleanliness. However, from a normative juridical perspective, the Regional Regulation is still general and has not specifically regulated the prevention of marine plastic waste as a coastal issue. As a result, the problem of marine plastic waste in coastal areas does not receive a different priority from urban waste in general.

The Tambakrejo case shows the weakness of cross-sector policy integration at the regional level. The development of flood and storm control infrastructure is not accompanied by waste and waste management arrangements, thus exacerbating the accumulation of plastic waste in coastal settlements. This condition reflects the suboptimal principle of prevention and prudence (precautionary principle) which should be the basis of regional environmental policies.

In addition, the Semarang City Regional Regulation has not explicitly regulated the mechanism for the participation of coastal communities in the prevention of marine plastic waste. In fact, Presidential Regulation No. 83 of 2018 places changes in behavior and community participation as the main pillars. The absence of this arrangement causes the participation of coastal communities to be voluntary and unsustainable, as seen in the cases of Mangunharjo and Tirang Beach.

Overall, although local policies already exist and support the management of plastic waste in general, there is no explicit and integrated legal instrument that regulates the prevention of marine plastic waste at the city level. The integration between municipal waste management and marine plastic reduction strategies is still partial and has not been clearly stated in a single regulatory document that directly regulates the flow of plastic into the sea.

Lack of Accommodation for the Role of Coastal Communities

The findings of the study show that the role of coastal communities in existing regulations is still minimal. Regulations such as Regional Regulation Number 12 of 2025 concerning Waste Management only include the term "community participation" in general without a concrete strategy to Active involvement of coastal communities in marine debris prevention. The context of marine waste prevention, including the participation of coastal communities in monitoring, reporting, or mitigation programs in coastal areas, has not been specifically stated in this regulation(SEMARANG CITY REGIONAL REGULATION NUMBER 12 OF 2025 CONCERNING WASTE MANAGEMENT, 2025).

Other findings in the academic study show challenges in the relationship between government policy and community practices in waste management, including a lack of coordination between formal policies and existing community activities. The study found that existing regulations often do not "touch" the concerns of the community due to the lack of community involvement in the formulation and implementation process, which has an impact on the effectiveness of policy implementation(Elizabeth et al., 2025).

This can also be seen from the implementation of community-based waste management programs in Semarang which, according to previous studies, still faces challenges such as low community awareness and the need for more intensive socialization to support effective community involvement(Sidarta, 2021).

The Need for Regulatory Harmonization and Institutional Strengthening

Referring to data and legal material analysis, it can be concluded that regulatory harmonization between general urban waste management and marine debris prevention schemes needs to be strengthened. Current local regulations do not fully recognize the complexity of marine debris as a cross-sectoral issue that requires a joint framework of various agencies, local agencies, and community groups. The researchers found that this harmonization is important so that overlapping or fragmented regulations do not hinder implementation at the local level.

Strengthening local institutions through the establishment of coordination forums involving local governments, coastal communities, environmental NGOs, and academia is needed to integrate marine debris prevention strategies in local policy planning and implementation. The integration can also strengthen the effectiveness of supervision and law enforcement against plastic waste management violations(C. Waste & Profile, 2024).

Collaboration between local governments, academics, NGOs, and the community is essential. For example, a cross-sectoral education and cooperation campaign in Semarang (although not only focused on the sea) has been initiated through seminars and workshops with stakeholders on plastic management in the city, which opens up space for dialogue and joint action plans on plastic waste reduction (including preventive efforts that can be implemented on the coast)(Soegijapranata Catholic University, 2018).

Increasing Community Participation Through Education, Incentives, and Community Supervision

Sustainable efforts to prevent marine plastic waste need to be supported by increasing coastal community participation through educational approaches, incentives, and community-based monitoring mechanisms. Sustainable public education can increase environmental awareness and encourage changes in community behavior in managing plastic waste at its source.

Community empowerment programs have been proven to increase awareness and preventive measures. For example, the study of Raising awareness of the coastal community of Semarang showed that educational activities, 3R (Reduce, Reuse, Recycle) training, and strengthening of local groups have been Increase knowledge and community involvement in maintaining coastal cleanliness, which is an important basis in preventing the accumulation of plastic waste in the ocean(Retawimbi et al., 2025).

In addition, providing incentives to local communities to practice the 3R (Reduce, Reuse, Recycle) scheme, especially in coastal areas, for example through the support of waste bank facilities, access to people's capital, or awards for communities that have succeeded in reducing waste leakage can increase community motivation and involvement.

Community-based surveillance, such as the establishment of coastal watch voluntary groups involved in monitoring marine and coastal zones to prevent illegal dumping of litter, can also strengthen the implementation of marine litter prevention policies that are more responsive to local conditions.

4. CONCLUSION

Marine plastic pollution along the coast of Semarang is a multifactorial problem driven by land-based waste leakage, inadequate drainage systems, and infrastructure development that fails to account for waste flows and environmental impacts. Addressing this issue requires a comprehensive and integrated approach rather than isolated interventions. Continuous scientific monitoring is essential to provide baseline data for assessing the effectiveness of mitigation measures and guiding evidence-based decision-making. At the same time, empowering coastal communities through environmental education and the implementation of the 3R principles (Reduce, Reuse, and Recycle) is crucial for reducing plastic waste at its source. Equally important is the synergy between government policies and community participation, particularly in development planning that systematically incorporates environmental considerations. Therefore, preventing marine plastic waste in Semarang City depends on harmonizing national regulations with more context-specific local policies while fostering active

community involvement. A strong collaboration between top-down policy implementation and bottom-up community engagement, supported by environmental education, community empowerment, and strengthened local institutions, has significant potential to improve the effectiveness of sustainable marine debris management and reduce the accumulation of plastic waste in coastal ecosystems.

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