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Indonesia's Policy in Addressing Marine Debris

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Abstract
Marine debris is a serious global environmental problem that affects the sustainability of marine ecosystems and human health. This research aims to analyze the threats posed by marine debris, such as its impact on marine life, ecosystems, and economies, as well as discuss Indonesia's policies in addressing the issue. The study aims to analyze the threats of marine debris to marine life, ecosystems, and economies, and identify the main sources of plastic waste in the ocean. This research utilizes secondary data analysis and literature review as research methods. The results show that marine debris has significant impacts on marine organisms and economic sectors. Indonesia's policies include improved waste management and increased public awareness. This research provides insights and recommendations for maintaining the sustainability of Indonesia's marine environment. In conclusion, this research highlights the importance of comprehensive policies and coordinated actions in addressing the issue of marine debris. Prevention efforts, proper waste management, and public awareness of the importance of maintaining the cleanliness of the ocean are key factors in reducing the negative impacts of marine debris. This research is expected to provide insights and recommendations for the government and other stakeholders in their efforts to preserve the sustainability of Indonesia's marine environment.

Keywords: Marine Debris, Waste Ocean, And Marine Environment

INTRODUCTION

The ocean is one of the 17 goals of the Sustainable Development Goals (SDGs) or sustainable development (2015-2030), which is measured by balancing three dimensions of sustainable development: environment, social, and economic. The ocean is one of the aquatic ecosystems that have the ability to maintain the sustainability of ecosystems, serving as the ultimate reservoir for all types of water waste generated from human activities. As stated by Darmono (2001), the ocean receives materials carried by water from agricultural areas, household waste, garbage, waste from ships, oil spills, and other waste materials.

The problem of waste is inevitable due to the increasing population and human activities that contribute to the generation of various types of waste, including food waste, paper, cardboard, plastic, textiles, leather, garden waste, wood, glass, metal, household items, hazardous waste, and so on (Taufiqurrahman, 2016). Improper waste disposal, as stated by Subekti (2017), directly impacts the cleanliness and environmental health of the surrounding area. During the rainy season, the waste enters water bodies, increasing the river's water flow. This condition results in the drifting of the waste, which is carried towards river estuaries and eventually reaches the sea. Marine debris refers to solid materials intentionally or unintentionally left in the ocean, posing a threat to the survival and sustainability of marine life according to CSIRO (2014) cited in Zulkarnaen (2017). Coastal and marine pollution continues to worsen due to the entry of human and natural activities' remnants into the sea. The ocean receives materials carried by water from agricultural areas, household waste, garbage, waste from ships, offshore oil spills, and many other discarded materials (Elyazar, 2007). Marine debris poses a direct threat to marine organisms, marine habitats, and human health, resulting in serious socio-economic

losses. The alarming spread of marine debris is evident, with 14 billion tons of waste being dumped into the oceans every year (Hetherington et al., 2005).

Waste that enters the ocean, carried by currents and moves along the direction of ocean currents, is known as marine debris. Marine debris refers to residual materials and products that are intentionally or unintentionally left or discarded into the ocean by humans, including objects that are transported to the sea through rivers and household and industrial waste disposal channels (Yogiesti, 2010). In general, marine debris encompasses any objects found on the ocean surface, in the water, and on beaches as a result of human activities (Dwiyanto, 2011). Various sizes of marine debris can be found in marine waters, including coastal areas, ranging from large-sized (megadebris and macrodebris), both of which can pose significant risks to the direct health of marine organisms, especially marine animals such as fish, turtles, and birds, due to ingestion or entanglement. These incidents can cause internal bleeding, ulcers, respiratory and digestive system blockages, and even death for marine life (Muti'ah et al., 2019). The impacts of marine debris can threaten the survival and sustainability of aquatic biota, according to Isman (2016) cited in Bangun et al. (2019). If marine debris continues to increase, it will have negative effects on the food chain, the economy, and the health of coastal communities, and this cannot be avoided. Plastic waste, in large quantities, can affect biota that falls into the IUCN Red List or not, according to Gall and Thompson (2015) cited in Assuyuti et al. (2018). Plastic waste is suspected to be an agent affecting coral reef diseases, as mentioned by Harrison et al. (2011). Plastic waste can persist for years, causing environmental pollution. When plastic waste is burned, it releases gases that pollute the air and pose a respiratory hazard to humans. If plastic waste is buried in the soil, it contaminates the soil and groundwater (Pribadi et al., 2017).

Plastic is a synthetic organic polymer made from petroleum with ideal properties for various applications, including packaging, construction, household and sports equipment, vehicles, electronics, and agriculture. Over 300 million tons of plastic are produced each year, with half of it used to make disposable items such as shopping bags, cups, and straws. If improperly disposed of, plastic waste can damage the environment and biodiversity. At least 14 million tons of plastic end up in the oceans every year. Plastic debris is currently the most abundant type of waste in the oceans, accounting for 80% of all marine debris found from surface waters to deep-sea sediments. Plastic is found on coastlines of every continent, with more plastic waste found near popular tourist destinations and densely populated areas.

Under the influence of UV radiation from the sun, wind, currents, and other natural factors, plastic breaks down into small particles called microplastics (particles smaller than 5 mm) or nanoplastics (particles smaller than 100 nm). Their small size makes it easy for marine organisms to accidentally ingest them. Many countries lack the infrastructure to prevent plastic pollution, such as sanitary landfills, incineration facilities, recycling capacity, circular economy infrastructure, and proper waste management and disposal systems. This results in plastic leakage into rivers and the ocean. The global legal and illegal plastic waste trade can also damage ecosystems where waste management systems are inadequate to handle plastic waste. The main sources of plastic waste found in the ocean come from land, including runoff from rain and urban areas, sewer overflows, improper waste disposal, inadequate waste management and disposal, industrial activities, tire abrasion, construction, and illegal dumping. Marine-based plastic pollution primarily originates from the fishing industry, maritime activities, and aquaculture.

Marine debris is solid persistent material intentionally or unintentionally discarded and left in the marine environment (CSIRO, 2014). Marine debris can cause numerous problems for humans, ecosystems, and our economy. It particularly impacts wildlife. Marine debris has been documented by Gall and found to affect over 700 species, ranging from coastal vegetation to plankton, invertebrates, fish, cetaceans, sea turtles, and seabirds. Several marine animals become entangled in fishing nets and plastic packing straps, such as whales, turtles, and other species.

These types of debris can entangle animals, impede their ability to swim, and cause injuries. Abandoned fishing gear can also continue to trap fish and other animals, known as "ghost fishing," after being lost or discarded by fishermen.

RESEARCH METHODS

This research utilizes secondary data analysis and literature review as research methods. Secondary data analysis method is used to gather information from existing data sources, such as government reports, statistical data, and relevant scientific publications on marine debris. The literature review method is employed to collect and analyze relevant literature that has been published. By employing these two methods, the researchers will gain a comprehensive understanding of the threats and impacts of marine debris, as well as the policies implemented by Indonesia to address this issue.

RESULT AND DISCUSSION

Threats from Marine Debris

Marine debris can pose significant threats to wildlife through ingestion. When an animal ingests debris, it can block its stomach, puncture internal organs with sharp edges, and even create a false sense of fullness, leading to sickness or starvation. Animals such as turtles may mistake balloons or plastic bags for their prey. As plastic debris breaks down into smaller pieces, it becomes easier for smaller species like zooplankton to consume. Some debris, such as derelict and abandoned vessels, can be hazardous to habitats and seafarers. Sunken ships may be difficult to spot underwater, leading to collisions in navigational channels and damage to other vessels. Large debris, including fishing gear, ships, and discarded equipment, can crush and smother sensitive habitats like coral reefs.

Marine pollution caused by debris results in ecosystem damage and harm to marine organisms due to waste from human activities. According to Yulia (2006), factors contributing to ecosystem damage and environmental degradation are caused by various human activities. To meet human needs, certain activities are carried out that actually contribute to environmental degradation in their surroundings (Lingkungan, 2016). Some marine debris can even act as "hitchhikers" and transport invasive species. These are organisms that attach themselves to marine debris and travel to areas where they would not naturally be found. Marine debris can also impact our economy. Dirty beaches can affect tourism and recreation, which are major contributors to coastal and Great Lakes economies. These sectors heavily rely on healthy coastal and marine resources and the aesthetic quality of the environment. Plastic pollution is a widespread issue that affects the marine environment. It threatens the health of the oceans, marine species, food security and safety, human health, coastal tourism, and contributes to climate change.

Furthermore, plastic pollution in the ocean also has detrimental impacts on the country's economy. Plastic pollution in the ocean can lead to a decline in economic sectors such as fisheries, tourism, and others. Upon further investigation, it is estimated that 80% of marine debris originates from land, although this figure cannot be well substantiated due to the lack of data on the exact mass of plastic waste being disposed of from land into the ocean.

Marine debris also has negative impacts on marine and coastal ecosystems. Ocean litter can damage carbon-absorbing ecosystems such as mangroves, seagrass beds, and coral reefs. According to reports, in 2016, marine debris had harmed over 800 species, with 40% of these

species being marine mammals and 44% being seabirds [5]. This data was later updated at the UN Ocean Conference in New York in 2017, where it was mentioned that each year marine debris had been responsible for the deaths of approximately 1 million seabirds, 100,000 marine mammals, turtles, and large numbers of fish. Marine debris also has negative impacts on the fisheries, shipping, and tourism sectors.

According to the data and information collected and analyzed in this study, there are several estimates of the amount of marine debris in Indonesia. A study by Jambeck et al. in 2015 estimated the amount to be 1.29 million metric tons (MMT), ranking Indonesia as the world's second-highest contributor to marine debris. Then, in 2019, local researchers from LIPI and others released their findings stating that the local marine debris amounted to 0.57 MMT at the end of 2019. The Ministry of Environment and Forestry (KLHK) and the Ministry of Maritime Affairs and Fisheries (KKP) stated that in 2019, marine debris reached 0.56 MMT [2]. Therefore, the dominant amount of marine debris in Indonesia is estimated to range between 0.56 and 0.59 MMT per year in 2019. This fact positions Indonesia as the sixth-highest contributor to marine debris in the world, compared to its previous ranking of second. Furthermore, the progress of marine debris reduction programs in Indonesia reached 15.3% from 2018 to 2020, with approximately 55% remaining as the target for reducing marine debris by 70% within three years before 2025.

2.2 Handling Plastic Pollution in the Sea based on International Law

The increasing plastic pollution in the ocean and its detrimental impacts have drawn global attention to marine plastic debris, leading to the establishment of international agreements that are bilateral, multilateral, or regional in nature to address marine pollution, such as the United Nations Conference on the Human Environment 1972 (Stockholm Conference). The Stockholm Conference gave birth to the Stockholm Declaration. Furthermore, there are bilateral agreements between countries to address marine pollution, such as the Agreement between the Government of the Russian Federation and the Government of the People's Republic of China on Cooperation in the Sphere of Environmental Protection 1994, the Memorandum between the United States of America and Brazil Regarding Environmental Cooperation 1990, and the Agreement on Environmental Cooperation between the Government of the Republic of Turkey and the Government of Georgia 1997.

The Stockholm Declaration contains 26 general principles of international environmental law along with their enforcement and 109 recommended action plans for the human environment. However, the principles of the Stockholm Conference are not legally binding, so the conference was followed by the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Dumping), and its 1996 Protocol. Furthermore, the United Nations Convention on the Law of the Sea 1982 (UNCLOS) also regulates environmental pollution in the marine realm. At the regional level, there are agreements such as the Convention for the Protection of the Marine Environment of the Northeast Atlantic 1992 (OSPAR), the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean 1995 (Barcelona Convention), and the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities 1996 (Sycrause Protocol). Additionally, there is the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region 1983 (Cartagena Convention) and the Protocol Concerning Pollution from Land-Based Sources and Activities to the Convention for the Protection and Development of the Wider Caribbean Region 1999.

In Article 205 of UNCLOS 1982, concerning pollution originating from land, such as plastic pollution, member states of the convention are required to implement laws and regulations aimed at preventing, reducing, and controlling pollution in the marine environment. To address pollution sources originating from land, actions need to be taken to manage waste and refuse on

land to prevent them from being discharged into the sea. These actions are not separate from international cooperation, thus requiring regulatory adjustments between countries regarding the handling of land-based marine pollution. It is also necessary to issue recommended regional and global regulations, standards, and procedures. In the event of disputes between UNCLOS 1982 member states regarding plastic pollution in the sea, parties can choose peaceful means agreed upon or seek resolution through the International Tribunal Law of the Sea (ITLOS), the International Court of Justice, or arbitration.

Marine environmental pollution is not only sourced from land but also from ships. To prevent marine pollution from ships, an international convention for the prevention of pollution from ships (The International Convention for the Prevention of Pollution from Ships 1973/78) was established. This convention, formed by the International Maritime Organization (IMO), addresses pollution resulting from ship operations as well as unintentional pollution by ships. Over time and with technological advancements, the MARPOL convention is constantly updated to comply with the latest operational and environmental standards. MARPOL convention member states are responsible for inspecting ships operating under their authority, and regardless of the waters in which a ship sails, a ship flying the flag of a MARPOL convention member state must still adhere to MARPOL regulations.

Annex V of the MARPOL convention regulates the handling of plastic waste in the marine environment. Annex V aims to reduce and eliminate the discharge of garbage from ships into the sea. The scope of Annex V applies to all types of ships, including merchant ships, non-commercial ships such as cruise ships and yachts. Disposal of garbage into the sea is prohibited as stipulated in Annex V, but there are exceptions as outlined in regulations 4, 5, and 6, which allow for the disposal of certain non-hazardous waste such as food waste, carcasses, cleaning agents, deck washwater, and its external cargo under specific conditions. The waste covered by Annex V of the MARPOL convention includes all types of food waste, domestic and operational ship-generated waste, all types of plastics, cargo residues, incinerator ash, cooking oil, fishing gear, and carcasses originating from ship operations and continuously or periodically discharged. Fresh fish and parts thereof generated from fishing activities during the voyage or as a result of aquaculture activities are not considered waste under Annex V. The responsibility for imposing costs and penalties for MARPOL violations lies with the flag state of the ship.

Next, there is the Marine Debris Research, Prevention and Reduction Act (MDPRA) 200654. MDPRA is a United States regulation aimed at addressing existing pollution in the sea and is intended to clean up marine debris pollution. MDPRA has programs that can identify, determine sources, assess, reduce, and prevent marine debris pollution and its adverse effects on the marine environment and navigation safety at sea. In addition to national regulations, there are international regulations that can serve as the basis for demanding accountability in cases of EGP, namely the Responsibility of States for Internationally Wrongful Acts 2001, particularly in Part Three regarding the implementation of state responsibility internationally, specifically Article 42, which stipulates that a state has the right to act as an injured state to demand accountability from another state that has violated its obligations, with the request for accountability being made on behalf of that state itself or a group of states, including that state or the international community as a whole, and the violation of obligations specifically affecting that state or fundamentally altering the position of another state with regard to the obligations of that other state. According to the author's analysis, the resolution of EGP disputes based on the Responsibility of States for Internationally Wrongful Acts 2001 can be resolved through the International Court of Justice (ICJ), in accordance with the jurisdiction of the ICJ as provided in Article 36 of the Statute of the International Court of Justice. It may be considered that the pollution by EGP waste is predominantly caused by foreign countries outside the United States, making it possible to file an international claim for pollution caused by EGP waste, considering the significant

environmental impact of marine pollution caused by EGP waste. However, to date, no one has made an international claim regarding EGP waste.

Policies for Reducing Marine Debris in Indonesia

To address the issue of marine debris, the Indonesian Government has issued the National Action Plan for Marine Debris Management 2018-2025, which was established in Presidential Decree No. 83 of 2018 on Marine Debris Management. In this regulation, the Indonesian government is committed to reducing marine debris by 70%, reducing solid waste by 30%, and managing 70% of solid waste within 8 years from 2018 to 2025. The National Action Plan for Marine Debris Management 2018-2025 is divided into 5 main strategies for reducing marine debris in Indonesian waters, which are then broken down into activities with clear and measurable timelines for quantity targets and implementation years.

The five strategies are as follows:

a. National Stakeholder Awareness Movement
b. Land-based Waste Management
c. Coastal and Marine Waste Management
d. Funding Mechanisms, Institutional Strengthening, and Law Enforcement
e. Research and Development

Previously, in 2017, marine debris monitoring was conducted by the Ministry of Environment and Forestry in Indonesia. This monitoring activity was carried out on beaches in 18 regencies/cities in Indonesia, targeting macro (>2.5 cm) and meso (0.5-2.5 cm) marine debris using the Litter Classification System (LCS). As a result, the estimated national marine debris on the coast is around 1.2 million tons, with 41% of it being plastic debris, or approximately 0.49 million tons of plastic waste on Indonesian beaches. The National Plastic Action Plan (NPAP) is a multi-stakeholder platform that brings together policymakers, experts, the business sector, entrepreneurs, and civil society organizations to collaborate in reducing marine debris by 70% by 2025. In preliminary research, the inflow of plastic waste into national waters is projected to grow by 30% between 2017 and 2025, from 620,000 tons per year to around 780,000 tons per year.

CONCLUSION

With a baseline of marine debris ranging from 0.49 to 0.86 million tons per year, serious efforts are needed to reduce marine debris by 70% by 2025. With increasing amounts of waste flowing into the ocean, the environmental and economic risks to be restored become more significant. The management of marine debris also needs to be strengthened with more aggressive technology and massive interventions to handle the increasing amount of waste. The government plans to operate 12 waste-to-energy plants (PLTSa) across Indonesia from 2019 to 2020. Additionally, the government has implemented an Integrated Waste Management using Refuse Derived Fuel (RDF) in Cilacap, which is a milestone in waste management in Indonesia. In addition to the above innovations, the use of pyrolysis technology can also be employed to break down plastic waste into fuel such as diesel, gasoline, and kerosene. With pyrolysis, plastic waste can generate three fuel components, namely 60% diesel, 25% gasoline, and 15% kerosene. However, high-temperature waste treatment poses negative risks to health and the surrounding environment due to the residue and emissions produced during combustion. Cleaner and healthier waste management can be achieved by using a low-temperature approach, such as anaerobic digestion aided by microorganisms in the management of organic waste since household waste is still predominantly organic waste. However, this low-temperature approach requires more time and stronger commitment from the entire community.

Addressing marine debris is the responsibility of all parties and should be done starting from when waste is still on land, at the upstream of rivers, along river flows, and when waste reaches the ocean. To achieve the target of managing marine debris by 2025, several decisive efforts need to be made, such as changing people's mindset and habits regarding waste disposal, commitment from producers to reduce single-use plastics, strengthening government regulations, and implementing appropriate technological interventions.

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