Analysis of Marine Plastic Pollution and Environmental Problems

Yiyang Shi *

Department of Changwang, Nanjing University of Information Science and Technology, Nanjing, China

* Corresponding Author Email: 202083310018@nuist.edu.cn

Abstract. Marine plastic pollution has been an increasing problem for many years, and plastic products in use today are a crucial source of ocean pollution. While an increasing number of studies have announced the environmental, social and economic influences of marine plastic pollution in a multitude of ways, little research has focused on policy and general assembly tools for reducing plastic pollution. This paper concentrates on the analysis of marine litter sources and effects and policies, with current actions being taken in various countries and locations around the world. Existing knowledge provides a strong basis for useful action. However, policies and other initiatives to date have been largely inadequate. While some approaches are effective, some issues remain in practice. Such as poorly enforced and technically expensive legislation, and a lack of public education. Furthermore, the extents and dynamics of all pioneering spirits are distinctly different, and at present there is a lack of coordination at all levels and close cooperation between them.

Keywords: Marine pollution, plastic pollution, political policy.

1. Introduction

The ocean is one of the most valuable resources on earth and plays an important role in maintaining ecological balance. The demand for plastics has modified since its popularity in the 1950s because of their social health, safety, and energy behooves [1]. However, because of the oldness and resistance of plastics to an organic phenomenon, their general use has resulted in the prevalence of poor waste management practices. Marine pollution is an increasingly serious problem as human activities continue to increase [2]. In particular, plastic pollution has become one of the major environmental issues facing the world today. Plastic products are becoming increasingly common, but also have a severe impact on the Marine environmental environment. Plastic has a detrimental effect on the situation by ruining environmental habitats, entangling marine creatures, assisting the movement of intrusive species between habitats, and deposited in the sediment, contributing to potential influences on creatures that live and hunt in benthic animals [3]. Plastic has both physical and chemical effects when consumed by marine animals. Physical effects, apart from entanglement, consist of the following: When plastic is absorbed by marine creatures, the gastrointestinal tract is blocked, which can result in wrong satiety. In a review of 340 primary publications, at least 690 different parts were found to be impacted by marine debris [4]. The public sets eyes on the chemical impact of ingested microplastic and microplastics. This is also a matter of increasing concern [5]. Plastics can work as a useful delivery system for toxic waste materials, such as plastic additions during manufacturing, or chemicals (such as heavy metals) that adsorb onto plastics from the surrounding environment.

In this article, we focus on five areas. Beginning with the definition and sources of pollution from marine plastics. Plastic waste is the buildup of plastic contents (such as plastic bottles) in the earth's area, which negatively impacts animals, wildlife habitats, and humans. Plastics that act as contaminants may be divided into micro, medium, or large fragments depending on their size. Since plastic is cheap and durable, the level of human plastic production is high. The three main structures of plastic that lead to plastic waste are miniature plastic and giant plastic and large plastic. They can also be called micro fragments, medium fragments and large fragments. The second problem is the damage caused by marine plastic pollution. All marine animals – from plankton, seafood, and birds, to chelonians and vertebrates – are at grave risk of poisoning, behavioral conditions, hunger and

suffocation. In addition, corals, angiospermous trees, and seagrass beds are filled with plastic pollution, leaving them with no access to oxygen and light. Thirdly, plastic pollution of the ocean pollutes in many ways. Marine plastic pollution could create change in marine ecosystems, threatening marine habitats and possibly leading to the extinction of some species. As well as threatening marine life, affecting the reproduction of marine life and causing species populations to decline. Threatening human health. Plastic pollutants can be ingested by fish and other marine life and are difficult to break down and can affect health when they enter the body. Fourthly, there are a few issues in the process of controlling marine plastic pollution. There is little awareness of the country's environmental protection. Litter laws and regulations at sea are not perfect. The mechanisms for monitoring and managing marine litter, particularly marine plastics, are not perfect and so. Fifthly, the focus of this article will be on the global approach to marine plastic pollution. Many countries and regions have enacted relevant legislation, such as prohibiting the demand for single-use plastic products and requiring businesses to recycle and remove waste plastic products. While many countries are using new technology to reduce plastic pollution. Such as research and development of efficient recycling and waste processing technology, the use of new clean energy and so on. It also calls for raising public awareness of the difficulty of ocean plastic waste, leading the public to change their lifestyle and reduce waste generation and discharge. As a result, people must explore a feasible method of governance to solve the problem at its root.

2. Marine plastic pollution

In 2021, the United Nations Environment Program (UNEP) report "From Pollution to Solutions, a Global Assessment of Marine Debris and Plastic Pollution" showed that 85% of marine debris is plastic; as of 2040, the number of plastic pollution that flows into marine areas has been shown to almost triple, with 23 million to 37 million tons of plastic flowing into the ocean every year, equal to every meter of coastline in the world 50 kilograms of plastic. Once the marine plastic waste has degraded to microplastics, it will go to the people's bodies with fish and other creatures in the ocean. This non-degradable material will certainly have detrimental effects on people’s health in the long term. Thus, there is an urgent need to control marine plastic pollution.

2.1. Definition and sources of marine plastic pollution

Plastic pollution is defined as all kinds of plastic items found in the ocean, such as plastic containers, plastic bottles, plastic trophies, plastic artifacts, plastic packaging, and the like. In addition to harming the Marine ecological environment, these plastic products pose some threat to human health. Sources of Marine plastic pollution primarily include the following aspects: production, consumption, disposal, and grading of trash. Plastics contribute to plastic pollution in three major ways: miniature plastics, giant plastics, and large plastics. The density of large plastics and microplastics is highest in the Northern Hemisphere, especially in city centers and border waters. Plastics could be discovered on t coasts of a lot of islands as the ocean actually transports rubbish. Plastics, both large and enormous, can be discovered in packaging, shoes, and other household things that are washed away from the ship or disposed of at landfill sites. Articles related to fishing are easy to be discovered near distant islands. They are also assorted as micro-fragments, medium-sized fragments, and large fragments [6]. The plastic parts are divided into primary and secondary parts. The base plastic retains its original look when picked up. Such as bottle caps and cigarette butts and microbeads among others. In contrast, secondary plastics are small plastics produced by the breakdown of primary plastics [6]. In this article, we provide a comprehensive analysis of marine plastic pollution and explore feasible treatment approaches from different perspectives. Ideas for marine plastic pollution research primarily include the investigation of the sources and arrangement of plastic waste, the investigation of the influence of plastic waste on marine ecology and people’s health and the exploration of effective treatment methods including the legal system, scientific and technological means, public education, etc.

2.2. The harm of marine plastic pollution

Marine plastic pollution will severely affect the marine environment, leading to the death of Marine life, destruction of habitat and other problems. On the other hand, Marine pollution also affects human health. Plastic components are present in the bodies of fish and other fish, and long-term ingestion of these waste materials can lead to people's health problems. This has been a source of great concern worldwide. One kind of plastic of involvement in marine plastic waste is particulate rubber. Rubber pelletization is the production of plastic pellets (microplastics), typically used in the manufacture of plastic products transported on freighters. Billions of rubber particles are estimated to end up in the ocean each year, and approximately 10% of the world's beach litter consists of rubber particles. The decomposition of marine plastic usually occurs within a year, but is not perfect. Toxic materials such as bisphenol A and polystyrene immerse the water in some plasticity during this process [7]. The most ordinary kinds of plastic waste in the ocean are polystyrene waste and particulate rubber, constituting most of the marine litter as well as plastic bags and food containers. Over 5 trillion plastic portions are floating around in the ocean (divided into four categories: small, little big, medium and large). Sending garbage into the ocean is poisonous to marine creatures and humans. Toxins found in the composition of plastics include the toxic carcinogens diethylhexyl phthalate, lead, cadmium and mercury. These highly toxic substances and chemicals are ingested by plankton, fish, and eventually humans via the food chain. The consumption of fish containing these toxins may increase cancer, immune dysfunction, and congenital malformations.

2.3. The influence of marine plastic pollution

The impact of ocean plastic waste on the marine ecological environment can be seen primarily in the following aspects: First, anthropogenic damage to marine ecosystems. Marine plastic pollution damages marine ecosystems, threatens marine habitats, and may result in the extinction of certain species. On the other hand, because of the durability of plastic materials, it is difficulty to decompose in the marine, and may exist in the ocean for a long part of time, leading to the long-term marine waste ecological environment. Plastic waste is highly variable in its distribution considering certain factors such as atmospheric conditions and ocean streams, coastal geography, city places, and trade lines. In addition, the population of a particular region plays an important role in this. Plastics easily appear in closed places like the Caribbean. They are a method of distributing living creatures to distant shores that are not discovered in their natural environment. Which may increase the variability and diffusion of creatures in some places of low biodiversity. Plastic could serve as a carrier for chemical wastes such as continual organic waste materials and dense metals. Secondly, it poses a threat to marine life. Marine plastic waste is a direct danger to marine life, such as marine animals may accidentally ingest plastic waste, resulting in indigestion, malnutrition and even death. Plastic pollution may also affect reproduction of Marine life, leading to a decline in the number of species. Plastic waste has the possibility to poison creatures and negatively affect the human food indefinite quantity. Plasticity waste has been pictured as eminently important to expand marine mammals [8]. It has been observed that some marine kinds, such as sea chelonian, have large amounts of plastic in their stomachs. In such cases, the animal usually dies of starvation because plastic can block the animal's digestive area. Marine animals may become involved in plastic commodity such as nets, leading to injuries and even death. Thirdly, there is a threat to human health. Fish and other Marine organisms may ingest plastic pollutants, which are difficult to break down and may have health effects when they enter the human body, such as liver damage and endocrine disruption. The usage of chemical additions in the plastics manufacturing process results in potentially harmful effects of plastics that may cause cancer or support endocrine break. Some additions are function as phthalate-based softeners and as brominated combustion agents. Biomonitoring resulted in the discovery of plastic materials such as bisphenol A and phthalates in the population. Humans may come in contact with these chemicals via the nose, mouth, or skin. Certain materials worked in plastics production can lead to dermatitis when they contact with human skin. These toxic materials are only worked in trace quantities in many plastics. However, inert materials or polymers often require extensive testing

to determine the presence of toxic elements in plastics. As a result, people must take steps to deal with the difficulty of plastic pollution in the oceans.

2.4. Problems of dealing with Marine plastic pollution

First, the national awareness of environmental protection is not strong. There is little knowledge about plastic pollution in the ocean. They think that plastic pollution in the ocean has nothing to do with them and do not give enough attention to it. Second, the laws and regulations on Marine garbage are not perfect [9]. There are a number of laws and regulations aimed at preventing and controlling marine debris pollution, but there is currently no legislation on marine debris. Because the management of marine plastic waste in our country includes the protection of the environment, marine, agriculture, housing and other departments, there is a lack of preparation of special policies and systems at the national level. Third, the monitoring and management mechanism of marine litter, especially marine plastic, is not sound. In the actual governance, there are some difficulties such as multi-headed governance, unclear authority and responsibility, and poor investment, and the joint efforts of national departments, localized governments and the people have not yet been created.

2.5. Current global treatment of Marine plastic pollution

Countries and international organizations have adopted a range of governance methods to effectively deal with the problem of marine plastic waste. In many countries and regions, relevant laws have been passed, such as prohibiting the demand for single-use plastic products and requiring companies to recycle and disincline waste plastics [10]. On the other hand, some international organizations have also formulated corresponding international regulations such as the Global Action Plan on Marine Plastic Waste. Second, nations have embraced scientific and technological means [11]. In addition, scientific and technological means are one of important ways of solving the problem of ocean plastic waste [12]. For example, the development of new materials, the research and development of effective recycling and waste treatment technologies, the use of new clean energy, and so on. In addition, public education is a significant means of hindering and controlling marine pollution from plastic waste [13]. Educational activities should be carried out to educate the public about the problem of marine plastic waste and guide the public in their lifestyle and reduce waste generation and disposal. Although the above treatment methods are effective, some problems still exist in practice, such as lack of law enforcement, high technical costs, and lack of public education.

China is a maritime country, as well as an important producer and user of plastic products. Therefore, China also has a lot of useful experience in controlling Marine plastic pollution. The Chinese government has developed a series of relevant laws and regulations, such as the Action Plan for Plastic Pollution Prevention and Control, to take precautions and control plastic pollution. In addition, China has strengthened law enforcement and cracked down on violations. In addition, China promotes waste separation in the urbanization process, and through separation and recycling, recyclable waste can be reused to reduce waste emissions. At the same time, through scientific and technological means such as biodegradable plastic and plastic recycling technology, various recycling and waste treatment technologies have been developed, effectively reducing plastic waste emissions. The Chinese government and social organizations are actively carrying out publicity and education activities to guide the public to change their lifestyles and reduce plastic waste production and emissions. In conclusion, solving marine plastic pollution is a global challenge that requires the joint efforts of all countries. China has made some progress in addressing marine plastic pollution, but it still needs continuous efforts and improvements. Humanity should actively explore plastic pollution prevention methods suitable for each country's situation through legislation, scientific and technological means, garbage classification, publicity and education, and contribute to building a beautiful China and a beautiful world.

3. Conclusion

Pollution of marine litter is an analyzable environmental issue that causes a large number of environmental issues such as ecosystem, animal and human impacts. There are plenty of terrestrial and marine sources and a few simple methods. There has been a significant increase in the technological inclination of the problem and the effective scope of solutions, although there is still much space that needs to be addressed. In spite of policies, if not further, the problem will only grow by taking steps to prevent pollution. As a result, many methods, policies, and plans of action focus on taking steps to simplify and prevent marine pollution. Short-term methods that come to improving pollution governance in developing countries should be significant. It is not soft to design and implement sustainable methods. Effective efforts to difficult marine litter demand a broad range of public and private efforts across sectors from nation to global scales. Successful actions seek to achieve many goals, including the design, implementation, and implementation of many policies, and laws aimed at changing people's behavior, adopting new technologies, and revising the waste management of current production, use, and production practices. In other words, actively involved consumers, producers, policymakers, regulators, residents, tourists, (fishing) industries, and businesses. In order to move towards a sustainable and resilient society, it may be necessary to raise awareness for all stakeholders in the society. Finding methods in which initiatives that build others influence could result in key innovative methods. Humans should actively explore methods of preventing and controlling plastic pollution appropriate to the national conditions of each country through a variety of means, such as legislation, scientific and technological means, trash classification, advertising and education, and contribute to the construction of a beautiful world.

References

[1] Andrady, A.L., Neal, M.A., 2009. Applications and societal benefits of plastics. Philosophical Transactions of the Royal Society B: Biological Sciences 364 (1526), 1977–1984.

[2] Worm, B., Lotze, H.K., Jubinville, I., Wilcox, C., Jambeck, J., 2017. Plastic as a persistent marine pollutant. Annual Review of Environment and Resources 42 (1), 1–26.

[3] Sheavly, S.B., Register, K.M., 2007. Marine debris & plastics: Environmental concerns, sources, impacts and solutions. Journal of Polymers and the Environment 15 (4), 301–305.

[4] Gall, S.C., Thompson, R.C., 2015. The impact of debris on marine life. Marine Pollution Bulletin 92 (1), 170–179.

[5] Brennecke, D., Duarte, B., Paiva, F., Caçador, I., Canning-Clode, J., 2016. Microplastics as vector for heavy metal contamination from the marine environment. Estuarine, Coastal and Shelf Science 178, 189–195.

[6] Chuangwen Hao. What is plastic pollution? A popular science introduction on plastic pollution. July 27,2022. Retrieved on March 15 2023.retrieved from: http://www.photoint.net/article/26332.html.

[7] Emma Schmaltz, Emily C. Melvin, Zoie Diana, Ella F. Gunady, Daniel Rittschof, Jason A. Somarelli, John Virdin, Meagan M. Dunphy-Daly, 2020. Plastic pollution solutions: emerging technologies to prevent and collect marine plastic pollution. Environment International 144, 1-17.

[8] Nicola J. Beaumont, Margrethe Aanesen, Melanie C. Austen, Tobias Börger, James R. Clark, Matthew Cole, Tara Hooper, Penelope K. Lindeque, Christine Pascoe, Kayleigh J. Wyles, 2019. Global ecological, social and economic impacts of marine plastic. Marine Pollution Bulletin 142, 189-195.

[9] Lam, C.-S., Ramanathan, S., Carbery, M., Gray, K., Vanka, K.S., Maurin, C., Bush, R., Palanisami, T., 2018. A comprehensive analysis of plastics and microplastic legislation worldwide. Water, Air, & Soil Pollution 229 (11), 345.

[10] Dirk Xanthos, Tony R. Walker, 2017. International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): A review. Marine Pollution Bulletin 118,17-26.

[11] DeSombre, E.R., 2018. Ocean governance. In: Dauvergne, P., Alger, J. (Eds.), A Research Agenda for Global Environmental Politics. Edward Elgar Publishing, Ltd., pp. 114–125.

[12] Nielsen, T.D., Hasselbalch, J., Holmberg, K., Stripple, J., 2020. Politics and the plastic crisis: A review throughout the plastic life cycle. WIREs Energy and Environment 9 (1), e360.

[13] Mohanraj, C., Senthilkumar, T., Chandrasekar, M., 2017. A review on conversion techniques of liquid fuel from waste plastic materials: Waste plastics, conversion techniques, CI engine operations. International Journal of Energy Research 41 (11), 1534–1552.