International Journal of Advanced Multidisciplinary Research
ISSN: 2393-8870
www.ijarm.com
(A Peer Reviewed, Referred, Indexed and Open Access Journal)
DOI: 10.22192/ijamr Volume 10, Issue 2 -2023

Review Article

DOI: http://dx.doi.org/10.22192/ijamr.2023.10.02.008

# Microplastics as Pollutants in the Marine Environment: A Review

**Jonnele D. Matre**
Polytechnic College of Botolan, Philippines
E-mail: *jonnelematre70@gmail.com*

**Joemark D. Ablian**
Polytechnic College of Botolan, Philippines
E-mail: *Joemark.ablian@gmail.com*

**Mark Anthony R. Gantang**
Polytechnic College of Botolan, Philippines

**Keywords**

microplastics,
marine environment,
pollutant,
literature review

## Abstract

Microplastics have been present in the marine environment for a long time and have been found in various levels of the water and on the bottom of the ocean and on beaches around the world. The main focus of this paper is to explore the problem of plastic pollution in the ocean and the detrimental effects it has on human populations, marine life, and their living spaces. It highlights the fact that plastics take ten to twenty years to degrade, and that plastic pollution kills over one million marine species annually. This paper mentions the high percentage of plastic waste in the South Asian region and the consequences of inadequate handling of solid waste on the quality of soil, air, and water. The research also delves into the effect of microplastics and their impact on the natural world., including the harm and death of marine birds, animals, fish, and reptiles due to plastic entanglement and ingestion. Further research is needed to address knowledge gaps in the field, such as a clear and consistent microplastic size definition, adequate technologies for identifying minute microplastics and nano plastics, and improved and adopted routine, high throughput microplastic sampling procedures.

## Introduction

Plastics are all around us and have become a hot issue in academic circles (Duan, 2020). The accumulation of plastic materials and fragments in the environment that harms human populations, wildlife, and the place they live in is referred to as plastic pollution. However, did you know that it takes them ten to twenty years to degrade? In addition, plastic kills over one million marine species annually, including turtles, fish, and mammals (Singh, Mishra, & Das, 2020). In the South Asian region, the third greatest percentage of municipal solid trash is made up of plastic in the form of bags, bottles, packaging, etc. (World Bank, 2012). One might assume that the lockdowns have resulted in less waste due to decreased consumption (Lopez, 2021). The quality of the soil, the air, and the water are all impacted by improper solid waste management (Das, Lee, Kumar, Kim, Sang Soo Lee, Bhattacharya, 2019). According to Douglas Lobber (2017), there are numerous issues with plastic shopping bags around the world, and human and environmental impacts are the biggest ones. While marine life can be suffocated and starved by larger plastic objects such as bags and straws, the consumption of fish and other animals contaminated with microplastics also poses a risk to human health. Human exposure to plastic can disrupt hormones and have negative effects on pregnancy and birth (Polka, 2018)

The impact that large plastic waste, referred to as 'microplastics', may have on the marine ecosystem has been a subject of extensive debate and ecological examination for a considerable time. Microplastics' inclusion in the aesthetics of the aquatic environment, as well as the economic ramifications for the tourism sector, is a risk for many marine industries such as transportation, fishing, energy generation, and agriculture since plastic could cause tangles and harm to the serious environmental problems, and equipment (Mofijur, Ahmed, & Rahman, 2021). The environmental impact of microplastics includes the harm and death of marine birds, animals, fish, and reptiles as a result of plastic entanglement and ingestion (Cole, Lindeque, Halsband, & Galloway, 2011). Microplastics are classified as hazardous because of their microscopic size. Bioavailable to organisms throughout the food web their composition and relatively wide surface area make them prone to attaching Organic contaminants in the water, as well as plasticizer leaching that is harmful Ingestion of microplastics may therefore by introducing toxins to the base of the food chain, from which there bioaccumulation potential (Okoye, Addey, & Oderinde, 2022).

The transmission of harmful compounds to biota by microplastic intake is a major concern. However, little existing research has investigated toxicity. Using microplastic vectors in preparation for the future, the researcher presents a list of knowledge gaps that we believe should be addressed by the further community of scientists such as (1) employing a clear and consistent microplastic size definition, with additional size definitions for nano- and mesoplastics, (2) develop adequate technologies for identifying minute microplastics and nano plastics in the water column and sediment and (3) improve and adopt routine, high-throughput microplastic sampling procedures to allow for better comparison of results from various study sites.

The main goal of this research is to address the problem of microplastics as pollutants in the marine environment. It is believed that in order to effectively tackle this issue, the government should first pass laws that restrict the sources of plastic waste and the use of plastic additives. Additionally, the plastic industry should take responsibility for its products after they have been used by implementing recycling or upgrading programs.

## Objective of the Study

The objectives of this paper are: (1) to determine the objective of other studies (2) to determine the results of previous research (3) and highlight necessary recommendations in light of the previews and presented literature review. The study aims to identify effective strategies for

mitigating the negative effects of microplastics in the marine environment and to inform policy and management decisions related to plastic pollution in the oceans.

## Materials and Methods

### Research Design

A literature review is an in-depth examination of previous research on a topic, providing an overview of existing knowledge, findings, and conclusions (Andruss, 2022). A literature review can generally be defined as an organized method of gathering and combining prior research findings (Baumeister, Leary, Tranfield, Denyer, & Smart, 2003). The literature review involves a comprehensive examination of relevant studies in a particular area of study. A thorough and competent literature review as a research approach provides a solid base for enhancing knowledge and promoting theoretical growth (Webster & Watson, 2002). It involves listing, describing, summarizing, evaluating, and clarifying previous research, and providing a theoretical background for the current research. The literature review should demonstrate to the reader that the author has thoroughly studied, evaluated, and incorporated the work of previous researchers in the field and that their current research is well-conceived. It also acknowledges the contributions of prior researchers in the subject area.

### Data Collection

The research paper also features studies that cover the year 2012 through 2022. Furthermore, the researchers chose this period to better assess the validity of the research issue under inquiry, which has previously been conducted by several researchers. Because of the relevant and timely research question, the most recent years of coverage are deemed necessary for the paper's validation. This would then correspond to the research study's correctness and reliability.

## Results and Discussion

This section presents a summary of the literation reviewed for this study, which pertains to microplastic as a pollutant in the marine environment. The overview includes the objectives, findings,implications recommendations, recommendations, and future scope and limitations of previous studies. This section aims to provide a comprehensive understanding of the related studies on this topic.

*Table 1. Objectives of the Study*

| Objectives | Author |
|---|---|
| The impact of plastic waste on aquatic animals such as fish, crabs, and birds | (Stephanie, Hara, Patrick, Lydia, Victoria, Wilson & Karen, 2012); (Tulio, Rochman& C. M, 2019); (Gawsia Wahidunnessa, Heather, Emily Duncan, Imogen, Nazmul, Nelm, Sarah, Sarker, Subrat, Sunanda & Bushra, 2021); (Shiva & Subhankar, 2017) |
| Potential harm to human health | (Al-Thawadi & Salwa, 2020); (Halden & Rolf, 2010 ) |
| The effects of plastic pollution on sea ecology and marine life. | (Marcus, Nikolai, Martin, Anna, Gwen & Stiv, 2013); (The Blue, 2013) |
| The effect of microplastics on the environment | (Matthew, Pennie, Claudia, Galloway & Tamara, 2011); (Coscodan, 2022) |

As shown in the Table 1, the negative impacts of plastic waste on the environment and living organisms have been well-documented in numerous studies. Plastic waste has been shown to have harmful effects on aquatic animals, such as physical injury and reduced growth due to ingestion (Stephanie et al., 2012), changes in the chemical composition of animal tissues and organs (Hara et al., 2019), and entanglement and death of marine mammals, birds, and reptiles (Wahidunnessa et al., 2021). Plastic waste in the ocean can also have negative impacts on remote coastal and island ecosystems (Shiva &Subhankar, 2017). Human health is also at risk due to exposure to plastic chemicals, which can lead to endocrine disruption, reproductive toxicity, developmental toxicity (Al-Thawadi&Salwa, 2020), and persistent and bioaccumulative plastic chemicals (Halden & Rolf, 2010). Plastic pollution in the ocean has been shown to have negative impacts on biodiversity and ocean food webs (Marcus et al., 2013) and to modify the distribution of species (The Blue, 2013). Microplastics have been shown to have negative impacts on the health and survival of organisms that ingest them (Matthew et al., 2011) and contribute to the contamination of soil and freshwater systems (Coscodan, 2022).

This table presents the results of the studies in a more detailed manner by outlining them individually, in contrast to the first table that grouped the studies into three categories. This table provides a more thorough analysis of each study and enables a more complete understanding of the studies, instead of the broad perspective provided by the classification in the first table.

*Table 2. Findings of Related Studies*

| Findings | Author |
|---|---|
| Studies have shown that microplastics and nanoplastics can be consumed by various aquatic creatures, from tiny plankton to big fish, causing harm to their internal organs and hindering growth and reproduction. | (Al-Thawadi, Salwa, 2020) |
| Research has revealed that Northern fulmars have a significant rate of plastic ingestion, with most birds examined had plastic in their stomachs. Additionally, studies have found that the amount of plastic detected in the digestive systems of Northern fulmars has increased over time, revealing a worsening issue of plastic contamination in the region. | (Avery-Gomm, Stephanie; D.O'Hara, Patrick; Kleine, Lydia; Bowes, Victoria; Wilson, Laurie K.; L.Barry, Karen, 2012) |
| Research has shown that plastic waste is prevalent in oceans and coastal regions and can have detrimental effects on marine life and ecosystems, such as physical harm to internal organs, decreased growth and reproduction, and the transfer of harmful chemicals to organisms | (Bucci, K.; Tulio, M.; Rochman, C. M., 2019) |
| Studies have found that the presence of plastic waste in aquatic environments in Bangladesh can result in aquatic animals becoming entangled or ingesting plastic, leading to physical harm to their internal organs and decreased growth and reproduction. | (Chowdhury, GawsiaWahidunnessa; J.Koldewey, Heather; EmilyDuncan; E.Napper, Imogen; HasanNiloy, Md. Nazmul; E.Nelm, Sarah; Sarker, Subrat; Bholah, Sunanda; Nishatij, Bushra, 2021) |

| | |
|---|---|
| Studies have found that microplastics can exert a significant influence on sea creatures and their environments., such as causing physical harm to internal organs, reducing growth and reproduction, and transferring toxic chemicals to organisms. | (Cole, Matthew; Lindeque, Pennie; Halsband, Claudia; Galloway, Tamara S, 2011) |
| Research has revealed that plastic waste is widespread in the South Pacific subtropical gyre, a region where ocean currents converge and plastic waste accumulates. Studies have found that this plastic debris can have detrimental effects on marine life and ecosystems, such as causing physical harm to internal organs, reducing growth and reproduction, and transferring toxic chemicals to organisms. | (Eriksen, Marcus; Maximenko, Nikolai; Thiel, Martin; Cummins, Anna; Lattind, Gwen; Wilsona, Stiv, 2013) |
| Research has shown that certain types of plastic, including polyvinyl chloride (PVC) and polyurethane (PU), can release substances known as plasticizers and other additives that can be dangerous when inhaled or ingested. | (Halden, Rolf U., 2010) |
| Research has shown that marine creatures, including fish and shellfish, can ingest microplastics, resulting in physical harm to their internal organs and decreased growth and reproduction. | (Sharma, Shiva; Chatterjee, Subhankar, 2017) |
| Research has indicated that individuals can make small changes in their habits to decrease their use of plastic and prevent plastic pollution from reaching the ocean. | (Marble, The Blue, 2013) |
| Research has revealed that specific microorganisms, like fungi and bacteria, can efficiently break down plastic materials through the process of phytoremediation. | (Michael, Coscodan, 2022) |

The studies by Al-Thawadi (2020), Avery-Gomm et al. (2012), Bucci et al. (2019), Chowdhury et al. (2021), Cole et al. (2011), Eriksen et al. (2013), Halden (2010), Sharma and Chatterjee (2017), Marble (2013), and Coscodan (2022) show the negative impacts of plastic waste, particularly micro- and nano plastics, on aquatic creatures and environments. These studies indicate the presence of plastic waste in various aquatic environments, including oceans, coastal regions, and remote areas like the South Pacific subtropical gyre. The studies demonstrate that plastic waste can lead to physical harm to internal organs, reduced growth and reproduction, and transfer of toxic chemicals to organisms. Plastic waste can also release dangerous substances when ingested or inhaled. The studies highlight the need for individuals to reduce their use of plastic and for collective action to prevent plastic pollution. However, a study by Coscodan (2022) suggests that phytoremediation by specific microorganisms can effectively break down plastic materials.

This table presents the recommendation provided by each study. This table offers a handy summary of the recommendations made by the available studies.

*Table 3. Recommendations of Related Studies*

| Recommendations | Author(s) |
|---|---|
| Conducting additional research on the detrimental impacts of microplastics and nanoplastics on aquatic organisms., including both laboratory and in-the-wild investigations to understand how these pollutants cause harm and the long-term consequences of exposure. | (Al-Thawadi, Salwa, 2020) |
| Examining the rates at which Northern fulmars consume plastic in various areas of the eastern North Pacific to see if there are any differences in the amount of plastic pollution across the region. | (Avery-Gomm, Stephanie; D.O'Hara, Patrick; Kleine, Lydia; Bowes, Victoria; Wilson, Laurie K.; L.Barry, Karen, 2012) |
| Conducting additional research to examine the specific impacts of plastic pollution on various marine creatures and the environments they inhabit. | (Bucci, K.; Tulio, M.; Rochman, C. M., 2019) |
| Creating and executing plans for managing waste that effectively decreases the amount of plastic entering aquatic ecosystems. | (Chowdhury, GawsiaWahidunnessa; J.Koldewey, Heather; EmilyDuncan; E.Napper, Imogen; HasanNiloy, Md. Nazmul; E.Nelm, Sarah; Sarker, Subrat; Bholah, Sunanda; Nishatij, Bushra, 2021) |
| Creating advanced techniques and tools to identify and measure the presence of microplastics in the ocean, such as utilizing satellite imagery and involving the participation of members of the public in data collection. | (Cole, Matthew; Lindeque, Pennie; Halsband, Claudia; Galloway, Tamara S, 2011) |
| Carrying out more extensive and regular evaluations of plastic waste in the gyre to gain a clearer understanding of the spread, makeup, and dimensions of plastic particles. | (Eriksen, Marcus; Maximenko, Nikolai; Thiel, Martin; Cummins, Anna; Lattind, Gwen; Wilsona, Stiv, 2013) |
| Further research over an extended period of time is required to gain a more comprehensive understanding of the potential negative impacts on health caused by being exposed to plastic pollution. | (Halden, Rolf U., 2010) |

| | |
|---|---|
| The study should aim to give a thorough understanding of what is currently known about the impacts of microplastic contamination on both oceanic organisms and human well-being. | (Sharma, Shiva; Chatterjee, Subhankar, 2017) |
| Collecting information through surveys and conversations to understand the current views and actions regarding the use and disposal of plastic in different neighborhoods. | (Marble, The Blue, 2013) |
| Additional research should be done to examine the ability of various plant types to remove plastic pollutants through phytoremediation. | (Michael, Coscodan, 2022) |

The current research emphasizes the need for further investigation into the impacts of plastic pollution, specifically microplastics and nanoplastics, on the environment and human health. This is supported by studies by Al-Thawadi (2020), Avery-Gomm et al. (2012), Bucci et al. (2019), Chowdhury et al. (2021), Cole et al. (2011), Eriksen et al. (2013), Halden (2010), Sharma and Chatterjee (2017), Marble (2013), and Michael (2022). These studies call for a better understanding of how plastic pollution causes harm to aquatic organisms, differences in plastic consumption by wildlife, specific impacts on marine creatures and their habitats, implementation of effective waste management plans, advanced techniques to measure microplastics, regular evaluations of plastic waste in the ocean, the investigation into potential health impacts, a comprehensive understanding of the impacts of microplastic contamination, public views and actions towards plastic use and disposal, and the ability of plants to remove plastic pollutants through phytoremediation. These findings highlight the importance of further research in this area.

## Conclusion

In conclusion, various studies have demonstrated that plastic pollution is a significant problem in marine environments, with microplastics and nanoplastics found to be harmful to various aquatic creatures. Research has shown that these pollutants can cause physical harm to internal organs, hinder growth and reproduction, and transfer toxic chemicals to organisms. Studies have also revealed that plastic waste is prevalent in oceans and coastal regions and that the ingestion of plastic by marine animals is a growing problem. The studies also highlighted specific types of plastic, such as PVC and PU, which can release dangerous substances when inhaled or ingested.

## Recommendations

The studies have also recommended conducting more research on the detrimental impacts of microplastics and nano plastics on aquatic organisms and developing effective waste management strategies to decrease the amount of plastic entering aquatic ecosystems. Additionally, it's highlighted that specific microorganisms can efficiently break down plastic materials through the process of phytoremediation and individuals can make small changes in their habits to decrease their use of plastic and prevent plastic pollution from reaching the ocean.

## References


Al-Thawadi, S.(2020, February 19). Microplastics and nanoplastics in aquatic environments: challenges and threats to aquatic organisms. pp. 4419–4440. Retrieved from https://link.springer.com/article/10.1007/s13369-020-04402-z

Avery-Gomm, S., D.O'Hara, P., Kleine, L., Bowes, V., Wilson, L. K., &L.Barry, K. (2012, September 9). Northern fulmars as biological monitors of trends of plastic pollution in the eastern North Pacific. 64, pp. 1776-1781. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0025326X12001828

Baumeister, Leary, Tranfield, Denyer, & Smart. (2003, November). Literature review as a research methodology: An overview and guidelines. Retrieved from https://www.sciencedirect.com/science/article/pii/S0148296319304564

Bucci, K., Tulio, M., &Rochman, C. M. (2019, November 23). What is known and unknown about the effects of plastic pollution: A meta-analysis and systematic review. Retrieved from https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/eap.2044

Chowdhury, G. W., J.Koldewey, H., Emily Duncan, E.Napper, I., HasanNiloy, M. N., E.Nelm, S., . . . Nishatij, B. (2021, March 20). Plastic pollution in aquatic systems in Bangladesh: A review of current knowledge. 761. Retrieved from https://www.sciencedirect.com/science/article/pii/S0048969720368169

Cole, M., Lindeque, P., Halsband, C., & Galloway, T. S. (2011, December). Microplastics as contaminants in the marine environment: A review. Retrieved from https://www.sciencedirect.com/science/article/pii/S0025326X11005133

Cole, M., Lindeque, P., Halsband, C., & Galloway, T. S. (2011, December 12). Microplastics as contaminants in the marine environment: a review. 62, pp. 2588-2597. Retrieved from https://www.sciencedirect.com/science/article/pii/S0025326X11005133

Das, S., Lee, S.-H., Kumar, P., Kim, K. H., Lee, S. S., & Bhattacharya, S. S. (2019, August). Solid waste management: Scope and the challenge of sustainability. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0959652619314209

Eriksen, M., Maximenko, N., Thiel, M., Cummins, A., Lattind, G., Wilsona, S., . . . Rifmand, S. (2013, March 15). Plastic pollution in the South Pacific subtropical gyre. 68, pp. 71-76. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0025326X12006224

Halden, R. U. (2010, April 21). Plastics and Health Risks. 31, pp. 179-194. Retrieved from https://www.annualreviews.org/doi/abs/10.1146/annurev.publhealth.012809.103714 https://www.sciencedirect.com/science/article/abs/pii/S0269749113004387

LI, W., TSE, H., & L.FOK. (2016, October 1). Plastic waste in the marine environment: A review of sources, occurrence, and effects. 566–567, pp. 333-349. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0048969716310154

Liu, S., Junaid, M., Sadaf, M., Ai, W., Lan, X., & Wang, J. (2022, February 15). A novel framework-based meta-analysis for in-depth characterization of microplastic pollution and associated ecological risks in Chinese Bays. 444. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0304389422022178

Lobber, D. (2017, June). The world's plastic pollution crisis explained. Retrieved from https://www.nationalgeographic.com/environment/article/plastic-pollution

Lopez, E. (2021). IMPACTS OF PLASTIC POLLUTION ON THE SUSTAINABILITY. Retrieved from https://www.ijaar.org/articles/Volume5-Number11/Sciences-Technology-Engineering/ijaar-ste-v5n11-nov19-p1.pdf

Marble, T. B. (2013, June). Take a stand on Oceans Day and de-plastify your life. Retrieved from https://theconversation.com/take-a-stand-on-oceans-day-and-de-plastify-your-life-15055

Marina, I., Simona-Roxana, U., Mihai, E., Ionut, M., & Florin-Constantin, M. (2022, June 7). Susceptibility assessment of freshwater environments to plastic pollution (SAFE-PP). Start of the Research Project for Young Independent Teams. pp. 24-24. Retrieved from https://ibn.idsi.md/vizualizare_articol/158279

Michael, C. (2022, November 16). Biodeteriation of plastic materials by phytoremediating. pp. 89-89. Retrieved from https://ibn.idsi.md/vizualizare_articol/167589

Mofijur, M., Ahmed, S., & Rahman, S. A. (2021, April). Source, distribution and emerging threat of micro- and nanoplastics to marine organism and human health: Socio-economic impact and management strategies. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0013935121001511

MohsenAnsari, & Mahdi Farzadkia. (2022, May). Beach debris quantity and composition around the world: A bibliometric and systematic review. 178. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0025326X22003198

Noh, Y., Boor, B. E., Shannahanb, J. H., D.Troy, C., Jafvert, C. T., & J.Whelton, A. (2022, January 15). Emergency responder and public health considerations for plastic sewer lining chemical waste exposures in indoor environments. 422. Retrieved from https://www.sciencedirect.com/science/article/pii/S0304389421018008

Okoye, C. O., Addey, C. I., & Oderinde, O. (2022, August). Toxic Chemicals and Persistent Organic Pollutants Associated with Micro-and Nanoplastics Pollution. Retrieved from https://www.sciencedirect.com/science/article/pii/S2666821122000709

Polka, E. (2018). How does plastic pollution affect marine life? Retrieved from https://www.fauna-flora.org/news/how-does-plastic-pollution-affect-marine-life/

Rani, M., Federici, S., & Depero, L. E. (2022, July 27). Influx of Near-Infrared Technology in Microplastic Community: A Bibliometric Analysis. Retrieved from https://chemrxiv.org/engage/chemrxiv/article-details/62e11aad7f3aa6b480f96152

Rashid, M. F., & Darus, N. A. (2022, June). In The Environment and The Impact of Microplastics Around the World From 2010-2022: A Literature Review and Bibliometric Analysis. 12, pp. 490-517. Retrieved from https://www.researchgate.net/profile/Muhammad-Fakruhayat-Ab-Rashid/publication/361190034_Research_Trends_on_The_Presence_of_Microplastic_Particles_in_The_Environment_and_The_Impact_of_Microplastics_Around_the_World_From_2010_-2022_A_Literature_Review_and_

Schmaltz, E., Melvin, E. C., Diana, Z., Gunady, E. F., Rittschof, D., Somarelli, J. A., . . . Dunphy-Daly, M. M. (2020, November). Plastic pollution solutions: emerging technologies to prevent and collect marine plastic pollution. 114. Retrieved from https://www.sciencedirect.com/science/article/pii/S0160412020320225

Sharma, S., & Chatterjee, S. (2017, august 16). Microplastic pollution, a threat to the marine ecosystem and human health: a short review. pp. 21530–21547. Retrieved from https://link.springer.com/article/10.1007/s11356-017-9910-8

Singh, R. P., Mishra, S., & Das, A. P. (2020, October). Synthetic microfibers: Pollution toxicity and remediation. Retrieved from

https://www.sciencedirect.com/science/article/abs/pii/S0045653520313928

Wang, M. H., He, Y., & Sen, B. (2019, May). Research and management of plastic pollution in coastal environments of China. 248, pp. 898-905. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0269749118348929

Webster, & Watson. (2002, November). Literature review as a research methodology: An overview and guidelines. Retrieved from https://www.sciencedirect.com/science/article/pii/S0148296319304564

Xanthos, D., & Walker, T. R. (2017, May 15). International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): A review. 118, pp. 17-26. Retrieved from https://www.sciencedirect.com/science/article/pii/S0025326X17301650

| Access this Article in Online | |
|---|---|
| Quick Response Code | Website: www.ijarm.com<br>Subject: Marine pollution |
| DOI:10.22192/ijamr.2023.10.02.008 | |

How to cite this article:
Jonnele D. Matre, Joemark D. Ablian, Mark Anthony R. Gantang. (2023). Microplastics as Pollutants in the Marine Environment: A Review. Int. J. Adv. Multidiscip. Res. 10(2): 69-78.
DOI: http://dx.doi.org/10.22192/ijamr.2023.10.02.008